
# SAMPLING PLAN IMPLEMENTATION ON MACHINING COMPONENTS USING STATISTICAL PROCESS CONTROL

**Prof. A.P.Edlabadkar**

**Dr. S. S. Chaudhari**

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# SAMPLING PLAN IMPLEMENTATION ON MACHINING COMPONENTS USING STATISTICAL PROCESS CONTROL

## (Project Report)

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# Preface

This project has undertaken in TAL Manufacturing Solutions Limited, MIHAN, and Nagpur. Statistical process control (SPC) has been extensively utilized in many various industries including automotive, electronics, and aerospace, among others. SPC tools like control charts, process capability analysis, sampling inspection, etc., have definitive and powerful impact on internal control and improvement for batch and production systems. By using SPC tools specially the X bar and R Chart and Process capability study which is that the Cp and Cpk indices , variation thanks to assignable causes within the process has been identified where the 4M; Men, Machines, Methods, and Materials, causes become the most source of variation.

Different stakeholders have different opinions towards the worth added by implementing SPC. For the operators, simple manufacturing and fewer setup time are helpful. While for the engineers, lower scrap rate and better production rate are valuable improvements. For the upper management team, potential annual savings in dollars is that the greatest value. 80% of the failure modes are often addressed by SPC, with 60% reduction within the scrap rate from these failure modes. Using an equivalent analysis for the whole machining center, an identical percentage of failure modes like tool change, tool wear, threads and initial setup that now appear throughout the machining center are often reduced by implementing SPC. This work presents a case study on the appliance of quality tools to enhance product quality. It aims to scale back inspection time for manufactured parts and improve the performance of current process by reducing the variability within the dimension of parts produced, by diminish rejections and improving the method. By completing mathematical calculations and using various SPC tools, process capability study was done.

With immense pride and sense of gratitude, we take golden opportunity to express we sincere regards to **Dr. U. P. Waghe,** Principal YCCE, Nagpur.

We attribute our success in this venture to our **Mr. PramodSawwalakhe** for his guidance throughout the project. Our sincere regards to him for giving me his outstanding guidance, enthusiastic suggestion and invaluable encouragement which helped us to complete the project.

Our thanks are to all those who have shown there keen interest in this work and provide much needed encouragement.

**Prof. A. P. Edlabadkar**
**Dr. S. S. Chaudhari**

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# LIST OFSYMBOLS

| S.No. | Contents | Abbrevations |
|---|---|---|
| 1. | Capability index | Cp |
| 2. | Capability index | Cpk |
| 3. | 6-sigma | 6σ |
| 4. | Upper specification limit | USL |
| 5. | Lower specification limit | LSL |
| 6. | Process mean | μ |

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# Chapter 1

# INTRODUCTION

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# INTRODUCTION

## 1.1OVERVIEW

The implementation of quality tools (QTs) and methodologies is important to scale back defective items, and thus reducing the general quality costs. This will be achieved by reducing process variability, allowing further increase in organization’s competitiveness and sustainability. The standard function within a corporation ensures compliance with product specifications and implements process improvements, to supply with greater efficiency. Control Charts are important tools wont to monitor a process, to make sure that process is during a state of statistical control and thus improving product quality.

Statistical Process Control (SPC) procedures can assist you monitor process behavior. the foremost successful SPC tool is that the control chart. SPC originally developed by Walter Shewhart within the early 1920s. Statistical Process Control internal control refers to using statistical techniques for measuring and improving the standard of processes and includes SPC additionally to other techniques, like sampling plans, experimental design, variation reduction, process capability analysis, and process improvement plans.

The SPC consists of choosing quality characteristics within the process, collecting data from the method output and calculating process capability indices. The Cp should be a minimum of 1.33 so as for the method to be considered capable. Cpk indicates whether it's capable and the way well-centered the method is. If the method isn't capable, the development steps or make an enhancement to the method must be taken by the corporate . SPC is employed to watch the consistency of processes wont to manufacture a product as designed. It aims to urge and keep processes in check . SPC can make sure that the merchandise is being manufactured as designed and intended. SPC are often applied whenever work is being done. Initially, it had been applied to only production processes, but is has evolved to the purpose where it's applied to any work situation where data are often gathered. As companies work toward quality goal, SPC is employed in additional diverse situations. SPC involves the utilization of statistical signals to spot the source of variation, to enhance performance and to take care of control of processes at higher quality levels. The statistical concepts that are applied in SPC are very basic and may be learned by everyone in company.

## A. Statistical Process Control (SPC)

Statistical process control (SPC) is usually considered a group of tools meant to extend the standard of a process by reducing its variability, thus making each individual product produced conform to a particular standard.

## B. SPC Implementations

In SPC application, it is important to understand and identify key product characteristics which are critical to customers or key process variation as shown in Fig 1. The key steps for implementing SPC are:

- Identify defined processes
- Identify measurable attributes of the process
- Characterize natural variation of attributes
- Track process variation
- If the process is in control, continue to track
- If the process is not in control
    - Identify assignable cause
    - Remove assignable cause
    - Return to ‘Track process variation’[1].

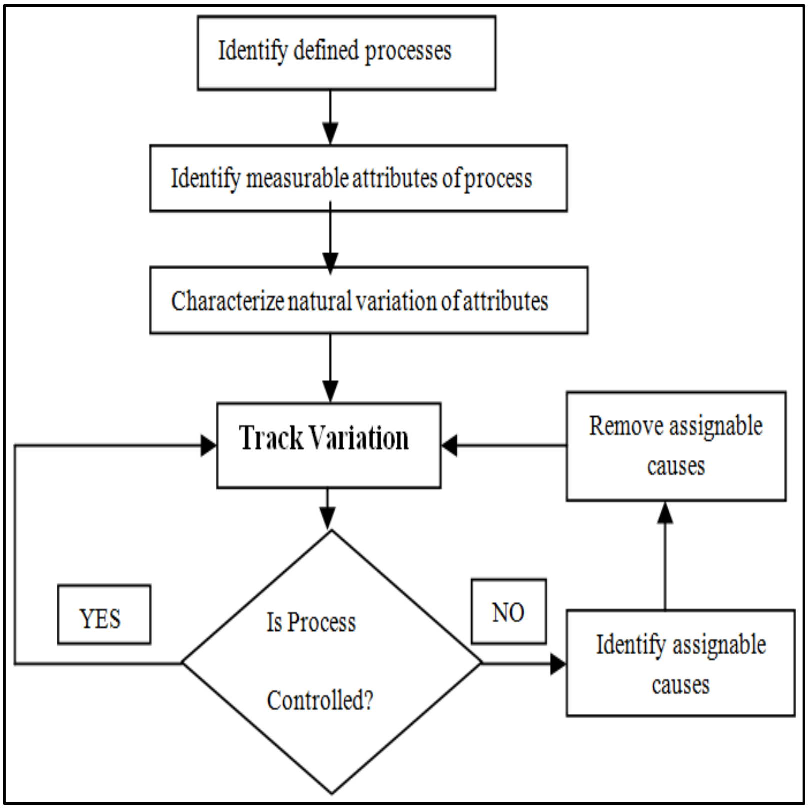


Figure 1: Steps in SPC Implementation

## C. Types of Variation

Variation exists in all processes around us. For example:

• Every person is different

• No two snowflakes are identical

• Each fingerprint is unique

The two types of variation that we are interested in are ‘common cause’ and ‘special cause’ variation.

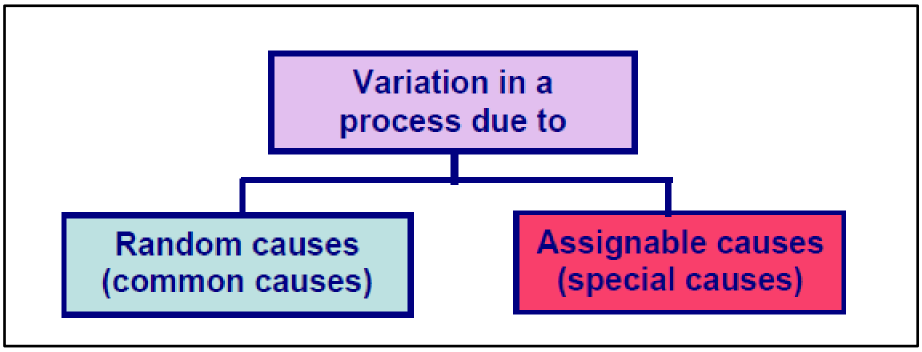


Figure 2: Types of Variation

1. **Common Cause**

   All processes have random variation - known as ‘common cause variation’. Aprocess is said to be ‘in control’ if it exhibits only common cause variation i.e.the process is completely stable and predictable.

2. **Special Cause**

   Unexpected events/unplanned situations can result in ‘special causevariation’. A process is said to be ‘out of control’ if it exhibits special causevariation i.e. the process is unstable.

## D. Sources of Variation

Variation in a process can occur through a number of different sources. For example:

- People - Every person is different
- Materials - Each piece of material/item/tool is unique
- Methods - Signatures for example
- Measurement - Samples from certain areas etc can bias results
- Environment - The effect of seasonality on hospital admissions[2].

## E. Types of Data

1. **Discrete Data**

   Where the observations can only take certain numerical values. Almost allcounts of events e.g. number of patients, number of operations etc.

2. **Continuous Data**

   These data are usually obtained by a form of measurement where theobservations are not restricted to certain values. For example - height, age,weight, blood pressure etc.

### F. Basic Tools for SPC

There are seven tools of SPC, they are:

a) Flow Chart

b) Pareto Chart

c) Check Sheet

d) Cause-and-effect diagram

e) Histogram

f) Control chart, and

g) Scatter plot

For the purpose of this study, Control Chart is chosen to be implemented as a SPC tool. Control chart is broken-line graph illustrates how a process or a point in process behaves over time. Samples are periodically taken, checked or measured and the results plotted in the chart. This chart can show how the specific measurement changes, how the variation in measurement changes or how the proportion of defective pieces changes over time. Control chart are used to find sources of special cause variation, to measure the problem of causes and to maintain control the process that is operating effectively[3].

### G. Control Charts

Control charts are an integral part of **SPC.** They are a reflection of the current state of the system. Variability in the production process and between production processes is a common sight in any manufacturing company. These may be due to systematic (assignable) variations, or due to random variations. The key to having successful control of the process is to eliminate the systematic variations such as tool wear, shift change of operators, tool change, etc., and only have random variations in place.
Control charts can be used when:

- Determining if a process is stable or not.
- Observing patterns of process variation from assignable causes and random causes.

- Controlling an ongoing process and rectifying the errors as they occur.
- Predicting the expected range of outcomes.
- Determining if the quality improvement project needs to aim at specific problems or focus on fundamental changes to the process[4].

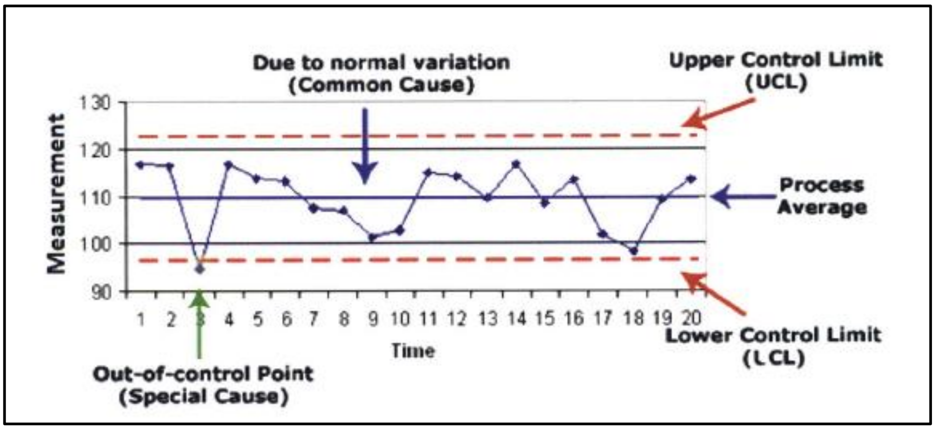


Figure 3: Different components of control chart

1. **Individual Chart( I Chart):** Individuals Chart is used to monitor the mean of process when we have continuous data that are individual observations that are not in subgroups. This control chart is used to monitor process stability over time so that you can identify and correct instabilities in a process.

   For example, a hospital administrator wants to determine whether the time to perform outpatient hernia surgery is stable. Because the data are not collected in subgroups, the administrator uses an individuals chart (I chart) to monitor the mean of the surgery times [5].

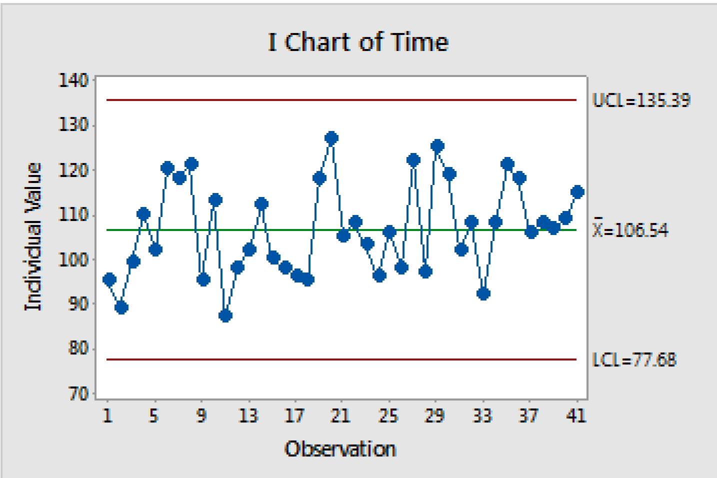

Figure 4: Individual Chart

2. **Moving Range Chart:** Moving Range Chart is used to monitor the variation of your process when we have continuous data that are individual observations not in subgroups. This control chart to monitor process stability over time so that you can identify and correct instabilities in a process.

   A hospital administrator wants to monitor whether the variation in surgery times is stable. Because the data are not collected in subgroups, the administrator uses a moving range chart to monitor the variation of the surgery times [6].

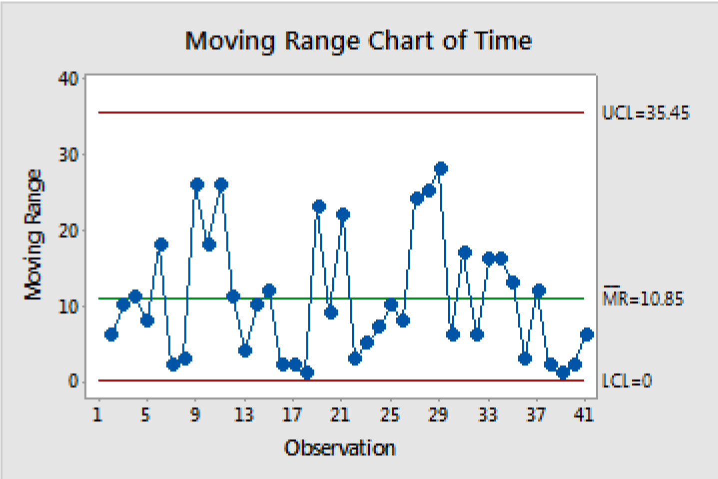


Figure 5: Moving Range Chart

## H. Capability Histogram

The capability histogram shows the distribution of your sample data. Each bar on the histogram represents the frequency of data within an interval. The within and overall curves on the histogram are normal distribution curves that are generated using the process mean and different estimates of process variation. The dashed within curve uses the within-subgroup standard deviation. The solid overall curve uses the overall standard deviation.

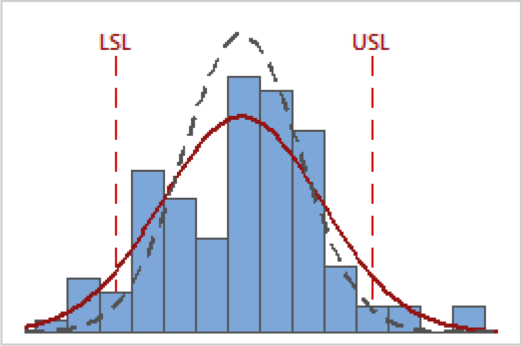


Figure 6: Capability Histogram

In these results, the process data appear fairly centered between the specification limits. However, the process spread is larger than the specification spread, which suggests poor capability. Although most of the data are within the specification limits, there are nonconforming parts below the lower specification limit (LSL) and above the upper specification limit (USL) [7].

## 1.2LITERATURE SURVEY

Table 1: Literature Survey

| S. N. | TITLE | AUTHORS | YEAR | PUBLISHER | FINDINGS/ ABSTRACT |
|---|---|---|---|---|---|
| 1 | Application of SPC and quality tools for process improvement[8]. | Sérgio Sousa, Nuno Rodrigues | June, 2017 | University of Minho, Portugal | Identify main causes of variability in the production process through application of QTs and propose measures to improve process and reduce percentage of defective parts. |
| 2 | Statistical Process Control (SPC) in a High Volume Machining Center: Value of Standard Operating Procedures[4]. | SiddharthUdayshankar | Sept, 2015 | MASSACHUSETTS INSTITUTE OF TECHNOLOGY(MIT) | By following a stand inspecting procedure, the operator produces less scrap and eliminates rejection of good parts. |
| 3 | Implementation of Statistical Process Control Techniques in Industry: A Review[9]. | Pranay S. Parmar, Vivek A. Deshpande | Nov, 2014 | Journal of Emerging Technologies and Innovative Research (JETIR) | SPC tools can be applied to different product for reducing the defect and thus improve quality. |
| 4 | Process Improvement using SPC in a Small Scale | Bhushan S. Jogi, Lekrajsing R. Gour | July, 2018 | International Journal of Trends in Scientific | Identification of abnormal variability caused by assignable causes with |

| | | | | | |
|---|---|---|---|---|---|
| | Industry[10]. | | | Research and Development(IJTSRD) | the aim to Making the process stable, Minimize the process variability and Improve the process performance. |
| 5 | Process Capability Analysis in Single and Multiple Batch Manufacturing Systems[11]. | Prof. Viraj V Atre | Aug, 2018 | International Journal of Engineering and Management Research (IJEMR) | Understanding process capability analysis and calculations of how to establish a stable, controlled and capable process. |
| 6 | Application of Statistical Process Control (SPC) in Manufacturing Industry in a Developing Country[1]. | IgnatioMadanhire, Charles Mbohwa | June, 2016 | Science Direct | Data was obtained to identify the major motives of, extent of application of different SPC tools, perceived benefits, difficulties encountered during implementation and the use of SPC to monitor and control process as well as products. |
| 7 | Implementation of statistical process control in small and medium enterprise industry[3]. | MOHD KHAIRUL RIZAL B ABD. HALIM | May, 2009 | Faculty of Mechanical Engineering, University Malaysia Pahang | Products improvement can be continuously monitored in the distributions of capability indices. |

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## 1.3 PROBLEM STATEMENT

This project presents the motivation behind the company's objective of implementing statistical process control in their machining center, identification of problem and the team's approach to solving the problem of scrap and quality loss in the machining center. The basic aim is to:

- Optimize manufacturing process efficiency
- Increase production volume and yields
- Reduce unscheduled downtime
- Reduce inventory and raw material cost
- Reduce customer complaints

SPC tools will be used in this study to solve these problems. This project is Sampling Plan Implementation on Machining Components using Statistical Process Control. SPC will increase the product quality and hence reduce the total work need to be done. In this project, SPC tools which is Average and Range ( $x$ and R) chart will be needed and will be used to solving this case study. Process Capability also will be needed in this study.

## 1.4 THESIS OBJECTIVE

The objective of this Project are:

1. To reduce the defect rate.
2. To implement SPC in the control phase of six sigma.
3. To reduce the rejections.
4. To improve the Quality by reducing the variability in the process.
5. To implement the SPC in plant to monitor process
6. To propose some improvement recommendation from the study of SPC.

## 1.5 THESIS CONTRIBUTION

Thesis deals with the objective of Sampling Plan Implementation on Machining Components using Statistical Process Control. This project focuses on SPC and

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Process Capability Analysis that had been applied in small and medium industry in the organization which includes:

1. Select Critical Parameters – Dimensions.
2. Data Collection – Data of machining components.
3. Study on Control Charts and Process Capability.
4. Data Evaluation – Using MINITAB.

## 1.6 COMPANY PROFILE

Industry Name: TAL Manufacturing Solutions Limited

Address: Sector 03, MIHAN-441108, Nagpur, Maharashtra.

CO-guide in Industry: Mr. PramodSawwalakhe

Mobile No: +91-7447421486

Email: pramod.sawwalakhe@tal.co.in


Figure 7: Industry

# Chapter 2

# LITERATURE REVIEW

# LITERATURE REVIEW

Based on seven summarized articles in table 1, the article with title process capability indices overview and extension is related in this case study. The objective of the article is to analyze the process capability indices that are Cp and Cpk. The method that used in this article is capability analysis, operating characteristic function, statistical process control, process performance, specification limits, and target value. From the result of the distributions of capability indices, the product improvement can be continuously monitored. In this article, statistical process control (SPC) and control chart is used to monitor the products quality. For the conclusion, capability indices help to prevent conformance products to be produced which do not meet the specification requirements and help continuously monitor product improvement.

**[1] Sérgio Sousa, Nuno Rodrigues, EusébioNunes,** "Application of SPC and quality tools for process improvement"[8].

It is a longitudinal case study describing two years since pre-production. It describes the activities chronologically.

1. Data collection of the potential critical variable in the pre-production phase.

    a. Construction of control charts for individual items.
    b. Determine process capability indices.

2. Definition of a process control procedure for production phase.

    a. If Cp<1 the manufacturing process should be redesigned.
    b. If Cp is around 1.33 the critical variable should be controlled.
    c. If Cp>1.6 the variable is classified as non critical and thus SPC is not applied.

3. Re-assessment of process capability (after increased level of defective items are detected)

    a. Construction of X bar- R Charts.

b. Re-assessment of process capability index Cp.
c. Analysis of control charts and comparision with historical data obtained during pre-production.

4. Identification of assignable causes. If necessary perform Measurement System Analysis.
5. Development of improvement proposals, to reduce variability of the critical variable.

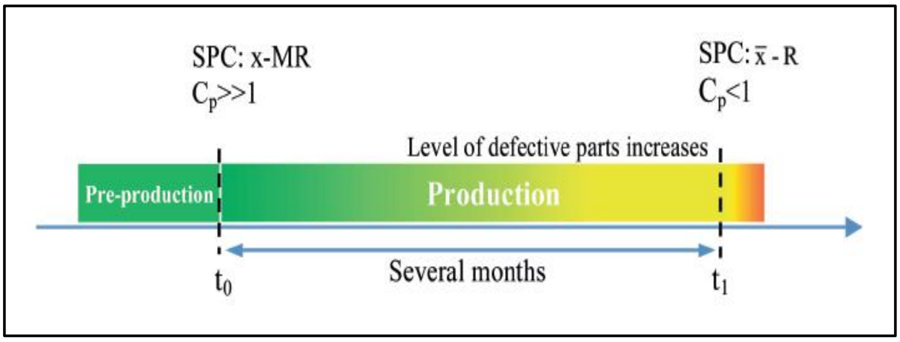


Figure 8: Evolution of Process Capability

**[2] IgnatioMadanhire, Charles Mbohwa**, "Application of Statistical Process Control (SPC) in Manufacturing Industry in a Developing Country"[1].

Questionnaire surveys and interviews were done on a population which was derived from Zimbabwean manufacturing industry based in Harare. Data collection also entailed use of observation, company documents and structured experiments. The objective was to assess the level to which SPC methodology tools were used across the industry, implementation difficulties encountered and to establish gaps which could provide ready opportunities for implementation industry wide in the country.

**[3] Bhushan S. Jogi, Lekrajsing R. Gour, Nikhil Turkar,** "Process Improvement using SPC in a Small Scale Industry"[10].

The study was carried out in a small scale industrydealing in production and supplying of sheet metalpress components, machined components withfabricated steel assemblies for automobile industry. Inthis case study, Statistical process control study wasimplemented in the industry to improve theperformance of the process involving rejection andrework. For progressing in our study we collected thedata for past period and did a detailed analysis of thedata to find out the current performance of the parts.We did rejection data analysis and plotted parettochart to find out the part involving high rejection rateand also to determine the critical parts in it. From theanalysis, we found out that out of several parts beingproduced, part no.9139 involved very high rejectionrate and accounted to a major share of total partsbeing rejected .Therefore we selected this part for ourstudy. Initially we did the SPC study for a part havingnumber.

In methodology, study of process characteristics of part has been done. Collection of data about forming process of child parts was carried out. Also the collection of readings of critical dimension i.e. 57 was done and afterwards X and R charts were plotted for the respective dimension. After plotting the control charts next step was to calculate process capability indices ($C_p$, $C_{pk}$, $P_p$, $P_{pk}$ ). The results which were obtained help to identify the scope of improvement and do the same. After required improvement next step was to carry out the SPC study again for the critical dimension and check whether the process was under control or not. Different SPC tools such as histogram, pareto chart, control charts, cause and effect diagram, process capability studies were used. Aim of the study was to improve the process
capability and to reduce the rejection rate.

**[4] Prof. Viraj V Atre**, "Process Capability Analysis in Single and Multiple Batch Manufacturing Systems"[11].

The method adopted by the man working on a certain machine, with a certain material is bound to some variation as different men will have different styles / methods of working. Speed, Accuracy, Precision, Linearity, Bias, Skills are the attributes which cause variations from men to men working on the same machines, same materials, same methodology. It is said that two men cannot work identically same, even if they fall in the super skilled category. However, by imparting proper training, and adopting a standard operating procedure (SOP) or Work instructional procedure (WI) these types of variations can be surely reduced.

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**Process Capability**: A process has to go through three stages to make it a capable process in both the long and short run:

**1.** Process should be in Control

**2.** Process should be Stable

**3.** Process should be capable of producing the same results in short term and long term.

**4.** Process should be centered on the mean.

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# Chapter 3

# WORK DONE

# WORK DONE

## 3.1WORK FLOW

In this case study, process capability analysis wascarried out in an sheet metal pressed or machining components manufacturing company to determine the varianceincluded in the critical dimensions of various parts inproduction. The entire production line was firstreviewed to understand the position and importance ofeach operation involved in the manufacturing process capability indices for the current process havebeen estimated to decide the current extent of theprocess. Various SPC tools have been used foranalyzing the data and process improvement.

Collecteddata included, rejection data forperiods, measurements of different dimensions ofdifferent parts for the first 50 parts build on themachine for starting the mass production run bycollecting the data and then performing the beginningSPC study for various dimensions of various parts and then calculating the capability indices and plottingother control charts for the studied dimensions anddetermining the current performance of the process assuch the process capability indices are up to thenecessary level or not and if they aren't up to the required level then finding the root cause which is causing the variation and thus stating why the current process is not able to meet the required levels and once the assignable root is known, finding ways to improve it and implementing the improvements and then again doing the SPC study after improvement to know whether the performance of process is stable or not and if it fulfills requirement maintaining it and if not then repeating the same procedure.

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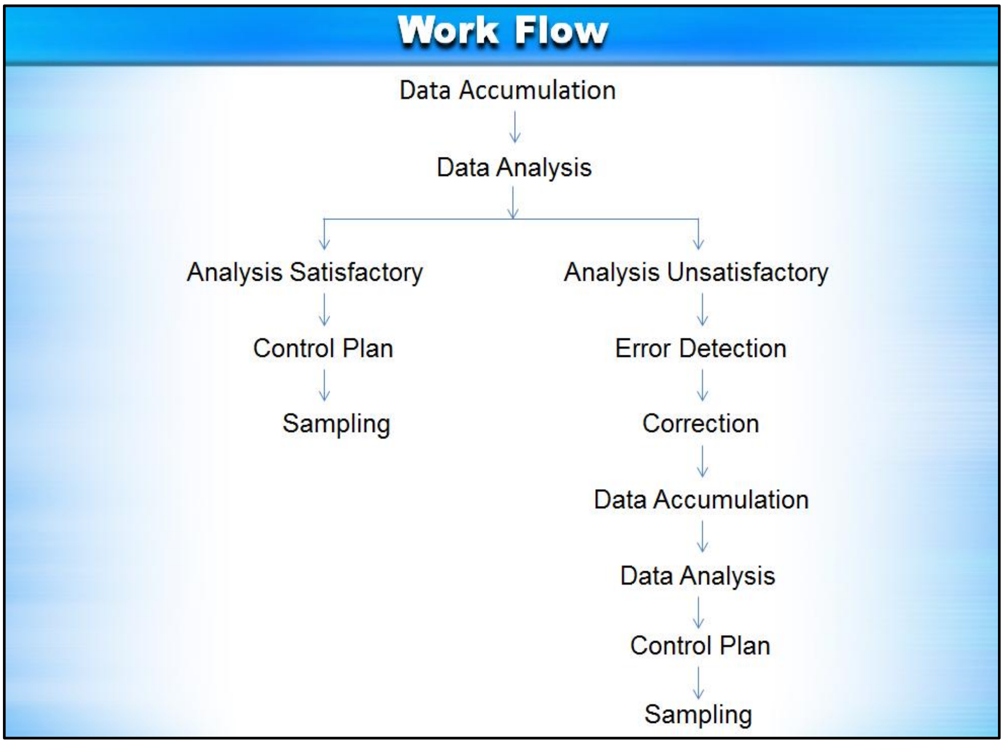


Figure 9: Work Flow

## 3.2 <u>DATA COLLECTION</u>

**Data Accumulation of 28 Parts of Airbus A320 for Statistical Process Control**

This includes dimensions of all features/characteristics of parts like length, thickness, height, radius, angle etc. 50 observations are taken for each feature of the part.

We collected the past data for this part from the quality control department to know the dimensions which are having major problems and accounting to rejections and from the past data.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TAL | Aerospace Quality Management System | | | | | Format No. : | QAD-AQM-F113-R03 Dt. 15/10/2018 |
| DEPARTMENT: | QUALITY ASSURANCE DEPARTMENT | | | | | QAP No./IMS No. : | |
| TITLE: | First Piece Inspection Report | | | | | Date: | |
| Customer: | RUAG | Project: | A320 Sec-15 Sub Assembly | TAL Part No.: | 100-01007001###### | Work Order: | |
| Part Description: | LINK SUPPORT/ PENDELSTUETZE | Customer Part No.: | D53371079202008 | Drawing No.: | 15 D53371079 | Op. No.: | |
| | | Customer Part Rev.: | D | Drawing Rev.: | D | RM Batch No.: | |

Measuring instrument used :

| Sr. | Name / Type |
|---|---|
| 1 | CMM |
| 2 | Digital Micrometer |
| 3 | Profile Projector |
| 4 | Digital Vernier |
| 5 | Surafce Roughness Tester |
| 6 | 3-Leg Micrometer |

| Sr. No./ Ballooning no./BID# | KC/CC | Feature/Characteristic Description | Acceptance Criteria LSL | Acceptance Criteria USL | Instrument Used | 1000421919 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4.1 | * | Thickness (6.0) | ═ 0.2 A | | Digital Micrometer | 6.05 | 5.926 | 6 | 5.968 | 6.049 | 5.97 | 6.079 | 5.97 |
| 4.2 | * | Thickness (6.0) | 5.90 | 6.10 | Digital Micrometer | 6.019 | 5.98 | 5.941 | 6.011 | 5.925 | 5.9979 | 5.98 | 5.998 |
| 5.1 | KC* | Radius (6.0) | 5.50 | 6.50 | Profile Projector | 6.084 | 5.996 | 6.049 | 5.991 | 6.047 | 5.94 | 5.87 | 6.01 |
| 5.2 | KC* | Radius (6.0) | 5.50 | 6.50 | Profile Projector | 6.311 | 6.2 | 6.05 | 6.009 | 6.011 | 6.097 | 6.184 | 5.949 |
| 6.1 | - | Intersection Distance (52.0) | 51.70 | 52.30 | Profile Projector | 51.901 | 51.934 | 51.98 | 51.97 | 51.997 | 51.944 | 51.901 | 51.94 |
| 6.2 | - | Intersection Distance (52.0) | 51.70 | 52.30 | Profile Projector | 51.995 | 52.065 | 51.98 | 51.97 | 51.97 | 51.917 | 51.89 | 51.991 |
| 7 | * | Distance (49.0) | 48.70 | 49.30 | Digital Vernier | 48.95 | 48.98 | 48.9 | 48.96 | 48.96 | 48.94 | 48.92 | 48.98 |

FPIR-OP. NO 15 | FPIR-OP. NO 45 | FPIR-OP. NO 175 | IPIR-OP. NO 15 | IPIR-OP. NO 45 | IPIR-OP. NO 175 | Sheet1 | Sheet2

Ready 42 of 50 records found 83%

| | A | B | C / D | E | F | G / H | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 7 | * | Distance (49.0) | 48.70 | 49.30 | Digital Vernier | 48.95 | 48.98 | 48.9 | 48.96 | 48.96 | 48.94 | 48.92 | 48.98 |
| 29 | 9.1 | - | Intersection Distance (25.0) | 24.80 | 25.20 | Profile Projector | 25.17 | 25.097 | 24.901 | 25.009 | 24.89 | 24.94 | 25.049 | 25.11 |
| 30 | 9.2 | - | Intersection Distance (25.0) | 24.80 | 25.20 | Profile Projector | 24.937 | 24.895 | 24.997 | 24.907 | 25.04 | 25.09 | 24.894 | 24.943 |
| 31 | 10 | KC* | Width (29.0) | 28.80 | 29.20 | Digital Vernier | 29.19 | 29.15 | 29.12 | 29.14 | 29.12 | 29.14 | 29.14 | 29.18 |
| 32 | 11.1 | - | Chamfer Length (0.5) | 0.3 | 0.7 | Profile Projector with Mould | 0.54 | 0.559 | 0.53 | 0.569 | 0.529 | 0.521 | 0.543 | 0.539 |
| 33 | 11.2 | - | Chamfer Angle (45°) | 44°0' | 46°0' | Profile Projector with Mould | 44°53' | 44°58' | 44°49' | 45°01' | 44°51' | 44°45' | 45°19' | 45°12' |
| 34 | 11.3 | - | Chamfer Length (0.5) | 0.3 | 0.7 | Profile Projector with Mould | 0.53 | 0.55 | 0.549 | 0.561 | 0.529 | 0.521 | 0.492 | 0.508 |
| 35 | 11.4 | - | Chamfer Angle (45°) | 44°0' | 46°0' | Profile Projector with Mould | 44°53' | 44°58' | 44°51' | 44°30' | 44°30' | 44°45' | 45°19' | 45°12' |
| 36 | 12 | * | Surface Roughness (1.6Ra) | Max. 1.6µm | | Check by surface roughness tester all around | <1.6 | <1.6 | <1.6 | <1.6 | | | | |
| 37 | 13.1 | - | Radius (6.0) | 5.50 | 6.50 | Profile Projector | 5.846 | 5.875 | 5.894 | 5.984 | 6.079 | 6.184 | 6.194 | 6.189 |
| 38 | 13.2 | - | Radius (6.0) | 5.50 | 6.50 | Profile Projector | 5.838 | 6.188 | 6.094 | 5.998 | 5.94 | 5.89 | 5.984 | 5.84 |
| 39 | 14 | KC* | Inner Diameter (16.5) | 16.30 | 16.70 | Digital Vernier | 16.44 | 16.45 | 16.44 | 16.44 | 16.42 | 16.44 | 16.41 | 16.43 |
| 40 | 15.1 | - | Chamfer Length (0.5) | 0.3 | 0.7 | Profile Projector with Mould | 0.501 | 0.509 | 0.509 | 0.512 | 0.487 | 0.497 | 0.513 | 0.47 |
| 41 | 15.2 | - | Chamfer Angle (45°) | 44°0' | 46°0' | Profile Projector with Mould | 45°01' | 44°54' | 45°20' | 45°12' | 44°40' | 44°50' | 44°10' | 44°17' |
| 42 | 15.3 | - | Chamfer Length (0.5) | 0.3 | 0.7 | Profile Projector with Mould | 0.519 | 0.525 | 0.517 | 0.481 | 0.509 | 0.501 | 0.479 | 0.489 |
| 43 | 15.4 | - | Chamfer Angle (45°) | 44°0' | 46°0' | Profile Projector with Mould | 44°51' | 44°52' | 44°31' | 44°21' | 45°20' | 45°10' | 44°30' | 44°49' |
| 44 | 15.5 | - | Chamfer Length (0.5) | 0.3 | 0.7 | Profile Projector with Mould | 0.48 | 0.501 | 0.479 | 0.491 | 0.47 | 0.489 | 0.501 | 0.419 |
| 45 | 15.6 | - | Chamfer Angle (45°) | 44°0' | 46°0' | Profile Projector with Mould | 44°51' | 44°54' | 44°10' | 44°29' | 44°10' | 44°39' | 44°30' | 44°51' |

FPIR-OP. NO 15 | FPIR-OP. NO 45 | FPIR-OP. NO 175 | IPIR-OP. NO 15 | IPIR-OP. NO 45 | IPIR-OP. NO 175 | Sheet1 | Sheet2

Figure 10: Work Order

| 1 | Sr. No. | Internal | Part No. | Part Family | WO Qty. | Inspection Time/Part (Min) | Fixture | Inspection Methodology | Total Characteristics | KC Charact. | Readings Available |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 9 | RG-094 | 100-00094######### | Medium Bed | 1 | 25 | Individual | CMM + Manual | 154 | 59 | 7 |
| 3 | 10 | RG-095 | 100-00095######### | Medium Bed | 1 | 25 | Individual | CMM + Manual | 154 | 59 | 29 |
| 4 | 11 | RG-096B | 100-00096B######## | Medium Bed | 1 | 25 | Individual | CMM + Manual | 181 | 56 | 12 |
| 5 | 12 | RG-097B | 100-00097B######## | Medium Bed | 1 | 25 | Individual | CMM + Manual | 181 | 56 | 5 |
| 6 | 20 | RG-105 | 100-00105######### | Small Bed | 5 | 6 | Individual | CMM + Manual | 96 | 12 | 5 |
| 7 | 35 | RG-136 | 100-00136######### | Small Bed | 8 | 10 | Individual | CMM + Manual | 133 | 24 | 8 |
| 8 | 41 | RG-142 | 100-00142######### | Long Bed | 1 | 25 | Bavius-142 | CMM + Manual | 216 | 67 | 5 |
| 9 | 42 | RG-143 | 100-00143######### | Long Bed | 1 | 25 | Bavius-142 | CMM + Manual | 216 | 67 | 3 |
| 10 | 45 | RG-146A | 100-00146A######## | Long Bed | 1 | 25 | MAZAK-146A | CMM + Manual | 220 | 26 | 34 |
| 11 | 46 | RG-147A | 100-00147A######## | Long Bed | 1 | 25 | MAZAK-146A | CMM + Manual | 220 | 26 | 29 |
| 12 | 47 | RG-148 | 100-00148######### | Long Bed | 1 | 25 | MAZAK-148 | CMM + Manual | 199 | 7 | 6 |
| 13 | 87 | RG-540 | 100-00540######### | Medium Bed | 1 | 25 | Individual | CMM + Manual | 131 | 68 | 24 |
| 14 | 88 | RG-541 | 100-00541######### | Medium Bed | 1 | 25 | Individual | CMM + Manual | 131 | 68 | 16 |
| 15 | 90 | RG-543B | 100-00543B######## | Medium Bed | 1 | 25 | Individual | CMM + Manual | 181 | 67 | 5 |
| 16 | 99 | RG-552 | 100-00552######### | Long Bed | 1 | 25 | Huron-552 | CMM + Manual | 229 | 67 | 1 |
| 17 | 103 | RG-556A | 100-00556A######## | Long Bed | 1 | 25 | MAZAK-146A | CMM + Manual | 219 | 2 | 50 |
| 18 | 104 | RG-557A | 100-00557A######## | Long Bed | 1 | 25 | MAZAK-146A | CMM + Manual | 219 | 2 | 1 |
| 19 | 105 | RG-558 | 100-00558######### | Long Bed | 1 | 25 | MAZAK-148 | CMM + Manual | 226 | 0 | 1 |
| 20 | 106 | RG-559 | 100-00559######### | Long Bed | 1 | 25 | MAZAK-148 | CMM + Manual | 226 | 0 | 1 |
| 21 | 118 | 1C1 | 100-01004001###### | Bracket | 26 | 1 | Individual | Manual | 89 | 3 | 24 |
| 22 | 119 | 2C1 | 100-01005001###### | Bracket | 12 | 1 | Lang | Manual | 70 | 5 | 12 |
| 23 | 122 | 5C1 | 100-01007001###### | Bracket | 12 | 1 | Individual | CMM + Manual | 46 | 7 | 48 |
| 24 | 123 | 6C1 | 100-01008001###### | Bracket | 12 | 1 | Lang | Manual | 84 | 5 | 12 |
| 25 | 125 | 8A | 100-01003000###### | Bracket | 26 | 1 | Individual | Manual | 56 | 4 | 12 |
| 26 | 127 | 10A | 100-01011000###### | Bracket | 26 | 1 | Individual | Manual | 77 | 4 | 84 |
| 27 | 132 | 15C1 | 100-01000006###### | Extrusion | 12 | 1 | 4+1 Individual | CMM + Manual | 36 | 8 | 12 |
| 28 | 134 | 19C1 | 100-01001001###### | Bracket | 30 | 0.5 | Routing | Manual | 18 | 1 | 10 |

