P-3649

A STUDY ON STATISTICAL PROCESS CONTROL FOR SCREWS IN K-TECH ENGINEERING,COIMBATORE

by

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Under the guidance of

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A PROJECT REPORT

submitted

In partial fulfillment of the requirements

for the award of the degree

of

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Department of Management Studies

KUMARAGURU COLLEGE OF TECHNOLOGY

(An autonomous institution affiliated to Anna University, Coimbatore)

Coimbatore - 641 049

November, 2011

KCT
BUSINESS SCHOOL

BONAFIDE CERTIFICATE

Certified that this project report titled **"A STUDY ON STATISTICAL PROCESS NTROL TAKEN FOR SCREWS IN K-TECH ENGINEERING, COIMBATORE"** is the afide work of **Mr.M.S.KIRAN KUMAR, 10MBA26** who carried out the project under my ervision. Certified further, that to the best of my knowledge the work reported herein does not n part of any other project report or dissertation on the basis of which a degree or award was ferred on an earlier occasion on this or any other candidate.

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PROJECT COMPLETION CERTIFICATE *

This is to certify that Mr. M.S. Kiran Kumar, Roll No 10MBA26, a student of KCT Business School, Kumaraguru College of Technology, and Coimbatore had undergone a Project entitled

A Study on Statistical Controls used in K-Tech Engineering, Coimbatore

Between 27.06.11 and 06.08.11

During the tenure, his performance was **Very Good**

for K-tech engineering

Manager.

Signature of the
Organization Guide

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CHAPTER 1

1.1 INTRODUCTION TO THE STUDY

Process of converting raw materials into finished goods is known as production. Production refers to the economic process of converting of inputs into outputs. Production uses resources to create a good or service that is suitable for use, gift-giving in a gift economy, or exchange in a market economy. This can include manufacturing, storing, shipping, and packaging. Some economists define production broadly as all economic activity other than consumption. They see every commercial activity other than the final purchase as some form of production.

Production is a process, and as such it occurs through time and space. Because it is a flow concept, production is measured as a "rate of output per period of time". There are three aspects to production processes:

1. The quantity of the good or service produced,
2. The form of the good or service created,
3. The temporal and spatial distribution of the good or service produced.

THE PRODUCTION PROCESS

A production process can be defined as any activity that increases the similarity between the pattern of demand for goods and services, and the quantity, form, shape, size, length and distribution of these goods and services available to the market place.

The production process refers to the stages (phases) required to complete a media product, from the idea to the final master copy.

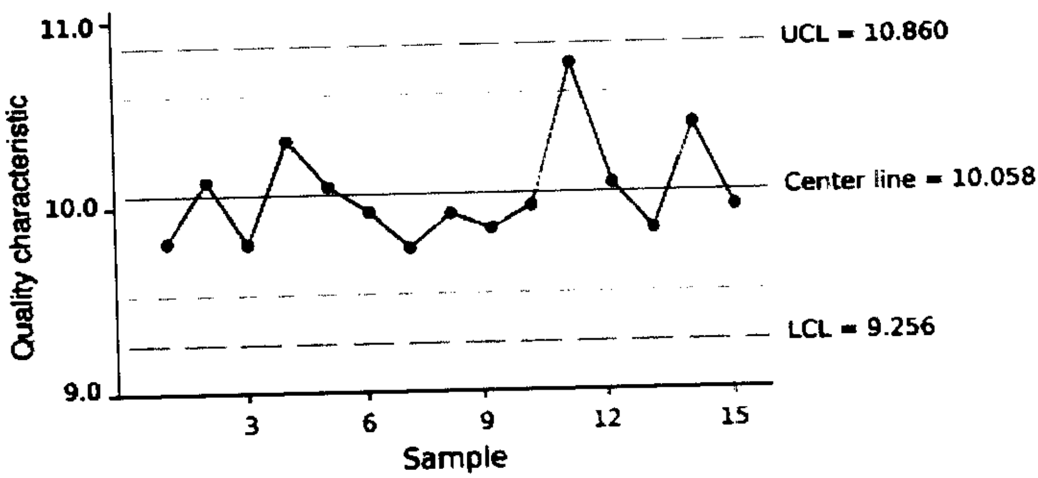
The three main stages of production are:

1. **Pre-production**: Planning, scripting & storyboarding, etc.
2. **Production**: The actual shooting/recording.
3. **Post-production**: Everything between production and creating the final master copy.

CONTROL CHARTS

Its also known as **Shewhart charts** or **process-behaviour charts**, in statistical process control are tools used to determine whether or not a manufacturing or business process is in a state of statistical control.

PICTORIAL EXAMPLE



BENEFITS OF THE CONTROL CHARTS

- Helps in reducing the process variability
- Performance monitoring over time
- Out-of-control and a particular trend is immediately known
- Helps in deciding the quality of out coming samples of a lot

HOW TO DRAW CONTROL CHARTS

1. Identify the objective of using the Control Chart. Typically this will be either to detect defects or to monitor a suspect or critical process. For example, 'to monitor the accuracy of a breakfast cereal packet filling process'. The process selected should repeat sufficiently often to provide enough measures to be able to plot a Control Chart.
2. Identify the actual measurement to be made, including what to measure, and where in the process to measure it. Select the measurements based on their ability to identify problems or defects.