Figure 11: Data Accumulated

| | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | KC/CC | Feature/Characteristic Description | LSL | USL | Instrument Used | 1000421919 | | | | | | | | | | | |
| 2 | • | Thickness (6.0) | 5.9 | 6.1 | Digital Micrometer | 6.05 | 5.926 | 6 | 5.968 | 6.049 | 5.97 | 6.079 | 5.97 | 5.991 | 5.99 | 6.019 | 6.018 |
| 3 | • | Thickness (6.0) | 5.9 | 6.1 | Digital Micrometer | 6.019 | 5.98 | 5.941 | 6.011 | 5.925 | 5.998 | 5.98 | 5.998 | 5.922 | 5.97 | 5.967 | 5.951 |
| 4 | KC* | Radius (6.0) | 5.5 | 6.5 | Profile Projector | 6.084 | 5.996 | 6.049 | 5.991 | 6.047 | 5.94 | 5.87 | 6.01 | 6.057 | 5.91 | 5.898 | 5.971 |
| 5 | KC* | Radius (6.0) | 5.5 | 6.5 | Profile Projector | 6.311 | 6.2 | 6.05 | 6.009 | 6.011 | 6.097 | 6.184 | 5.949 | 6.109 | 6.041 | 5.899 | 5.989 |
| 6 | - | Intersection Distance (52.0) | 51.7 | 52.3 | Profile Projector | 51.9 | 51.93 | 51.98 | 51.97 | 52 | 51.94 | 51.9 | 51.94 | 51.98 | 52 | 51.97 | 51.99 |
| 7 | - | Intersection Distance (52.0) | 51.7 | 52.3 | Profile Projector | 52 | 52.07 | 51.98 | 51.97 | 51.97 | 51.92 | 51.89 | 51.99 | 51.93 | 52.05 | 51.94 | 51.64 |
| 8 | • | Distance (49.0) | 48.7 | 49.3 | Digital Vernier | 48.95 | 48.98 | 48.9 | 48.96 | 48.96 | 48.94 | 48.92 | 48.98 | 48.97 | 48.96 | 48.98 | 48.94 |
| 9 | - | Intersection Distance (25.0) | 24.8 | 25.2 | Profile Projector | 25.17 | 25.1 | 24.9 | 25.01 | 24.89 | 24.94 | 25.05 | 25.11 | 25.19 | 25.11 | 24.9 | 24.91 |
| 10 | - | Intersection Distance (25.0) | 24.8 | 25.2 | Profile Projector | 24.94 | 24.9 | 25 | 24.91 | 25.04 | 25.09 | 24.89 | 24.94 | 24.88 | 24.98 | 24.97 | 24.94 |
| 11 | KC* | Width (29.0) | 28.8 | 29.2 | Digital Vernier | 29.19 | 29.15 | 29.12 | 29.14 | 29.12 | 29.14 | 29.14 | 29.18 | 29.14 | 24.2 | 29.1 | 29.18 |
| 12 | - | Chamfer Length (0.5) | 0.3 | 0.7 | Profile Projector with Mould | 0.54 | 0.559 | 0.53 | 0.569 | 0.529 | 0.521 | 0.543 | 0.539 | 0.549 | 0.551 | 0.541 | 0.549 |
| 13 | - | Chamfer Length (0.5) | 0.3 | 0.7 | Profile Projector with Mould | 0.53 | 0.55 | 0.549 | 0.561 | 0.529 | 0.521 | 0.492 | 0.508 | 0.57 | 0.551 | 0.541 | 0.531 |
| 14 | - | Radius (6.0) | 5.5 | 6.5 | Profile Projector | 5.846 | 5.875 | 5.894 | 5.984 | 6.079 | 6.184 | 6.194 | 6.189 | 6.072 | 5.89 | 6.12 | 5.94 |
| 15 | - | Radius (6.0) | 5.5 | 6.5 | Profile Projector | 5.838 | 6.188 | 6.094 | 5.998 | 5.94 | 5.89 | 5.984 | 5.84 | 6.053 | 0.553 | 5.94 | 5.969 |
| 16 | KC* | Inner Diameter (16.5) | 16.3 | 16.7 | Digital Vernier | 16.44 | 16.45 | 16.44 | 16.44 | 16.42 | 16.44 | 16.41 | 16.43 | 16.41 | 16.45 | 16.45 | 16.43 |
| 17 | - | Chamfer Length (0.5) | 0.3 | 0.7 | Profile Projector with Mould | 0.501 | 0.509 | 0.509 | 0.512 | 0.487 | 0.497 | 0.513 | 0.47 | 0.501 | 0.459 | 0.499 | 0.519 |
| 18 | - | Chamfer Length (0.5) | 0.3 | 0.7 | Profile Projector with Mould | 0.519 | 0.525 | 0.517 | 0.481 | 0.509 | 0.501 | 0.479 | 0.489 | 0.549 | 0.489 | 0.54 | 0.47 |
| 19 | - | Chamfer Length (0.5) | 0.3 | 0.7 | Profile Projector with Mould | 0.48 | 0.501 | 0.479 | 0.491 | 0.47 | 0.489 | 0.501 | 0.419 | 0.496 | 0.459 | 0.498 | 0.488 |
| 20 | - | Chamfer Length (0.5) | 0.3 | 0.7 | Profile Projector with Mould | 0.48 | 0.501 | 0.519 | 0.515 | 0.57 | 0.521 | 0.559 | 0.49 | 0.496 | 0.499 | 0.524 | 0.541 |
| 21 | • | Width (36.0) | 36 | 36.3 | Digital Vernier | 36.18 | 36.15 | 36.15 | 36.14 | 36.1 | 36.18 | 36.12 | 36.14 | 36.12 | 36.18 | 36.2 | 36.16 |
| 22 | • | Distance (20.0) | 19.8 | 20.2 | Digital Vernier | 20.14 | 20.19 | 20.15 | 20.12 | 20.15 | 20.18 | 20.18 | 20.2 | 20.09 | 20.16 | 20.19 | 20.13 |
| 23 | - | Radius (10.0) | 9 | 11 | Profile Projector | 10.01 | 10.04 | 10.04 | 10.07 | 10.07 | 10.02 | 10.08 | 10.09 | 10 | 10.06 | 10.1 | 10.05 |
| 24 | - | Radius (10.0) | 9 | 11 | Profile Projector | 10.01 | 10.01 | 10.01 | 10.05 | 10.1 | 10.08 | 10.14 | 10.09 | 10.02 | 9.91 | 10.06 | 10.02 |
| 25 | - | Radius (10.0) | 9 | 11 | Profile Projector | 10.49 | 10.01 | 10.06 | 10.04 | 10.05 | 10.04 | 10.11 | 9.98 | 10 | 9.998 | 1.029 | 10.03 |

| | S | T | U | V | W | X | Y | Z | AA | AB | AC | AD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1000422273 | | | | | | | | | | | |
| 2 | 5.946 | 5.986 | 5.974 | 5.946 | 5.976 | 6.049 | 5.941 | 5.961 | 6.041 | 5.957 | 5.964 | 5.996 |
| 3 | 6.039 | 5.976 | 6.054 | 6.036 | 5.98 | 5.976 | 5.941 | 4.976 | 5.964 | 5.951 | 6.041 | 6.036 |
| 4 | 6.12 | 5.961 | 6.071 | 5.961 | 5.871 | 5.77 | 6.121 | 6.041 | 5.981 | 5.961 | 5.98 | 5.876 |
| 5 | 5.947 | 6.086 | 6.12 | 5.761 | 5.786 | 5.841 | 5.871 | 6.041 | 6.12 | 6.041 | 6.121 | 6.101 |
| 6 | 51.78 | 51.75 | 51.85 | 51.77 | 51.79 | 51.74 | 51.89 | 51.8 | 51.79 | 51.97 | 51.76 | 51.8 |
| 7 | 51.89 | 51.85 | 51.79 | 51.89 | 51.84 | 51.88 | 51.88 | 51.9 | 51.88 | 51.89 | 51.85 | 51.9 |
| 8 | 48.94 | 49.09 | 49.07 | 48.92 | 48.95 | 49.09 | 48.94 | 49.09 | 49.1 | 48.85 | 48.99 | 48.91 |
| 9 | 24.94 | 25.04 | 25.04 | 24.94 | 25.05 | 25.03 | 24.94 | 25.04 | 25.08 | 24.97 | 24.94 | 25.04 |
| 10 | 24.89 | 24.97 | 25.05 | 24.98 | 24.93 | 24.94 | 25.05 | 24.94 | 24.89 | 25.04 | 25.03 | 24.36 |
| 11 | 29.14 | 29.18 | 29.13 | 29.14 | 29.18 | 29.15 | 29.12 | 29.17 | 29.16 | 29.16 | 29.18 | 29.15 |
| 12 | 0.479 | 0.541 | 0.534 | 0.491 | 0.536 | 0.546 | 0.489 | 0.541 | 0.514 | 0.491 | 0.501 | 0.541 |
| 13 | 0.53 | 0.514 | 0.494 | 0.509 | 0.497 | 0.494 | 0.521 | 0.536 | 0.489 | 0.514 | 0.521 | 0.491 |
| 14 | 5.891 | 5.961 | 6.091 | 5.961 | 6.039 | 5.896 | 5.891 | 5.976 | 6.049 | 6.121 | 6.049 | 5.981 |
| 15 | 6.126 | 6.049 | 5.976 | 6.029 | 5.876 | 5.967 | 6.047 | 6.038 | 6.049 | 5.791 | 5.896 | 5.975 |
| 16 | 16.43 | 16.48 | 16.42 | 16.4 | 16.49 | 16.44 | 16.43 | 16.48 | 16.52 | 16.39 | 16.44 | 16.48 |
| 17 | 0.496 | 0.509 | 0.524 | 0.496 | 0.54 | 0.529 | 0.491 | 0.512 | 0.534 | 0.486 | 0.541 | 0.489 |
| 18 | 0.504 | 0.486 | 0.489 | 0.476 | 0.48 | 0.517 | 0.544 | 0.536 | 0.509 | 0.491 | 0.536 | 0.509 |
| 19 | 0.479 | 0.496 | 0.504 | 0.521 | 0.508 | 0.479 | 0.494 | 0.489 | 0.53 | 0.541 | 0.512 | 0.539 |
| 20 | 0.514 | 0.536 | 0.496 | 0.484 | 0.496 | 0.54 | 0.516 | 0.496 | 0.499 | 0.489 | 0.511 | 0.519 |
| 21 | 36.04 | 36.02 | 36.08 | 36.04 | 36.08 | 36.04 | 36.04 | 36.09 | 36.05 | 36.02 | 36.04 | 36.08 |
| 22 | 19.96 | 20.04 | 19.94 | 19.94 | 20.08 | 20.02 | 19.94 | 20.04 | 20.04 | 19.94 | 20.04 | 20.08 |
| 23 | 9.896 | 10.12 | 10.05 | 9.941 | 9.891 | 10.08 | 9.961 | 10.04 | 10.13 | 19.89 | 9.981 | 10.03 |
| 24 | 9.946 | 10.05 | 10.36 | 9.891 | 10.24 | 10.05 | 10.08 | 10.09 | 9.946 | 10.04 | 9.981 | 10.03 |
| 25 | 9.891 | 9.946 | 9.991 | 9.946 | 10.05 | 10.06 | 9.876 | 9.899 | 9.996 | 10.05 | 10.12 | 10.24 |

| | AE | AF | AG | AH | AI | AJ | AK | AL | AM | AN | AO | AP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1000434429 | | | | | | | | | | | |
| 2 | 5.981 | 6.041 | 5.96 | 5.986 | 5.987 | 6.034 | 6.041 | 5.971 | 5.98 | 5.986 | 5.97 | 6.034 |
| 3 | 5.971 | 6.051 | 5.6 | 5.996 | 6.009 | 6.054 | 6.051 | 6.041 | 6.009 | 6.041 | 6.039 | 6.054 |
| 4 | 6.041 | 6.121 | 6.04 | 5.891 | 6.036 | 5.891 | 6.121 | 6.04 | 6.036 | 5.951 | 5.961 | 5.891 |
| 5 | 6.032 | 5.871 | 5.99 | 5.941 | 5.95 | 5.941 | 5.871 | 5.956 | 5.95 | 6.036 | 6.051 | 5.941 |
| 6 | 51.78 | 51.79 | 51.8 | 51.79 | 51.89 | 51.84 | 51.79 | 51.79 | 51.89 | 51.78 | 51.77 | 51.84 |
| 7 | 51.78 | 51.79 | 51.8 | 51.88 | 51.8 | 51.89 | 51.79 | 51.89 | 51.8 | 51.78 | 51.85 | 51.89 |
| 8 | 49.09 | 48.92 | 51.9 | 48.92 | 49.1 | 48.94 | 48.92 | 48.94 | 49.1 | 51.89 | 51.85 | 48.94 |
| 9 | 25.04 | 24.98 | 48.9 | 24.94 | 25.04 | 25.04 | 24.98 | 24.95 | 25.04 | 49.06 | 49.1 | 25.04 |
| 10 | 24.94 | 25.1 | 24.1 | 25.02 | 25.14 | 25.09 | 25.1 | 25.04 | 25.14 | 25.09 | 25.1 | 25.09 |
| 11 | 29.14 | 29.18 | 24.9 | 29.17 | 29.12 | 29.15 | 29.18 | 29.15 | 29.12 | 25.08 | 25.1 | 29.15 |
| 12 | 0.49 | 0.476 | 0.48 | 0..479 | 0.521 | 0.501 | 0.476 | 0.493 | 0.521 | 0.512 | 0.542 | 0.501 |
| 13 | 0.47 | 0.491 | 0.51 | 0.479 | 0.521 | 0.512 | 0.491 | 0.496 | 0.521 | 0.526 | 0.542 | 0.512 |
| 14 | 5.981 | 6.031 | 5.89 | 5.891 | 6.076 | 6.046 | 6.031 | 4.961 | 6.076 | 5.941 | 6.046 | 6.046 |
| 15 | 5.941 | 5.98 | 6.03 | 6.121 | 5.971 | 6.044 | 5.98 | 6.091 | 5.971 | 6.029 | 5.941 | 6.044 |
| 16 | 16.44 | 16.48 | 16.4 | 16.4 | 16.48 | 16.4 | 16.48 | 16.44 | 16.48 | 16.48 | 16.49 | 16.4 |
| 17 | 0.391 | 0.486 | 0.48 | 0.412 | 0.541 | 0.546 | 0.486 | 0.486 | 0.541 | 0.464 | 0.541 | 0.546 |
| 18 | 0.548 | 0.588 | 0.53 | 0.549 | 0.486 | 0.541 | 0.588 | 0.391 | 0.486 | 0.526 | 0.489 | 0.541 |
| 19 | 0.391 | 0.486 | 0.52 | 0.481 | 0.52 | 0.501 | 0.486 | 0.478 | 0.52 | 0.496 | 0.489 | 0.501 |
| 20 | 0.514 | 0.526 | 0.48 | 0.487 | 0.554 | 0.546 | 0.526 | 0.54 | 0.554 | 0.486 | 0.541 | 0.546 |
| 21 | 36.04 | 36.08 | 36 | 36.05 | 6.02 | 36.02 | 36.08 | 36.06 | 6.02 | 36.06 | 36.02 | 36.02 |
| 22 | 19.91 | 19.94 | 20 | 19.97 | 20.06 | 20.08 | 19.94 | 20.04 | 20.06 | 20.04 | 20.08 | 20.08 |
| 23 | 9.941 | 10.04 | 9.98 | 9.986 | 9.941 | 10.06 | 10.04 | 10.06 | 9.941 | 10.41 | 10.25 | 10.06 |
| 24 | 9.986 | 9.991 | 9.89 | 10.25 | 10.04 | 10.04 | 9.991 | 10.04 | 10.04 | 10.05 | 10.04 | 10.04 |
| 25 | 10.04 | 10.24 | 9.98 | 9.991 | 10.41 | 10.12 | 10.24 | 10.12 | 10.41 | 10.03 | 10.05 | 10.12 |

| | AQ | AR | AS | AT | AU | AV | AW | AX | AY | AZ | BA | BB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1000420865 | | | | | | | | | | | |
| 2 | 6.05 | 5.926 | 6 | 5.968 | 6.049 | 5.97 | 6.079 | 5.97 | 5.99 | 6.019 | 6.018 | 5.991 |
| 3 | 6.019 | 5.98 | 5.941 | 6.011 | 5.925 | 5.998 | 5.98 | 5.998 | 5.97 | 5.967 | 5.951 | 5.922 |
| 4 | 6.084 | 5.996 | 6.049 | 5.991 | 6.047 | 5.94 | 5.87 | 6.01 | 5.91 | 5.898 | 5.971 | 6.057 |
| 5 | 6.311 | 6.2 | 6.05 | 6.009 | 6.011 | 6.097 | 6.184 | 5.949 | 6.041 | 5.899 | 5.989 | 6.109 |
| 6 | 51.9 | 51.93 | 51.98 | 51.97 | 52 | 51.94 | 51.9 | 51.94 | 52 | 51.97 | 51.99 | 51.98 |
| 7 | 52 | 52.07 | 51.98 | 51.97 | 51.97 | 51.92 | 51.89 | 51.99 | 52.05 | 51.94 | 51.64 | 51.93 |
| 8 | 48.95 | 48.98 | 48.9 | 48.96 | 48.96 | 48.94 | 48.92 | 48.98 | 48.96 | 48.98 | 48.94 | 48.97 |
| 9 | 25.17 | 25.1 | 24.9 | 25.01 | 24.89 | 24.94 | 25.05 | 25.11 | 25.11 | 24.9 | 24.91 | 25.19 |
| 10 | 24.94 | 24.9 | 25 | 24.91 | 25.04 | 25.09 | 24.89 | 24.94 | 24.98 | 24.97 | 24.94 | 24.88 |
| 11 | 29.19 | 29.15 | 29.12 | 29.14 | 29.12 | 29.14 | 29.14 | 29.18 | 24.2 | 29.1 | 29.18 | 29.14 |
| 12 | 0.54 | 0.559 | 0.53 | 0.569 | 0.529 | 0.521 | 0.543 | 0.539 | 0.551 | 0.541 | 0.549 | 0.549 |
| 13 | 0.53 | 0.55 | 0.549 | 0.561 | 0.529 | 0.521 | 0.492 | 0.508 | 0.551 | 0.541 | 0.531 | 0.57 |
| 14 | 5.846 | 5.875 | 5.894 | 5.984 | 6.079 | 6.184 | 6.194 | 6.189 | 5.89 | 6.12 | 5.94 | 6.072 |
| 15 | 5.838 | 6.188 | 6.094 | 5.998 | 5.94 | 5.89 | 5.984 | 5.84 | 0.553 | 5.94 | 5.969 | 6.053 |
| 16 | 16.44 | 16.45 | 16.44 | 16.44 | 16.42 | 16.44 | 16.41 | 16.43 | 16.45 | 16.45 | 16.43 | 16.41 |
| 17 | 0.501 | 0.509 | 0.509 | 0.512 | 0.487 | 0.497 | 0.513 | 0.47 | 0.459 | 0.499 | 0.519 | 0.501 |
| 18 | 0.519 | 0.525 | 0.517 | 0.481 | 0.509 | 0.501 | 0.479 | 0.489 | 0.489 | 0.54 | 0.47 | 0.549 |
| 19 | 0.48 | 0.501 | 0.479 | 0.491 | 0.47 | 0.489 | 0.501 | 0.419 | 0.459 | 0.498 | 0.488 | 0.496 |
| 20 | 0.48 | 0.501 | 0.519 | 0.515 | 0.57 | 0.521 | 0.559 | 0.49 | 0.499 | 0.524 | 0.541 | 0.496 |
| 21 | 36.06 | 36.02 | 36.06 | 36.02 | 36.06 | 36.02 | 36.06 | 36.02 | 36.06 | 36.02 | 36.06 | 36.02 |
| 22 | 20.04 | 20.08 | 20.04 | 20.08 | 20.04 | 20.08 | 20.04 | 20.08 | 20.04 | 20.08 | 20.04 | 20.08 |
| 23 | 10.41 | 10.06 | 10.41 | 10.06 | 10.41 | 10.06 | 10.41 | 10.06 | 10.41 | 10.06 | 10.41 | 10.06 |
| 24 | 10.05 | 10.04 | 10.05 | 10.04 | 10.05 | 10.04 | 10.05 | 10.04 | 10.05 | 10.04 | 10.05 | 10.04 |
| 25 | 10.03 | 10.12 | 10.03 | 10.12 | 10.03 | 10.12 | 10.03 | 10.12 | 10.03 | 10.12 | 10.03 | 10.12 |

Figure 12: Data of 5C1

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z | AA | AB | AC | AD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | BID | KC/CC | Feature | LSL | USL | Instrument Used | | | | | | | | | | | | 1000419919 | | | | | | | | | | | | |
| 2 | 4 | - | Intersection Distance (67.0) | 66.20 | 67.80 | Profile Projector | 67.014 | 67.121 | 67.078 | 67.098 | 67.149 | 67.129 | 67.08 | 67.067 | 67.079 | 67.009 | 67.21 | 67.2 | 67.143 | 67.091 | 67.093 | 67.167 | 67.147 | 67.197 | 67.187 | 67.179 | 67.041 | 66.989 | 66.981 | 66.998 |
| 3 | 8 | - | Width (39.0) | 38.20 | 39.80 | Digital Vernier | 39.04 | 39.01 | 39.09 | 39.02 | 38.98 | 38.99 | 39.08 | 39.02 | 39.01 | 39.01 | 39.02 | 39.02 | 39.01 | 39.02 | 39.04 | 39.02 | 39.01 | 39.04 | 39.09 | 39.08 | 39.07 | 39 | 39.04 | 39 |
| 4 | 9 | - | Width (44.5) | 43.70 | 45.30 | Digital Vernier | 44.49 | 44.54 | 44.59 | 44.65 | 44.61 | 44.59 | 44.54 | 44.54 | 44.51 | 44.45 | 44.63 | 44.57 | 44.49 | 44.54 | 44.56 | 44.59 | 44.54 | 44.56 | 44.61 | 44.62 | 44.63 | 44.54 | 44.49 | 44.53 |
| 5 | 17 | - | Intersection Distance (75.4) | 74.60 | 76.20 | Profile Projector | 75.091 | 75.014 | 75.189 | 75.312 | 75.29 | 75.41 | 75.49 | 75.291 | 75.439 | 75.509 | 75.019 | 75.1 | 75.041 | 75.09 | 75.179 | 75.249 | 75.289 | 75.094 | 75.094 | 75.409 | 39.07 | 75.024 | 75.094 | 75.419 |
| 6 | 20 | - | Step Distance (133.5) | 133.00 | 134.00 | Digital Vernier | 133.49 | 133.63 | 133.54 | 133.64 | 133.51 | 133.61 | 133.5 | 133.69 | 133.52 | 133.46 | 133.51 | 133.6 | 133.49 | 133.54 | 133.61 | 133.61 | 133.54 | 133.64 | 133.69 | 133.79 | 133.49 | 133.5 | 133.54 | 133.64 |
| 7 | 21 | * | Thickness (2.0) | 1.80 | 2.20 | Digital Micrometer | 2.047 | 2.021 | 2.009 | 2.033 | 2.037 | 2.041 | 2.022 | 2.013 | 2.017 | 2.019 | 2.071 | 2.061 | 2.049 | 2.009 | 2.033 | 2.033 | 1.989 | 1.949 | 1.979 | 2.025 | 2.039 | 2.079 | 2.069 | 1.989 |
| 8 | 22 | * | Thickness (3.5) | 3.30 | 3.70 | Digital Micrometer | 3.47 | 3.496 | 3.467 | 3.513 | 3.517 | 3.539 | 3.437 | 3.473 | 3.483 | 3.491 | 3.492 | 3.498 | 3.419 | 3.494 | 3.473 | 3.473 | 3.483 | 3.484 | 3.494 | 3.498 | 3.449 | 3.494 | 3.51 | 3.549 |
| 9 | 23 | * | Thickness (5.0) | 4.80 | 5.20 | Digital Micrometer | 4.991 | 4.997 | 4.987 | 4.967 | 4.967 | 4.4976 | 5.001 | 5.029 | 5.013 | 5.021 | 5.028 | 4.957 | 5.019 | 4.984 | 4.979 | 4.979 | 4 .954 | 5.094 | 5.047 | 4.997 | 4.991 | 4.989 | 4.979 | 4.909 |
| 10 | 24 | * | Thickness (6.5) | 6.30 | 6.70 | Digital Micrometer | 6.467 | 6.481 | 6.487 | 6.497 | 6.498 | 6.491 | 6.501 | 6.515 | 6.525 | 6.519 | 6.529 | 6.549 | 6.479 | 6.489 | 6.54 | 6.56 | 6.47 | 6.398 | 6.458 | 6.51 | 6.519 | 6.498 | 6.498 | 6.479 |
| 11 | 25 | * | Thickness (8.0) | 7.80 | 8.20 | Digital Micrometer | 7.994 | 7.984 | 7.973 | 7.998 | 7.971 | 7.988 | 8.02 | 8.056 | 8.06 | 8.12 | 8.09 | 8.067 | 7.994 | 7.989 | 7.979 | 7.987 | 7.89 | 8.049 | 8.079 | 8.069 | 8.059 | 8.069 | 7.994 | 8.09 |
| 12 | 27 | * | Step Distance (6.7) | 6.60 | 6.80 | Height Gauge | 6.74 | 6.71 | 6.73 | 6.74 | 6.68 | 6.7 | 6.71 | 6.73 | 6.71 | 6.69 | 6.69 | 6.7 | 6.69 | 6.68 | 6.74 | 6.72 | 6.68 | 6.72 | 6.72 | 6.69 | 6.7 | 6.72 | 6.72 | 6.69 |
| 13 | 28 | * | Thickness (8.0) | 7.90 | 8.10 | Digital Micrometer | 7.94 | 8.048 | 8.017 | 7.987 | 8.012 | 8.011 | 7.943 | 7.974 | 7.974 | 8.12 | 8.079 | 8.019 | 7.984 | 8.049 | 8.074 | 8.081 | 8.024 | 8.041 | 8.051 | 7.981 | 7.974 | 7.973 | 8.032 | 8.034 |
| 14 | 30 | - | Distance (38.9) | 38.10 | 39.70 | Profile Projector | 38.974 | 38.89 | 38.89 | 39.041 | 39.049 | 39.115 | 39.21 | 38.917 | 38.959 | 39.019 | 39.073 | 38.92 | 38.994 | 38.979 | 38.849 | 38.91 | 39.094 | 38.94 | 38.914 | 39.014 | 39.14 | 39.39 | 38.974 | 38.966 |
| 15 | 31 | - | Distance (58.9) | 58.10 | 59.70 | Profile Projector | 58.949 | 58.874 | 58.829 | 58.912 | 58.879 | 58.789 | 59.09 | 59.085 | 59.079 | 58.873 | 58.813 | 59.01 | 58.973 | 58.967 | 59.094 | 59.029 | 58.967 | 59.086 | 58.91 | 58.89 | 58.794 | 58.984 | 58.81 | 58.74 |
| 16 | 32 | - | Distance (78.9) | 78.10 | 79.70 | Profile Projector | 78.741 | 78.91 | 78.949 | 78.819 | 78.817 | 78.891 | 78.79 | 78.99 | 78.991 | 78.943 | 78.907 | 78.94 | 78.949 | 78.95 | 79.069 | 79.079 | 79.084 | 79.019 | 78.941 | 78.941 | 78.814 | 78.849 | 78.809 | 78.798 |
| 17 | 33 | - | Distance (101.9) | 101.10 | 102.70 | Profile Projector | 101.97 | 102.1 | 102.09 | 102.08 | 101.97 | 102.08 | 101.9 | 101.89 | 101.91 | 101.98 | 101.98 | 102 | 101.84 | 101.89 | 101.79 | 101.65 | 101.79 | 101.89 | 102.1 | 101.95 | 101.95 | 102.02 | 102.09 | 101.98 |
| 18 | 34 | - | Distance (124.0) | 123.50 | 124.50 | Profile Projector | 124.01 | 123.99 | 124 | 124.1 | 123.89 | 123.79 | 123.8 | 124.04 | 124.01 | 123.93 | 124.03 | 123.9 | 123.79 | 123.94 | 123.91 | 123.98 | 123.78 | 123.85 | 124.05 | 124.09 | 123.91 | 123.78 | 123.65 | 123.97 |
| 19 | 38 | - | Radius (8.0) | 6.00 | 10.00 | Profile Projector | 8.319 | 8.21 | 8.199 | 8.098 | 8.041 | 8.019 | 7.983 | 7.973 | 8.013 | 8.037 | 8.093 | 7.993 | 7.984 | 8.121 | 8.017 | 8.043 | 8.037 | 7.91 | 7.943 | 7.901 | 7.941 | 7.963 | 8.34 | 8.249 |
| 20 | 39 | - | Angle (24°) | 23°10' | 24°50' | Profile Projector | 23°56' | 24°02' | 24°02' | 24°01' | 24°04' | 23°56' | 23°59' | 23°58' | 23°58' | 24°05' | 24°09' | 24°08' | 24°01' | 24°02' | 23°59' | 23°56' | 23°57' | 23°59' | 23°51' | 23°56' | 24°09' | 24°01' | 24°10' | 24°07' |
| 21 | 40 | - | Radius (19.0) | 17.00 | 21.00 | Profile Projector | 19.087 | 18.979 | 18.989 | 19.071 | 19.057 | 19.057 | 19.07 | 19.036 | 18.979 | 18.979 | 18.967 | 189.1 | 189.94 | 19.141 | 19.033 | 19.099 | 19.064 | 19.164 | 18.964 | 18.979 | 18.994 | 19.043 | 19.013 | 19.037 |
| 22 | 45 | - | Angle (38°) | 37°10' | 38°50' | Profile Projector | 38°10' | 38°02' | 38°09' | 38°01' | 37°59' | 37°56' | 30°00' | 38°02' | 38°02' | 37°51' | 38°02' | 38°03' | 38°01' | 38°02 | 37°59' | 38°10' | 38°09' | 38°04' | 38°09' | 38°09' | 38°09' | 38°04' | 38°01' | 38°02' |
| 23 | 46 | - | Radius (20.0) | 18.0 | 22.0 | Profile Projector | 20.23 | 20.29 | 19.97 | 20.73 | 20.096 | 20.017 | 20.01 | 20.019 | 20.079 | 20.065 | 20.139 | 19.99 | 19.989 | 20.201 | 20.21 | 20.109 | 20.22 | 20.39 | 20.39 | 20.124 | 20.069 | 20.013 | 20.111 | 20.089 |
| 24 | 47.1 | - | Chamfer Length (1.0) | 0.8 | 1.2 | Profile Projector with Mould | 1.009 | 0.998 | 0.949 | 0.979 | 0.979 | 0.978 | 0.948 | 0.979 | 0.959 | 0.968 | 0.979 | 0.967 | 0.949 | 0.949 | 0.947 | 1.01 | 1.019 | 0.989 | 0.993 | 0.941 | 0.898 | 0.873 | 0.929 | 1.009 |
| 25 | 47.2 | - | Chamfer Angle (45°) | 43°30' | 46°30' | Profile Projector with Mould | 45°01' | 44°59' | 44°49 | 44°56' | 45°09' | 44°25' | 44°35' | 44°37' | 45°27' | 44°51' | 45°49' | 45°02' | 45°01' | 45°02' | 44°56' | 44°43' | 44°53' | 44°57' | 44°58 | 45°02' | 45°29' | 44°29' | 44°51' | 44°59' |
| 26 | 48.1 | - | Chamfer Length (1.0) | 0.8 | 1.2 | Profile Projector with Mould | 0.941 | 1.067 | 1.041 | 0.978 | 0.984 | 0.989 | 0.915 | 0.925 | 0.92 | 0.959 | 0.967 | 0.979 | 0.843 | 0.894 | 0.909 | 0.904 | 0.973 | 0.891 | 0.973 | 0.983 | 0.993 | 1.043 | 1.094 | 0.879 |
| 27 | 48.2 | - | Chamfer Angle (45°) | 43°30' | 46°30' | Profile Projector with Mould | 44°15' | 44°75' | 44°53' | 44°53' | 44°53' | 44°51' | 44°63' | 44°01' | 45°05' | 44°44' | 44°57' | 44°47' | 44°51' | 44°45' | 44°49' | 44°51' | 44°53' | 45°02' | 45°19' | 44°43' | 45°17' | 45°15' | 44°37' | 44°57' |
| 28 | 52.1 | - | Non-Dimensional Radii (9.0) | 8.0 | 10.0 | Profile Projector | 9.047 | 8.941 | 8.971 | 8.971 | 8.89 | 8.894 | 8.91 | 8.917 | 9.067 | 9.117 | 9.163 | 9.064 | 8.979 | 8.981 | 8.997 | 8.941 | 8.893 | 9.043 | 9.079 | 8.901 | 8.943 | 9.127 | 9.073 | 9.067 |
| 29 | 52.2 | - | Non-Dimensional Radii (9.0) | 8.0 | 10.0 | Profile Projector | 8.8743 | 8.893 | 8.971 | 8.971 | 8.89 | 8.894 | 9.017 | 9.046 | 9.065 | 9.061 | 9.001 | 9.093 | 9.041 | 9.067 | 8.937 | 8.943 | 8.901 | 8.809 | 9.061 | 9.067 | 9.21 | 9.29 | 8.809 | 8.798 |
| 30 | 52.3 | - | Non-Dimensional Radii (8.0) | 7.0 | 8.0 | Profile Projector | 7.994 | 7.91 | 7.89 | 7.879 | 8.947 | 8.943 | 7.899 | 8.049 | 8.094 | 8.091 | 7.989 | 7.949 | 7.79 | 7.989 | 7.913 | 7.967 | 8.043 | 8.057 | 8.061 | 7.709 | 8.096 | 8.247 | 8.257 | 8.095 |
| 31 | 54.1 | - | Fillet Radii (4.0) | 3.5 | 4.5 | Profile Projector | 4.073 | 4.067 | 4.073 | 4.067 | 7.899 | 7.847 | 3.909 | 3.894 | 3.794 | 3.973 | 3.984 | 3.984 | 4.047 | 4.059 | 3.941 | 3.913 | 3.987 | 3.948 | 4.087 | 4.127 | 2.4.210 | 4.067 | 4.063 | 3.989 |
| 32 | 54.2 | - | Fillet Radii (4.0) | 3.5 | 4.5 | Profile Projector | 3.949 | 3.943 | 3.973 | 3.963 | 4.057 | 4.067 | 4.141 | 4.094 | 4.049 | 4.049 | 4.124 | 4.096 | 3.909 | 3.947 | 3.967 | 3.979 | 4.124 | 4.167 | 4.187 | 4.109 | 4.096 | 4.23 | 4.009 | 3.857 |
| 33 | 54.3 | - | Fillet Radii (4.0) | 3.5 | 4.5 | Profile Projector | 3.913 | 4.109 | 4.013 | 4.069 | 4.01 | 4.009 | 3.919 | 3.989 | 4.01 | 3.879 | 3.949 | 3.979 | 3.983 | 4.019 | 4.049 | 3.91 | 3.947 | 3.901 | 4.009 | 4.004 | 4.017 | 4.013 | 4.047 | 3.927 |
| 34 | 54.4 | - | Fillet Radii (4.0) | 3.5 | 4.5 | Profile Projector | 3.919 | 3.918 | 3.867 | 3.967 | 4.09 | 4.129 | 3.893 | 4.019 | 3.998 | 3.971 | 4.077 | 4.063 | 4.219 | 4.123 | 4.108 | 4.099 | 4.073 | 4.0963 | 4.053 | 3.907 | 3.873 | 3.837 | 3.837 | 3.987 |
| 35 | 54.5 | - | Fillet Radii (4.0) | 3.5 | 4.5 | Profile Projector | 3.994 | 3.947 | 3.778 | 3.791 | 4.067 | 3.912 | 4.061 | 4.011 | 3.971 | 4.013 | 3.977 | 3.966 | 3.973 | 4.047 | 4.057 | 4.037 | 4.054 | 4.036 | 3.989 | 3.786 | 3.939 | 4.017 | 3.917 | 2.48 |
| 36 | 54.6 | - | Fillet Radii (4.0) | 3.5 | 4.5 | Profile Projector | 3.991 | 3.967 | 3.891 | 3.878 | 4.07 | 3.929 | 4.011 | 3.919 | 4.012 | 4.123 | 3.879 | 4.055 | 4.047 | 3.941 | 3.989 | 3.983 | 3.961 | 3.978 | 4.091 | 3.789 | 4.012 | 3.969 | 3.959 | 2.49 |
| 37 | 55.1 | * | Diameter of Pilot Hole (2.5) | 2.30 | 2.70 | Pin Gauge | 2.49 | 2.48 | 2.48 | 2.49 | 3.989 | 4.023 | 2.5 | 2.49 | 2.48 | 2.49 | 2.5 | 2.49 | 2.46 | 2.49 | 2.48 | 2.49 | 2.48 | 2.46 | 2.49 | 2.47 | 2.5 | 2.49 | 2.49 | 2.49 |
| 38 | 55.2 | * | Diameter of Pilot Hole (2.5) | 2.30 | 2.70 | Pin Gauge | 2.48 | 2.49 | 2.49 | 2.49 | 2.48 | 2.49 | 2.5 | 2.49 | 2.49 | 2.48 | 2.49 | 2.48 | 2.49 | 2.48 | 2.49 | 2.47 | 2.5 | 2.49 | 2.5 | 2.46 | 2.46 | 2.49 | 2.51 | 2.48 |
| 39 | 55.3 | * | Diameter of Pilot Hole (2.5) | 2.30 | 2.70 | Pin Gauge | 2.48 | 2.5 | 2.49 | 2.5 | 2.49 | 2.48 | 2.49 | 2.49 | 2.5 | 2.49 | 2.48 | 2.5 | 2.48 | 2.47 | 2.49 | 2.48 | 2.5 | 2.5 | 2.49 | 2.49 | 2.48 | 2.49 | 2.5 | 2.49 |
| 40 | 55.4 | * | Diameter of Pilot Hole (2.5) | 2.30 | 2.70 | Pin Gauge | 2.5 | 2.5 | 2.49 | 2.49 | 2.49 | 2.49 | 2.48 | 2.49 | 2.49 | 2.5 | 2.49 | 2.5 | 2.46 | 2.49 | 2.5 | 2.49 | 2.51 | 2.5 | 2.48 | 2.49 | 2.48 | 2.5 | 2.48 | 2.49 |
| 41 | 55.5 | * | Diameter of Pilot Hole (2.5) | 2.30 | 2.70 | Pin Gauge | 2.49 | 2.49 | 2.48 | 2.49 | 2.49 | 2.5 | 2.49 | 2.49 | 2.49 | 2.5 | 2.49 | 2.49 | 2.49 | 2.48 | 2.48 | 2.5 | 2.47 | 2.49 | 2.49 | 2.48 | 2.49 | 2.48 | 2.49 | 2.49 |
| 42 | 55.6 | * | Diameter of Pilot Hole (2.5) | 2.30 | 2.70 | Pin Gauge | 2.49 | 2.48 | 2.48 | 2.49 | 2.49 | 2.5 | 2.49 | 2.48 | 2.48 | 2.49 | 2.48 | 2.48 | 2.5 | 2.49 | 2.49 | 2.49 | 2.48 | 2.47 | 2.49 | 2.49 | 2.48 | 2.49 | 2.5 | 2.5 |
| 43 | 55.7 | * | Diameter of Pilot Hole (2.5) | 2.30 | 2.70 | Pin Gauge | 2.48 | 2.49 | 2.5 | 2.5 | 2.5 | 2.5 | 2.49 | 2.49 | 2.49 | 2.49 | 2.49 | 2.49 | 2.49 | 2.47 | 2.48 | 2.48 | 2.49 | 2.48 | 2.49 | 2.49 | 2.48 | 2.49 | 2.47 | 2.49 |
| 44 | 55.8 | * | Diameter of Pilot Hole (2.5) | 2.30 | 2.70 | Pin Gauge | 2.49 | 2.49 | 2.49 | 2.5 | 2.49 | 2.49 | 2.5 | 2.5 | 2.49 | 2.48 | 2.49 | 2.48 | 2.49 | 2.49 | 2.49 | 2.49 | 2.5 | 2.49 | 2.49 | 2.5 | 2.49 | 2.48 | 2.5 | 2.48 |
| 45 | 55.9 | * | Diameter of Pilot Hole (2.5) | 2.30 | 2.70 | Pin Gauge | 2.5 | 2.48 | 2.48 | 2.5 | 2.49 | 2.49 | 2.51 | 2.5 | 2.48 | 2.48 | 2.48 | 2.49 | 2.48 | 2.5 | 2.49 | 2.49 | 2.49 | 2.5 | 2.48 | 2.48 | 2.48 | 2.49 | 2.48 | 2.49 |
| 46 | 55.10 | * | Diameter of Pilot Hole (2.5) | 2.30 | 2.70 | Pin Gauge | 2.51 | 2.49 | 2.49 | 2.5 | 2.48 | 2.5 | 2.52 | 2.5 | 2.49 | 2.48 | 2.5 | 2.48 | 2.49 | 2.5 | 2.5 | 2.5 | 2.5 | 2.49 | 2.5 | 2.49 | 2.5 | 2.48 | 2.49 | 2.48 |
| 47 | 55.11 | * | Diameter of Pilot Hole (2.5) | 2.30 | 2.70 | Pin Gauge | 2.48 | 2.49 | 2.49 | 2.49 | 2.5 | 2.49 | 2.5 | 2.5 | 2.49 | 2.49 | 2.49 | 2.49 | 2.5 | 2.49 | 2.49 | 2.48 | 2.49 | 2.48 | 2.49 | 2.5 | 2.49 | 2.47 | 2.5 | 2.49 |
| 48 | 55.12 | * | Diameter of Pilot Hole (2.5) | 2.30 | 2.70 | Pin Gauge | 2.49 | 2.49 | 2.48 | 2.49 | 2.49 | 2.48 | 2.49 | 2.49 | 2.48 | 2.5 | 2.49 | 2.49 | 2.49 | 2.48 | 2.5 | 2.49 | 2.49 | 2.47 | 2.48 | 2.51 | 2.47 | 2.5 | 2.49 | 2.5 |