Focus the measurement to minimize the likely variation. For example, a separate Control Chart for each of several identical canning lines will be more likely to identify problems on one line than using one chart for all the output of all lines, where significant variation on one line may be swamped by measures from the other lines.

Reduce waste by identifying the measurement at the earliest point in the process where problems may be detected.

The actual measurement should be reasonably easy to carry out.

3. Identify the type of Control Charts to use. This will depend on the type of measurement being made. For more details on selecting the right Control Chart for your application, see Choosing the type of Control Chart.
4. Choose the *subgroup*. This is the group of measurements that will make up each plotted point on the Control Chart.

   Each subgroup typically contains the same number of measurements, although p-charts and c-charts are bounded by events, such as time (e.g. measurements per week), people or batches. In any case, there should be enough measurements in each subgroup to make the chart statistically correct and Table gives guidelines for this.

   The subgroup should be selected with the aim of (a) making the measurement *within* each subgroup as consistent as possible, whilst (b) maximizing the chance of highlighting differences *between* subgroups. Considerations include:

   - Synchronizing measurement points with other process variables. For example, measure weekly rather than every four days.
   - Using experience to determine subgroups, for example, known tool wear rates.
   - Using larger subgroups, as they result in Control Charts which are more sensitive to change.
   - Using smaller subgroups when they are expensive or time-consuming.
   - Measuring more frequently when significant variation can occur over a short period.

- Initially measuring more, then reducing measurements as the data is understood.
- Using consecutive measurements, rather than a random sample, as this will result in less variation within the subgroup, with tighter, more sensitive control limits.
- Selecting subgroup measurement which seldom results in zero value points. For example, counting customer complaints per hour when there are only one or two per day, will give many points plotted on the zero line.

5. Prepare for measurement. This should aim to make measurement as simple and error-free as possible. If possible, automate the measurement process. If measurements are to be collected by hand, design a data collection form that eases both the collection and the subsequent calculations.

   Ensure that the people involved with the collection of data and construction and interpretation of the Control Chart are able to perform their tasks efficiently and accurately. Train them as appropriate, including the use of practical trials.

6. Make the measurements as planned in step 5.
7. Calculate mean and upper and lower control limits, using the links below for the appropriate Control Chart.
8. Draw the chart. This should include: One plotted point for each subgroup, with a line drawn between successive points. Horizontal lines for each of the central line, upper control limit and lower control limit. Labeling and other information to uniquely identify the chart and help with any subsequent investigation.

1.2 INDUSTRIAL PROFILE

Cast metal products are found in 90 percent of manufactured goods and equipment. From critical components for aircraft and automobiles to home appliances and surgical equipment, cast metal products are integral to the global economy and our way of life. The U.S. metal casting industry is the world's largest supplier of castings, shipping cast products valued at over $18 billion annually and directly employing 225,000 people. Metal casting companies are often at the heart of the economy in the communities where they reside. Of the 2,950 metal casting establishments located throughout the United States, over 80 percent are small businesses.

1.3 ORGANIZATION PROFILE

The beginning of K-TECH ENGINEERING in 1988 first attempt in producing Tools Components and Equipments using an limited facility. Currently they are manufacturing multiple products with greater customer satisfaction. The Company always keeps pace with the changing scenario and seldom fails in coming up with outstanding solutions every time. The unerring teamwork,which goes into the manufacture of every product, has brought in impeccable recognisation for the company as well as its products – worldwide.

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Phone Numbers: +91-422 - 2330696
+91-422 - 2331944

Fax: +91-422 - 2330962

Email: k-tech@eth.net, ktechengg@gmail.com

TURNOVER

The Sales Turnover of Financial Year 09-10 is RS 100cr.

CHAIRMAN

Mr.R.Nanda Kumar- MBA

QUALITY POLICY

K-TECH ENGINEERING COMPANY strive to achieve customer satisfaction by supplying the best quality &cost effective products on a timely manner by continously improving quality systems with effective team work.

QUALITY OBJECTIVE

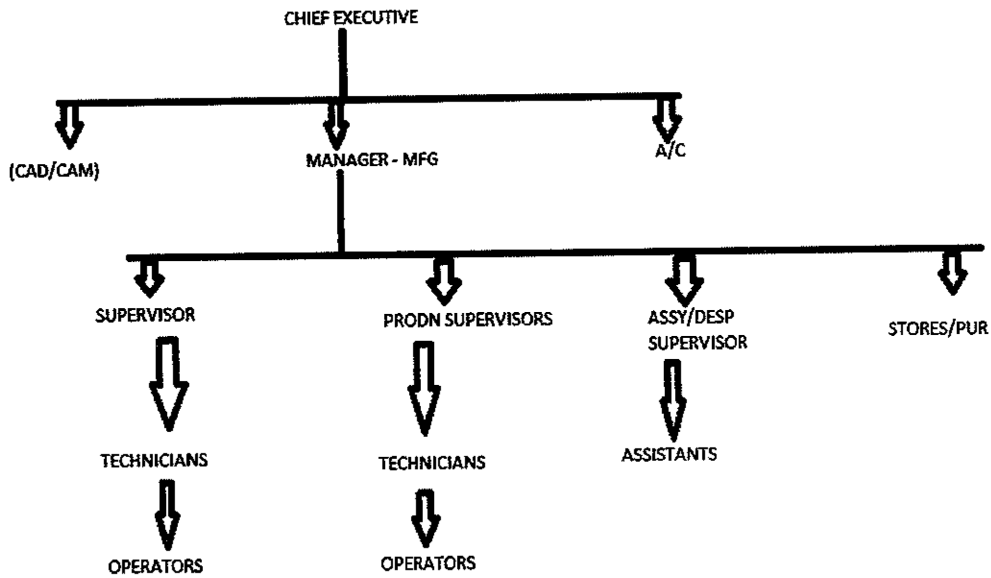
They set the specific and quantitative goals for several activities like

- Zero Rejections
- 100% Schedule adherence
- Multi skill
- 100% Customer Satisfaction

PRODUCTS

- Manufacture of press tools
- Pressure Die Cast Dies
- Production of Pressed Parts
- Machined Die Cast Shells
- Injection moulds and plastic components
- Telecom Connectors and
- Tea leaf harvesting machines

ORGANIZATION STRUCTURE



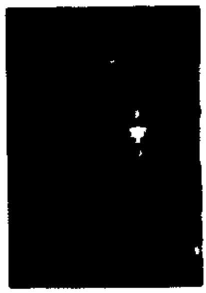
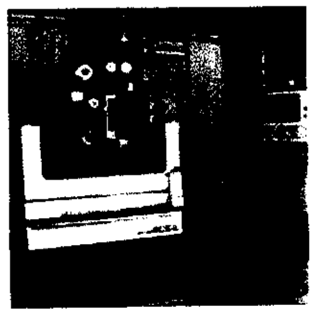
PRODUCTS

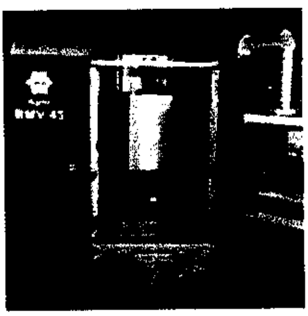
INFRASTRUCTURE

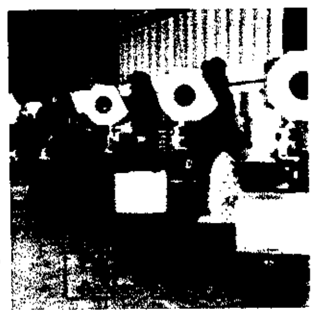




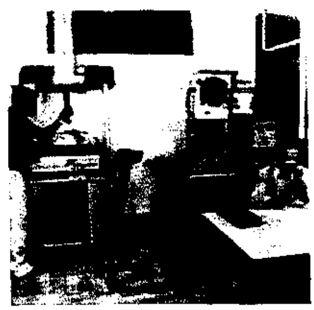








EMPLOYEES

K-TECH has a strong people oriented work culture that can be seen and felt across all its member concerns. At k-TECH people across the group were companies were very much interactive getting to know each other individually share their common experiences. There are 60 employees in their manufacturing sector.

Recruitment process is through Internal References and Advertisements.

PLANT CAPACITY

The company designed such a way each department section are clearly divided with sufficient space without any convenient to the systems presons and machines.

CERTIFICATION

An ISO:9001:2000 certified for quality control of their products

FUTURE PROSPECTS

- To manufacture coffee leaf harvester
- To manufacture Black Screw

GROWTH RATE

Company has grew 15% compared to previous year

COMPETITORS

Sj Engineering works, pvt limited

Naga Engineering, pvt limited

Energy Engineering works, pvt limited

Shanthi Engineering, pvt limited

CUSTOMERS

M/s PRICOL LTD, COIMBATORE.

M/s CRAFTSMAN AUTOMATION PVT LTD, COIMBATORE.

M/s L.G.BALAKRISHNAN & BROS LTD, COIMBATORE.

M/S. SLV ENGINEERS PVT LTD., COIMBATORE.

M/S. PENTA ENTERPRISES INDIA LTD., COIMBATORE.

M/s FCI OEN CONNECTORS INDIA LTD, COCHIN.

M/s SOURIAU INDIA LTD, COCHIN.

M/s. AVT NELLIAMPATHY, KERALA.

M/s. OOPPOOTTIL AGRICULTURAL SERVICES, KOTTAYAM & COONOOR.

M/s. TATA TEA LTD, MUNNAR.

M/s. BALANOOR PLANTATIONS, KARNATAKA.

M/s. PLAMAC INDIA LTD, KOLKATA.

M/s. SENVEC LANKA (PTE) LTD, COLOMBO.

M/s EJOT GMBH, GERMANY.

M/S. P.T.INDIRA ALDA JAKARTA, INDONESIA.

M/S. HATTORI SEISAKUSHO CO LTD JAPAN.

1.4 STATEMENT OF THE PROBLEM

Process Efficiency leads to quality production. The quality product is ensured through the stringent quality control measures followed at the production level. Hence the study focuses on the utilization of control charts in the production processes as a problem to be studied upon.