Fig 13: Data of 1C1

| KC/CC | Feature/Characteristic Description | Acceptance Criteria | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | LSL | USL | 1000433054 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| * | Width (39.0) | 38.7 | 39.3 | 39.04 | 39.1 | 39.16 | 39.09 | 39.16 | 39.16 | 39.16 | 39.14 | 39.16 | 39.1 | 39.14 | 39.14 | 36.16 | 39.1 | 39.15 | 39.16 | 39.06 | 39.19 | 39.14 | 39.1 | 39.15 | 39.14 | 39.16 | 39.09 | 39.14 | 39.16 | 39.16 | 39.11 |
| - | Radius (20.0) | 19 | 21 | 20.181 | 20.319 | 19.891 | 19.314 | 19.431 | 19.306 | 19.978 | 19.981 | 19.978 | 19.769 | 191.74 | 19.369 | 20.31 | 20.094 | 19.5 | 19.798 | 20.589 | 20.591 | 19.894 | 19.589 | 19.499 | 19.769 | 19.894 | 20.349 | 20.181 | 19.584 | 21 | 20.077 |
| - | Radius (17.0) | 16 | 18 | 17.077 | 17.049 | 16.998 | 16.989 | 16.978 | 17.026 | 17.095 | 17.081 | 17.049 | 16.995 | 16.979 | 17.064 | 16.978 | 16.959 | 17.09 | 16.915 | 17.097 | 16.949 | 17.064 | 16.989 | 16.983 | 17.064 | 17.049 | 17.142 | 17.077 | 16.995 | 17.049 | 17.077 |
| * | Width (44.5) | 44.2 | 44.8 | 44.61 | 44.69 | 44.67 | 44.74 | 44.71 | 44.69 | 44.69 | 44.69 | 44.7 | 44.72 | 44.67 | 44.71 | 44.71 | 44.68 | 44.69 | 44.61 | 44.67 | 44.68 | 44.67 | 44.68 | 44.67 | 44.68 | 44.69 | 44.64 | 44.67 | 44.67 | 44.69 | 44.68 |
| - | Intersection Distance (73.0) | 72 | 74 | 73.121 | 73.109 | 73.021 | 73.089 | 73.089 | 73.068 | 73.072 | 73.046 | 73.089 | 73.042 | 73.098 | 73.064 | 73.015 | 72.979 | 72.99 | 73.063 | 73.097 | 73.067 | 73.043 | 73.061 | 73.064 | 73.106 | 73.064 | 73.085 | 73.121 | 73.072 | 73.089 | 73.085 |
| - | Intersection Distance (117.0) | 116 | 118 | 117.25 | 117.23 | 117.13 | 117.2 | 117.19 | 117.11 | 117.21 | 117.23 | 117.21 | 117.095 | 117.19 | 117.26 | 117.17 | 117.2 | 117.2 | 117.17 | 117.21 | 117.22 | 117.21 | 117.11 | 117.12 | 117.2 | 117.26 | 117.25 | 117.21 | 117.21 | 117.23 | 117.23 |
| * | Thickness (2.5) | 2.3 | 2.7 | 2.61 | 2.666 | 2.595 | 2.615 | 2.6 | 2.656 | 2.59 | 2.619 | 2.639 | 2.629 | 2.66 | 2.619 | 2.629 | 2.63 | 2.619 | 2.61 | 2.619 | 2.639 | 2.641 | 2.614 | 2.929 | 2.613 | 2.614 | 2.643 | 2.641 | 2.613 | 2.637 | 2.666 |
| * | Thickness (1.6) | 1.4 | 1.8 | 1.641 | 1.615 | 1.637 | 1.637 | 1.617 | 1.609 | 1.641 | 1.627 | 1.621 | 1.649 | 1.627 | 1.629 | 1.64 | 1.645 | 1.639 | 1.611 | 1.639 | 1.649 | 1.631 | 1.625 | 1.62 | 1.624 | 1.619 | 1.617 | 1.625 | 1.637 | 1.619 | 1.615 |
| - | Distance (36.0) | 35 | 37 | 36.1 | 36.114 | 36.074 | 36.065 | 36.073 | 36.035 | 36.16 | 36.017 | 36.066 | 36.00\98 | 36.119 | 36.087 | 36.149 | 36.164 | 36.15 | 36.112 | 36.164 | 36.164 | 36.094 | 36.025 | 36.049 | 36.067 | 36.164 | 36.067 | 36.076 | 36.019 | 36.097 | 36.114 |
| - | Distance (76.0) | 75 | 77 | 75.965 | 75.901 | 75.981 | 75.989 | 75.99 | 75.956 | 76.165 | 75.842 | 75.875 | 76.097 | 75.998 | 75.968 | 76.069 | 75.979 | 75.98 | 75.911 | 75.964 | 75.978 | 75.909 | 75.925 | 75.949 | 75.949 | 75.061 | 75.984 | 75.974 | 75.864 | 76.097 | 75.901 |
| * | Thickness (3.9) | 3.7 | 4.1 | 3.91 | 3.941 | 3.944 | 3.929 | 3.943 | 3.953 | 3.909 | 3.943 | 3.915 | 3.963 | 3.941 | 3.929 | 3.961 | 3.959 | 3.91 | 3.914 | 3.934 | 3.968 | 3.911 | 3.925 | 3.949 | 3.925 | 3.949 | 3.94 | 3.961 | 3.938 | 3.951 | 3.941 |
| - | Chamfer Length (0.7) | 0.7 | 0.9 | 0.848 | 0.798 | 0.823 | 0.823 | 0.778 | 0.81 | 0.741 | 0.728 | 0.822 | 0.798 | 0.809 | 0.778 | 0.82 | 0.779 | 0.824 | 0.814 | 0.798 | 0.809 | 0.789 | 0.809 | 0.809 | 0.778 | 0.798 | 0.778 | 0.779 | 0.729 | 0.729 | 0.798 |
| * | Diameter of Pilot Hole (2.5) | 2.3 | 2.7 | 24.48 | 2.49 | 2.49 | 2.49 | 2.5 | 2.49 | 2.51 | 2.49 | 2.51 | 2.5 | 2.5 | 2.49 | 2.5 | 2.49 | 2.5 | 2.49 | 2.5 | 2.49 | 2.49 | 2.5 | 2.49 | 2.48 | 2.5 | 2.49 | 2.48 | 2.52 | 2.53 | 2.49 |
| * | Diameter of Pilot Hole (2.5) | 2.3 | 2.7 | 2.49 | 2.48 | 2.51 | 2.49 | 2.5 | 2.48 | 2.5 | 2.49 | 2.5 | 2.5 | 2.5 | 2.48 | 2.5 | 2.49 | 2.5 | 2.49 | 2.5 | 2.48 | 2.49 | 2.5 | 2.49 | 2.48 | 2.5 | 2.48 | 2.49 | 2.5 | 2.49 | 2.48 |
| * | Diameter of Pilot Hole (2.5) | 2.3 | 2.7 | 2.49 | 2.48 | 2.53 | 2.48 | 2.5 | 2.49 | 2.5 | 2.49 | 2.5 | 2.52 | 2.5 | 2.49 | 2.48 | 2.48 | 2.49 | 2.49 | 2.5 | 2.49 | 2.5 | 2.5 | 2.5 | 2.49 | 2.5 | 2.49 | 2.49 | 2.49 | 2.5 | 2.48 |
| * | Diameter of Pilot Hole (2.5) | 2.3 | 2.7 | 2.48 | 2.49 | 2.5 | 2.5 | 2.48 | 2.5 | 2.49 | 2.5 | 2.5 | 2.52 | 2.5 | 2.49 | 2.48 | 2.5 | 2.48 | 2.5 | 2.49 | 2.49 | 2.5 | 2.49 | 2.49 | 2.49 | 2.5 | 2.49 | 2.5 | 2.49 | 2.5 | 2.49 |
| * | Diameter of Pilot Hole (2.5) | 2.3 | 2.7 | 2.49 | 2.49 | 2.5 | 2.5 | 2.49 | 2.5 | 2.49 | 2.5 | 2.5 | 2.52 | 2.51 | 2.5 | 2.49 | 2.49 | 2.49 | 2.49 | 2.5 | 2.49 | 2.49 | 2.49 | 2.5 | 2.5 | 2.49 | 2.48 | 2.49 | 2.5 | 2.5 | 2.49 |
| * | Diameter of Pilot Hole (2.5) | 2.3 | 2.7 | 2.49 | 2.48 | 2.51 | 2.5 | 2.48 | 2.5 | 2.48 | 2.5 | 2.48 | 2.49 | 2.49 | 2.5 | 2.5 | 2.48 | 2.5 | 2.5 | 2.49 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.49 | 2.49 | 2.49 | 2.49 | 2.49 | 2.48 |
| * | Diameter of Pilot Hole (2.5) | 2.3 | 2.7 | 2.49 | 2.5 | 2.5 | 2.51 | 2.49 | 2.49 | 2.52 | 2.49 | 2.5 | 2.49 | 2.48 | 2.49 | 2.49 | 2.49 | 2.49 | 2.5 | 2.5 | 2.49 | 2.5 | 2.51 | 2.52 | 2.51 | 2.52 | 2.49 | 2.5 | 2.5 | 2.49 | 2.52 |
| * | Diameter of Pilot Hole (2.5) | 2.3 | 2.7 | 2.48 | 2.51 | 2.51 | 2.51 | 2.49 | 2.48 | 2.51 | 2.49 | 2.5 | 2.49 | 2.48 | 2.49 | 2.84 | 2.5 | 2.51 | 2.52 | 2.49 | 2.48 | 2.52 | 2.5 | 2.49 | 2.5 | 2.48 | 2.48 | 2.49 | 2.49 | 2.49 | 2.49 |
| * | Diameter of Pilot Hole (2.5) | 2.3 | 2.7 | 2.5 | 2.5 | 2.51 | 2.51 | 2.48 | 2.5 | 2.5 | 2.48 | 2.5 | 2.48 | 2.48 | 2.49 | 2.49 | 2.5 | 2.49 | 2.52 | 2.48 | 2.49 | 2.51 | 2.5 | 2.48 | 2.49 | 2.48 | 2.49 | 2.5 | 2.5 | 2.5 | 2.49 |
| * | Diameter of Pilot Hole (2.5) | 2.3 | 2.7 | 2.49 | 2.52 | 2.49 | 2.49 | 2.49 | 2.49 | 2.5 | 2.49 | 2.52 | 2.49 | 2.49 | 2.5 | 2.5 | 2.52 | 2.49 | 2.5 | 2.49 | 2.49 | 2.51 | 2.5 | 2.49 | 2.5 | 2.48 | 2.52 | 2.5 | 2.5 | 2.5 | 2.48 |
| * | Diameter of Pilot Hole (2.5) | 2.3 | 2.7 | 2.49 | 2.52 | 2.5 | 2.49 | 2.49 | 2.49 | 2.49 | 2.5 | 2.51 | 2.49 | 2.49 | 2.49 | 2.49 | 2.52 | 2.48 | 2.52 | 2.49 | 2.5 | 2.49 | 2.5 | 2.49 | 2.5 | 249 | 2.52 | 2.5 | 2.5 | 2.49 | 2.49 |
| * | Diameter of Pilot Hole (2.5) | 2.3 | 2.7 | 2.5 | 2.48 | 2.52 | 2.51 | 2.5 | 2.5 | 2.48 | 2.51 | 2.49 | 2.5 | 2.48 | 2.49 | 2.5 | 2.49 | 2.49 | 2.51 | 2.49 | 2.5 | 2.49 | 2.5 | 2.5 | 2.49 | 2.48 | 2.52 | 2.49 | 2.49 | 2.49 | 2.49 |
| - | Ground Radii (4.0) | 3.5 | 4.5 | 4.067 | 3.979 | 3.978 | 3.891 | 3.798 | 4.067 | 3.989 | 3.981 | 3.81 | 3.798 | 4.067 | 3.989 | 4.098 | 3.949 | 3.894 | 3.941 | 3.964 | 3.974 | 3.989 | 4.014 | 3.94 | 3.916 | 3.96 | 2.49 | 4.01 | 4.01 | 3.989 | 3.947 |
| - | Ground Radii (4.0) | 3.5 | 4.5 | 3.9989 | 3.947 | 4.051 | 3.983 | 4.015 | 3.9989 | 4.029 | 3.919 | 3.915 | 4.015 | 4.052 | 3.974 | 4.079 | 3.939 | 3.794 | 3.949 | 3.989 | 3.989 | 3.989 | 4.019 | 3.959 | 3.916 | 4.164 | 4.141 | 3.981 | 3.981 | 4.069 | 3.959 |
| - | Non Dimensioned Radii (8.0) | 7 | 9 | 7.937 | 7.796 | 7.907 | 7.769 | 7.998 | 7.937 | 8.076 | 7.867 | 7.979 | 7.998 | 7.998 | 7.965 | 7.879 | 7.964 | 7.91 | 7.894 | 7.874 | 7.941 | 7.894 | 7.964 | 7.967 | 7.934 | 7.673 | 3.941 | 7.709 | 7.709 | 7.894 | 7.883 |
| - | Non Dimensioned Radii (8.0) | 7 | 9 | 7.786 | 7.966 | 8.007 | 8.009 | 8.164 | 7.786 | 8.154 | 7.974 | 7.984 | 8.164 | 7.891 | 7.975 | 7.861 | 7.959 | 7.964 | 7.964 | 7.934 | 7.963 | 7.926 | 7.962 | 7.963 | 7.989 | 7.894 | 7.974 | 7.794 | 7.794 | 8.087 | 8.096 |
| - | Non Dimensioned Radii (8.0) | 7 | 9 | 7.977 | 8.185 | 7.994 | 8.019 | 8.169 | 7.977 | 8.301 | 7.954 | 7.904 | 8.169 | 8.14 | 8.247 | 8.175 | 8.093 | 8.064 | 8.013 | 8.149 | 8.109 | 7.949 | 7.901 | 7.964 | 7.809 | 7.964 | 7.793 | 7.894 | 7.894 | 8.129 | 8.148 |
| - | Non Dimensioned Radii (8.0) | 7 | 9 | 7.957 | 7.872 | 8.053 | 7.918 | 8.094 | 7.957 | 8.167 | 7.949 | 7.909 | 8.094 | 7.996 | 8.093 | 7.92 | 7.932 | 7.984 | 8.144 | 8.094 | 8.049 | 8.014 | 7.984 | 7.964 | 7.91 | 7.994 | 7.793 | 7.964 | 7.964 | 8.192 | 7.906 |

Figure 14: Data of 10A (Cont.)

| Actual Dimension / Observations | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1000433074 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 39.04 | 39.06 | 38.96 | 39.08 | 38.95 | 38.92 | 38.94 | 39.04 | 39.07 | 38.96 | 38.98 | 38.94 | 39.04 | 39.01 | 39.05 | 39.06 | 39.05 | 36.1 | 36.04 | 39.98 | 39.6 | 39.09 | 38.94 | 38.94 | 38.96 | 39.09 | 39.06 | 39.08 |
| 20.039 | 19.97 | 20.074 | 20.04 | 20.057 | 20.074 | 20.009 | 20.061 | 19.986 | 20.07 | 20.039 | 19.996 | 19.984 | 20.064 | 19.909 | 19.986 | 20.045 | 20.039 | 19.984 | 0.041 | 19.939 | 19.974 | 20.01 | 19.986 | 19.989 | 20.024 | 20.056 | 20.039 |
| 17.047 | 17.01 | 16.969 | 17.004 | 17.039 | 17.054 | 17.008 | 17.086 | 16.965 | 17.021 | 17.086 | 16.974 | 17.031 | 17.028 | 17.029 | 16.978 | 16.982 | 16.986 | 16.979 | 17.086 | 19.949 | 17.02 | 17.02 | 16.977 | 16.991 | 17.03 | 16.989 | 17.022 |
| 44.46 | 44.54 | 44.49 | 44.49 | 44.47 | 44.44 | 44.47 | 44.46 | 44.5 | 44.52 | 44.54 | 44.5 | 44.48 | 44.8 | 44.5 | 44.47 | 44.5 | 44.49 | 44.47 | 44.52 | 44.49 | 44.54 | 44.5 | 44.47 | 44.49 | 44.59 | 44.5 | 44.54 |
| 73.04 | 73.01 | 73.021 | 72.994 | 73.042 | 72.989 | 73.012 | 73.022 | 72.964 | 72.979 | 72.98 | 73.001 | 72.974 | 73.074 | 72.974 | 73.089 | 73.04 | 73.036 | 72.97 | 72.979 | 72.989 | 73.046 | 73.02 | 72.98 | 72.986 | 73.091 | 73.044 | 72.974 |
| 117.04 | 117 | 117.09 | 117 | 117.01 | 116.97 | 117.03 | 117.01 | 117.08 | 116.99 | 116.95 | 116.98 | 116.96 | 116.94 | 117.01 | 117.03 | 116.96 | 116.94 | 116.97 | 116.98 | 116.97 | 117.07 | 117 | 117.04 | 116.99 | 117.04 | 117.09 | 117.01 |
| 2.522 | 2.53 | 2.474 | 2.479 | 2.536 | 2.474 | 2.484 | 2.531 | 2.488 | 2.53 | 2.502 | 2.496 | 2.489 | 2.541 | 2.489 | 2.554 | 2.541 | 2.491 | 2.489 | 2.52 | 2.471 | 2.519 | 2.539 | 2.486 | 2.469 | 2.531 | 2.536 | 2.586 |
| 1.622 | 1.661 | 1.596 | 1.634 | 1.636 | 1.622 | 1.641 | 1.636 | 1.629 | 1.622 | 1.639 | 1.644 | 1.631 | 1.639 | 1.614 | 1.632 | 1.636 | 1.664 | 1.629 | 1.641 | 11.639 | 1.674 | 1.625 | 1.624 | 1.624 | 1.639 | 1.641 | 1.622 |
| 36.078 | 35.97 | 35.989 | 36.091 | 35.96 | 35.964 | 36.022 | 36.036 | 35.974 | 35.984 | 36.071 | 35.996 | 35.941 | 36.017 | 36.041 | 35.969 | 35.584 | 36.022 | 36.059 | 36.041 | 35.97 | 35.941 | 35.99 | 36.021 | 36.014 | 36.036 | 35.991 | 35.981 |
| 76.014 | 76.07 | 75.986 | 76.123 | 76.074 | 76.055 | 76.054 | 76.07 | 76.028 | 75.977 | 75.98 | 76.019 | 76.022 | 76.02 | 75.981 | 76.037 | 75.994 | 75.976 | 76.049 | 76.022 | 75.971 | 76.041 | 76.09 | 76.044 | 75.984 | 76.029 | 75.974 | 75.984 |
| 3.894 | 3.879 | 3.984 | 3.874 | 3.89 | 3.949 | 3.936 | 3.88 | 3.879 | 3.949 | 3.936 | 3.94 | 3.899 | 3.874 | 3.936 | 3.874 | 3.89 | 3.946 | 3.929 | 3.94 | 3.849 | 3.964 | 3.896 | 3.941 | 3.941 | 3.916 | 3.896 | 3.944 |
| 0.754 | 0.789 | 0.77 | 0.78 | 0.774 | 0.714 | 0.794 | 0.78 | 0.789 | 0.769 | 0.771 | 0.789 | 0.784 | 0.764 | 0.769 | 0.789 | 0.716 | 0.794 | 0.774 | 0.789 | 0.769 | 0.786 | 0.77 | 0.764 | 0.786 | 0.77 | 0.769 | 0.74 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5. | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.55 | 2.55 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 4.004 | 4.026 | 4.034 | 4.019 | 4.074 | 3.896 | 4.02 | 3.989 | 3.896 | 4.029 | 4.007 | 4.019 | 4.034 | 4.074 | 3.974 | 3.989 | 4.029 | 3.899 | 3.949 | 4.019 | 4.029 | 4.019 | 3.899 | 3.949 | 3.899 | 4.074 | 4.019 | 4.029 |
| 3.974 | 4.089 | 4.076 | 4.069 | 4.02 | 4.006 | 3.989 | 3.974 | 4.006 | 4.039 | 3.976 | 4.069 | 4.076 | 4.02 | 3.974 | 4.009 | 4.036 | 4.081 | 4.074 | 4.069 | 4.039 | 4.069 | 4.081 | 4.074 | 4.081 | 4.02 | 4.069 | 4.039 |
| 8.061 | 8.024 | 8.005 | 8.041 | 8.074 | 7.99 | 8.009 | 8.001 | 7.99 | 7.984 | 7.99 | 8.041 | 8.027 | 8.074 | 8.026 | 7.986 | 7.994 | 8.036 | 7.976 | 8.041 | 7.984 | 8.041 | 8.036 | 7.976 | 8.036 | 8.074 | 8.041 | 7.984 |
| 8.027 | 8.03 | 8.074 | 7.98 | 8.039 | 7.984 | 8.005 | 8.007 | 7.984 | 7.976 | 7.969 | 7.98 | 8.079 | 8.039 | 7.984 | 8.029 | 8.046 | 8.079 | 8.004 | 7.98 | 7.976 | 7.98 | 8.079 | 8.004 | 8.079 | 8.039 | 7.98 | 7.976 |
| 7.981 | 8.02 | 7.994 | 8.036 | 8.014 | 7.985 | 7.986 | 7.999 | 7.985 | 8.022 | 8.01 | 8.036 | 7.994 | 8.014 | 7.986 | 8.011 | 7.977 | 7.989 | 7.988 | 8.036 | 8.022 | 8.036 | 7.989 | 7.988 | 7.989 | 8.014 | 8.036 | 8.022 |
| 7.989 | 8.039 | 7.994 | 8.03 | 8.047 | 8.049 | 8.005 | 7.987 | 8.049 | 8.016 | 8.024 | 8.03 | 7.994 | 8.047 | 8.028 | 7.941 | 7.986 | 7.974 | 8.031 | 8.03 | 8.016 | 8.03 | 7.974 | 8.031 | 7.974 | 8.047 | 8.03 | 8.016 |

Figure 15: Data of 10A (Cont.)

Publication Partner:

International Journal of Scientific and Research Publications (ISSN: 2250-3153)

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1000433075 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 39.06 | 39.09 | 39.96 | 36.04 | 39.1 | 39.09 | 39.94 | 39.07 | 36.04 | 39.1 | 38.93 | 38.96 | 39.96 | 39.08 | 39.04 | 39.08 | 39.07 | 38.96 | 38.98 | 39.04 | 38.98 | 39.05 | 36.1 | 36.04 | 39.05 | 38.96 | 39.08 | 39.04 |
| 19.974 | 19.986 | 19.946 | 19.984 | 20.039 | 19.314 | 20.03 | 20.01 | 19.984 | 20.319 | 19.96 | 19.974 | 19.986 | 20.02 | 20.064 | 19.974 | 19.946 | 20.031 | 20.057 | 20.039 | 19.974 | 20.05 | 20.039 | 19.984 | 20.045 | 20.07 | 19.974 | 20.019 |
| 16.987 | 17.041 | 17.074 | 16.979 | 17.056 | 16.989 | 16.987 | 16.986 | 16.979 | 17.049 | 17.02 | 16.984 | 17.171 | 17.086 | 16.946 | 17.046 | 17.08 | 17.021 | 17.009 | 17.047 | 17.021 | 16.98 | 16.986 | 16.979 | 16.982 | 17.021 | 16.991 | 27.012 |
| 44.4 | 44.56 | 44.44 | 44.47 | 44.49 | 44.74 | 44.45 | 44.49 | 44.47 | 44.69 | 44.48 | 44.54 | 44.54 | 44.8 | 44.56 | 44.51 | 44.49 | 44.49 | 44.54 | 44.46 | 44.69 | 44.5 | 44.49 | 44.47 | 44.5 | 44.52 | 44.45 | 44.48 |
| 72.97 | 73.021 | 73.044 | 72.97 | 72.986 | 73.089 | 72.986 | 73.049 | 72.97 | 73.109 | 73.01 | 73.025 | 72.969 | 73.046 | 73.046 | 73.071 | 72.98 | 73.086 | 72.949 | 73.04 | 73.109 | 73.01 | 73.025 | 72.969 | 73.04 | 72.979 | 72.986 | 73.064 |
| 116.95 | 116.97 | 117.02 | 116.97 | 116.98 | 117.2 | 117.09 | 117.03 | 116.97 | 117.23 | 1E+05 | 116.99 | 116.97 | 117.02 | 117.05 | 117.07 | 116.95 | 116.9 | 116.93 | 117.04 | 117.23 | 1E+05 | 116.99 | 116.97 | 116.96 | 116.99 | 116.99 | 116.98 |
| 2.489 | 2.52 | 2.514 | 2.489 | 2.54 | 2.615 | 2.53 | 2.474 | 2.489 | 2.666 | 2.489 | 2.481 | 2.52 | 2.541 | 2.489 | 2.526 | 2.531 | 2.549 | 2.322 | 2.522 | 2.666 | 2.489 | 2.481 | 2.52 | 2.541 | 2.53 | 2.522 | 2.536 |
| 1.629 | 1.631 | 1.62 | 1.629 | 1644 | 1.637 | 1.65 | 1.622 | 1.629 | 1.615 | 1.65 | 1.654 | 1.624 | 1.63 | 1.619 | 1.622 | 1.64 | 1.624 | 1.629 | 1.622 | 1.65 | 1.65 | 1.654 | 1.624 | 1.636 | 1.622 | 1.629 | 1.63 |
| 36.04 | 35.974 | 39.984 | 36.059 | 36.02 | 36.065 | 36.041 | 35.973 | 36.059 | 36.114 | 36.02 | 36.089 | 35.986 | 36.014 | 36.026 | 36.009 | 36.041 | 36.074 | 35.986 | 36.078 | 36.022 | 36.02 | 36.089 | 35.986 | 35.584 | 35.984 | 36.019 | 36.039 |
| 75.988 | 76.074 | 76.059 | 76.049 | 76.074 | 75.989 | 76.009 | 75.982 | 76.049 | 75.901 | 75.96 | 76.02 | 75.941 | 75.974 | 76.041 | 76.041 | 75.979 | 76.026 | 76.046 | 76.014 | 75.964 | 75.96 | 76.02 | 75.941 | 75.994 | 75.977 | 76.986 | 76.02 |
| 3.891 | 3.924 | 3.984 | 3.929 | 3.949 | 3.929 | 3.874 | 3.89 | 3.929 | 3.941 | 3.874 | 3.936 | 3.874 | 3.941 | 3.946 | 3.949 | 3.956 | 3.929 | 3.894 | 3.894 | 3.874 | 3.929 | 3.949 | 3.929 | 3.89 | 3.949 | 3.922 | 3.92 |
| 0.771 | 0.796 | 0.784 | 0.774 | 0.769 | 0.823 | 0.784 | 0.785 | 0.774 | 0.798 | 0.764 | 0.764 | 0.781 | 0.774 | 0.756 | 0.769 | 0.784 | 0.789 | 0.772 | 0.754 | 0.764 | 0.774 | 0.769 | 0.823 | 0.716 | 0.769 | 0.774 | 0.78 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.25 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 0.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 4.049 | 3.986 | 4.029 | 3.949 | 4.044 | 3.891 | 4.081 | 3.972 | 3.949 | 3.979 | 3.98 | 3.896 | 3.986 | 4.091 | 4.109 | 4.041 | 3.974 | 3.991 | 4.021 | 4.004 | 3.891 | 3.891 | 4.041 | 3.974 | 4.029 | 4.029 | 4.009 | 4.017 |
| 3.994 | 3.974 | 4.081 | 4.074 | 4.039 | 3.983 | 4.046 | 4.56 | 4.074 | 3.947 | 4.012 | 3.97 | 4.009 | 4.037 | 3.986 | 3.994 | 3.977 | 4.036 | 4.033 | 3.974 | 3.983 | 3.983 | 3.994 | 3.977 | 4.036 | 4.039 | 3.991 | 3.974 |
| 7.98 | 7.994 | 8.036 | 7.976 | 8.046 | 7.769 | 7.974 | 7.989 | 7.976 | 7.796 | 8.008 | 7.959 | 7.974 | 8.026 | 8.049 | 8.031 | 8.026 | 8.019 | 7.899 | 8.061 | 7.769 | 7.769 | 8.031 | 8.026 | 7.994 | 7.984 | 8.02 | 7.986 |
| 8.004 | 8.024 | 8.079 | 8.004 | 8.04 | 8.009 | 8.03 | 8.022 | 8.004 | 7.966 | 8.022 | 8.056 | 8.026 | 7.984 | 7.989 | 7.97 | 7.991 | 7.976 | 7.989 | 8.027 | 8.009 | 8.009 | 7.97 | 7.991 | 8.046 | 7.976 | 7.991 | 7.969 |
| 7.994 | 8.044 | 7.989 | 7.988 | 8.074 | 8.019 | 8.022 | 8.027 | 7.988 | 8.185 | 7.98 | 8.089 | 7.986 | 8.031 | 8.049 | 8.022 | 8.016 | 8.036 | 7.984 | 7.981 | 8.019 | 8.019 | 8.022 | 8.016 | 7.977 | 8.022 | 8.022 | 7.949 |
| 8.039 | 8.026 | 7.974 | 8.031 | 8.036 | 7.918 | 8.041 | 8.02 | 8.031 | 7.872 | 8.029 | 8.046 | 8.007 | 8.031 | 8.029 | 8.049 | 8.036 | 7.979 | 7.981 | 7.989 | 7.918 | 7.918 | 8.049 | 8.036 | 7.986 | 8.016 | 7.977 | 8.039 |

Figure 16: Data of 10A

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# Chapter 4

# RESULTS AND DISCUSSION

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## 4.1ANALYSIS

Analysis was done by using Minitab 19 software. Normal Capability Sixpack Report to assess the assumptions for normal capability analysis and to evaluate only the major indices of process capability. Using this analysis, you can do the following:

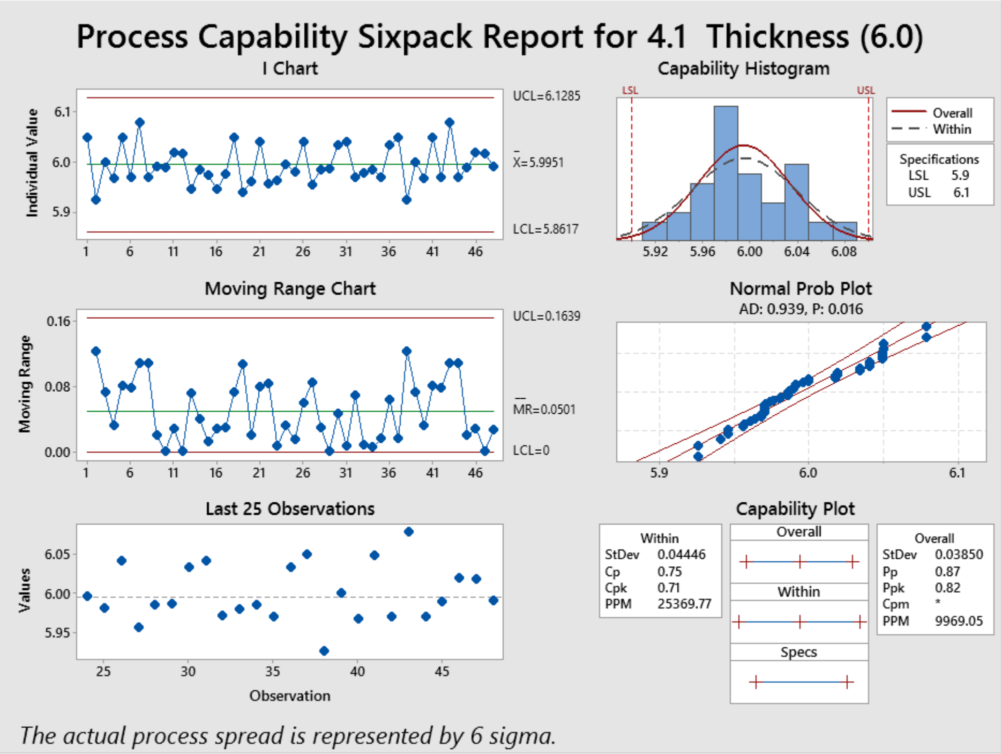
- Determine whether the process is stable and in control
- Determine whether the data follow a normal distribution
- Estimate overall capability (Pp, Ppk) and potential capability (Cp, Cpk)

To perform the analysis, you must specify a lower or upper specification limit (or both) to define your process requirements. The analysis evaluates the spread of the process data in relation to the specification limits. When a process is capable, the process spread is smaller than the specification spread. The analysis can also indicate whether your process is centered and on target. In addition, the analysis estimates the proportion of product that does not meet specifications.

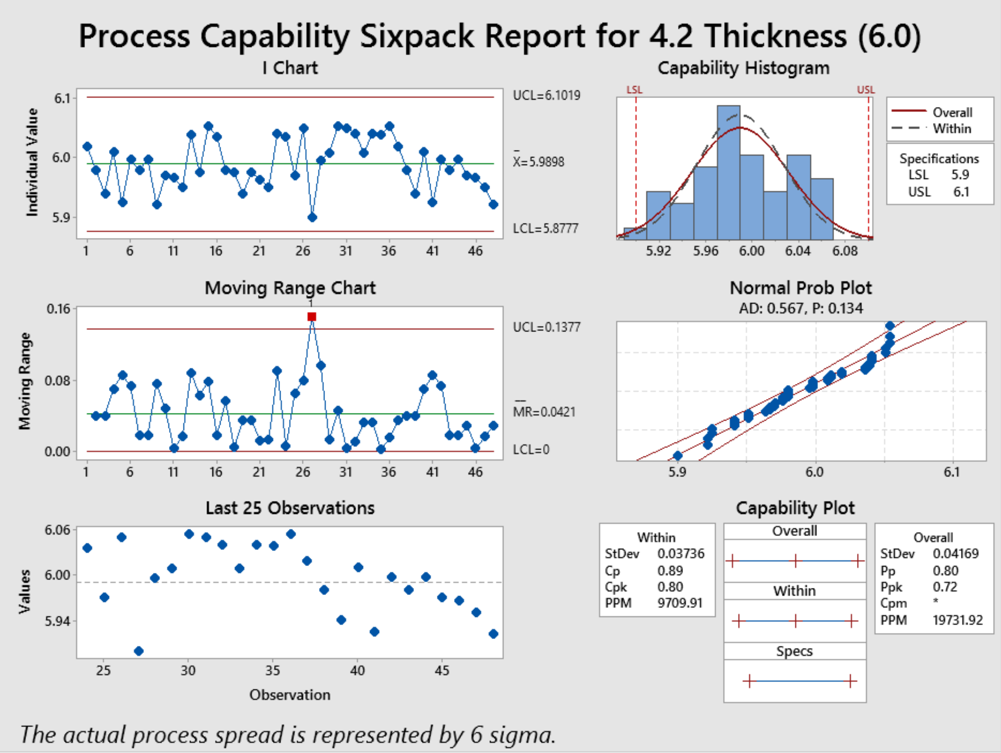
For example, a quality analyst wants to evaluate the capability of a bolt manufacturing process. To satisfy customer requirements, the thread length of the bolts should be within 0.5 mm of the target of 20 mm. The analyst uses normal capability sixpack to quickly assess main capability indices and evaluate the assumptions for normal capability analysis[12].