1.5 OBJECTIVES OF THE STUDY

Primary objective:

To study the process control for screws followed at K-Tech Engineering

Secondary objectives:

To study the production process sequence in manufacturing the screws.

To study the deviation in the quality specifications through quality control charts.

1.6 SCOPE OF THE STUDY

The scope of the study is confined within K-Tech Engineering Pvt Ltd, Coimbatore and applicable for the production of screws.

CHAPTER-2 REVIEW OF LITERATURE

CHAPTER 2

REVIEW OF LITERATURE

- **D.R. Prajapati, P.B. Mahapatra**[1] observed that It has been concluded that 100% inspection cannot be relied upon to sort out non-conforming products from a product stream. So researchers have suggested to design suitable statistical tools e.g., control charts, which can be used to control the process of manufacturing. A control chart defines a statistic and some criteria such that the probability of statistic meeting the criteria is high when the process is under control and low when the process is out of control. Shewhart (1931) proposed first general model of control charts for variables. Since then, various approaches and their applications have been developed in this area. This paper provides a survey and brief summary of the work on the control charts for variables to monitor the process mean and dispersion from 1931 to 2008

- **S.F. Yang, M.A. Rahim**[2] observed that Control charts are widely used for process surveillance. The design of a control chart refers to the choice of sample size, the width of the control limits, and the interval between samples. Economic designs have been widely investigated and shown to be an effective method of determining control chart parameters. This article describes two different manufacturing process models to which the X^- control chart is applied: The first model assumes that the process continues in operation while searches for the assignable cause are made, and the second assumes that the process must be shut down during the search. Economic models of the control chart for these two manufacturing process models are developed.

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[1] To study the General model of control charts for variables.

[2] To study the Economic models of the control chart

- **Leandro G Barajas, Magnus B Egerstedt, Edward W Kamen, Alex Goldstein** [3]Observed that this paper presents a neural network model for the Stencil Printing Process (SPP) in Surface Mount Technology (SMT) manufacturing of Printed Circuit Boards (PCB). A practical model description that decomposes the overall steady-state process in independently modelled subspaces is provided. The neural network model can be updated in real-time procuring a method to control the process by dynamically searching the optimal set point of the control variables. The optimization is performed by minimizing the mean squared error with respect to the desired solder brick height; furthermore, in the case when multiple solutions exist, the set point that yields the lowest variance is used. The process simulator is mainly suitable for offline testing and debugging of more complex closed-loop control algorithms for the SPP optimization providing a common and realistic framework for algorithm performance evaluation.

- **Yun-Kung Chungl, Yun-Show Chen**[4], Observed that it is well known that Artificial Neural Networks (ANNs) are adaptable or plastic multivariate models and then can be modeled to solve complex statistical prediction and pattern recognition problems. Multivariate statistical process control (MSPC) charts are classical multivariate quality control tools. Hotelling multivariate T2 is one of them. This paper covers both the theoretical and practical considerations of an ART2 ANN and the T2 control chart. The main reasons why ART2 is taken as an alternative MSPC tool are its abilities to learn patterns in an unknown environment and to learn a new pattern without having to retrain all of already learned patterns, which the both learning abilities are named stability-plasticity resolvability. This paper compares identification accuracy of the two MSPC tools. Guidelines are developed for demonstration necessity.

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[3] To study the neural network model can be updated in real-time procuring a method to control the process

[4] To study the multivariate statistical process control (MSPC) charts are classical multivariate quality

- **RW Samohyl**[5] Observed that in order to identify and analyze the major causes of variability that affect the accuracy of the forecast object simultaneously monitoring two or more forecasts depends on the development of specific statistical tools including graphics that support monitoring in real time. Procedures for calculating forecasts may depend upon purely subjective insight or upon statistical methods like Box-Jenkins or other computational methods such as neural networks and exponential smoothing models (R package forecast). In other words, the forecast model may be based upon either subjective or scientific principles. An important question involves the measurement of forecast accuracy and the determination of the relevance of forecasting model. The researcher must determine when a forecast error is disturbingly large, and how should the model be corrected to improve forecast accuracy.

- **B.L. McCarthy** [6] Observed that for statistical process control (SPC) charts has been for process control and improvement in manufacturing businesses. However, the number of applications reported in domains outside of conventional production systems has been increasing in recent years. Implementing SPC chart approaches in non-standard applications gives rise to many potential complications and poses a number of challenges. This paper reviews non-standard applications of SPC charts reported in the literature from the period 1989 to 2000, inclusive. Non-standard applications are analysed with respect to application domain, data sources used and control chart techniques employed. Applications are classified into five groups according to the types of problem to which control chart techniques have been applied.

[5] To study the monitoring two or more forecasts
[6] ... (SPC) charts ... for process control and improvement in manufacturing businesses.

CHAPTER-3 RESEARCH METHODOLOGY

CHAPTER 3
RESEARCH METHODOLOGY

3.1 DESCRIPTIVE RESEARCH

Descriptive research design is a scientific method which involves observing and describing the behavior of a subject without influencing it in any way. The study describes the existing phenomenon and hence it is a descriptive research.

3.2 DATA AND SOURCES OF DATA

The study uses Primary data. The data is collected from the samples collected by the researcher.