## A. Analysis for 5C1

### 1. Process Capability Sixpack Report for 4.1 Thickness (6.0)




### 2. Process Capability Sixpack Report for 4.2 Thickness (6.0)

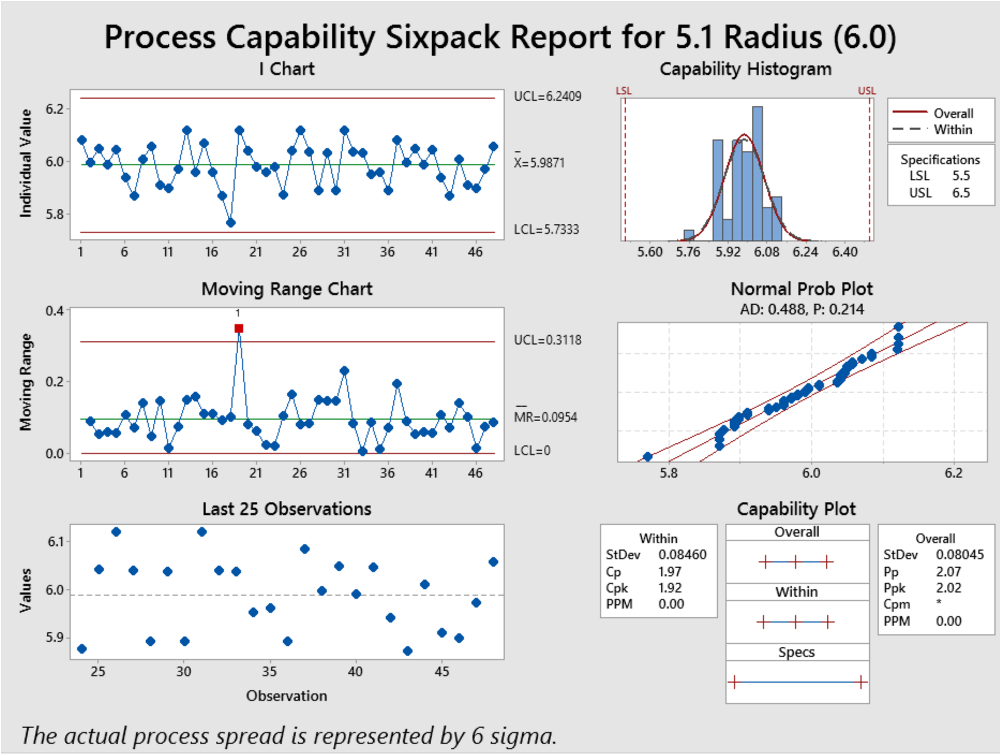



## Test Results for MR Chart of 4.2 Thickness (6.0)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 27

### 3. Process Capability Sixpack Report for 5.1 Radius (6.0)

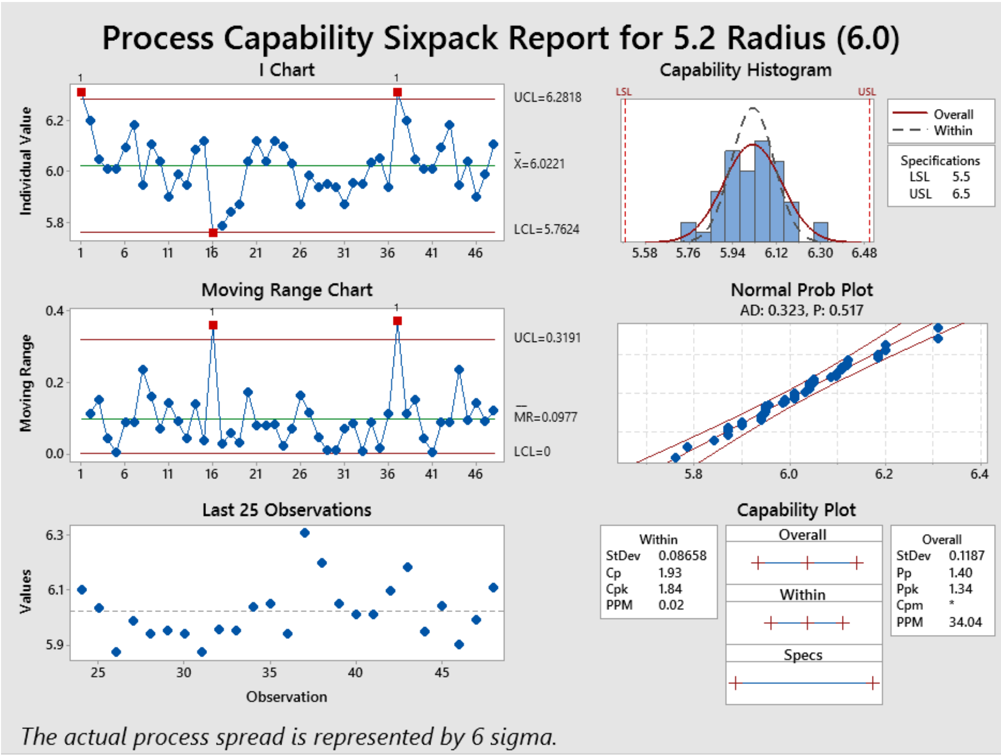



## Test Results for MR Chart of 5.1 Radius (6.0)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 19

## 4. Process Capability Sixpack Report for 5.2 Radius (6.0)




## Test Results for I Chart of 5.2 Radius (6.0)

TEST 1. One point more than 3.00 standard deviations from center line.

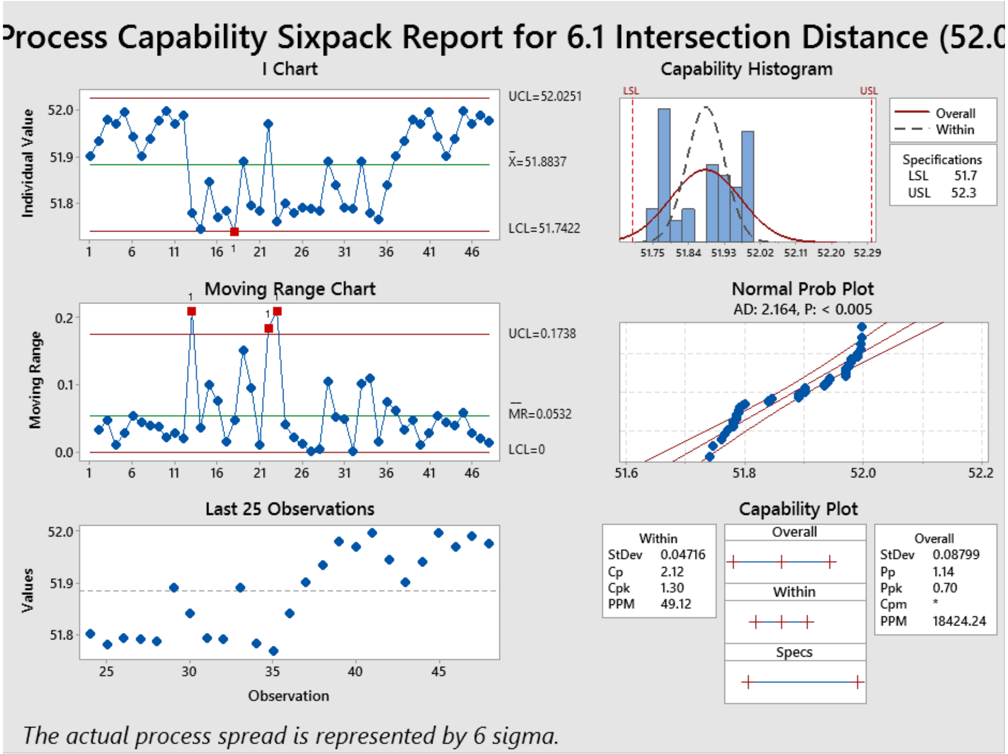
Test Failed at points: 1, 16, 37

## Test Results for MR Chart of 5.2 Radius (6.0)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 16, 37

**5. Process Capability Sixpack Report for 6.1 Intersection Distance (52.0**




## Test Results for I Chart of 6.1 Intersection Distance (52.0

TEST 1. One point more than 3.00 standard deviations from center line.

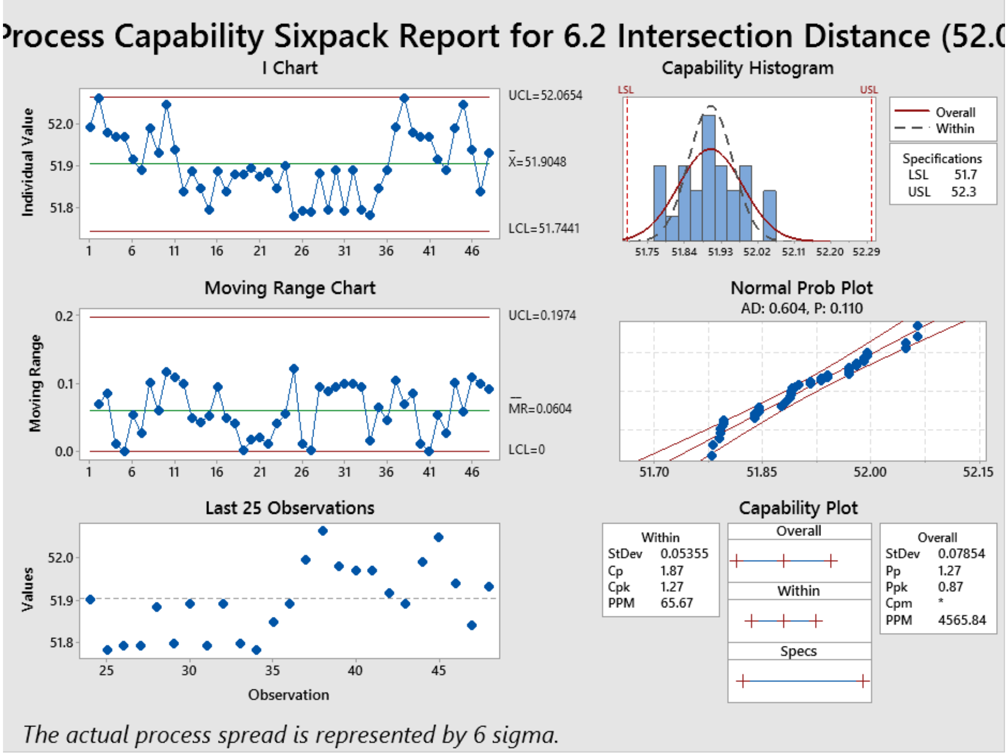
Test Failed at points: 18

## Test Results for MR Chart of 6.1 Intersection Distance (52.0

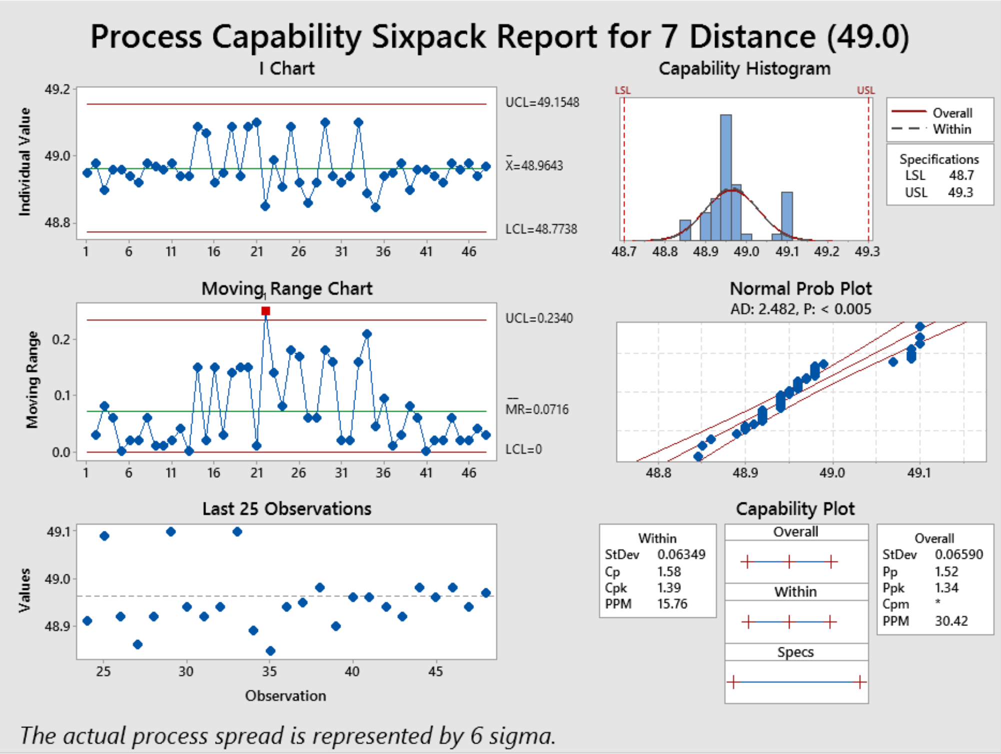
TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 13, 22, 23

**6. Process Capability Sixpack Report for 6.2 Intersection Distance (52.0**




## 7. Process Capability Sixpack Report for 7 Distance (49.0)




## Test Results for MR Chart of 7 Distance (49.0)

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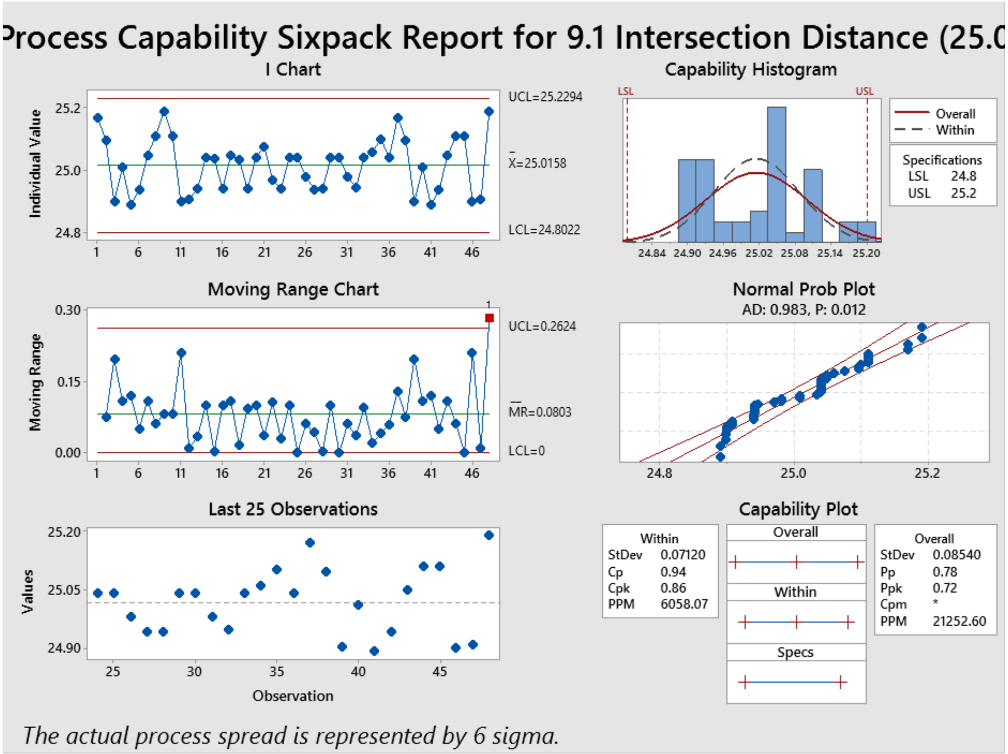
TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 22

## 8. Process Capability Sixpack Report for 9.1 Intersection Distance (25.0

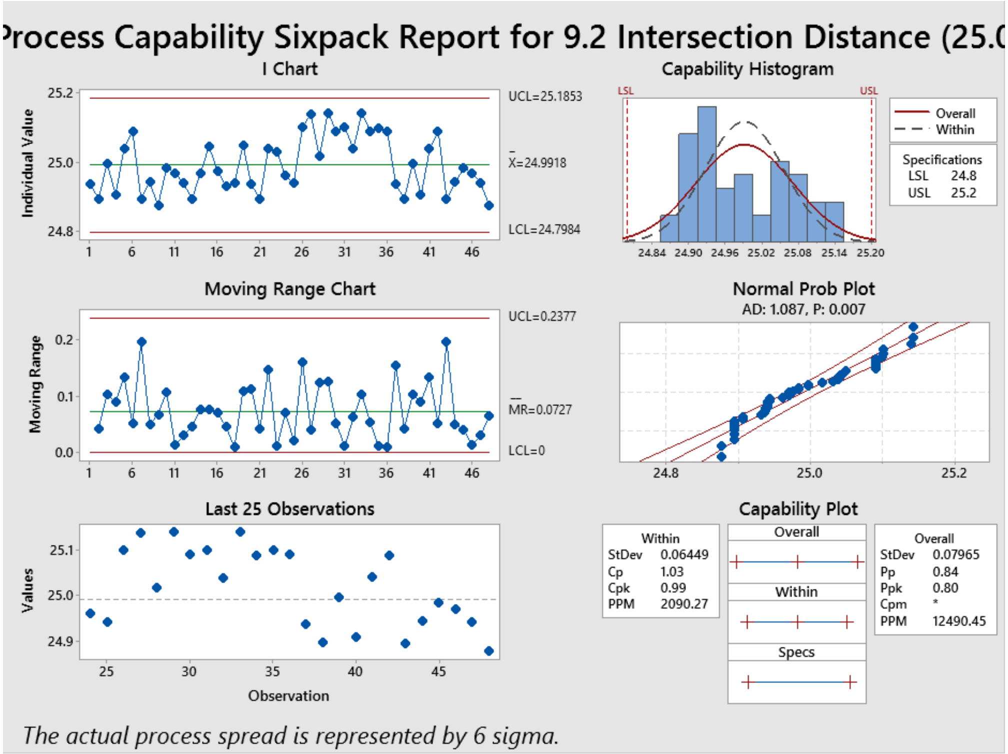



### Test Results for MR Chart of 9.1 Intersection Distance (25.0

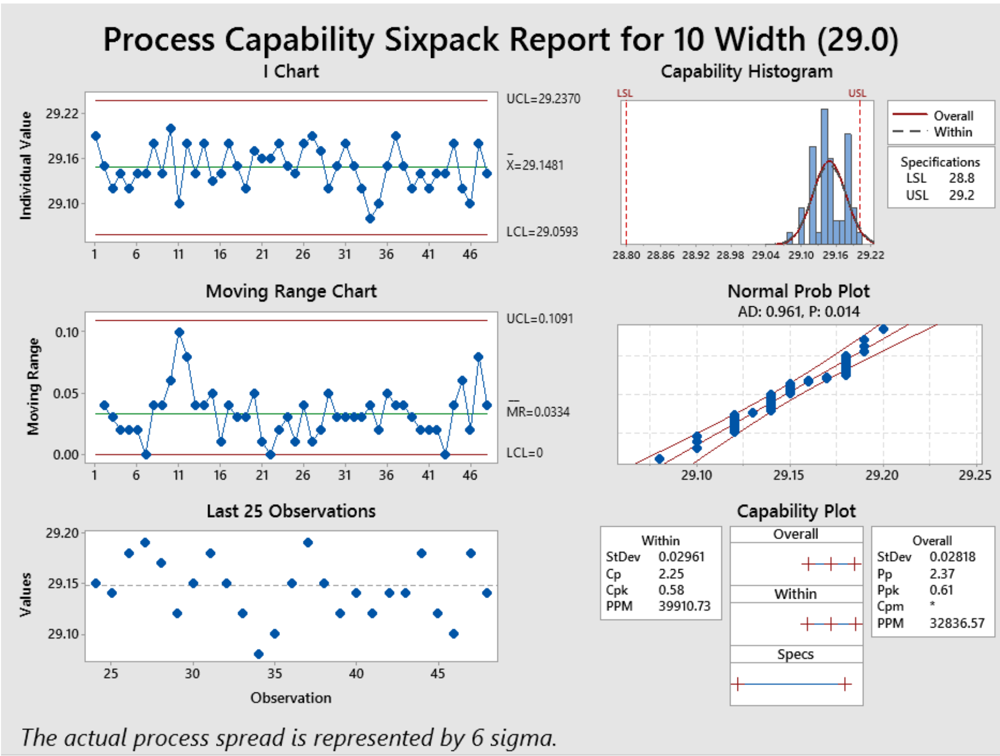
TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 48

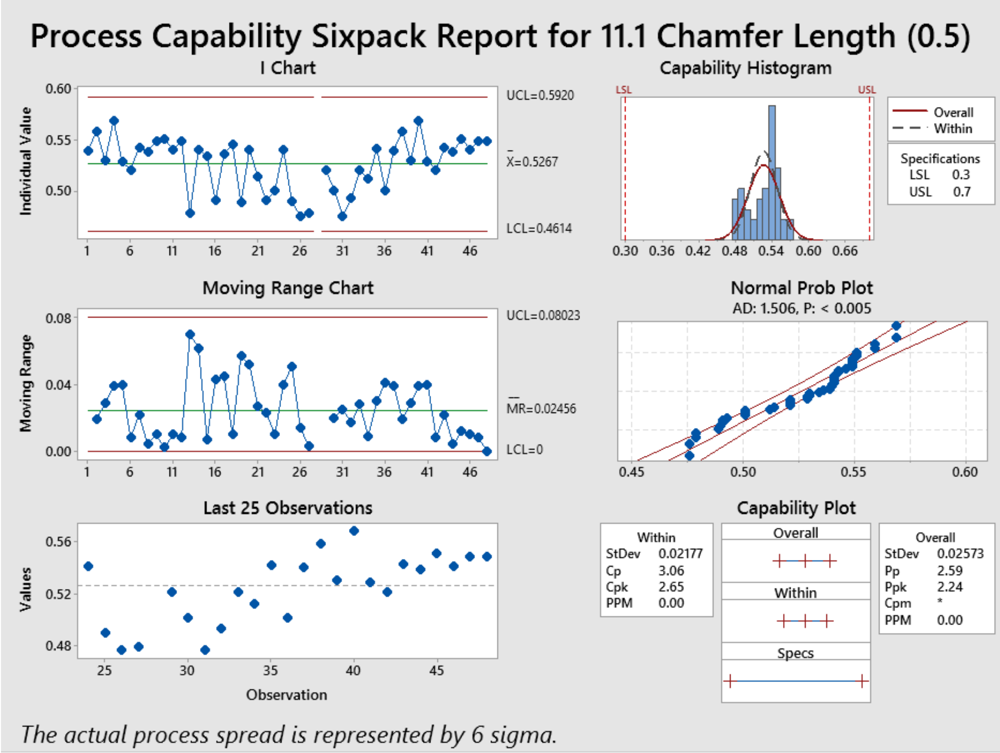
## 9. Process Capability Sixpack Report for 9.2 Intersection Distance (25.0



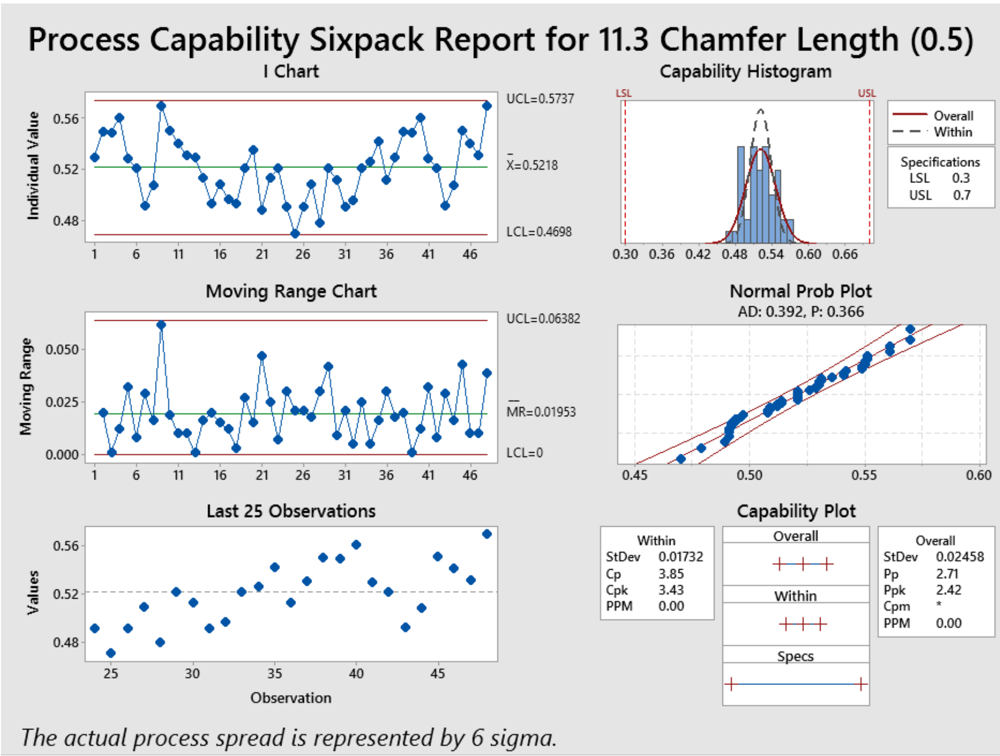

## 10. Process Capability Sixpack Report for 10 Width (29.0)



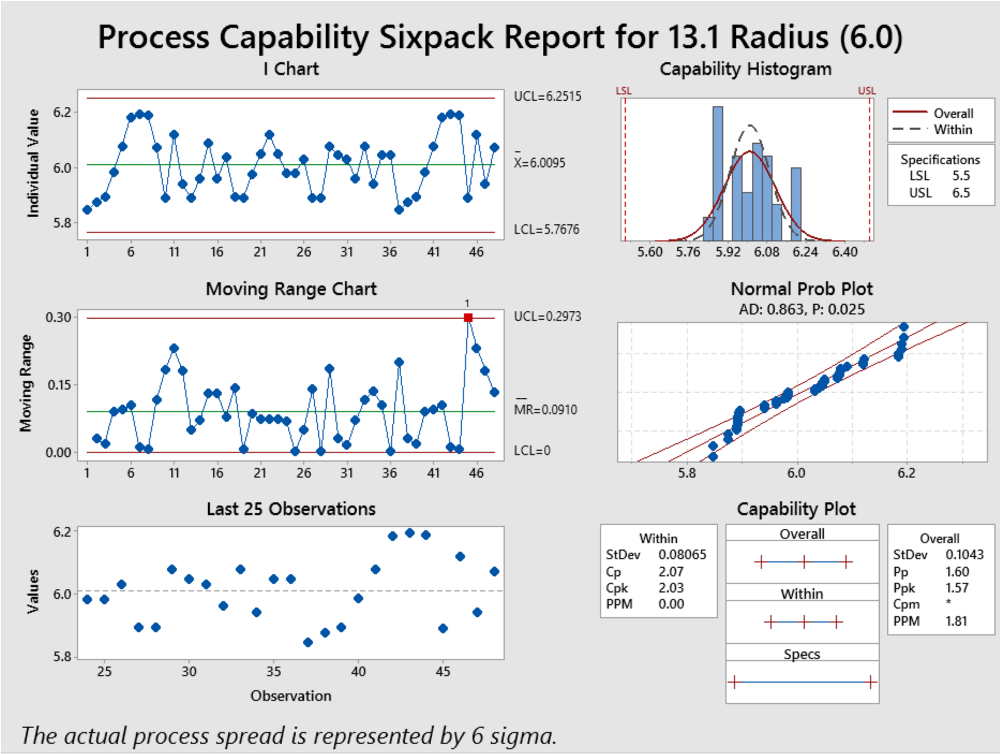

## 11. Process Capability Sixpack Report for 11.1 Chamfer Length (0.5)




## 12. Process Capability Sixpack Report for 11.3 Chamfer Length (0.5)




## 13. Process Capability Sixpack Report for 13.1 Radius (6.0)

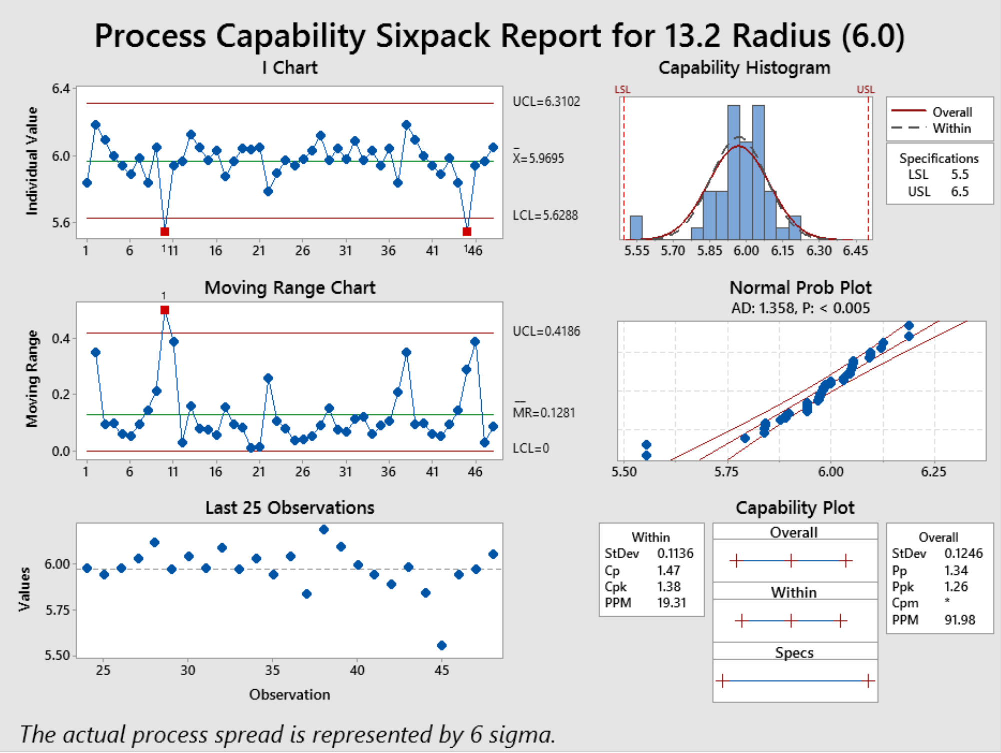



## Test Results for MR Chart of 13.1 Radius (6.0)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 45

**14. Process Capability Sixpack Report for 13.2 Radius (6.0)**




## Test Results for I Chart of 13.2 Radius (6.0)

TEST 1. One point more than 3.00 standard deviations from center line.

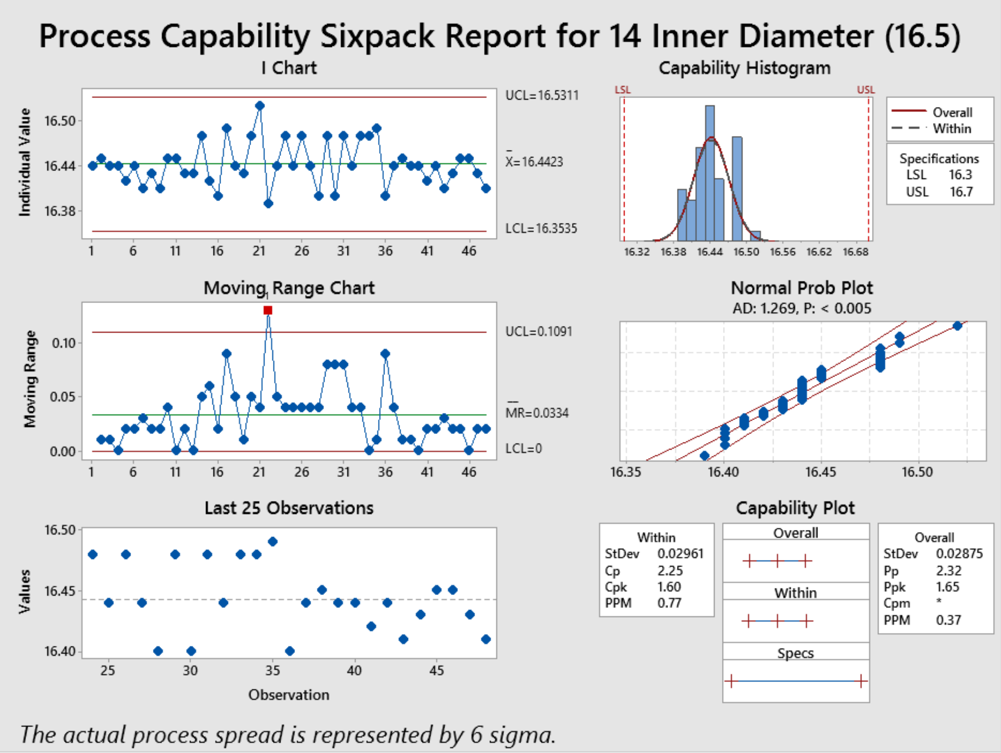
Test Failed at points: 10, 45

## Test Results for MR Chart of 13.2 Radius (6.0)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 10

**15. Process Capability Sixpack Report for 14 Inner Diameter (16.5)**

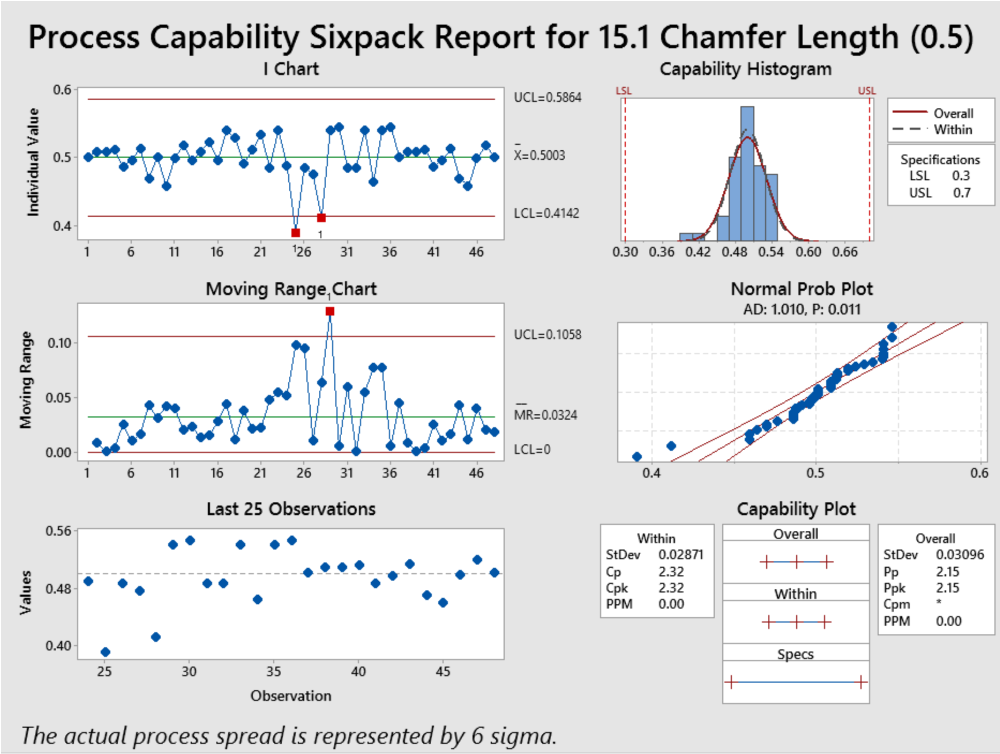



## Test Results for MR Chart of 14 Inner Diameter (16.5)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 22

**16. Process Capability Sixpack Report for 15.1 Chamfer Length (0.5)**




## Test Results for I Chart of 15.1 Chamfer Length (0.5)

TEST 1. One point more than 3.00 standard deviations from center line.

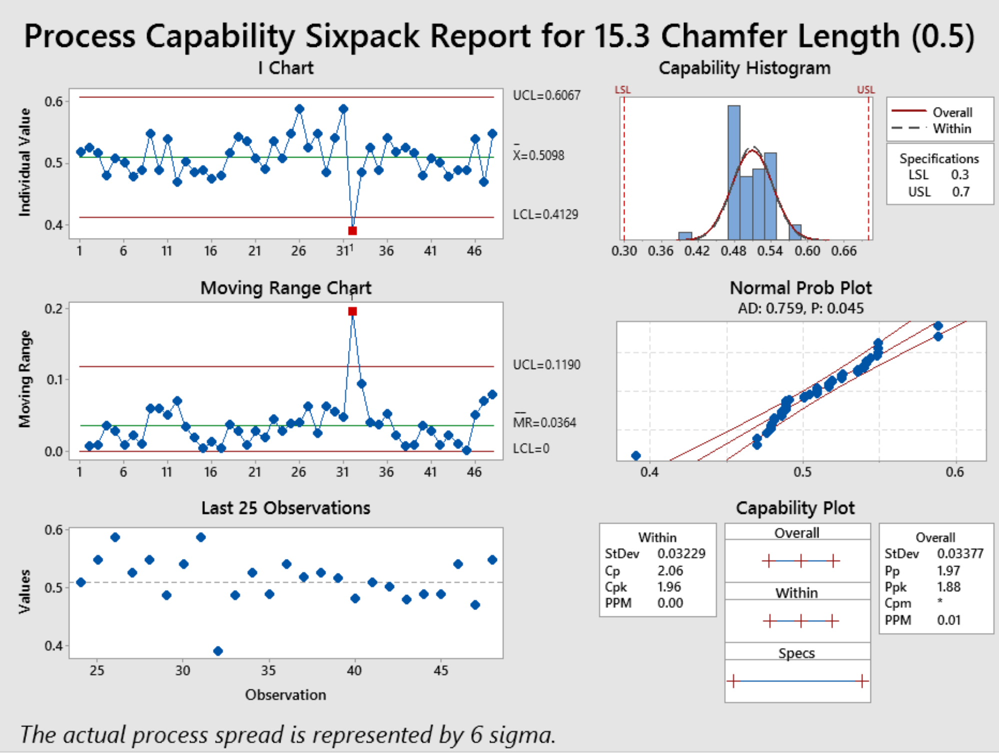
Test Failed at points: 25, 28

## Test Results for MR Chart of 15.1 Chamfer Length (0.5)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 29

**17. Process Capability Sixpack Report for 15.3 Chamfer Length (0.5)**




## Test Results for I Chart of 15.3 Chamfer Length (0.5)

TEST 1. One point more than 3.00 standard deviations from center line.

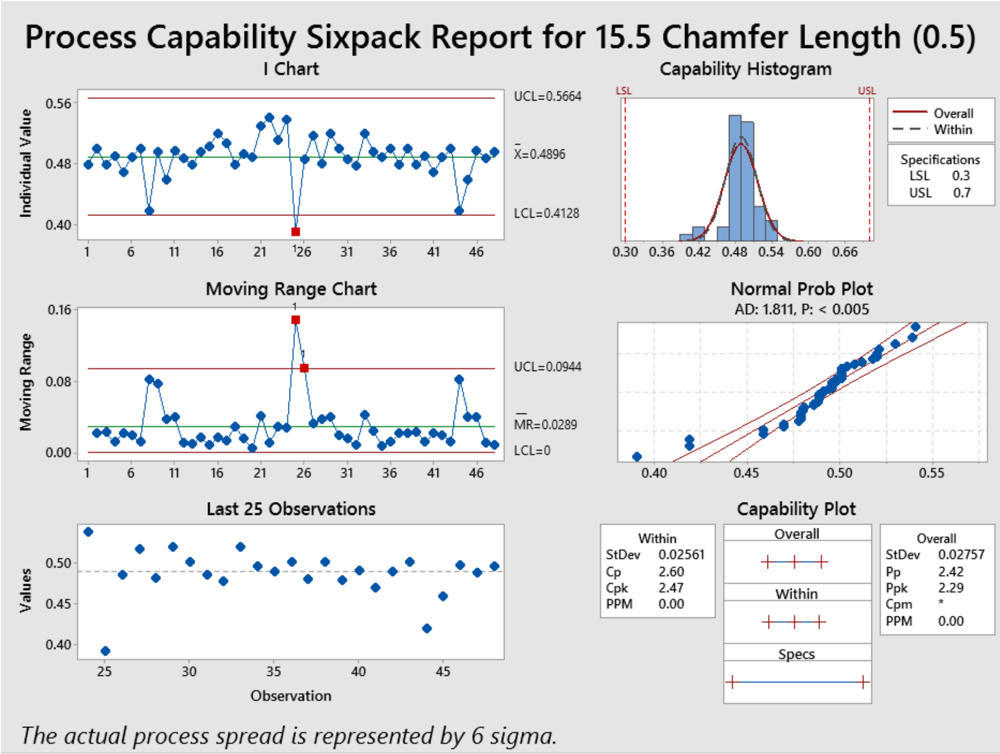
Test Failed at points: 32

## Test Results for MR Chart of 15.3 Chamfer Length (0.5)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 32

**18. Process Capability Sixpack Report for 15.5 Chamfer Length (0.5)**




### Test Results for I Chart of 15.5 Chamfer Length (0.5)

TEST 1. One point more than 3.00 standard deviations from center line.

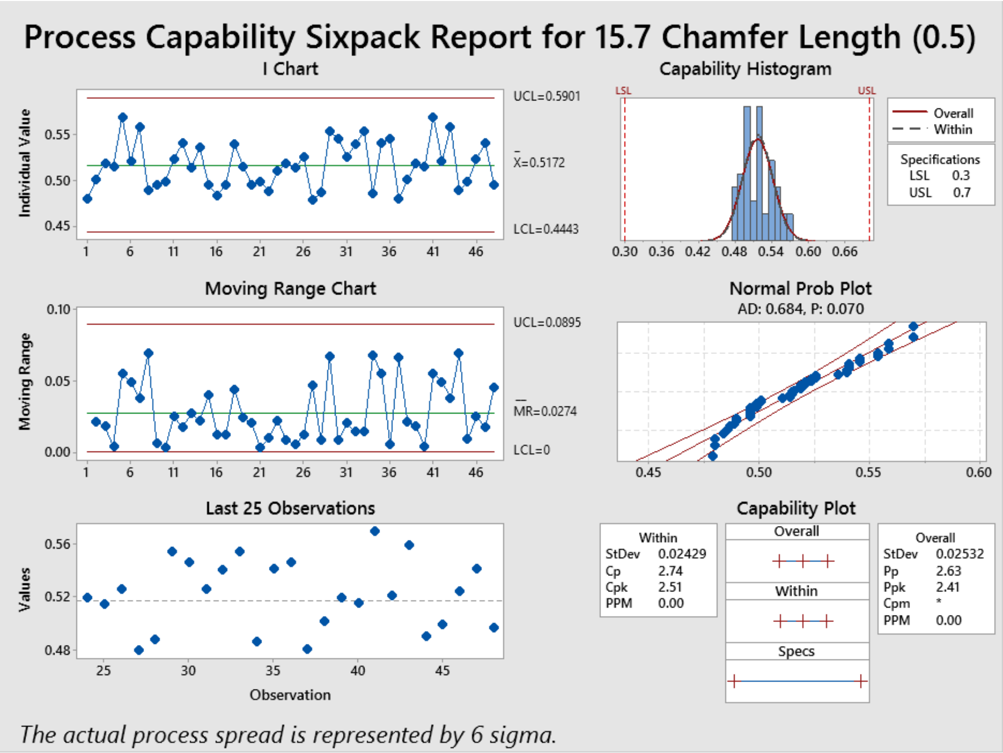
Test Failed at points: 25

### Test Results for MR Chart of 15.5 Chamfer Length (0.5)

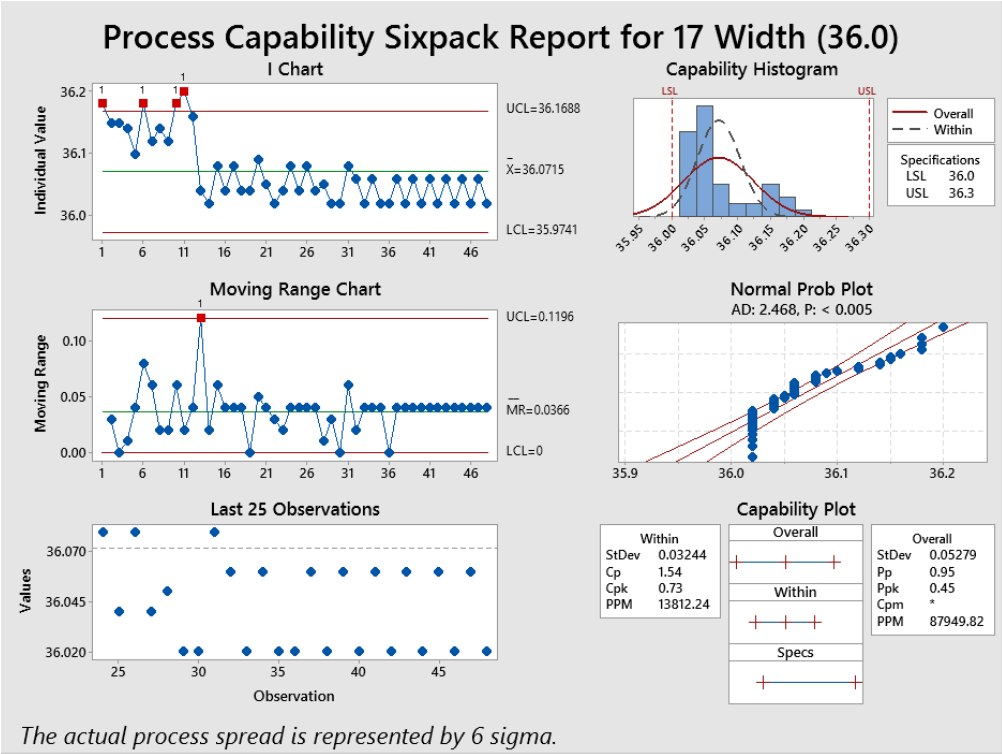
TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 25, 26

**19. Process Capability Sixpack Report for 15.7 Chamfer Length (0.5)**




## 20. Process Capability Sixpack Report for 17 Width (36.0)




## Test Results for I Chart of 17 Width (36.0)

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TEST 1. One point more than 3.00 standard deviations from center line.

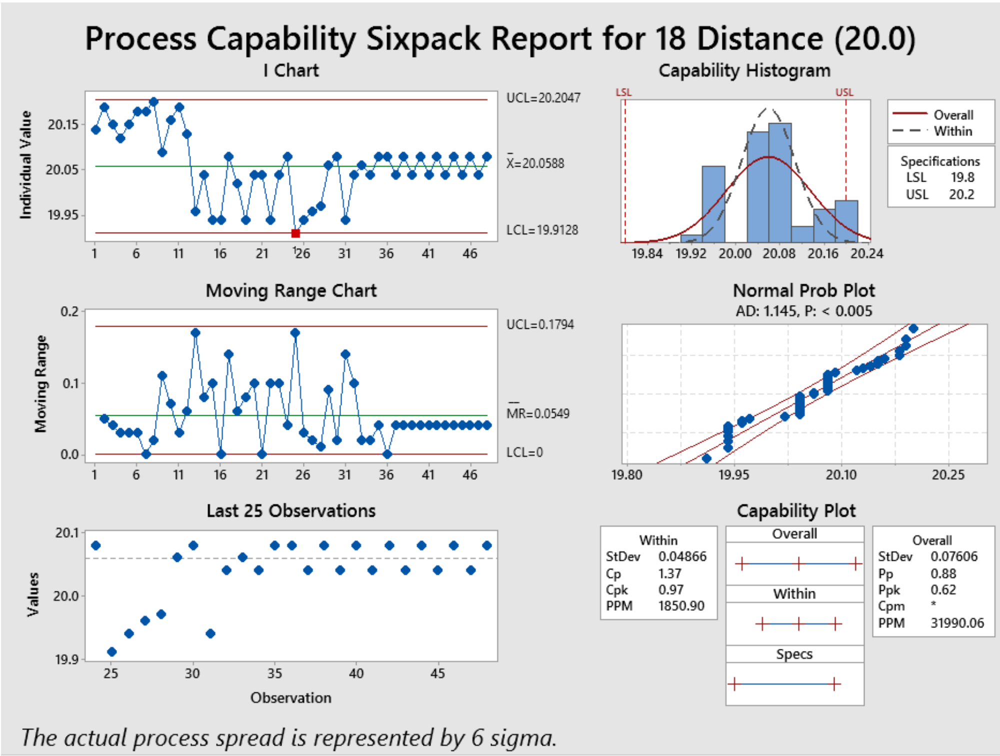
Test Failed at points: 1, 6, 10, 11

## Test Results for MR Chart of 17 Width (36.0)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 13

### 21. Process Capability Sixpack Report for 18 Distance (20.0)

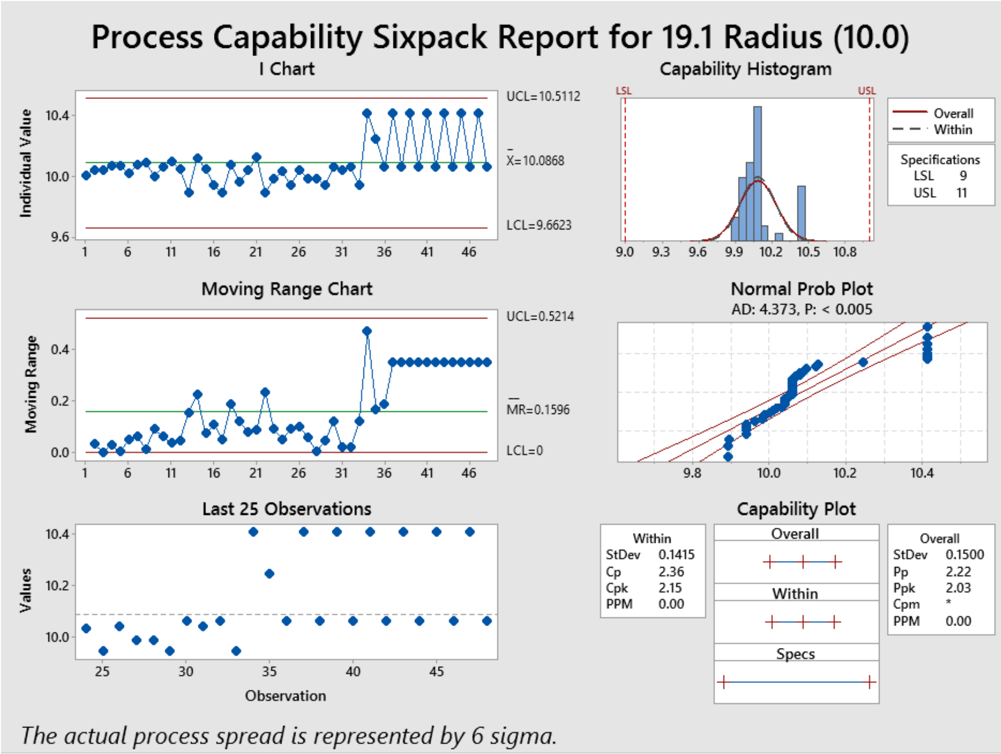



## Test Results for I Chart of 18 Distance (20.0)

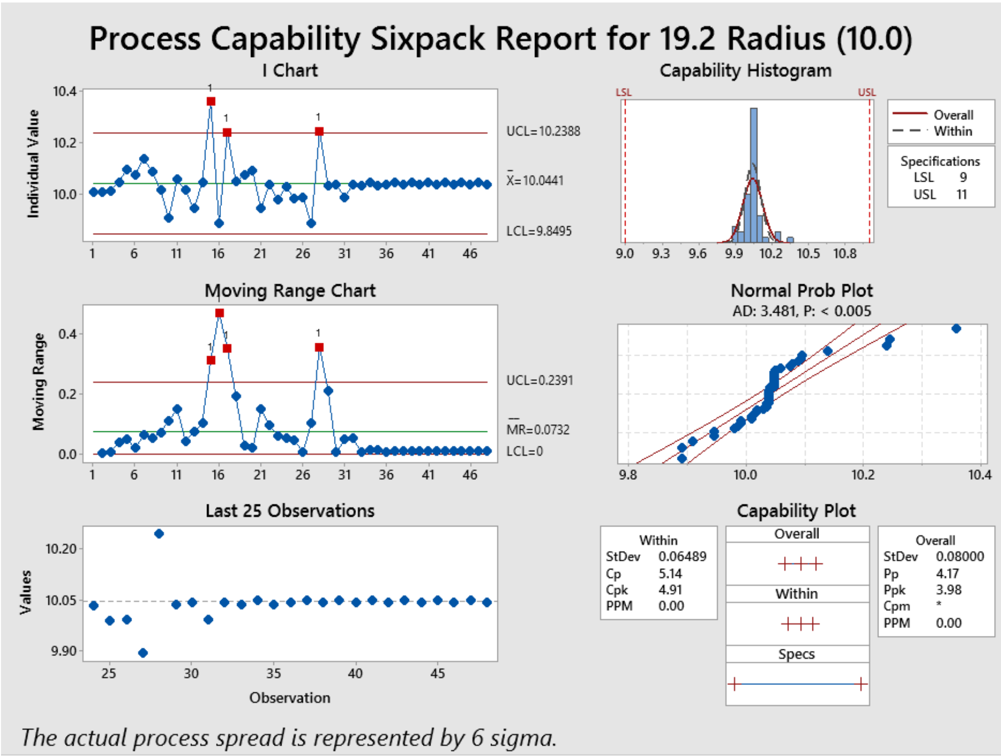
TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 25

### 22. Process Capability Sixpack Report for 19.1 Radius (10.0)




## 23. Process Capability Sixpack Report for 19.2 Radius (10.0)




## Test Results for I Chart of 19.2 Radius (10.0)

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TEST 1. One point more than 3.00 standard deviations from center line.

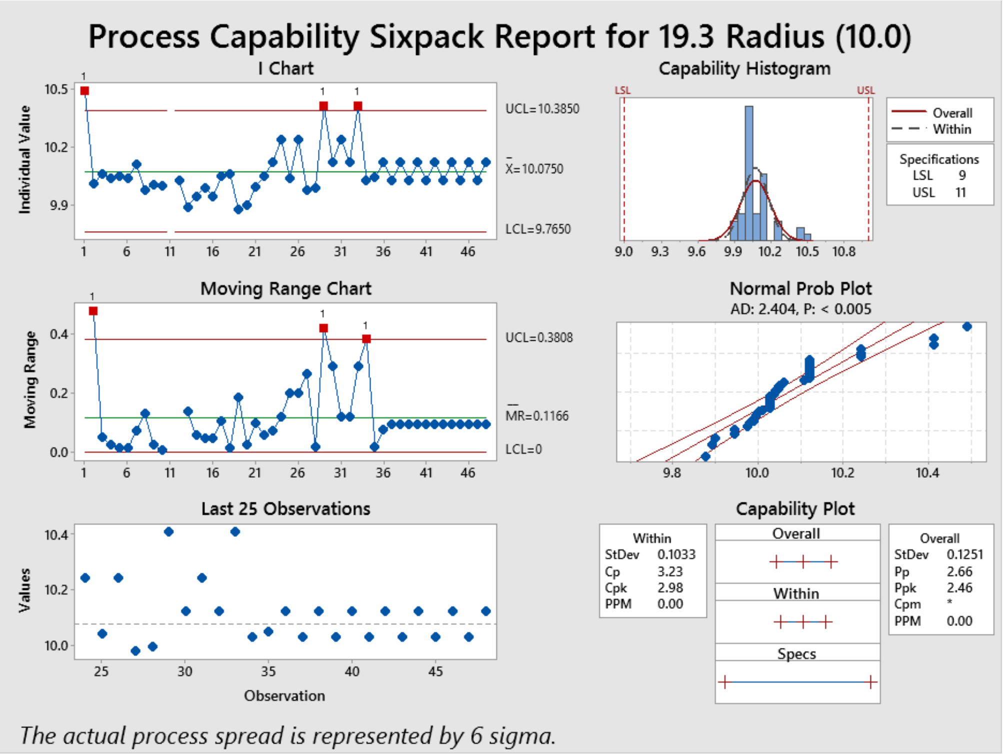
Test Failed at points: 15, 17, 28

### Test Results for MR Chart of 19.2 Radius (10.0)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 15, 16, 17, 28

### 24. Process Capability Sixpack Report for 19.3 Radius (10.0)




### Test Results for I Chart of 19.3 Radius (10.0)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 1, 29, 33

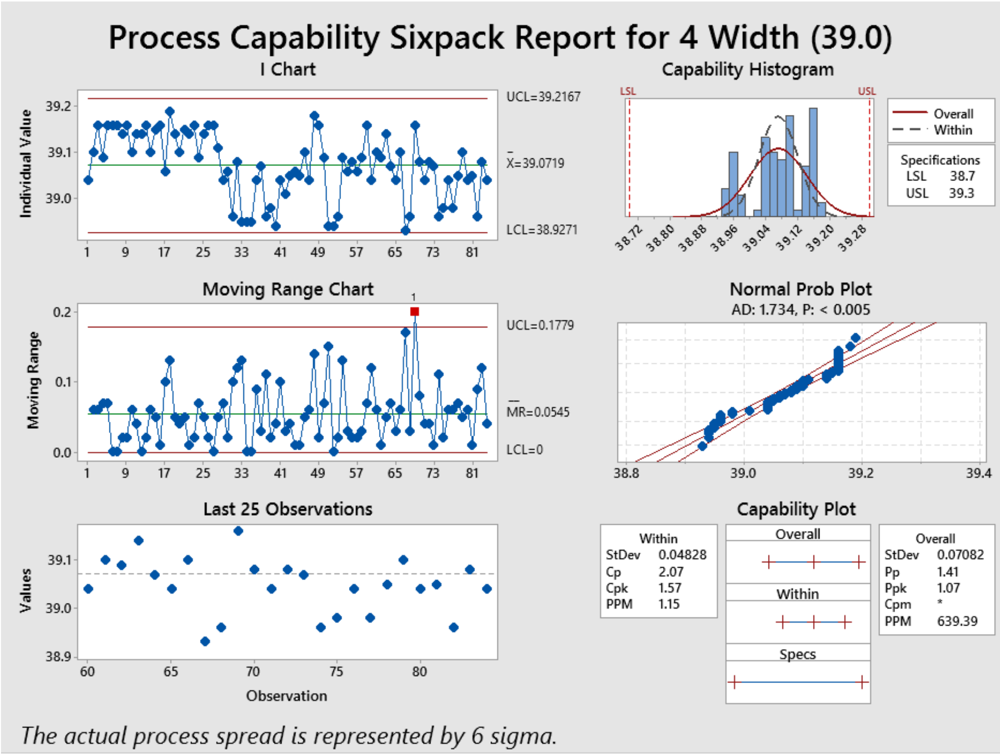
### Test Results for MR Chart of 19.3 Radius (10.0)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 2, 29, 34

## B. Analysis for 10A

1. **Process Capability Sixpack Report for 4 Width (39.0)**

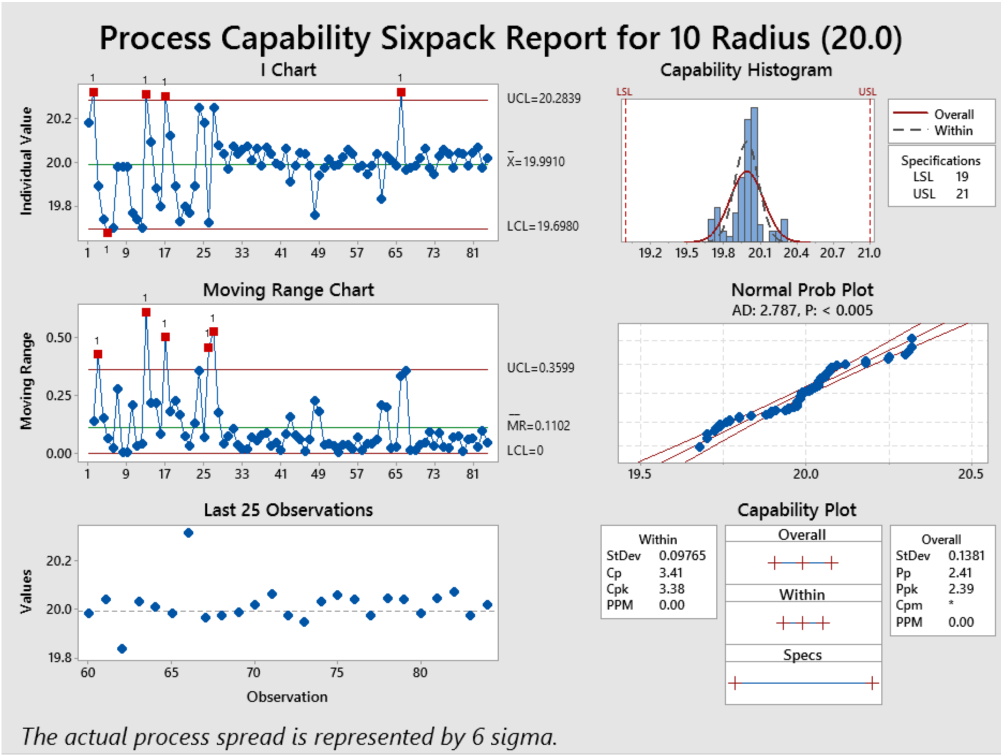



## Test Results for MR Chart of 4 Width (39.0)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 69

2. **Process Capability Sixpack Report for 10 Radius (20.0)**




## Test Results for I Chart of 10 Radius (20.0)

TEST 1. One point more than 3.00 standard deviations from center line.

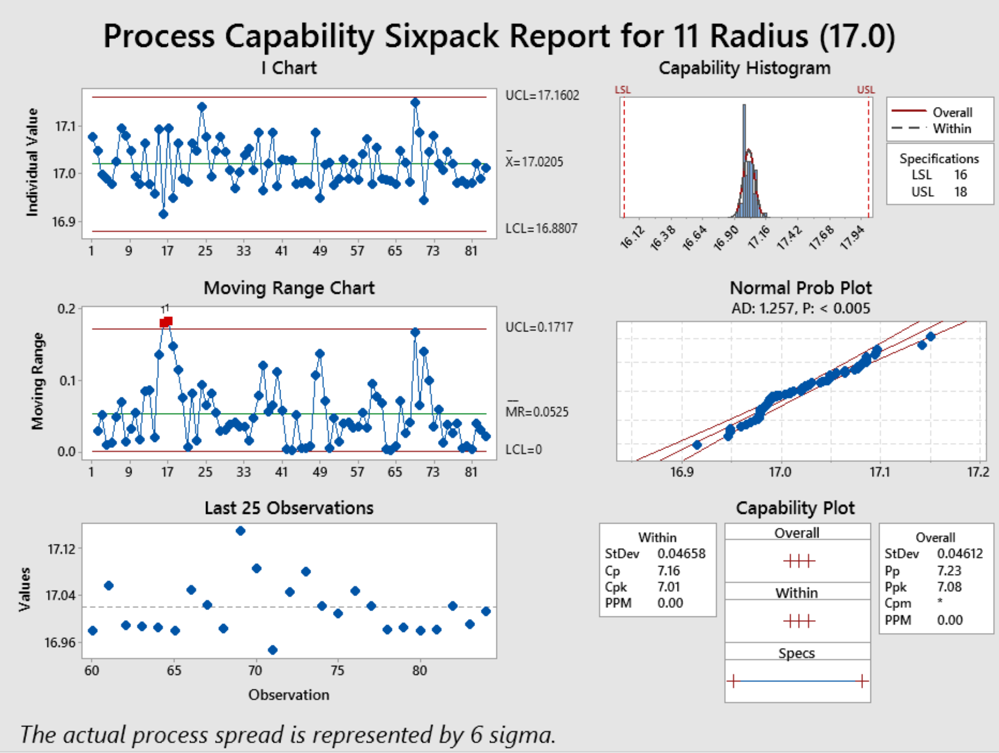
Test Failed at points: 2, 5, 13, 17, 66

## Test Results for MR Chart of 10 Radius (20.0)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 3, 13, 17, 26, 27

3. **Process Capability Sixpack Report for 11 Radius (17.0)**

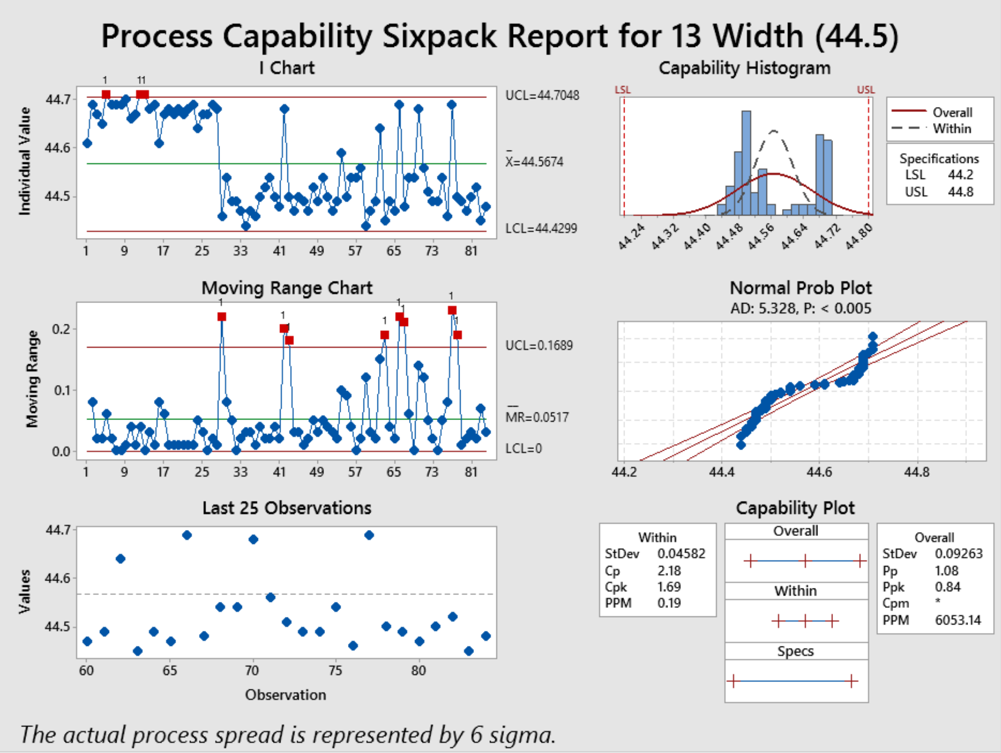



## Test Results for MR Chart of 11 Radius (17.0)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 16, 17

4. **Process Capability Sixpack Report for 13 Width (44.5)**




### Test Results for I Chart of 13 Width (44.5)

TEST 1. One point more than 3.00 standard deviations from center line.

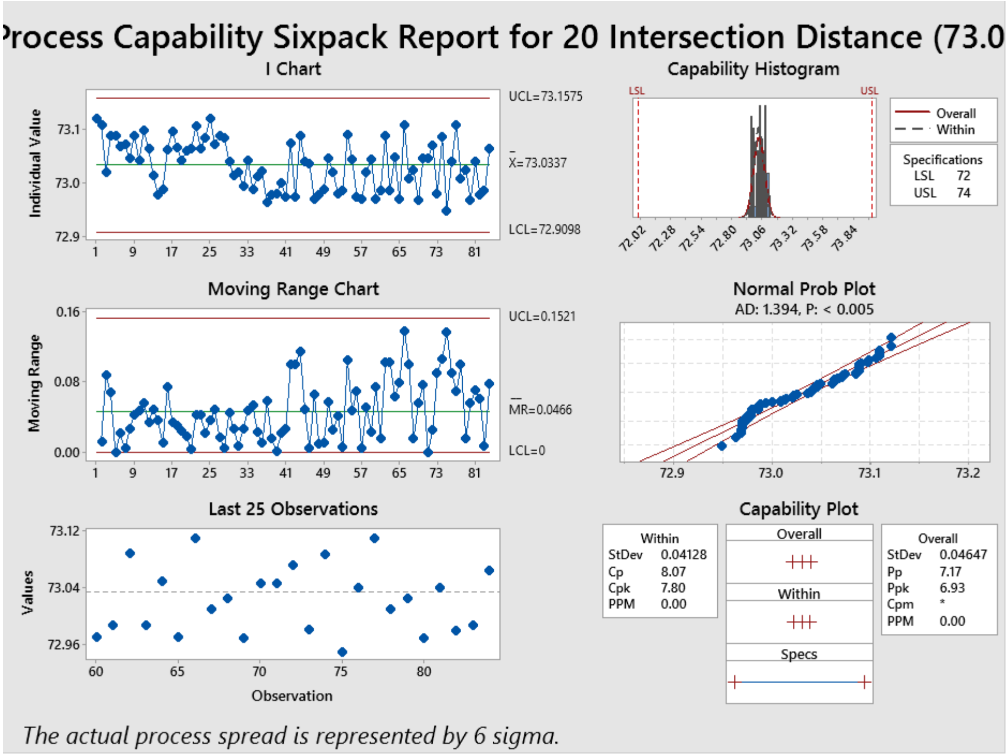
Test Failed at points: 5, 12, 13

### Test Results for MR Chart of 13 Width (44.5)

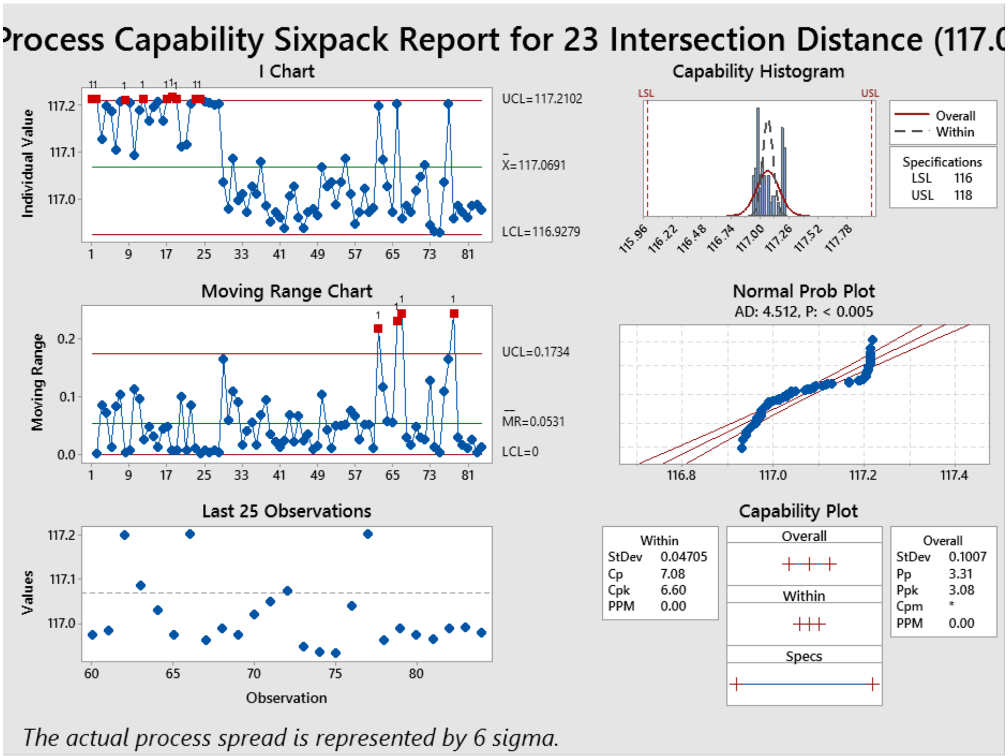
TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 29, 42, 43, 63, 66, 67, 77, 78

**5. Process Capability Sixpack Report for 20 Intersection Distance (73.0)**




## 6. Process Capability Sixpack Report for 23 Intersection Distance (117.0




### Test Results for I Chart of 23 Intersection Distance (117.0

TEST 1. One point more than 3.00 standard deviations from center line.

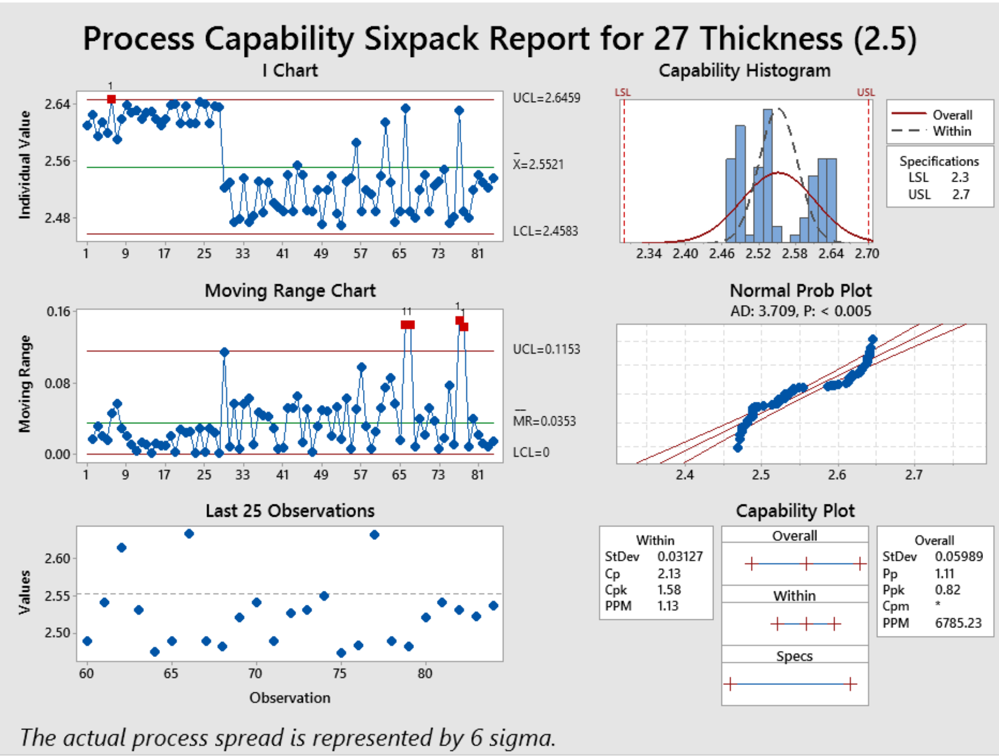
Test Failed at points: 1, 2, 8, 12, 17, 18, 19, 23, 24

**Test Results for MR Chart of 23 Intersection Distance (117.0**

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 62, 66, 67, 78

## 7. Process Capability Sixpack Report for 27 Thickness (2.5)




**Test Results for I Chart of 27 Thickness (2.5)**

TEST 1. One point more than 3.00 standard deviations from center line.