The data collected are:

- Control Plans of K-Tech Engineering
- Diameter of the screw.
- Length of the screw.

3.3 TIME PERIOD COVERED

- Five production days during the month of November 2011

3.4 POPULATION AND SAMPLE SIZE

- Population size: 30,000 screws produced a day.
- Sample size: 30 screws taken at random time intervals.

3.5 SAMPLING TECHNIQUE

Non-probability sampling method is used for the study. The sample selection technique is Convenience Sampling Technique. Each day, 5 sample screws were drawn from the production line at random intervals. Similarly, the sampling procedure was administered for 5 days.

3.6 STATISTICAL TOOL USED

- Control chart.

3.7 LIMITATION OF THE STUDY

- The sample size taken is relatively small.
- The study is confined only for the screws. The firm is also producing other components.
- The choice of sample day and time was at the researcher's convenience.

CHAPTER -4 ANALYSIS AND INTERPRETATION

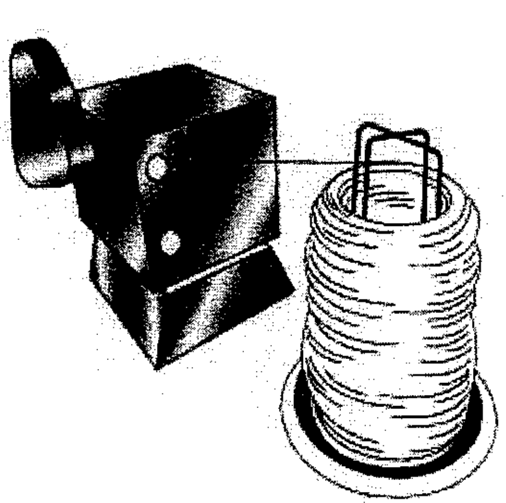
CHAPTER 4

ANALYSIS AND INTERPRETATION

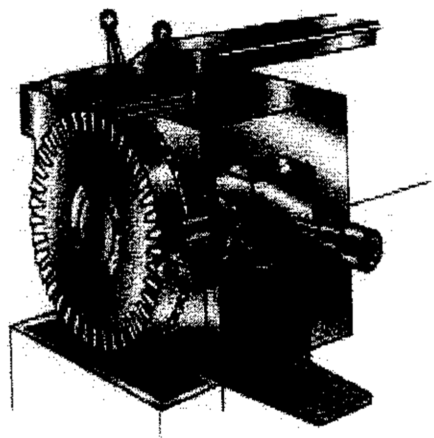
PRODUCTION PROCESS

Raw material is got from the suppliers Screws are generally made from low to medium carbon steel wire, but other tough and inexpensive metals may be substituted, such as stainless steel, brass, nickel alloys, or aluminum alloy. Quality of the metal used is of utmost importance in order to avoid

HEADING MACHINE



Cold heading machine with wire feed.



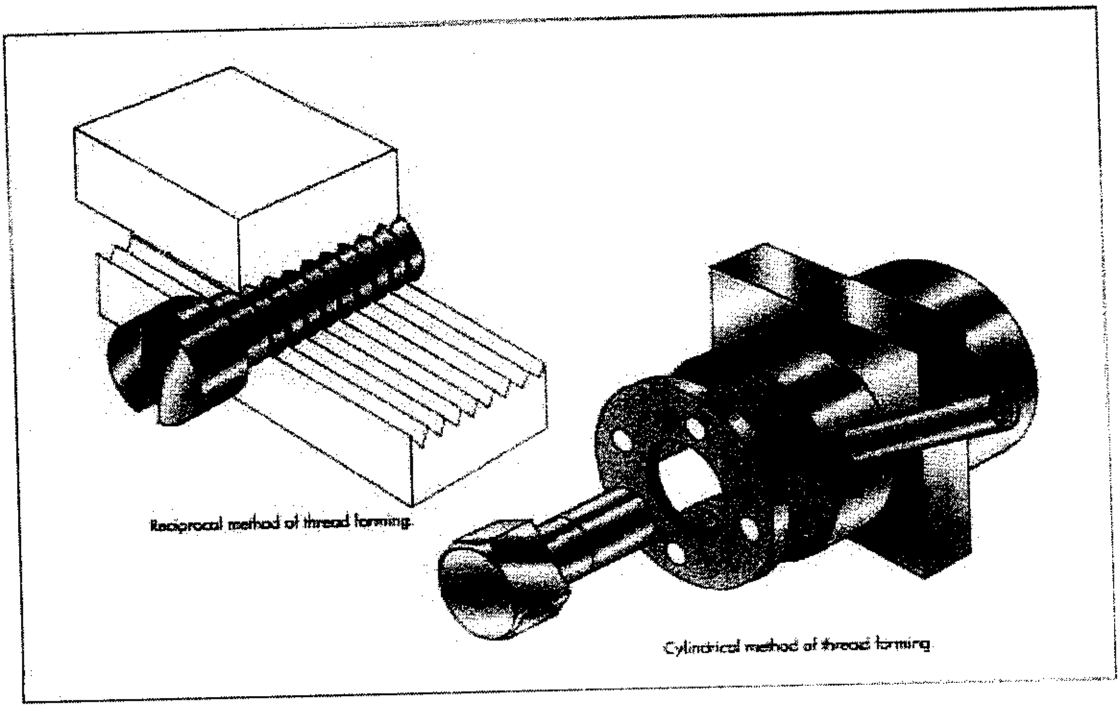
Head slotting machine.

The cold heading machine cuts a length of wire and makes two blows on the end, forming a head. In the head slotting machine . A circular cutter slots the screws as the wheel revolves.

THREAD ROLLING

- Once cold headed, the screw blanks are automatically fed to the thread-cutting dies from a vibrating hopper. The hopper guides the screw blanks down to the dies.
- The blank is then cut using one of three techniques. In the reciprocating die, two flat dies are used to cut the screw thread. One die is stationary, while the other moves in a reciprocating manner, and the screw blank is rolled between the two.When a centerless cylindrical die is used, the screw blank is rolled

THREAD ROLLING MACHINE

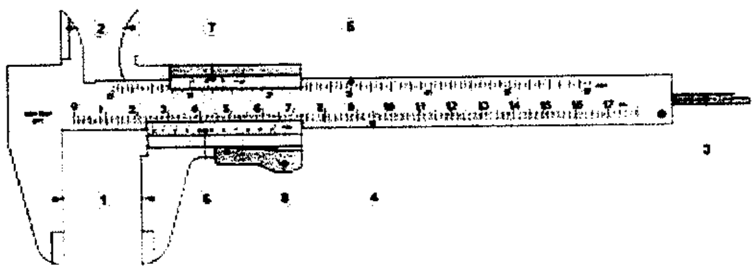


between three round dies in order to create the finished thread. The final method of thread rolling is the planetary rotary die process. It holds the screw blank stationary, while several die-cutting machines roll around the blank.

QUALITY INSPECTION

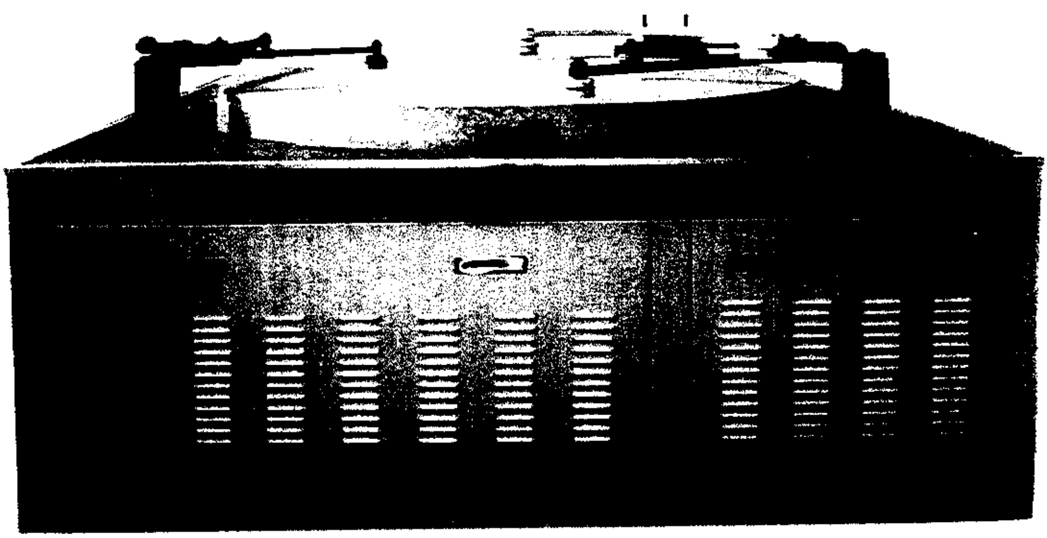
Quality assistant duty is to check the screws quality. Random samples are taken at equal intervals from the output and checked its diameter and length using Vernier Caliper. Incase of any defects corrections are done in the process and made sure of producing good quality screws according to customer specifications.

VERNIER CALIPER



POLISHING

Then the screws are been polished using mould polishing kit machine. Polishing is done for avoiding rust forming in screws. After the polishing, screws are kept in open air for drying. Then screws are packed in wooden boxes and supplied to the customers.