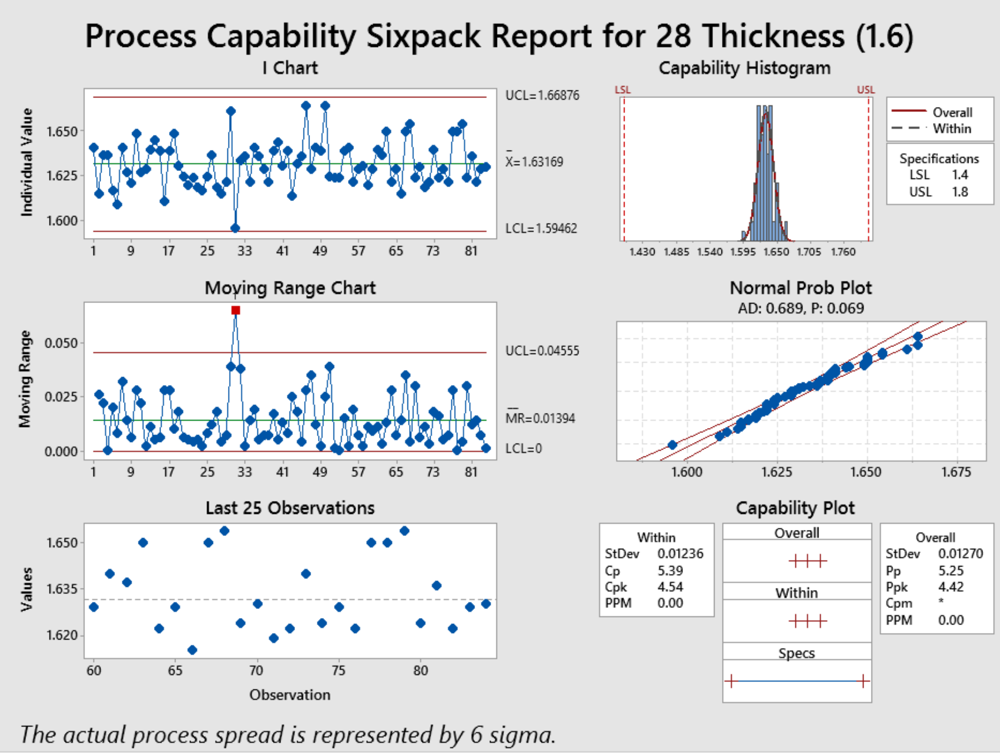
Test Failed at points: 6

**Test Results for MR Chart of 27 Thickness (2.5)**

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 66, 67, 77, 78

## 8. Process Capability Sixpack Report for 28 Thickness (1.6)

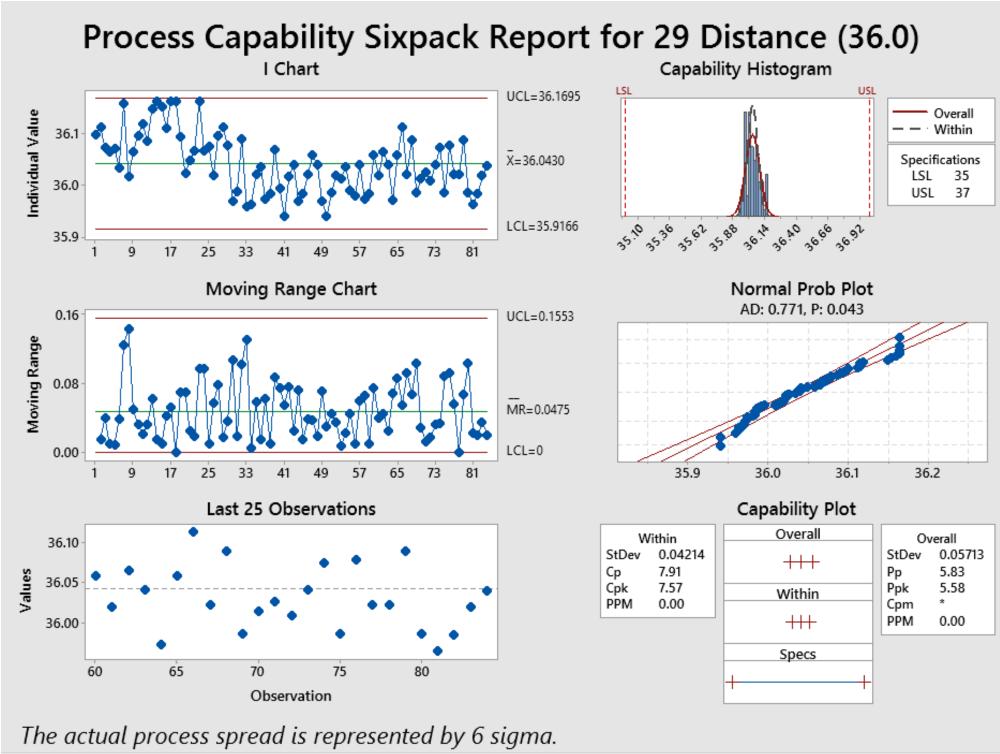



## Test Results for MR Chart of 28 Thickness (1.6)

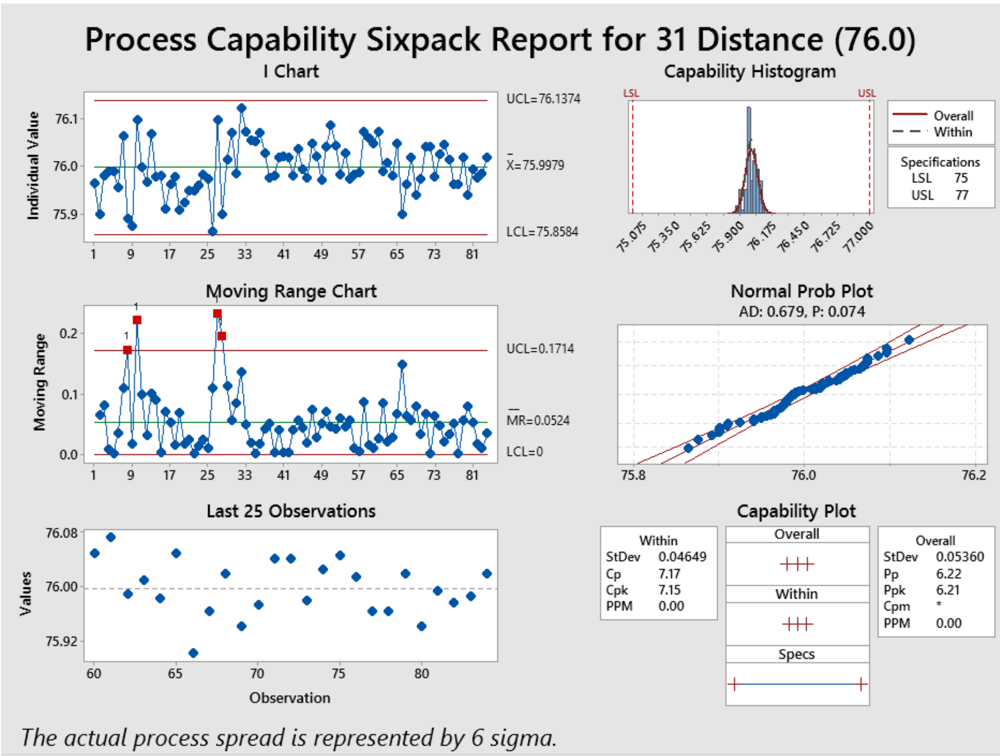
TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 31

## 9. Process Capability Sixpack Report for 29 Distance (36.0)




## 10. Process Capability Sixpack Report for 31 Distance (76.0)

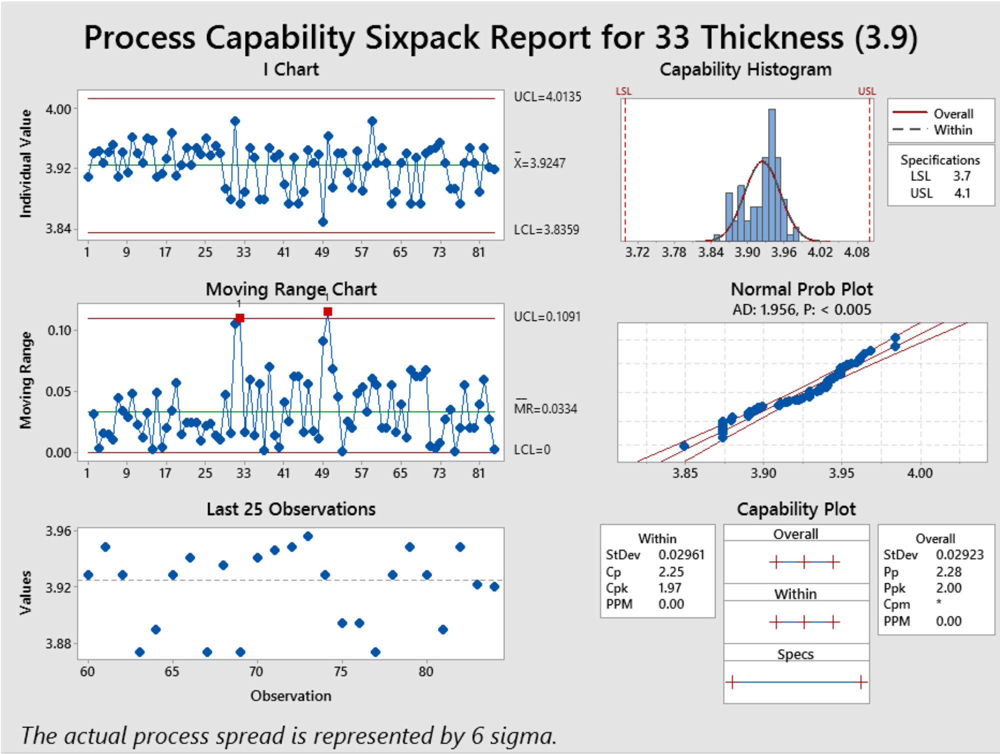



## Test Results for MR Chart of 31 Distance (76.0)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 8, 10, 27, 28

### 11. Process Capability Sixpack Report for 33 Thickness (3.9)

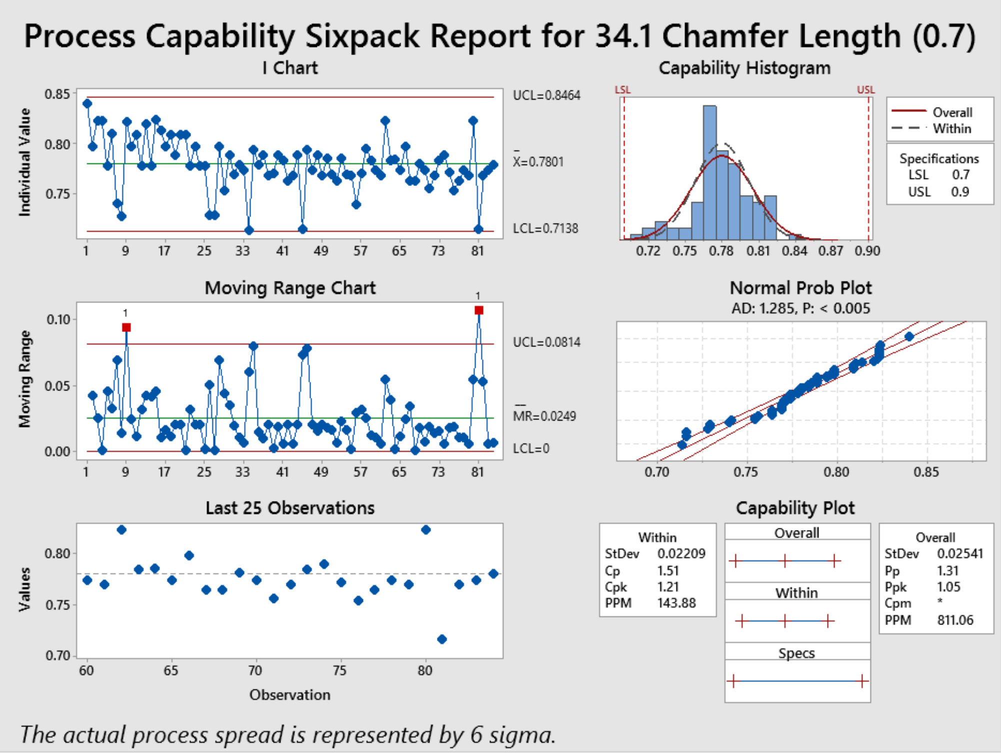



#### Test Results for MR Chart of 33 Thickness (3.9)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 32, 50

### 12. Process Capability Sixpack Report for 34.1 Chamfer Length (0.7)

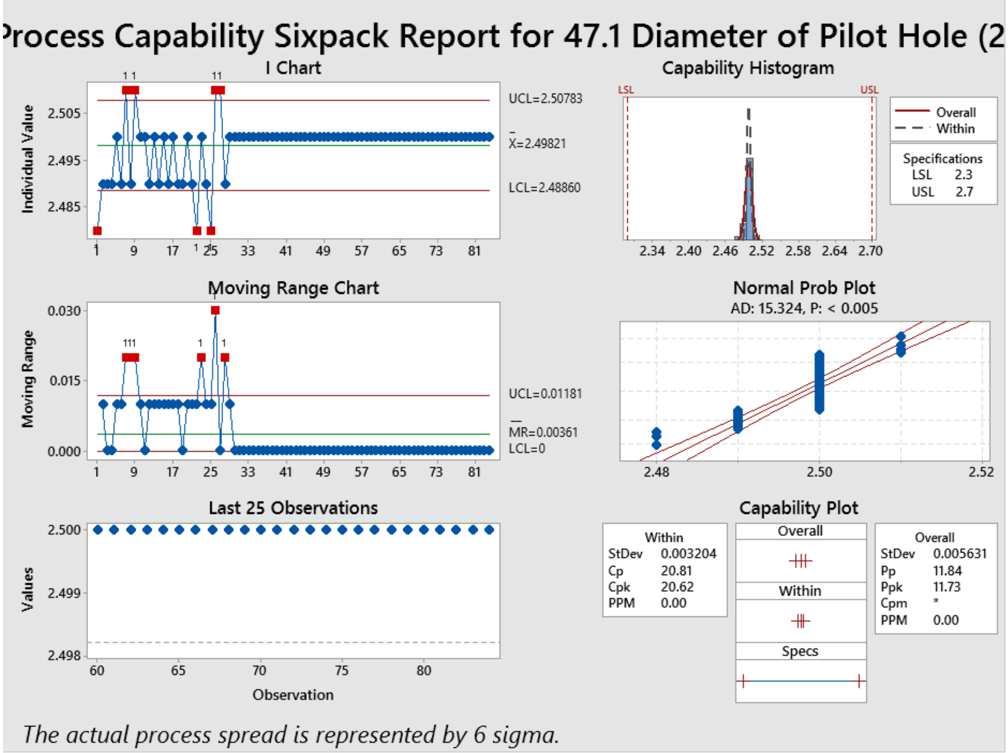



## Test Results for MR Chart of 34.1 Chamfer Length (0.7)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 9, 81

**13. Process Capability Sixpack Report for 47.1 Diameter of Pilot Hole (2.**




## Test Results for I Chart of 47.1 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

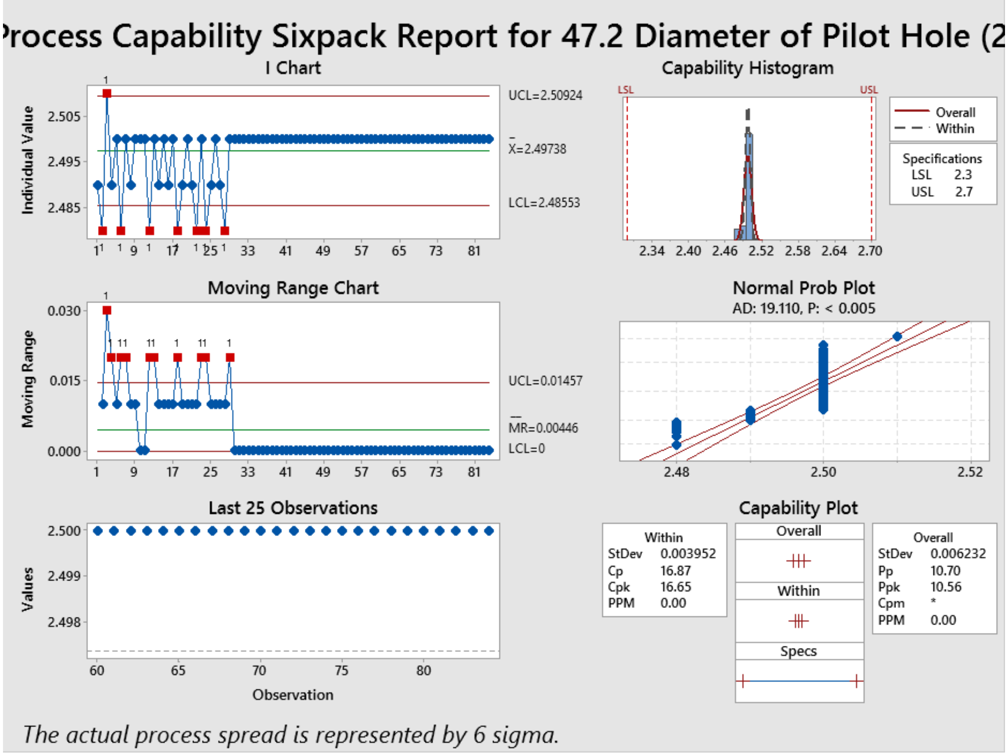
Test Failed at points: 1, 7, 9, 22, 25, 26, 27

## Test Results for MR Chart of 47.1 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 7, 8, 9, 23, 26, 28

**14. Process Capability Sixpack Report for 47.2 Diameter of Pilot Hole (2.**




## Test Results for I Chart of 47.2 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

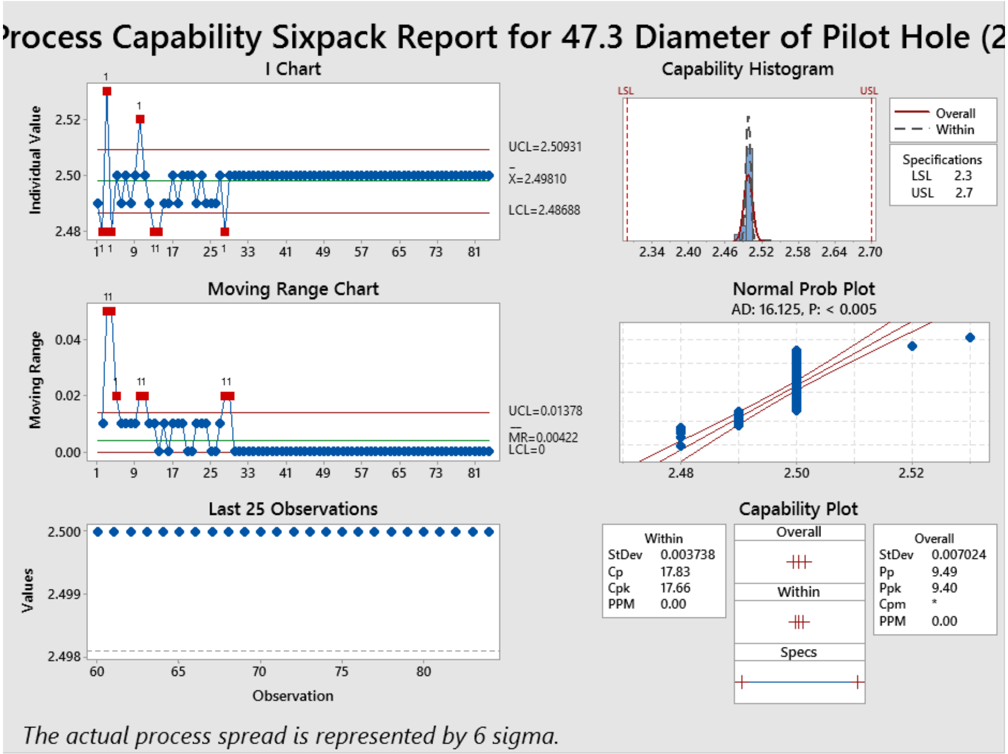
Test Failed at points: 2, 3, 6, 12, 18, 22, 24, 28

## Test Results for MR Chart of 47.2 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 3, 4, 6, 7, 12, 13, 18, 23, 24, 29

**15. Process Capability Sixpack Report for 47.3 Diameter of Pilot Hole (2.**




## Test Results for I Chart of 47.3 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

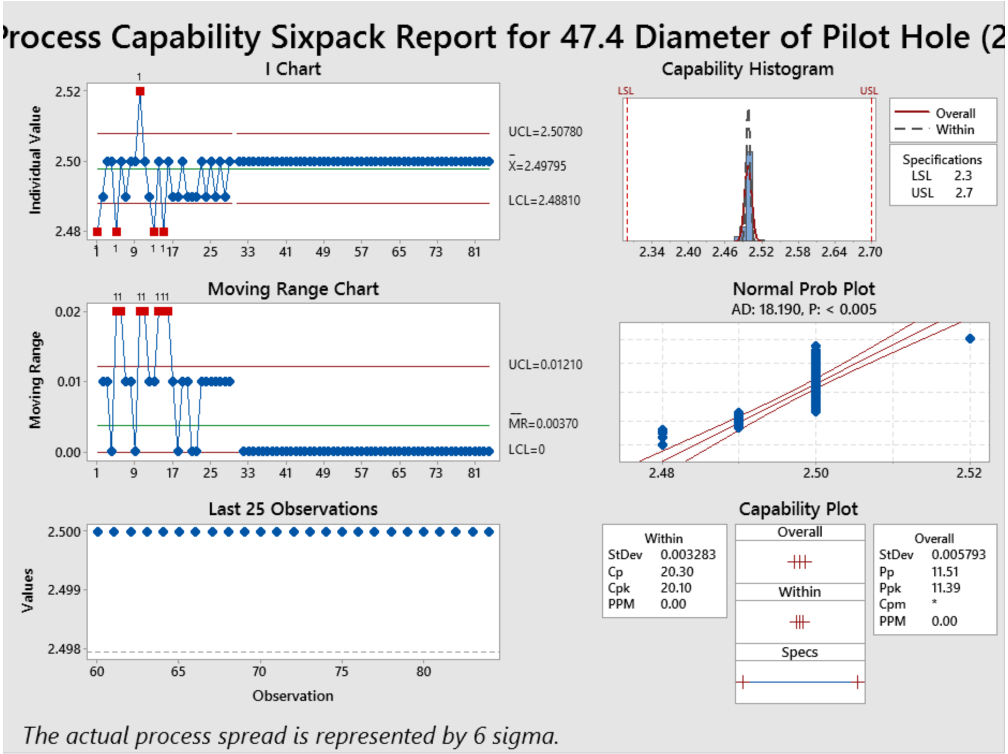
Test Failed at points: 2, 3, 4, 10, 13, 14, 28

## Test Results for MR Chart of 47.3 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 3, 4, 5, 10, 11, 28, 29

**16. Process Capability Sixpack Report for 47.4 Diameter of Pilot Hole (2.**




## Test Results for I Chart of 47.4 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

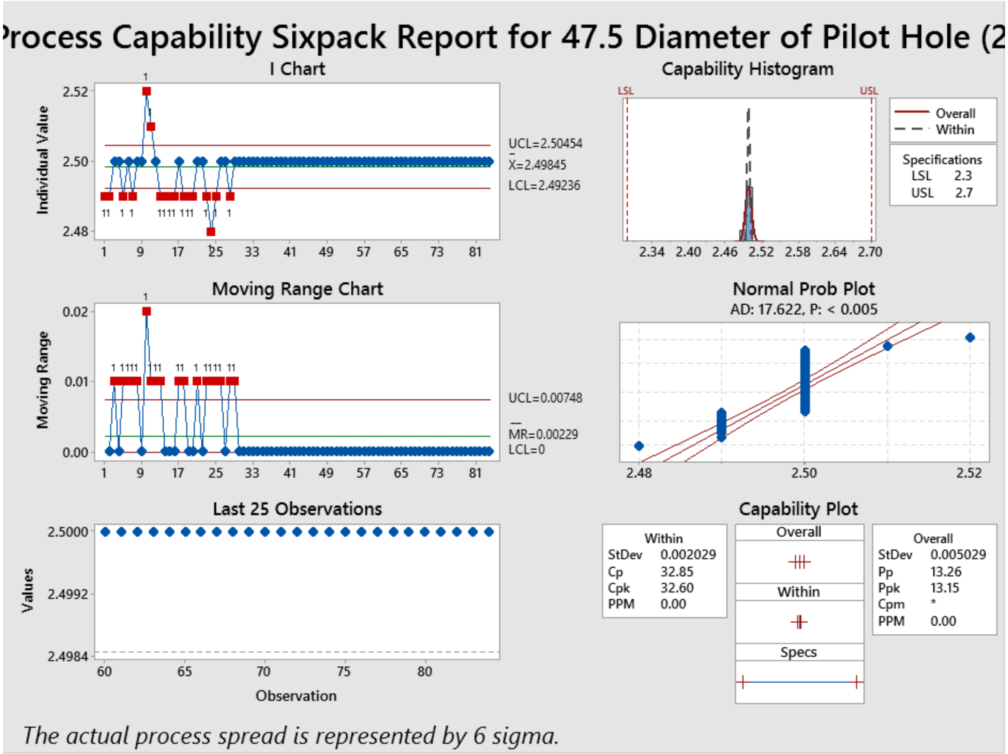
Test Failed at points: 1, 5, 10, 13, 15

## Test Results for MR Chart of 47.4 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 5, 6, 10, 11, 14, 15, 16

**17. Process Capability Sixpack Report for 47.5 Diameter of Pilot Hole (2.**




## Test Results for I Chart of 47.5 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

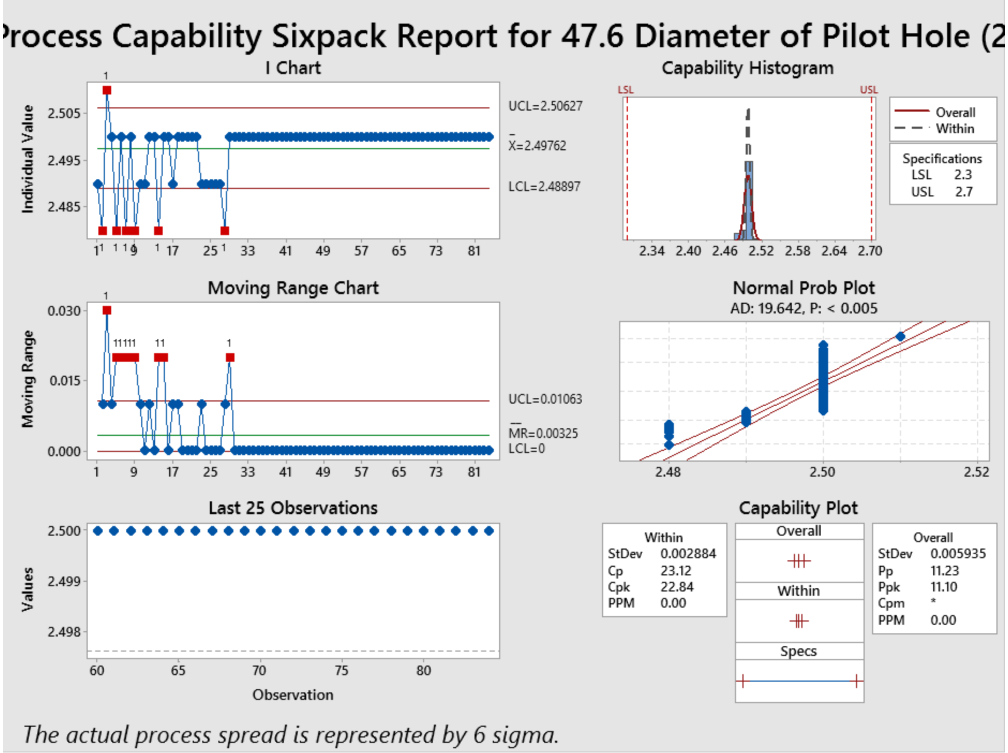
Test Failed at points: 1, 2, 5, 7, 10, 11, 13, 14, 15, 16, 18, 19, 20, 23, 24, 25, 28

## Test Results for MR Chart of 47.5 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 3, 5, 6, 7, 8, 10, 11, 12, 13, 17, 18, 21, 23, 24, 25, 26, 28, 29

**18. Process Capability Sixpack Report for 47.6 Diameter of Pilot Hole (2.**




## Test Results for I Chart of 47.6 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

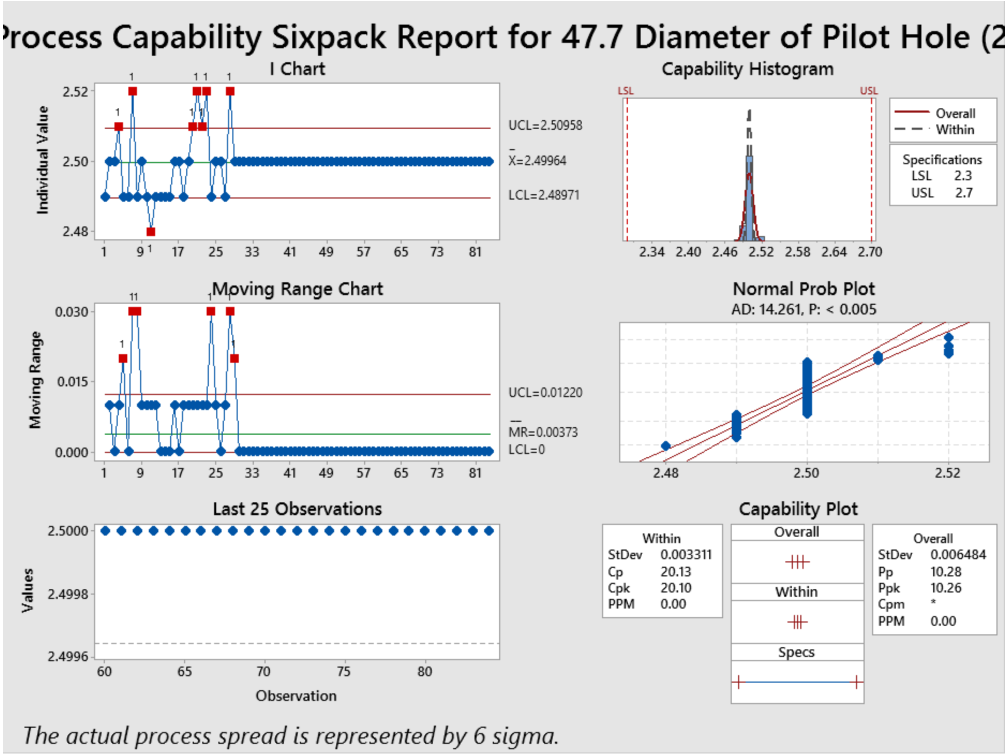
Test Failed at points: 2, 3, 5, 7, 9, 14, 28

## Test Results for MR Chart of 47.6 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 3, 5, 6, 7, 8, 9, 14, 15, 29

**19. Process Capability Sixpack Report for 47.7 Diameter of Pilot Hole (2.**




## Test Results for I Chart of 47.7 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

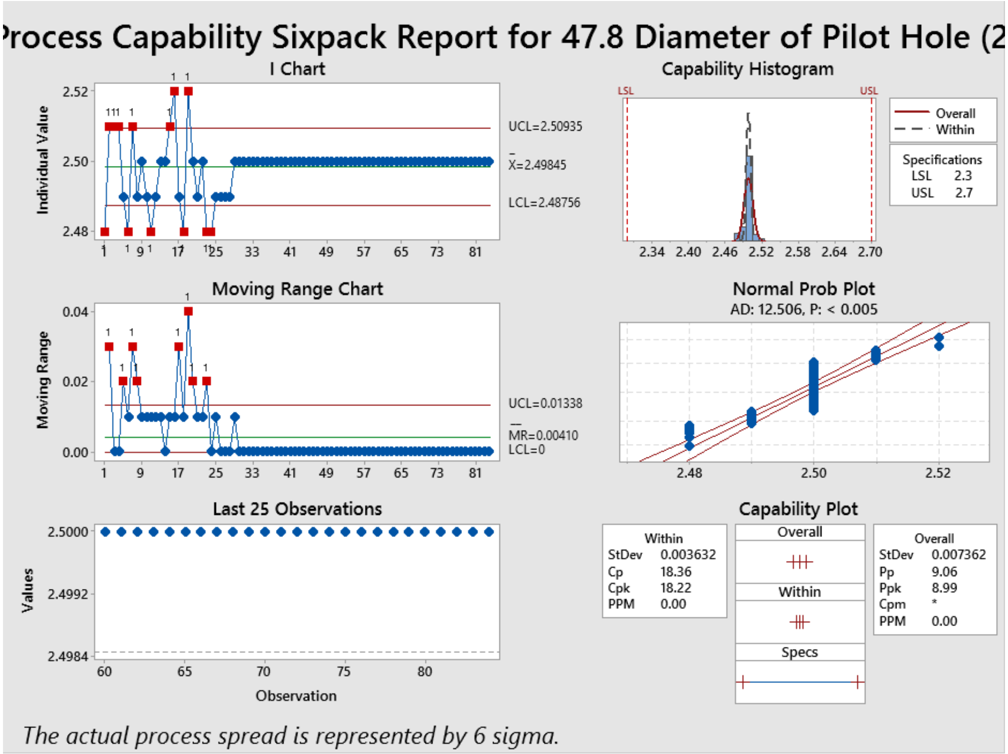
Test Failed at points: 4, 7, 11, 20, 21, 22, 23, 28

## Test Results for MR Chart of 47.7 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 5, 7, 8, 24, 28, 29

**20. Process Capability Sixpack Report for 47.8 Diameter of Pilot Hole (2.**




## Test Results for I Chart of 47.8 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

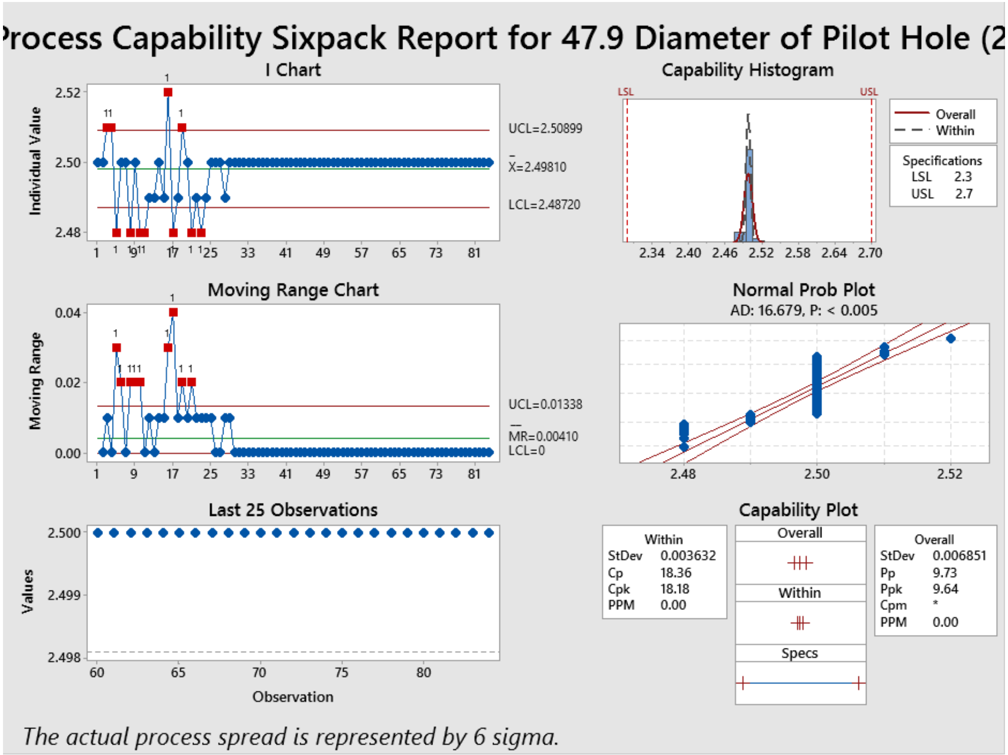
Test Failed at points: 1, 2, 3, 4, 6, 7, 11, 15, 16, 18, 19, 23, 24

## Test Results for MR Chart of 47.8 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 2, 5, 7, 8, 17, 19, 20, 23

**21. Process Capability Sixpack Report for 47.9 Diameter of Pilot Hole (2.**




## Test Results for I Chart of 47.9 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

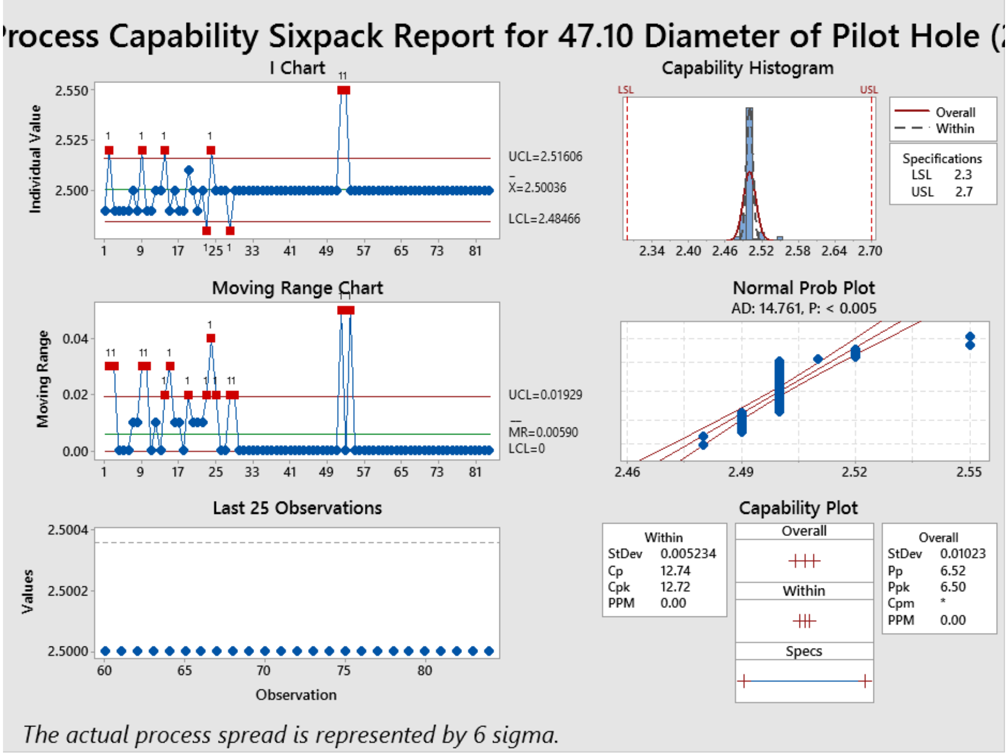
Test Failed at points: 3, 4, 5, 8, 10, 11, 16, 17, 19, 21, 23

## Test Results for MR Chart of 47.9 Diameter of Pilot Hole (2.

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 5, 6, 8, 9, 10, 16, 17, 19, 21

**22. Process Capability Sixpack Report for 47.10 Diameter of Pilot Hole (2**




## Test Results for I Chart of 47.10 Diameter of Pilot Hole (2

TEST 1. One point more than 3.00 standard deviations from center line.

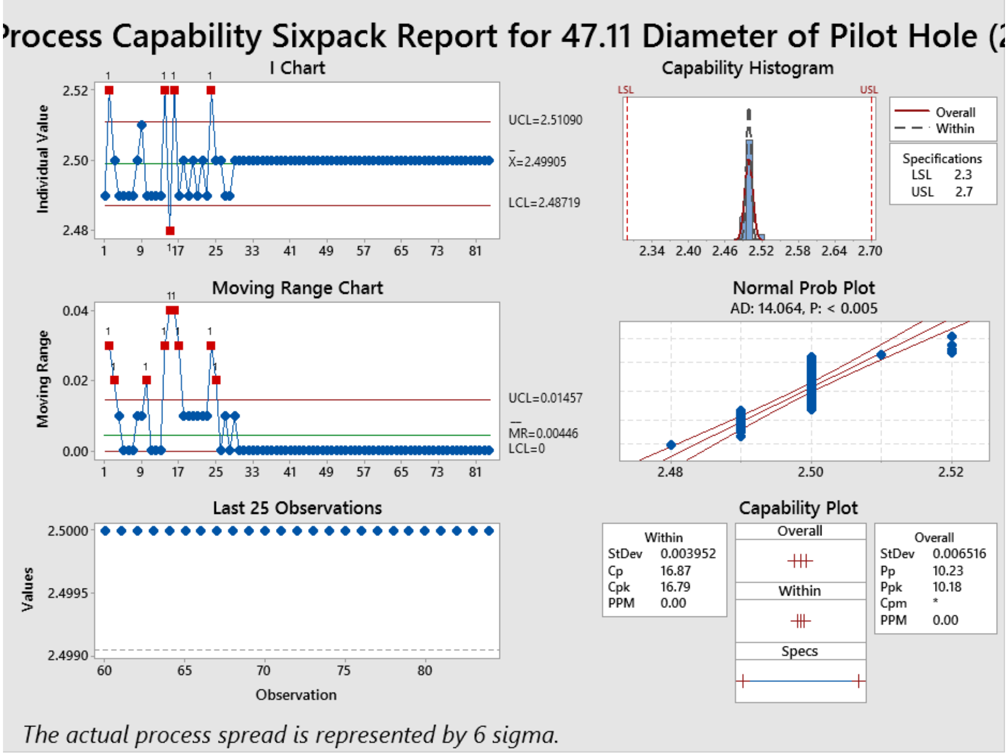
Test Failed at points: 2, 9, 14, 23, 24, 28, 52, 53

## Test Results for MR Chart of 47.10 Diameter of Pilot Hole (2

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 2, 3, 9, 10, 14, 15, 19, 23, 24, 25, 28, 29, 52, 54

**23. Process Capability Sixpack Report for 47.11 Diameter of Pilot Hole (2**




## Test Results for I Chart of 47.11 Diameter of Pilot Hole (2

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 2, 14, 15, 16, 24

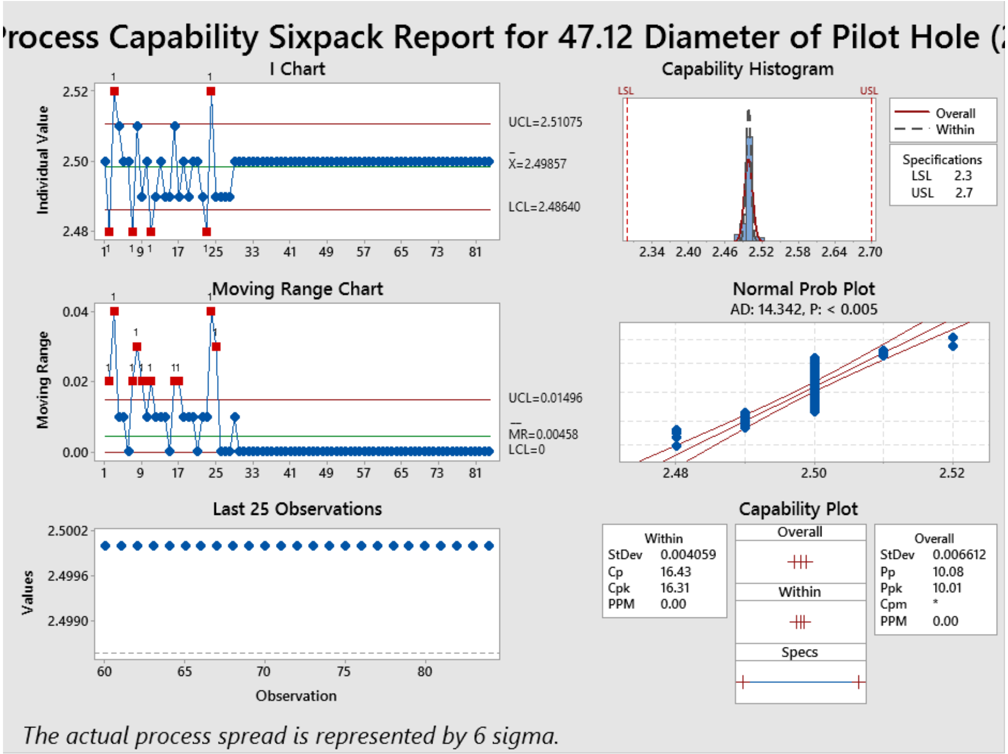
## Test Results for MR Chart of 47.11 Diameter of Pilot Hole (2

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 2, 3, 10, 14, 15, 16, 17, 24, 25

**24. Process Capability Sixpack Report for 47.12 Diameter of Pilot Hole (2**

Publication Partner:
International Journal of Scientific and Research Publications (ISSN: 2250-3153)




## Test Results for I Chart of 47.12 Diameter of Pilot Hole (2

TEST 1. One point more than 3.00 standard deviations from center line.