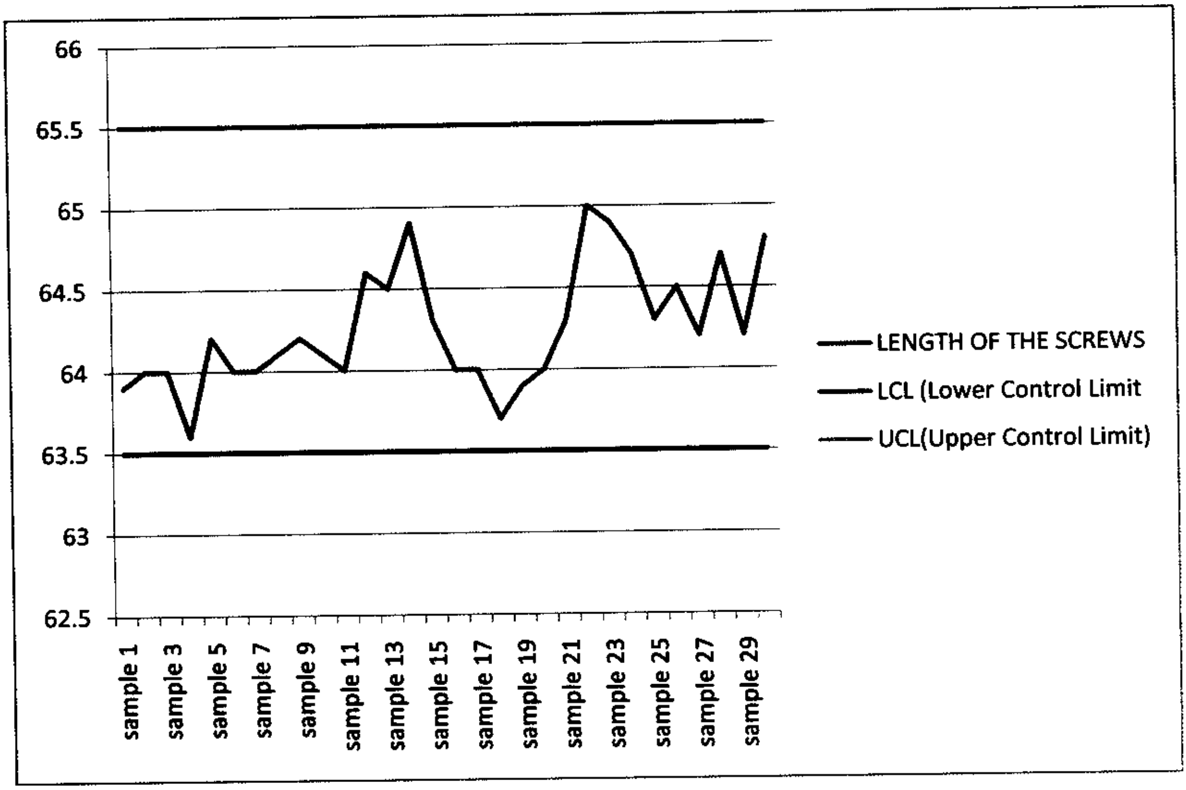
INTERPRETATION

TABLE 4.1 LENGTH OF THE SCREWS

S.NO	LENGTH OF THE SCREWS	LCL(LOWER CONTROL LIMIT)	UCL(UPPER CONTROL LIMIT)
sample 1	63.9	63.5	65.5
sample 2	64	63.5	65.5
sample 3	64	63.5	65.5
sample 4	63.6	63.5	65.5
sample 5	64.2	63.5	65.5
sample 6	64	63.5	65.5
sample 7	64	63.5	65.5
sample 8	64.1	63.5	65.5
sample 9	64.2	63.5	65.5
sample 10	64.1	63.5	65.5
sample 11	64	63.5	65.5
sample 12	64.6	63.5	65.5
sample 13	64.5	63.5	65.5
sample 14	64.9	63.5	65.5
sample 15	64.3	63.5	65.5
sample 16	64	63.5	65.5
sample 17	64	63.5	65.5
sample 18	63.7	63.5	65.5
sample 19	63.9	63.5	65.5
sample 20	64	63.5	65.5
sample 21	64.3	63.5	65.5
sample 22	65	63.5	65.5
sample 23	64.9	63.5	65.5
sample 24	64.7	63.5	65.5
sample 25	64.3	63.5	65.5
sample 26	64.5	63.5	65.5
sample 27	64.2	63.5	65.5
sample 28	64.7	63.5	65.5
sample 29	64.2	63.5	65.5
sample 30	64.8	63.5	65.5