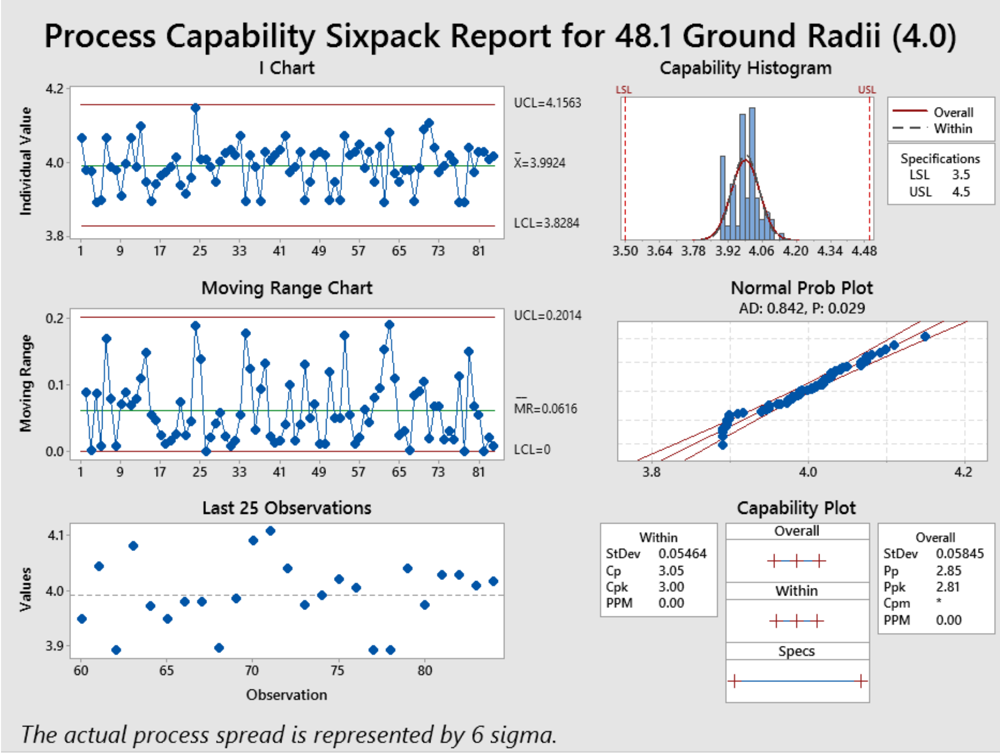
Test Failed at points: 2, 3, 7, 11, 23, 24

## Test Results for MR Chart of 47.12 Diameter of Pilot Hole (2

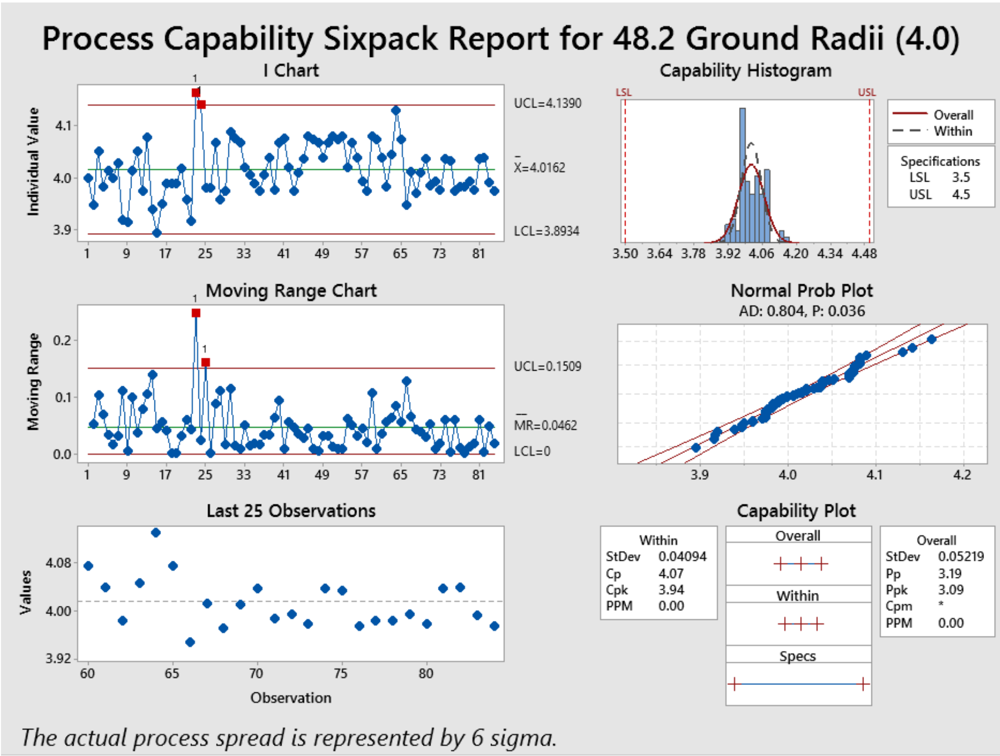
TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 2, 3, 7, 8, 9, 11, 16, 17, 24, 25

**25. Process Capability Sixpack Report for 48.1 Ground Radii (4.0)**




## 26. Process Capability Sixpack Report for 48.2 Ground Radii (4.0)




### Test Results for I Chart of 48.2 Ground Radii (4.0)

Publication Partner:
International Journal of Scientific and Research Publications (ISSN: 2250-3153)

TEST 1. One point more than 3.00 standard deviations from center line.

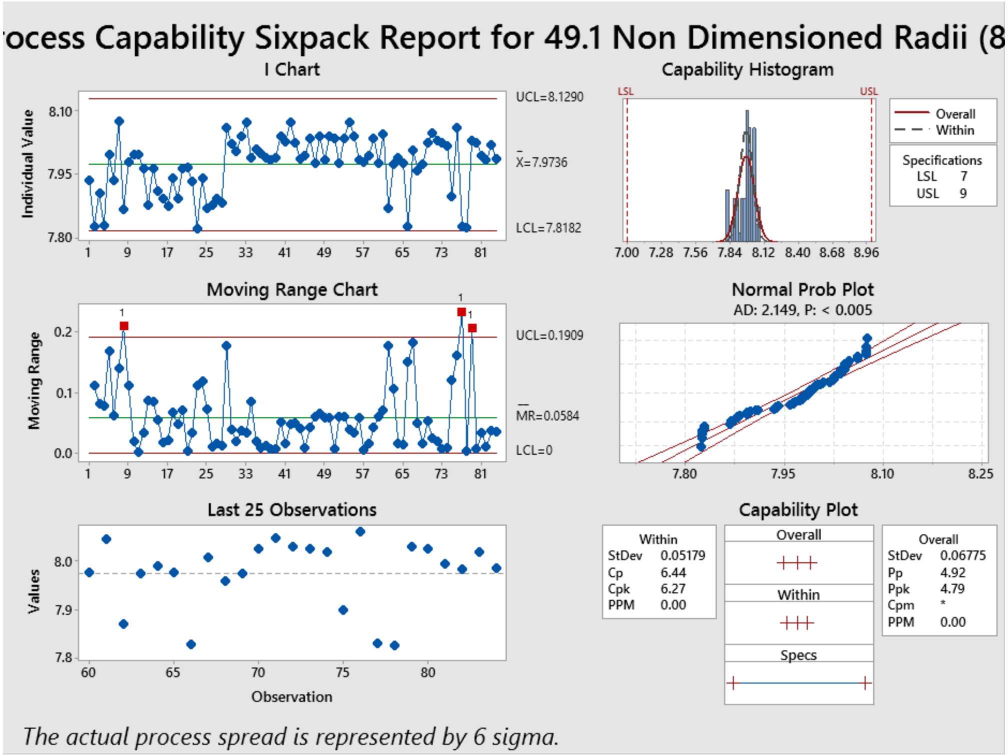
Test Failed at points: 23, 24

### Test Results for MR Chart of 48.2 Ground Radii (4.0)

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 23, 25

## 27. Process Capability Sixpack Report for 49.1 Non Dimensioned Radii (8.0

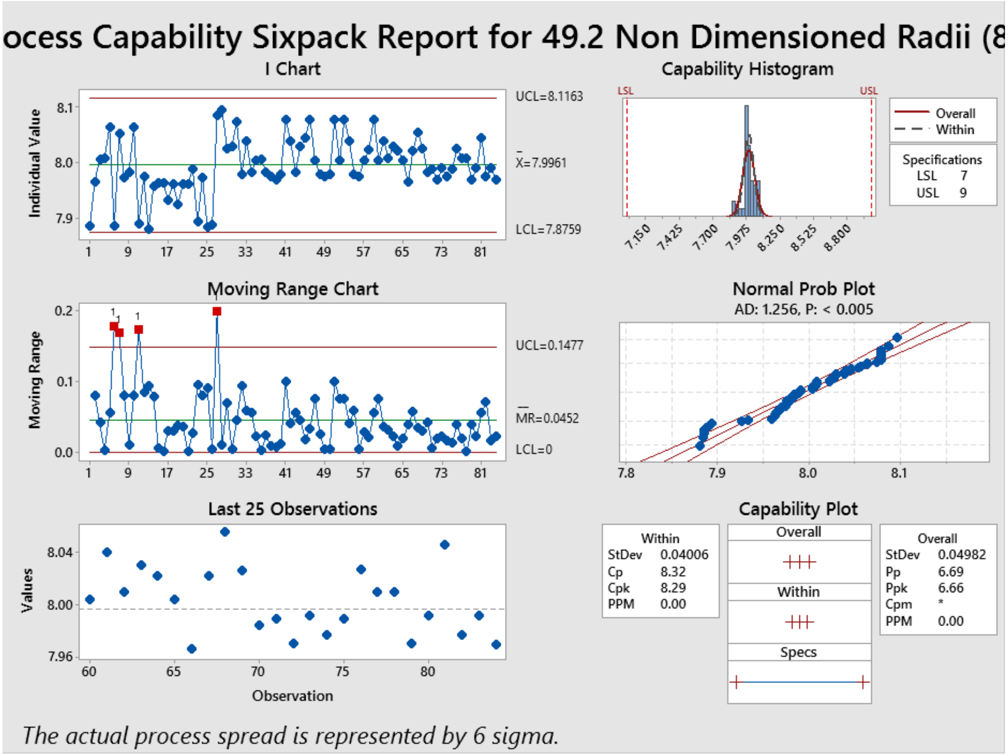



### Test Results for MR Chart of 49.1 Non Dimensioned Radii (8.0

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 8, 77, 79

## 28. Process Capability Sixpack Report for 49.2 Non Dimensioned Radii (8.0

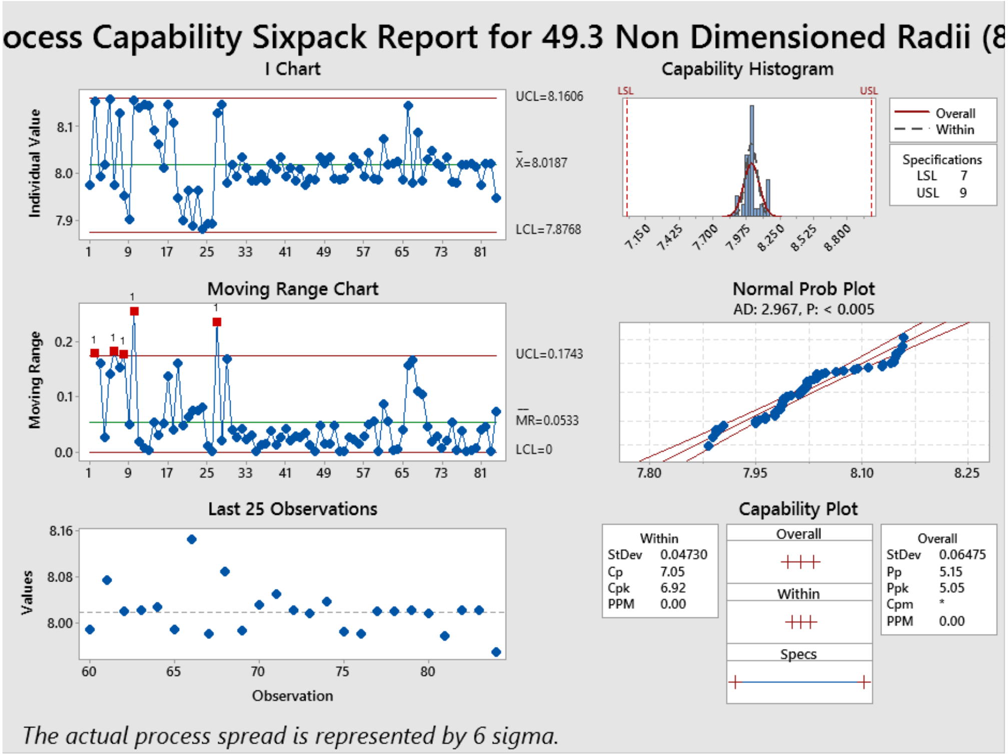



### Test Results for MR Chart of 49.2 Non Dimensioned Radii (8.0

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 6, 7, 11, 27

**29. Process Capability Sixpack Report for 49.3 Non Dimensioned Radii (8.0**

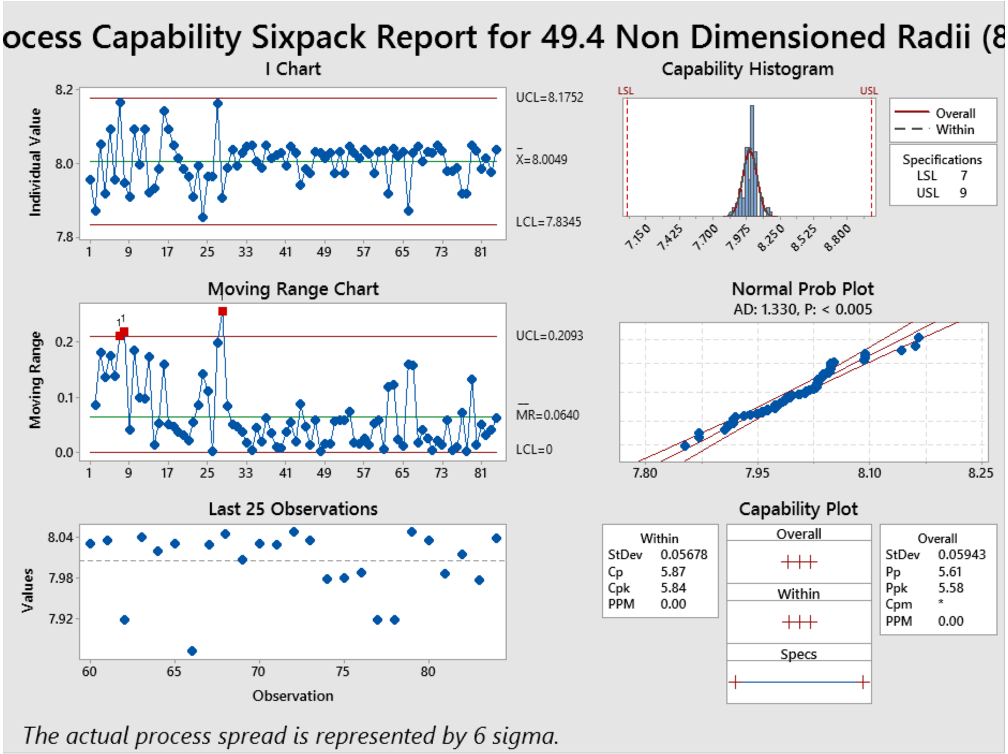



## Test Results for MR Chart of 49.3 Non Dimensioned Radii (8.0

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 2, 6, 8, 10, 27

**30. Process Capability Sixpack Report for 49.4 Non Dimensioned Radii (8.0**




## Test Results for MR Chart of 49.4 Non Dimensioned Radii (8.0

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 7, 8, 28

### C. CONTROL CHART ANALYSIS AND REACTION PLAN:

a. If the process is not stable then improve the process.

b. Control charts should not be used for unstable process.

c. Example of failure modes and reaction plan for threading tools in the manufacture of columns

#### 1. Single Peak

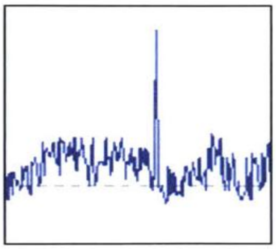


Figure 17: Single Peak

Cause: This may be caused due to the chip on the threading insert.

Reaction Plan: Blow the chip away.

Cause: When the machine stops and the engine oil gets cold

Reaction: Monitor the machine until it warms up

Cause: Change of Operator

Reaction: None **(**Add in the reaction plan, if known)

2. **Sudden Mean Shift (Up)**

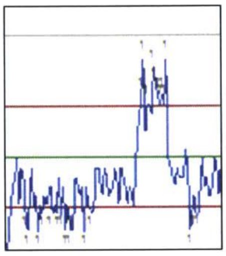


Figure 18: Sudden Mean Shift(Up)

Cause: Threading insert tool wear

Reaction Plan: Change insert

Cause: When the collar becomes loose

Reaction: Tighten the collar

3. **Gradual Shift (Up)**

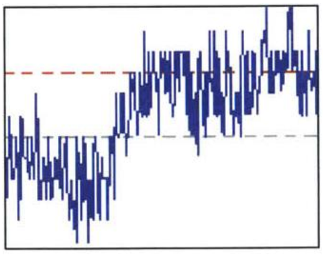


Figure 19: Gradual Shift(Up)

Cause: When the tool wears

Reaction Plan: Do an offset.

Cause: When the threading insert is not aiming in the correct direction

Reaction: Adjust the insert accordingly.

Cause: When there is a material difference between bars

Reaction: None **(**Add in the reaction plan, if known)

4. **Sudden Mean Shift (Down)**

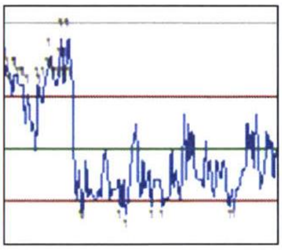


Figure 20: Sudden Mean Shift (Down)

Cause: When the operator does an offset

Reaction Plan: None **(**Add in the reaction plan, if known)

Cause: When there is chip accumulation

Reaction: Clean the chips from the tool and ensure it is placed back properly.

Cause: When the guide bushing is loose

Reaction: Tighten the guide busing

Cause: When the machine stops and the engine oil gets cold

Reaction Plan: Monitor the machine until it warms up

Cause: When the guide busing is too tight

Reaction: The guide bushing needs to be loosen up.

5. **Small Slope Shift (Up)**

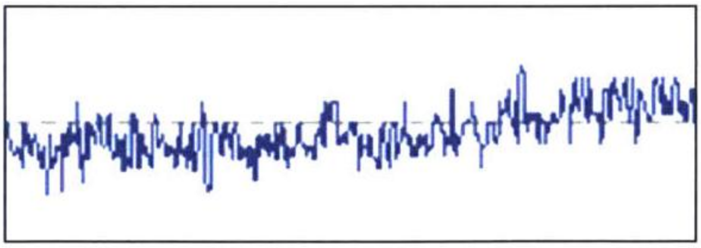


Figure 21: Small Slope Shift(Up)

Cause: This may be caused

Reaction Plan: Do an offset

## 4.2 RESULTS

### 1. Cp and Cpk Values of 5C1

| BID/Work Order No. | 4.1 Thickness (6.0) | 4.2 Thickness (6.0) | 5.1 Radius (6.0) | 5.2 Radius (6.0) | 6.1 Intersection Distance | 6.2 Intersection Distance | 7 Distance (49.0) | 9.1 Intersection Distance | 9.2 Intersection Distance | 10 Width (29.0) | 11.1 Chamfer Length (0.5) | 11.3 Chamfer Length (0.5) | 13.1 Radius (6.0) | 13.2 Radius (6.0) | 14 Inner Diameter (16.5) | 15.1 Chamfer Length (0.5) | 15.3 Chamfer Length (0.5) | 15.5 Chamfer Length (0.5) | 15.7 Chamfer Length (0.5) | 17 Width (36.0) | 18 Distance (20.0) | 19.1 Radius (10.0) | 19.2 Radius (10.0) | 19.3 Radius (10.0) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1000421919 | 6.05 | 6.019 | 6.084 | 6.311 | 51.901 | 51.995 | 48.95 | 25.17 | 24.937 | 29.19 | 0.54 | 0.53 | 5.846 | 5.838 | 16.44 | 0.501 | 0.519 | 0.48 | 0.48 | 36.18 | 20.14 | 10.009 | 10.01 | 10.49 |
| | 5.926 | 5.98 | 5.996 | 6.2 | 51.934 | 52.065 | 48.98 | 25.097 | 24.895 | 29.15 | 0.559 | 0.55 | 5.875 | 6.188 | 16.45 | 0.509 | 0.525 | 0.501 | 0.501 | 36.15 | 20.19 | 10.04 | 10.01 | 10.011 |
| | 6 | 5.941 | 6.049 | 6.05 | 51.98 | 51.98 | 48.9 | 24.901 | 24.997 | 29.12 | 0.53 | 0.549 | 5.894 | 6.094 | 16.44 | 0.509 | 0.517 | 0.479 | 0.519 | 36.15 | 20.15 | 10.04 | 10.014 | 10.059 |
| | 5.968 | 6.011 | 5.991 | 6.009 | 51.97 | 51.97 | 48.96 | 25.009 | 24.907 | 29.14 | 0.569 | 0.561 | 5.984 | 5.998 | 16.44 | 0.512 | 0.481 | 0.491 | 0.515 | 36.14 | 20.12 | 10.069 | 10.049 | 10.038 |
| | 6.049 | 5.925 | 6.047 | 6.011 | 51.997 | 51.97 | 48.96 | 24.89 | 25.04 | 29.12 | 0.529 | 0.529 | 6.079 | 5.94 | 16.42 | 0.487 | 0.509 | 0.47 | 0.57 | 36.1 | 20.15 | 10.067 | 10.097 | 10.049 |
| | 5.97 | 5.9979 | 5.94 | 6.097 | 51.944 | 51.917 | 48.94 | 24.94 | 25.09 | 29.14 | 0.521 | 0.521 | 6.184 | 5.89 | 16.44 | 0.497 | 0.501 | 0.489 | 0.521 | 36.18 | 20.18 | 10.017 | 10.079 | 10.039 |
| | 6.079 | 5.98 | 5.87 | 6.184 | 51.901 | 51.89 | 48.92 | 25.049 | 24.894 | 29.14 | 0.543 | 0.492 | 6.194 | 5.984 | 16.41 | 0.513 | 0.479 | 0.501 | 0.559 | 36.12 | 20.18 | 10.079 | 10.14 | 10.109 |
| | 5.97 | 5.998 | 6.01 | 5.949 | 51.94 | 51.991 | 48.98 | 25.11 | 24.943 | 29.18 | 0.539 | 0.508 | 6.189 | 5.84 | 16.43 | 0.47 | 0.489 | 0.419 | 0.49 | 36.14 | 20.2 | 10.091 | 10.09 | 9.98 |
| | 5.991 | 5.922 | 6.057 | 6.109 | 51.977 | 51.932 | 48.97 | 25.191 | 24.876 | 29.14 | 0.549 | 0.57 | 6.072 | 6.053 | 16.41 | 0.501 | 0.549 | 0.496 | 0.496 | 36.12 | 20.09 | 10.001 | 10.02 | 10.004 |
| | 5.99 | 5.97 | 5.91 | 6.041 | 51.998 | 52.049 | 48.96 | 25.11 | 24.983 | 24.2 | 0.551 | 0.551 | 5.89 | 0.553 | 16.45 | 0.459 | 0.489 | 0.459 | 0.499 | 36.18 | 20.16 | 10.061 | 9.91 | 9.998 |
| | 6.019 | 5.967 | 5.898 | 5.899 | 51.97 | 51.94 | 48.98 | 24.899 | 24.97 | 29.1 | 0.541 | 0.541 | 6.12 | 5.94 | 16.45 | 0.499 | 0.54 | 0.498 | 0.524 | 36.2 | 20.19 | 10.097 | 10.059 | 1..029 |
| | 6.018 | 5.951 | 5.971 | 5.989 | 51.99 | 51.64 | 48.94 | 24.908 | 24.94 | 29.18 | 0.549 | 0.531 | 5.94 | 5.969 | 16.43 | 0.519 | 0.47 | 0.488 | 0.541 | 36.16 | 20.13 | 10.051 | 10.017 | 10.028 |
| 1000422273 | 5.946 | 6.039 | 6.12 | 5.947 | 51.781 | 51.889 | 48.94 | 24.941 | 24.894 | 29.14 | 0.479 | 0.53 | 5.891 | 6.126 | 16.43 | 0.496 | 0.504 | 0.479 | 0.514 | 36.04 | 19.96 | 9.896 | 9.946 | 9.891 |
| | 5.986 | 5.976 | 5.961 | 6.086 | 51.746 | 51.846 | 49.09 | 25.041 | 24.97 | 29.18 | 0.541 | 0.514 | 5.961 | 6.049 | 16.48 | 0.509 | 0.486 | 0.496 | 0.536 | 36.02 | 20.04 | 10.121 | 10.049 | 9.946 |
| | 5.974 | 6.054 | 6.071 | 6.12 | 51.846 | 51.794 | 49.07 | 25.039 | 25.046 | 29.13 | 0.534 | 0.494 | 6.091 | 5.976 | 16.42 | 0.524 | 0.489 | 0.504 | 0.496 | 36.08 | 19.94 | 10.049 | 10.36 | 9.991 |
| | 5.946 | 6.036 | 5.961 | 5.761 | 51.771 | 51.889 | 48.92 | 24.941 | 24.976 | 29.14 | 0.491 | 0.509 | 5.961 | 6.029 | 16.4 | 0.496 | 0.476 | 0.521 | 0.484 | 36.04 | 19.94 | 9.941 | 9.891 | 9.946 |
| | 5.976 | 5.98 | 5.871 | 5.786 | 51.786 | 51.84 | 48.95 | 25.049 | 24.931 | 29.18 | 0.536 | 0.497 | 6.039 | 5.876 | 16.49 | 0.54 | 0.48 | 0.508 | 0.496 | 36.08 | 20.08 | 9.891 | 10.241 | 10.049 |
| | 6.049 | 5.976 | 5.77 | 5.841 | 51.74 | 51.881 | 49.09 | 25.034 | 24.94 | 29.15 | 0.546 | 0.494 | 5.896 | 5.967 | 16.44 | 0.529 | 0.517 | 0.479 | 0.54 | 36.04 | 20.02 | 10.079 | 10.05 | 10.06 |
| | 5.941 | 5.941 | 6.121 | 5.871 | 51.891 | 51.88 | 48.94 | 24.941 | 25.049 | 29.12 | 0.489 | 0.521 | 5.891 | 6.047 | 16.43 | 0.491 | 0.544 | 0.494 | 0.516 | 36.04 | 19.94 | 9.961 | 10.076 | 9.876 |
| | 5.961 | 4.976 | 6.041 | 6.041 | 51.796 | 51.896 | 49.09 | 25.041 | 24.936 | 29.17 | 0.541 | 0.536 | 5.976 | 6.038 | 16.48 | 0.512 | 0.536 | 0.489 | 0.496 | 36.09 | 20.04 | 10.039 | 10.094 | 9.899 |
| | 6.041 | 5.964 | 5.981 | 6.12 | 51.786 | 51.876 | 49.1 | 25.076 | 24.894 | 29.16 | 0.514 | 0.489 | 6.049 | 6.049 | 16.52 | 0.534 | 0.509 | 0.53 | 0.499 | 36.05 | 20.04 | 10.126 | 9.946 | 9.996 |
| | 5.957 | 5.951 | 5.961 | 6.041 | 51.97 | 51.886 | 48.85 | 24.97 | 25.041 | 29.16 | 0.491 | 0.514 | 6.121 | 5.791 | 16.39 | 0.486 | 0.491 | 0.541 | 0.489 | 36.02 | 19.94 | 19.891 | 10.041 | 10.051 |
| | 5.964 | 6.041 | 5.98 | 6.121 | 51.761 | 51.846 | 48.99 | 24.941 | 25.031 | 29.18 | 0.501 | 0.521 | 6.049 | 5.896 | 16.44 | 0.541 | 0.536 | 0.512 | 0.511 | 36.04 | 20.04 | 9.981 | 9.981 | 10.121 |
| | 5.996 | 6.036 | 5.876 | 6.101 | 51.801 | 51.901 | 48.91 | 25.041 | 24.361 | 29.15 | 0.541 | 0.491 | 5.981 | 5.975 | 16.48 | 0.489 | 0.509 | 0.539 | 0.519 | 36.08 | 20.08 | 10.031 | 10.031 | 10.241 |
| 1000434429 | 5.981 | 5.971 | 6.041 | 6.032 | 51.78 | 51.78 | 49.09 | 25.041 | 24.941 | 29.14 | 0.49 | 0.47 | 5.981 | 5.941 | 16.44 | 0.391 | 0.548 | 0.391 | 0.514 | 36.04 | 19.91 | 9.941 | 9.986 | 10.041 |
| | 6.041 | 6.051 | 6.121 | 5.871 | 51.791 | 51.791 | 48.92 | 24.981 | 25.101 | 29.18 | 0.476 | 0.491 | 6.031 | 5.98 | 16.48 | 0.486 | 0.588 | 0.486 | 0.526 | 36.08 | 19.94 | 10.041 | 9.991 | 10.241 |
| | 5.956 | 5.6 | 6.04 | 5.986 | 51.79 | 51.79 | 51.861 | 48.94 | 24.14 | 24.91 | 0.479 | 0.509 | 5.891 | 6.031 | 16.44 | 0.476 | 0.525 | 0.518 | 0.479 | 36.04 | 19.96 | 9.984 | 9.891 | 9.976 |
| | 5.986 | 5.996 | 5.891 | 5.941 | 51.786 | 51.884 | 48.92 | 24.941 | 25.017 | 29.17 | 0..479 | 0.479 | 5.891 | 6.121 | 16.4 | 0.412 | 0.549 | 0.481 | 0.487 | 36.05 | 19.97 | 9.986 | 10.246 | 9.991 |
| | 5.987 | 6.009 | 6.036 | 5.95 | 51.891 | 51.796 | 49.1 | 25.041 | 25.142 | 29.12 | 0.521 | 0.521 | 6.076 | 5.971 | 16.48 | 0.541 | 0.486 | 0.52 | 0.554 | 6.02 | 20.06 | 9.941 | 10.036 | 10.412 |
| | 6.034 | 6.054 | 5.891 | 5.941 | 51.84 | 51.891 | 48.94 | 25.041 | 25.091 | 29.15 | 0.501 | 0.512 | 6.046 | 6.044 | 16.4 | 0.546 | 0.541 | 0.501 | 0.546 | 36.02 | 20.08 | 10.059 | 10.04 | 10.121 |
| | 6.041 | 6.051 | 6.121 | 5.871 | 51.791 | 51.791 | 48.92 | 24.981 | 25.101 | 29.18 | 0.476 | 0.491 | 6.031 | 5.98 | 16.48 | 0.486 | 0.588 | 0.486 | 0.526 | 36.08 | 19.94 | 10.041 | 9.991 | 10.241 |
| | 5.971 | 6.041 | 6.04 | 5.956 | 51.79 | 51.89 | 48.94 | 24.946 | 25.039 | 29.15 | 0.493 | 0.496 | 4.961 | 6.091 | 16.44 | 0.486 | 0.391 | 0.478 | 0.54 | 36.06 | 20.04 | 10.059 | 10.041 | 10.121 |
| | 5.98 | 6.009 | 6.036 | 5.95 | 51.891 | 51.796 | 49.1 | 25.041 | 25.142 | 29.12 | 0.521 | 0.521 | 6.076 | 5.971 | 16.48 | 0.541 | 0.486 | 0.52 | 0.554 | 6.02 | 20.06 | 9.941 | 10.036 | 10.412 |
| | 5.986 | 6.041 | 5.951 | 6.036 | 51.781 | 51.781 | 51.89 | 49.06 | 25.09 | 25.08 | 0.512 | 0.526 | 5.941 | 6.029 | 16.48 | 0.464 | 0.526 | 0.496 | 0.486 | 36.06 | 20.04 | 10.412 | 10.049 | 10.029 |
| | 5.97 | 6.039 | 5.961 | 6.051 | 51.766 | 51.846 | 51.846 | 49.1 | 25.1 | 25.1 | 0.542 | 0.542 | 6.046 | 5.941 | 16.49 | 0.541 | 0.489 | 0.489 | 0.541 | 36.02 | 20.08 | 10.246 | 10.036 | 10.046 |
| | 6.034 | 6.054 | 5.891 | 5.941 | 51.84 | 51.891 | 48.94 | 25.041 | 25.091 | 29.15 | 0.501 | 0.512 | 6.046 | 6.044 | 16.4 | 0.546 | 0.541 | 0.501 | 0.546 | 36.02 | 20.08 | 10.059 | 10.04 | 10.121 |
| 1000420865 | 6.05 | 6.019 | 6.084 | 6.311 | 51.901 | 51.995 | 48.95 | 25.17 | 24.937 | 29.19 | 0.54 | 0.53 | 5.846 | 5.838 | 16.44 | 0.501 | 0.519 | 0.48 | 0.48 | 36.06 | 20.04 | 10.412 | 10.049 | 10.029 |
| | 5.926 | 5.98 | 5.996 | 6.2 | 51.934 | 52.065 | 48.98 | 25.097 | 24.895 | 29.15 | 0.559 | 0.55 | 5.875 | 6.188 | 16.45 | 0.509 | 0.525 | 0.501 | 0.501 | 36.02 | 20.08 | 10.059 | 10.04 | 10.121 |
| | 6 | 5.941 | 6.049 | 6.05 | 51.98 | 51.98 | 48.9 | 24.901 | 24.997 | 29.12 | 0.53 | 0.549 | 5.894 | 6.094 | 16.44 | 0.509 | 0.517 | 0.479 | 0.519 | 36.06 | 20.04 | 10.412 | 10.049 | 10.029 |
| | 5.968 | 6.011 | 5.991 | 6.009 | 51.97 | 51.97 | 48.96 | 25.009 | 24.907 | 29.14 | 0.569 | 0.561 | 5.984 | 5.998 | 16.44 | 0.512 | 0.481 | 0.491 | 0.515 | 36.02 | 20.08 | 10.059 | 10.04 | 10.121 |
| | 6.049 | 5.925 | 6.047 | 6.011 | 51.997 | 51.97 | 48.96 | 24.89 | 25.04 | 29.12 | 0.529 | 0.529 | 6.079 | 5.94 | 16.42 | 0.487 | 0.509 | 0.47 | 0.57 | 36.06 | 20.04 | 10.412 | 10.049 | 10.029 |
| | 5.97 | 5.9979 | 5.94 | 6.097 | 51.944 | 51.917 | 48.94 | 24.94 | 25.09 | 29.14 | 0.521 | 0.521 | 6.184 | 5.89 | 16.44 | 0.497 | 0.501 | 0.489 | 0.521 | 36.02 | 20.08 | 10.059 | 10.04 | 10.121 |
| | 6.079 | 5.98 | 5.87 | 6.184 | 51.901 | 51.89 | 48.92 | 25.049 | 24.894 | 29.14 | 0.543 | 0.492 | 6.194 | 5.984 | 16.41 | 0.513 | 0.479 | 0.501 | 0.559 | 36.06 | 20.04 | 10.412 | 10.049 | 10.029 |
| | 5.97 | 5.998 | 6.01 | 5.949 | 51.94 | 51.991 | 48.98 | 25.11 | 24.943 | 29.18 | 0.539 | 0.508 | 6.189 | 5.84 | 16.43 | 0.47 | 0.489 | 0.419 | 0.49 | 36.02 | 20.08 | 10.059 | 10.04 | 10.121 |
| | 5.99 | 5.97 | 5.91 | 6.041 | 51.998 | 52.049 | 48.96 | 25.11 | 24.983 | 24.2 | 0.551 | 0.551 | 5.89 | 0.553 | 16.45 | 0.459 | 0.489 | 0.459 | 0.499 | 36.06 | 20.04 | 10.412 | 10.049 | 10.029 |
| | 6.019 | 5.967 | 5.898 | 5.899 | 51.97 | 51.94 | 48.98 | 24.899 | 24.97 | 29.1 | 0.541 | 0.541 | 6.12 | 5.94 | 16.45 | 0.499 | 0.54 | 0.498 | 0.524 | 36.02 | 20.08 | 10.059 | 10.04 | 10.121 |
| | 6.018 | 5.951 | 5.971 | 5.989 | 51.99 | 51.64 | 48.94 | 24.908 | 24.94 | 29.18 | 0.549 | 0.531 | 5.94 | 5.969 | 16.43 | 0.519 | 0.47 | 0.488 | 0.541 | 36.06 | 20.04 | 10.412 | 10.049 | 10.029 |
| | 5.991 | 5.922 | 6.057 | 6.109 | 51.977 | 51.932 | 48.97 | 25.191 | 24.876 | 29.14 | 0.549 | 0.57 | 6.072 | 6.053 | 16.41 | 0.501 | 0.549 | 0.496 | 0.496 | 36.02 | 20.08 | 10.059 | 10.04 | 10.121 |
| LSL | 5.9 | 5.9 | 5.5 | 5.5 | 51.7 | 51.7 | 48.7 | 24.8 | 24.8 | 28.8 | 0.3 | 0.3 | 5.5 | 5.5 | 16.3 | 0.3 | 0.3 | 0.3 | 0.3 | 36 | 19.8 | 9 | 9 | 9 |
| USL | 6.1 | 6.1 | 6.5 | 6.5 | 52.3 | 52.3 | 49.3 | 25.2 | 25.2 | 29.2 | 0.7 | 0.7 | 6.5 | 6.5 | 16.7 | 0.7 | 0.7 | 0.7 | 0.7 | 36.3 | 20.2 | 11 | 11 | 11 |
| UCL | 6.1285 | 6.1019 | 6.2409 | 6.2818 | 52.0251 | 52.0654 | 49.1548 | 25.2294 | 25.1853 | 29.237 | 0.592 | 0.5737 | 6.2515 | 6.3102 | 16.5311 | 0.5864 | 0.6067 | 0.5664 | 0.5901 | 36.1688 | 20.2047 | 10.5112 | 10.2388 | 10.385 |
| Mean | 5.9951 | 5.9898 | 5.9871 | 6.0221 | 51.8837 | 51.9048 | 48.9643 | 25.0158 | 24.9918 | 29.1481 | 0.5267 | 0.5218 | 6.0095 | 5.9695 | 16.4423 | 0.5003 | 0.5098 | 0.4896 | 0.5172 | 36.0715 | 20.0588 | 10.0868 | 10.0441 | 10.075 |
| LCL | 5.8617 | 5.8777 | 5.7333 | 5.7624 | 51.7422 | 51.7441 | 48.7738 | 24.8022 | 24.7984 | 29.0593 | 0.4614 | 0.4698 | 5.7676 | 5.6288 | 16.3535 | 0.4142 | 0.4129 | 0.4128 | 0.4443 | 35.9741 | 19.9128 | 9.6623 | 9.8495 | 9.765 |
| Sigma | 0.04446 | 0.03736 | 0.0846 | 0.08658 | 0.04716 | 0.05355 | 0.06349 | 0.0712 | 0.06449 | 0.02961 | 0.02177 | 0.01732 | 0.08065 | 0.1136 | 0.02961 | 0.02871 | 0.03229 | 0.02561 | 0.02429 | 0.03244 | 0.04866 | 0.1415 | 0.06489 | 0.1033 |
| Cp | 0.75 | 0.89 | 1.97 | 1.93 | 2.12 | 1.87 | 1.58 | 0.94 | 1.03 | 2.25 | 3.06 | 3.85 | 2.07 | 1.47 | 1.25 | 2.32 | 2.06 | 2.6 | 2.74 | 1.54 | 1.37 | 2.36 | 5.14 | 3.23 |
| Cpk | 0.71 | 0.8 | 1.92 | 1.84 | 1.3 | 1.27 | 1.39 | 0.86 | 0.99 | 0.58 | 2.65 | 3.43 | 2.03 | 1.38 | 1.6 | 2.32 | 1.96 | 2.47 | 2.51 | 0.73 | 0.97 | 2.15 | 4.91 | 2.98 |