CONTROL CHART

CHART 4.1 LENGTH OF THE SCREWS



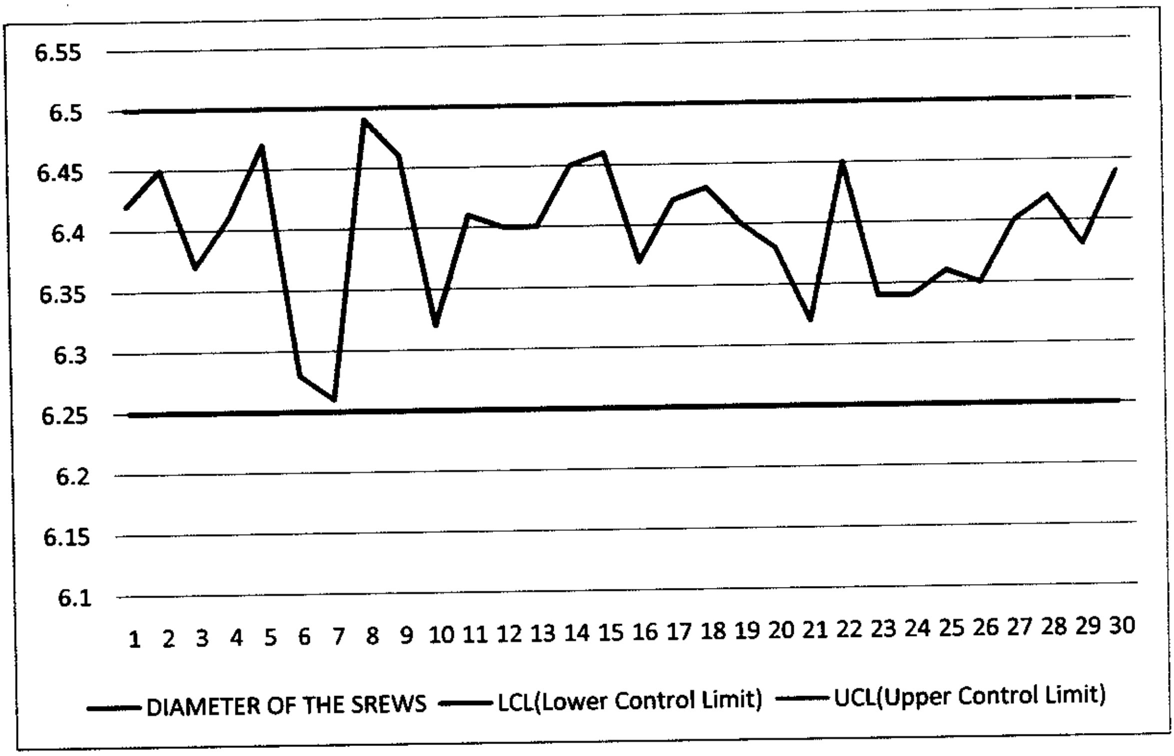
From this chart we can understand that screws that are manufactured are under control . All samples are found between the limits. Length of the screws should be between UCL-Upper Control Limit 65.5mm and LCL- Lower Control Limit 62.5 If the length of the screws deviate away from this limit those screws will be rejected .Then the process will be checked and correction will be made in order to get screws between the limits.

TABLE 4.2 DIAMETER OF THE SCREWS

S.NO	Diameter of the srew	LCL(Lower Control Limit)	UCL(Upper Control Limit)
sample 1	6.42	6.25	6.5
sample 2	6.45	6.25	6.5
sample 3	6.37	6.25	6.5
sample 4	6.41	6.25	6.5
sample 5	6.47	6.25	6.5
sample 6	6.28	6.25	6.5
sample 7	6.26	6.25	6.5
sample 8	6.49	6.25	6.5
sample 9	6.46	6.25	6.5
sample 10	6.32	6.25	6.5
sample 11	6.41	6.25	6.5
sample 12	6.4	6.25	6.5
sample 13	6.4	6.25	6.5
sample 14	6.45	6.25	6.5
sample 15	6.46	6.25	6.5
sample 16	6.37	6.25	6.5
sample 17	6.42	6.25	6.5
sample 18	6.43	6.25	6.5
sample 19	6.4	6.25	6.5
sample 20	6.38	6.25	6.5
sample 21	6.32	6.25	6.5
sample 22	6.45	6.25	6.5
sample 23	6.34	6.25	6.5
sample 24	6.34	6.25	6.5
sample 25	6.36	6.25	6.5
sample 26	6.35	6.25	6.5
sample 27	6.4	6.25	6.5
sample 28	6.42	6.25	6.5
sample 29	6.38	6.25	6.5
sample 30	6.44	6.25	6.5

CONTROL CHART

CHART 4.2 DIAMETER OF THE SCREWS



From this chart we can understand that screws that are manufactured are under control . All samples are found between the limits. Length of the screws should be between UCL-Upper Control Limit 65.5mm and LCL- Lower Control Limit 62.5 If the length of the screws deviate away from this limit those screws will be rejected .Then the process will be checked and correction will be made in order to get screws between the limits.

CHAPTER -5 FINDING, SUGGESTION AND CONCLUSION

CHAPTER 5

FINDINGS, SUGGESTIONS AND CONCLUSION

5.1 FINDINGS

The diameter of the screws upper control limit is 6.50mm and lower control limit is 6.25mm.The length of the screws upper control limit is 65.5mm and lower control limit is 63.5mm

REMEDIAL MEASURE

Control chart shows that all the samples are between control limits hence the screws doesn't have defects in it. In case if the samples taken is not between the limits its considered as defect so the process must be changed in order to manufacture good quality products with given specifications by the customers by changing the alignment in the threading process and heading process. This can be done only by skilled experienced workers.

5.2 SUGGESTION

K-Tech Engineering manufactures 30000 screws in a day. They get orders for 15 lakhs screws per month from various customers. They are using only one threading and heading machine for the production if that machines becomes repair until it is rectified production will be stopped hence my suggestion is company can purchase one more threading and heading machine. So that they can improve their production by increasing the quantity and at the time of repair in anyone of the machine production need not be stopped they can run with other machine.

5.4 SCOPE FOR THE FURTHER STUDY

The study can be conducted with larger sample size collected at short interval time. The study can also be enhance to cover all the components manufactured by the company.

5.3 CONCLUSION

Process Efficiency leads to quality production. The quality product is ensured through the stringent quality control measures followed at the production level. Hence the study focuses on the utilization of control charts in the production processes as a problem to be studied upon. A descriptive study is undertaken with 30 sample readings of the screws that are in the production run. The sample was collected at 5 different time intervals. The so collected readings were plotted in Control Chart for checking for the process deviations from the stated specifications. The study is concluded that there is no quality specification deviations in the production of screws at K-Tech Engineering.

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