Figure 22: Cp and Cpk Values of 5C1

## 2. Cp and Cpk Values of 1C1

| BID | BID-4 Intersection Distance (67.0) | BID-8 Width (39.0) | BID-9 Width (44.5) | BID-17 Intersection Distance (75.4) | BID-20 Step Distance (133.5) | BID-21 Thickness (2.0) | BID-22 Thickness (3.5) | BID-23 Thickness (5.0) | BID-24 Thickness (6.5) | BID-25 Thickness (8.0) | BID-27 Step Distance (6.7) | BID-28 Thickness (8.0) | BID-30 Distance (38.9) | BID-31 Distance (58.9) | BID-32 Distance (78.9) | BID-33 Distance (101.9) | BID-34 Distance (124.0) | BID-38 Radius (8.0) | BID-40 Radius (19.0) | BID-46 Radius (20.0) | BID-47.1 Chamfer Length (1.0) | BID-48.1 Chamfer Length (1.0) | BID-52.1 Non-Dimensional Radii (9.0) | BID-52.2 Non-Dimensional Radii (9.0) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1000419919 | 67.014 | 39.04 | 44.49 | 75.091 | 133.49 | 2.047 | 3.47 | 4.991 | 6.467 | 7.994 | 6.74 | 7.94 | 38.974 | 58.949 | 78.741 | 101.97 | 124.014 | 8.319 | 19.087 | 20.23 | 1.009 | 0.941 | 9.047 | 8.8743 |
| | 67.121 | 39.01 | 44.54 | 75.014 | 133.63 | 2.021 | 3.496 | 4.997 | 6.481 | 7.984 | 6.71 | 8.048 | 38.89 | 58.874 | 78.91 | 102.101 | 123.987 | 8.21 | 18.979 | 20.29 | 0.998 | 1.067 | 8.941 | 8.893 |
| | 67.078 | 39.09 | 44.59 | 75.189 | 133.54 | 2.009 | 3.467 | 4.987 | 6.487 | 7.973 | 6.73 | 8.017 | 38.89 | 58.829 | 78.949 | 102.09 | 123.997 | 8.199 | 18.989 | 19.97 | 0.949 | 1.041 | 8.971 | 8.971 |
| | 67.098 | 39.02 | 44.65 | 75.312 | 133.64 | 2.033 | 3.513 | 4.967 | 6.497 | 7.998 | 6.74 | 7.987 | 39.041 | 58.912 | 78.819 | 102.08 | 124.097 | 8.098 | 19.071 | 20.73 | 0.979 | 0.978 | 8.971 | 8.971 |
| | 67.149 | 38.98 | 44.61 | 75.29 | 133.51 | 2.037 | 3.517 | 4.967 | 6.498 | 7.971 | 6.68 | 8.012 | 39.049 | 58.879 | 78.817 | 101.974 | 123.894 | 8.041 | 19.057 | 20.096 | 0.979 | 0.984 | 8.89 | 8.89 |
| | 67.129 | 38.99 | 44.59 | 75.41 | 133.61 | 2.041 | 3.539 | 4.4976 | 6.491 | 7.988 | 6.7 | 8.011 | 39.115 | 58.789 | 78.891 | 102.079 | 123.791 | 8.019 | 19.057 | 20.017 | 0.978 | 0.989 | 8.894 | 8.894 |
| | 67.079 | 39.08 | 44.54 | 75.489 | 133.51 | 2.022 | 3.437 | 5.001 | 6.501 | 8.02 | 6.71 | 7.943 | 39.21 | 59.085 | 78.79 | 101.871 | 123.81 | 7.983 | 19.069 | 20.013 | 0.948 | 0.915 | 8.91 | 9.017 |
| | 67.067 | 39.02 | 44.54 | 75.291 | 133.69 | 2.013 | 3.473 | 5.029 | 6.515 | 8.056 | 6.73 | 7.974 | 38.917 | 59.085 | 78.99 | 101.891 | 124.039 | 7.973 | 19.036 | 20.019 | 0.979 | 0.925 | 8.917 | 9.046 |
| | 67.079 | 39.01 | 44.51 | 75.439 | 133.52 | 2.017 | 3.483 | 5.013 | 6.525 | 8.06 | 6.71 | 7.974 | 38.959 | 59.079 | 78.991 | 101.911 | 124.013 | 8.013 | 18.979 | 20.079 | 0.959 | 0.92 | 9.067 | 9.065 |
| | 67.009 | 39.01 | 44.45 | 75.509 | 133.46 | 2.019 | 3.491 | 5.021 | 6.519 | 8.12 | 6.69 | 8.12 | 39.019 | 58.873 | 78.943 | 101.978 | 123.925 | 8.037 | 18.979 | 20.065 | 0.968 | 0.959 | 9.117 | 9.061 |
| | 67.21 | 39.02 | 44.63 | 75.019 | 133.51 | 2.071 | 3.492 | 5.028 | 6.529 | 8.09 | 6.69 | 8.079 | 39.073 | 58.813 | 78.907 | 101.98 | 124.025 | 8.093 | 18.967 | 20.139 | 0.979 | 0.967 | 9.163 | 9.001 |
| | 67.196 | 39.02 | 44.57 | 75.099 | 133.62 | 2.061 | 3.498 | 4.957 | 6.549 | 8.067 | 6.7 | 8.019 | 38.919 | 59.013 | 78.937 | 101.97 | 123.91 | 7.993 | 189.09 | 19.989 | 0.967 | 0.979 | 9.064 | 9.093 |
| | 67.143 | 39.01 | 44.49 | 75.041 | 133.49 | 2.049 | 3.419 | 5.019 | 6.479 | 7.994 | 6.69 | 7.984 | 38.994 | 58.973 | 78.949 | 101.841 | 123.791 | 7.984 | 189.943 | 19.989 | 0.949 | 0.843 | 8.979 | 9.041 |
| | 67.091 | 39.02 | 44.54 | 75.09 | 133.54 | 2.009 | 3.494 | 4.984 | 6.489 | 7.989 | 6.68 | 8.049 | 38.979 | 58.967 | 78.95 | 101.894 | 123.941 | 8.121 | 19.141 | 20.201 | 0.949 | 0.894 | 8.981 | 9.067 |
| | 67.093 | 39.04 | 44.56 | 75.179 | 133.61 | 2.033 | 3.473 | 4.979 | 6.54 | 7.979 | 6.74 | 8.074 | 38.849 | 59.094 | 79.069 | 101.791 | 123.914 | 8.017 | 19.033 | 20.21 | 0.947 | 0.909 | 8.997 | 8.937 |
| | 67.167 | 39.02 | 44.59 | 75.249 | 133.61 | 2.033 | 3.473 | 4.979 | 6.56 | 7.987 | 6.72 | 8.081 | 38.91 | 59.029 | 79.079 | 101.649 | 123.979 | 8.043 | 19.099 | 20.109 | 1.01 | 0.904 | 8.941 | 8.943 |
| | 67.147 | 39.01 | 44.54 | 75.289 | 133.54 | 1.989 | 3.483 | 4.9 54 | 6.47 | 7.89 | 6.68 | 8.024 | 39.094 | 58.967 | 79.084 | 101.794 | 123.784 | 8.037 | 19.064 | 20.22 | 1.019 | 0.973 | 8.893 | 8.901 |
| | 67.197 | 39.04 | 44.56 | 75.094 | 133.64 | 1.949 | 3.484 | 5.094 | 6.398 | 8.049 | 6.72 | 8.041 | 38.94 | 59.086 | 79.019 | 101.894 | 123.849 | 7.91 | 19.164 | 20.39 | 0.989 | 0.891 | 9.043 | 8.809 |
| | 67.187 | 39.09 | 44.61 | 75.094 | 133.69 | 1.979 | 3.494 | 5.047 | 6.458 | 8.079 | 6.72 | 8.051 | 38.914 | 58.91 | 78.941 | 102.099 | 124.049 | 7.943 | 18.964 | 20.39 | 0.993 | 0.973 | 9.079 | 9.061 |
| | 67.179 | 39.08 | 44.62 | 75.409 | 133.79 | 2.025 | 3.498 | 4.997 | 6.51 | 8.069 | 6.69 | 7.981 | 39.014 | 58.89 | 78.941 | 101.949 | 124.094 | 7.901 | 18.979 | 20.124 | 0.941 | 0.983 | 8.901 | 9.067 |
| | 67.041 | 39.07 | 44.63 | 39.07 | 133.49 | 2.039 | 3.449 | 4.991 | 6.519 | 8.059 | 6.7 | 7.974 | 39.14 | 58.794 | 78.814 | 101.951 | 123.91 | 7.941 | 18.994 | 20.069 | 0.898 | 0.993 | 8.943 | 9.21 |
| | 66.989 | 39 | 44.54 | 75.024 | 133.5 | 2.079 | 3.494 | 4.989 | 6.498 | 8.069 | 6.72 | 7.973 | 39.39 | 58.984 | 78.849 | 102.017 | 123.784 | 7.963 | 19.043 | 20.013 | 0.873 | 1.043 | 9.127 | 9.29 |
| | 66.981 | 39.04 | 44.49 | 75.094 | 133.54 | 2.069 | 3.51 | 4.979 | 6.498 | 7.994 | 6.72 | 8.032 | 38.974 | 58.81 | 78.809 | 102.094 | 123.649 | 8.34 | 19.013 | 20.111 | 0.929 | 1.094 | 9.073 | 8.809 |
| | 66.998 | 39 | 44.53 | 75.419 | 133.64 | 1.989 | 3.549 | 4.909 | 6.479 | 8.09 | 6.69 | 8.034 | 38.966 | 58.74 | 78.798 | 101.984 | 123.973 | 8.249 | 19.037 | 20.089 | 1.009 | 0.879 | 9.067 | 8.798 |
| LSL | 66.2 | 38.2 | 43.7 | 74.6 | 133 | 1.8 | 3.3 | 4.8 | 6.3 | 7.8 | 6.6 | 7.9 | 38.1 | 58.1 | 78.1 | 101.1 | 123.5 | 6 | 17 | 18.0 | 0.8 | 0.8 | 8.0 | 8.0 |
| USL | 67.8 | 39.8 | 45.3 | 76.2 | 134 | 2.2 | 3.7 | 5.2 | 6.7 | 8.2 | 6.8 | 8.1 | 39.7 | 59.7 | 79.7 | 102.7 | 124.5 | 10 | 21 | 22.0 | 1.2 | 1.2 | 10.0 | 10.0 |
| UCL | 67.2271 | 39.1128 | 44.6859 | 82.4 | 133.8356 | 2.0895 | 3.5612 | 5.1555 | 6.5655 | 8.1229 | 6.765 | 8.1212 | 39.3043 | 59.1932 | 79.0703 | 102.1802 | 124.2328 | 8.2422 | 72.9 | 20.525 | 1.0343 | 1.0931 | 9.1662 | 9.1995 |
| Mean | 67.1017 | 39.0296 | 44.5587 | 73.72 | 133.5754 | 2.0264 | 3.4873 | 4.9749 | 6.4982 | 8.0237 | 6.7083 | 8.0176 | 39.0092 | 58.9343 | 78.9161 | 101.9522 | 123.9258 | 8.0595 | 33.2 | 20.148 | 0.9666 | 0.9602 | 8.999 | 8.9879 |
| LCL | 66.9764 | 38.9463 | 44.4316 | 65.03 | 133.3152 | 1.9632 | 3.4134 | 4.7943 | 6.4309 | 7.9245 | 6.6517 | 7.914 | 38.7141 | 58.6754 | 78.7602 | 101.7241 | 123.6188 | 7.8768 | 6.4 | 19.771 | 0.8988 | 0.8272 | 8.8318 | 8.7763 |
| Sigma | 0.07081 | 0.03141 | 0.05186 | 7.381 | 0.08214 | 0.03045 | 0.02878 | 0.1099 | 0.03351 | 0.05328 | 0.01971 | 0.04583 | 0.1198 | 0.1083 | 0.09609 | 0.1137 | 0.114 | 0.0226 | 48.13 | 0.1713 | 0.03515 | 0.0616 | 0.08271 | 0.1218 |
| Cp | 6.38 | 9.61 | 6.29 | 0.09 | 1.92 | 3.17 | 2.71 | 1.11 | 2.97 | 2.02 | 1.76 | 0.97 | 2.71 | 3.09 | 5.19 | 3.51 | 1.63 | 10.95 | 0.05 | 5.3 | 2.86 | 1.5 | 5.98 | 4.73 |
| Cpk | 5.57 | 9.25 | 5.83 | -0.1 | 1.63 | 2.75 | 2.54 | 0.97 | 2.95 | 1.78 | 1.62 | 0.8 | 2.34 | 2.96 | 5.09 | 3.28 | 1.39 | 10.62 | 0.31 | 4.91 | 2.46 | 1.2 | 5.97 | 4.67 |

Figure 23: Cp and Cpk Values of 1C1

## 3. Cp and Cpk Values of 10 A

| BID#/ Work Order No | 4 Width (39.0) | 10 Radius (20.0) | 11 Radius (17.0) | 13 Width (44.5) | 20 Intersection Distance (73.0) | 23 Intersection Distance (117.0) | 27 Thickness (2.5) | 28 Thickness (1.6) | 29 Distance (36.0) | 31 Distance (76.0) | 33 Thickness (3.9) | 34.1 Chamfer Length (0.7) | 47.1 Diameter of Pilot Hole (2.5) | 47.2 Diameter of Pilot Hole (2.5) | 47.3 Diameter of Pilot Hole (2.5) | 47.4 Diameter of Pilot Hole (2.5) | 47.5 Diameter of Pilot Hole (2.5) | 47.6 Diameter of Pilot Hole (2.5) | 47.7 Diameter of Pilot Hole (2.5) | 47.8 Diameter of Pilot Hole (2.5) | 47.9 Diameter of Pilot Hole (2.5) | 47.10 Diameter of Pilot Hole (2.5) | 47.11 Diameter of Pilot Hole (2.5) | 47.12 Diameter of Pilot Hole (2.5) | 48.1 Ground Radii (4.0) | 48.2 Ground Radii (4.0) | 49.1 Non Dimensioned Radii (8.0) | 49.2 Non Dimensioned Radii (8.0) | 49.3 Non Dimensioned Radii (8.0) | 49.4 Non Dimensioned Radii (8.0) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1000433054 | 39.04 | 20.181 | 17.077 | 44.61 | 73.121 | 117.254 | 2.61 | 1.641 | 36.1 | 75.965 | 3.91 | 0.848 | 24.48 | 2.49 | 2.49 | 2.48 | 2.49 | 2.49 | 2.49 | 2.48 | 2.5 | 2.49 | 2.49 | 2.5 | 4.067 | 3.9989 | 7.937 | 7.786 | 7.977 | 7.957 |
| | 39.1 | 20.319 | 17.049 | 44.69 | 73.109 | 117.234 | 2.666 | 1.615 | 36.114 | 75.901 | 3.941 | 0.798 | 2.49 | 2.48 | 2.48 | 2.49 | 2.49 | 2.48 | 2.5 | 2.51 | 2.5 | 2.52 | 2.52 | 2.48 | 3.979 | 3.947 | 7.796 | 7.966 | 8.185 | 7.872 |
| | 39.16 | 19.891 | 16.998 | 44.67 | 73.021 | 117.129 | 2.595 | 1.637 | 36.074 | 75.981 | 3.944 | 0.823 | 2.49 | 2.51 | 2.53 | 2.5 | 2.5 | 2.51 | 2.5 | 2.51 | 2.51 | 2.49 | 2.5 | 2.52 | 3.978 | 4.051 | 7.907 | 8.007 | 7.994 | 8.053 |
| | 39.09 | 19.314 | 16.989 | 44.74 | 73.089 | 117.201 | 2.615 | 1.637 | 36.065 | 75.989 | 3.929 | 0.823 | 2.49 | 2.49 | 2.48 | 2.5 | 2.5 | 2.5 | 2.51 | 2.51 | 2.51 | 2.49 | 2.49 | 2.51 | 3.891 | 3.983 | 7.769 | 8.009 | 8.019 | 7.918 |
| | 39.16 | 19.431 | 16.978 | 44.71 | 73.089 | 117.189 | 2.6 | 1.617 | 36.073 | 75.99 | 3.943 | 0.778 | 2.5 | 2.5 | 2.5 | 2.48 | 2.49 | 2.48 | 2.49 | 2.49 | 2.48 | 2.49 | 2.49 | 2.5 | 3.798 | 4.015 | 7.998 | 8.164 | 8.169 | 8.094 |
| | 39.16 | 19.306 | 17.026 | 44.69 | 73.068 | 117.107 | 2.656 | 1.609 | 36.035 | 75.956 | 3.953 | 0.81 | 2.49 | 2.48 | 2.49 | 2.5 | 2.5 | 2.5 | 2.49 | 2.48 | 2.5 | 2.49 | 2.49 | 2.5 | 4.067 | 3.9989 | 7.937 | 7.786 | 7.977 | 7.957 |
| | 39.16 | 19.978 | 17.095 | 44.69 | 73.072 | 117.209 | 2.59 | 1.641 | 36.16 | 76.165 | 3.909 | 0.741 | 2.51 | 2.5 | 2.5 | 2.49 | 2.49 | 2.48 | 2.52 | 2.51 | 2.5 | 2.5 | 2.49 | 2.48 | 3.989 | 4.029 | 8.076 | 8.154 | 8.301 | 8.167 |
| | 39.14 | 19.981 | 17.081 | 44.69 | 73.046 | 117.232 | 2.619 | 1.627 | 36.017 | 75.842 | 3.943 | 0.728 | 2.49 | 2.49 | 2.49 | 2.5 | 2.5 | 2.5 | 2.49 | 2.49 | 2.48 | 2.49 | 2.5 | 2.51 | 3.981 | 3.919 | 7.867 | 7.974 | 7.954 | 7.949 |
| | 39.16 | 19.978 | 17.049 | 44.7 | 73.089 | 117.207 | 2.639 | 1.621 | 36.066 | 75.875 | 3.915 | 0.822 | 2.51 | 2.5 | 2.5 | 2.5 | 2.5 | 2.48 | 2.5 | 2.5 | 2.5 | 2.52 | 2.51 | 2.49 | 3.81 | 3.915 | 7.979 | 7.984 | 7.904 | 7.909 |
| | 39.1 | 19.769 | 16.995 | 44.72 | 73.042 | 117.095 | 2.629 | 1.649 | 36.098 | 76.097 | 3.963 | 0.798 | 2.5 | 2.5 | 2.52 | 2.52 | 2.52 | 2.49 | 2.49 | 2.49 | 2.48 | 2.49 | 2.49 | 2.5 | 3.798 | 4.015 | 7.998 | 8.164 | 8.169 | 8.094 |
| | 39.14 | 191.739 | 16.979 | 44.67 | 73.098 | 117.19 | 2.66 | 1.627 | 36.119 | 75.9979 | 3.941 | 0.809 | 2.5 | 2.5 | 2.5 | 2.5 | 2.51 | 2.49 | 2.48 | 2.48 | 2.48 | 2.49 | 2.49 | 2.48 | 4.067 | 4.052 | 7.998 | 7.891 | 8.14 | 7.996 |
| | 39.14 | 19.369 | 17.064 | 44.71 | 73.064 | 117.264 | 2.619 | 1.629 | 36.087 | 75.968 | 3.929 | 0.778 | 2.49 | 2.48 | 2.49 | 2.49 | 2.5 | 2.5 | 2.49 | 2.49 | 2.49 | 2.5 | 2.49 | 2.49 | 3.989 | 3.974 | 7.965 | 7.975 | 8.247 | 8.093 |
| | 36.16 | 20.31 | 16.978 | 44.71 | 73.015 | 117.167 | 2.629 | 1.64 | 36.149 | 76.069 | 3.961 | 0.82 | 2.5 | 2.5 | 2.48 | 2.48 | 2.49 | 2.5 | 2.49 | 2.84 | 2.49 | 2.5 | 2.49 | 2.5 | 4.098 | 4.079 | 7.879 | 7.861 | 8.175 | 7.92 |
| | 39.1 | 20.094 | 16.959 | 44.68 | 72.979 | 117.198 | 2.63 | 1.645 | 36.164 | 75.979 | 3.959 | 0.779 | 2.49 | 2.49 | 2.48 | 2.5 | 2.49 | 2.48 | 2.49 | 2.5 | 2.5 | 2.52 | 2.52 | 2.49 | 3.949 | 3.939 | 7.964 | 7.959 | 8.093 | 7.932 |
| | 39.15 | 19.498 | 17.094 | 44.69 | 72.989 | 117.21 | 2.619 | 1.639 | 36.154 | 75.981 | 3.91 | 0.824 | 2.5 | 2.5 | 2.49 | 2.48 | 2.49 | 2.5 | 2.49 | 2.51 | 2.49 | 2.49 | 2.48 | 2.49 | 3.894 | 3.794 | 7.91 | 7.964 | 8.064 | 7.984 |
| | 39.16 | 19.798 | 16.915 | 44.61 | 73.063 | 117.167 | 2.61 | 1.611 | 36.112 | 75.911 | 3.914 | 0.814 | 2.49 | 2.49 | 2.49 | 2.5 | 2.49 | 2.5 | 2.5 | 2.52 | 2.52 | 2.5 | 2.52 | 2.51 | 3.941 | 3.949 | 7.894 | 7.964 | 8.013 | 8.144 |
| | 39.06 | 20.589 | 17.097 | 44.67 | 73.097 | 117.214 | 2.619 | 1.639 | 36.164 | 75.964 | 3.934 | 0.798 | 2.5 | 2.5 | 2.5 | 2.49 | 2.5 | 2.49 | 2.5 | 2.49 | 2.48 | 2.49 | 2.49 | 2.49 | 3.964 | 3.989 | 7.874 | 7.934 | 8.149 | 8.094 |
| | 39.19 | 20.591 | 16.949 | 44.68 | 73.067 | 117.219 | 2.639 | 1.649 | 36.164 | 75.978 | 3.968 | 0.809 | 2.49 | 2.48 | 2.49 | 2.49 | 2.49 | 2.5 | 2.49 | 2.48 | 2.49 | 2.49 | 2.5 | 2.5 | 3.974 | 3.989 | 7.941 | 7.963 | 8.109 | 8.049 |
| | 39.14 | 19.894 | 17.064 | 44.67 | 73.043 | 117.213 | 2.641 | 1.631 | 36.094 | 75.909 | 3.911 | 0.789 | 2.49 | 2.49 | 2.5 | 2.5 | 2.49 | 2.5 | 2.5 | 2.52 | 2.51 | 2.51 | 2.49 | 2.49 | 3.989 | 3.989 | 7.894 | 7.926 | 7.949 | 8.014 |
| | 39.1 | 19.589 | 16.989 | 44.68 | 73.061 | 117.114 | 2.614 | 1.625 | 36.025 | 75.925 | 3.925 | 0.809 | 2.5 | 2.5 | 2.5 | 2.49 | 2.49 | 2.5 | 2.51 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.014 | 4.019 | 7.964 | 7.962 | 7.901 | 7.984 |
| | 39.15 | 19.499 | 16.983 | 44.67 | 73.064 | 117.119 | 2.929 | 1.62 | 36.049 | 75.949 | 3.949 | 0.809 | 2.49 | 2.49 | 2.5 | 2.49 | 2.5 | 2.5 | 2.52 | 2.49 | 2.48 | 2.49 | 2.49 | 2.5 | 3.94 | 3.959 | 7.967 | 7.963 | 7.964 | 7.964 |
| | 39.14 | 19.769 | 17.064 | 44.68 | 73.106 | 117.204 | 2.613 | 1.624 | 36.067 | 75.949 | 3.925 | 0.778 | 2.48 | 2.48 | 2.49 | 2.49 | 2.5 | 2.5 | 2.51 | 2.5 | 2.49 | 2.5 | 2.5 | 2.49 | 3.916 | 3.916 | 7.934 | 7.989 | 7.809 | 7.91 |
| | 39.16 | 19.894 | 17.049 | 44.69 | 73.064 | 117.264 | 2.614 | 1.619 | 36.164 | 75.061 | 3.949 | 0.798 | 2.5 | 2.5 | 2.5 | 2.5 | 2.49 | 2.49 | 2.52 | 2.48 | 2.48 | 2.48 | 249 | 2.48 | 3.96 | 4.164 | 7.673 | 7.894 | 7.964 | 7.994 |
| | 39.09 | 20.349 | 17.142 | 44.64 | 73.085 | 117.254 | 2.643 | 1.617 | 36.067 | 75.984 | 3.94 | 0.778 | 2.49 | 2.48 | 2.49 | 2.49 | 2.48 | 2.49 | 2.49 | 2.48 | 2.49 | 2.52 | 2.52 | 2.52 | 2.49 | 4.141 | 3.941 | 7.974 | 7.793 | 7.793 |
| | 39.14 | 20.181 | 17.077 | 44.67 | 73.121 | 117.209 | 2.641 | 1.625 | 36.076 | 75.974 | 3.961 | 0.779 | 2.48 | 2.49 | 2.49 | 2.5 | 2.49 | 2.49 | 2.5 | 2.49 | 2.5 | 2.5 | 2.5 | 2.49 | 4.01 | 3.981 | 7.709 | 7.794 | 7.894 | 7.964 |
| | 39.16 | 19.584 | 16.995 | 44.67 | 73.072 | 117.207 | 2.613 | 1.637 | 36.019 | 75.864 | 3.938 | 0.729 | 2.52 | 2.5 | 2.49 | 2.49 | 2.5 | 2.49 | 2.5 | 2.49 | 2.5 | 2.5 | 2.5 | 2.49 | 4.01 | 3.981 | 7.709 | 7.794 | 7.894 | 7.964 |
| | 39.16 | 21 | 17.049 | 44.69 | 73.089 | 117.232 | 2.637 | 1.619 | 36.097 | 76.097 | 3.951 | 0.729 | 2.53 | 2.49 | 2.5 | 2.5 | 2.5 | 2.49 | 2.49 | 2.49 | 2.5 | 2.5 | 2.49 | 2.49 | 3.989 | 4.069 | 7.894 | 8.087 | 8.129 | 8.192 |
| | 39.11 | 20.077 | 17.077 | 44.68 | 73.085 | 117.234 | 2.666 | 1.615 | 36.114 | 75.901 | 3.941 | 0.798 | 2.49 | 2.48 | 2.48 | 2.49 | 2.49 | 2.48 | 2.52 | 2.49 | 2.49 | 2.48 | 2.49 | 2.49 | 3.947 | 3.959 | 7.883 | 8.096 | 8.148 | 7.906 |

Figure 24: Cp and Cpk Values of 10A(Cont.)

Publication Partner:

International Journal of Scientific and Research Publications (ISSN: 2250-3153)

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1000433074 | 39.04 | 20.039 | 17.047 | 44.46 | 73.04 | 117.039 | 2.522 | 1.622 | 36.078 | 76.014 | 3.894 | 0.754 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.004 | 3.974 | 8.061 | 8.027 | 7.981 | 7.989 |
| | 39.06 | 19.97 | 17.009 | 44.54 | 73.014 | 116.98 | 2.53 | 1.661 | 35.971 | 76.07 | 3.879 | 0.789 | 2.5 | 2.5 | 2.5 | 2.5. | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.026 | 4.089 | 8.024 | 8.03 | 8.02 | 8.039 |
| | 38.96 | 20.074 | 16.969 | 44.49 | 73.021 | 117.088 | 2.474 | 1.596 | 35.989 | 75.986 | 3.984 | 0.77 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.034 | 4.076 | 8.005 | 8.074 | 7.994 | 7.994 |
| | 39.08 | 20.04 | 17.004 | 44.49 | 72.994 | 116.999 | 2.479 | 1.634 | 36.091 | 76.123 | 3.874 | 0.78 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.019 | 4.069 | 8.041 | 7.98 | 8.036 | 8.03 |
| | 38.95 | 20.057 | 17.039 | 44.47 | 73.042 | 117.014 | 2.536 | 1.636 | 35.96 | 76.074 | 3.89 | 0.774 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.074 | 4.02 | 8.074 | 8.039 | 8.014 | 8.047 |
| | 38.92 | 20.074 | 17.054 | 44.44 | 72.989 | 116.974 | 2.474 | 1.622 | 35.964 | 76.055 | 3.949 | 0.714 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.896 | 4.006 | 7.99 | 7.984 | 7.985 | 8.049 |
| | 38.94 | 20.009 | 17.008 | 44.47 | 73.012 | 117.029 | 2.484 | 1.641 | 36.022 | 76.054 | 3.936 | 0.794 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.02 | 3.989 | 8.009 | 8.005 | 7.986 | 8.005 |
| | 39.04 | 20.061 | 17.086 | 44.46 | 73.022 | 117.014 | 2.531 | 1.636 | 36.036 | 76.07 | 3.88 | 0.78 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.989 | 3.974 | 8.001 | 8.007 | 7.999 | 7.987 |
| | 39.07 | 19.986 | 16.965 | 44.5 | 72.964 | 117.081 | 2.488 | 1.629 | 35.974 | 76.028 | 3.879 | 0.789 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.896 | 4.006 | 7.99 | 7.984 | 7.985 | 8.049 |
| | 38.96 | 20.07 | 17.021 | 44.52 | 72.979 | 116.988 | 2.53 | 1.622 | 35.984 | 75.977 | 3.949 | 0.769 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.029 | 4.039 | 7.984 | 7.976 | 8.022 | 8.016 |
| | 38.98 | 20.039 | 17.086 | 44.54 | 72.98 | 116.954 | 2.502 | 1.639 | 36.071 | 75.98 | 3.936 | 0.771 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.007 | 3.976 | 7.99 | 7.969 | 8.01 | 8.024 |
| | 38.94 | 19.996 | 16.974 | 44.5 | 73.001 | 116.975 | 2.496 | 1.644 | 35.996 | 76.019 | 3.94 | 0.789 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.019 | 4.069 | 8.041 | 7.98 | 8.036 | 8.03 |
| | 39.04 | 19.984 | 17.031 | 44.48 | 72.974 | 116.964 | 2.489 | 1.631 | 35.941 | 76.022 | 3.899 | 0.784 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.034 | 4.076 | 8.027 | 8.079 | 7.994 | 7.994 |
| | 39.01 | 20.064 | 17.028 | 44.8 | 73.074 | 116.941 | 2.541 | 1.639 | 36.017 | 76.02 | 3.874 | 0.764 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.074 | 4.02 | 8.074 | 8.039 | 8.014 | 8.047 |
| | 39.05 | 19.909 | 17.029 | 44.5 | 72.974 | 117.009 | 2.489 | 1.614 | 36.041 | 75.981 | 3.936 | 0.769 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.974 | 3.974 | 8.026 | 7.984 | 7.986 | 8.028 |
| | 39.06 | 19.986 | 16.978 | 44.47 | 73.089 | 117.029 | 2.554 | 1.632 | 35.969 | 76.037 | 3.874 | 0.789 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.989 | 4.009 | 7.986 | 8.029 | 8.011 | 7.941 |
| | 39.05 | 20.045 | 16.982 | 44.5 | 73.04 | 116.964 | 2.541 | 1.636 | 35.584 | 75.994 | 3.89 | 0.716 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.029 | 4.036 | 7.994 | 8.046 | 7.977 | 7.986 |
| | 36.1 | 20.039 | 16.986 | 44.49 | 73.036 | 116.941 | 2.491 | 1.664 | 36.022 | 75.976 | 3.946 | 0.794 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.899 | 4.081 | 8.036 | 8.079 | 7.989 | 7.974 |
| | 36.04 | 19.984 | 16.979 | 44.47 | 72.97 | 116.974 | 2.489 | 1.629 | 36.059 | 76.049 | 3.929 | 0.774 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.949 | 4.074 | 7.976 | 8.004 | 7.988 | 8.031 |
| | 39.98 | 0.041 | 17.086 | 44.52 | 72.979 | 116.981 | 2.52 | 1.641 | 36.041 | 76.022 | 3.94 | 0.789 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.019 | 4.069 | 8.041 | 7.98 | 8.036 | 8.03 |
| | 39.6 | 19.939 | 19.949 | 44.49 | 72.989 | 116.968 | 2.471 | 1.639 | 35.97 | 75.971 | 3.849 | 0.769 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.029 | 4.039 | 7.984 | 7.976 | 8.022 | 8.016 |
| | 39.09 | 19.974 | 17.02 | 44.54 | 73.046 | 117.071 | 2.519 | 1.674 | 35.941 | 76.041 | 3.964 | 0.786 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.019 | 4.069 | 8.041 | 7.98 | 8.036 | 8.03 |
| | 38.94 | 20.014 | 17.024 | 44.5 | 73.021 | 117.03 | 2.539 | 1.625 | 35.986 | 76.086 | 3.896 | 0.77 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.899 | 4.081 | 8.036 | 8.079 | 7.989 | 7.974 |
| | 38.94 | 19.986 | 16.977 | 44.47 | 72.98 | 117.039 | 2.486 | 1.624 | 36.021 | 76.044 | 3.941 | 0.764 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.55 | 2.5 | 2.5 | 3.949 | 4.074 | 7.976 | 8.004 | 7.988 | 8.031 |
| | 38.96 | 19.989 | 16.991 | 44.49 | 72.986 | 116.991 | 2.469 | 1.624 | 36.014 | 75.984 | 3.941 | 0.786 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.55 | 2.5 | 2.5 | 3.899 | 4.081 | 8.036 | 8.079 | 7.989 | 7.974 |
| | 39.09 | 20.024 | 17.03 | 44.59 | 73.091 | 117.039 | 2.531 | 1.639 | 36.036 | 76.029 | 3.916 | 0.77 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.074 | 4.02 | 8.074 | 8.039 | 8.014 | 8.047 |
| | 39.06 | 20.056 | 16.989 | 44.5 | 73.044 | 117.089 | 2.536 | 1.641 | 35.991 | 75.974 | 3.896 | 0.769 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.019 | 4.069 | 8.041 | 7.98 | 8.036 | 8.03 |
| | 39.08 | 20.039 | 17.022 | 44.54 | 72.974 | 117.014 | 2.586 | 1.622 | 35.981 | 75.984 | 3.944 | 0.74 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.029 | 4.039 | 7.984 | 7.976 | 8.022 | 8.016 |

Figure 25: Cp and Cpk Values of 10A(Cont.)

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| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1000433075 | 39.06 | 19.974 | 16.987 | 44.4 | 72.97 | 116.949 | 2.489 | 1.629 | 36.04 | 75.988 | 3.891 | 0.771 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.25 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.049 | 3.994 | 7.98 | 8.004 | 7.994 | 8.039 |
| | 39.09 | 19.986 | 17.041 | 44.56 | 73.021 | 116.974 | 2.52 | 1.631 | 35.974 | 76.074 | 3.924 | 0.796 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.986 | 3.974 | 7.994 | 8.024 | 8.044 | 8.026 |
| | 39.96 | 19.946 | 17.074 | 44.44 | 73.044 | 117.024 | 2.514 | 1.62 | 39.984 | 76.059 | 3.984 | 0.784 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 0.5 | 2.5 | 2.5 | 4.029 | 4.081 | 8.036 | 8.079 | 7.989 | 7.974 |
| | 36.04 | 19.984 | 16.979 | 44.47 | 72.97 | 116.974 | 2.489 | 1.629 | 36.059 | 76.049 | 3.929 | 0.774 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.949 | 4.074 | 7.976 | 8.004 | 7.988 | 8.031 |
| | 39.1 | 20.039 | 17.056 | 44.49 | 72.986 | 116.984 | 2.54 | 1644 | 36.02 | 76.074 | 3.949 | 0.769 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.044 | 4.039 | 8.046 | 8.04 | 8.074 | 8.036 |
| | 39.09 | 19.314 | 16.989 | 44.74 | 73.089 | 117.201 | 2.615 | 1.637 | 36.065 | 75.989 | 3.929 | 0.823 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.891 | 3.983 | 7.769 | 8.009 | 8.019 | 7.918 |
| | 39.94 | 20.03 | 16.987 | 44.45 | 72.986 | 117.086 | 2.53 | 1.65 | 36.041 | 76.009 | 3.874 | 0.784 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.081 | 4.046 | 7.974 | 8.03 | 8.022 | 8.041 |
| | 39.07 | 20.01 | 16.986 | 44.49 | 73.049 | 117.029 | 2.474 | 1.622 | 35.973 | 75.982 | 3.89 | 0.785 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.972 | 4.56 | 7.989 | 8.022 | 8.027 | 8.02 |
| | 36.04 | 19.984 | 16.979 | 44.47 | 72.97 | 116.974 | 2.489 | 1.629 | 36.059 | 76.049 | 3.929 | 0.774 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.949 | 4.074 | 7.976 | 8.004 | 7.988 | 8.031 |
| | 39.1 | 20.319 | 17.049 | 44.69 | 73.109 | 117.234 | 2.666 | 1.615 | 36.114 | 75.901 | 3.941 | 0.798 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.979 | 3.947 | 7.796 | 7.966 | 8.185 | 7.872 |
| | 38.93 | 19.964 | 17.024 | 44.48 | 73.009 | 116961 | 2.489 | 1.65 | 36.022 | 75.964 | 3.874 | 0.764 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.98 | 4.012 | 8.008 | 8.022 | 7.98 | 8.029 |
| | 38.96 | 19.974 | 16.984 | 44.54 | 73.025 | 116.989 | 2.481 | 1.654 | 36.089 | 76.02 | 3.936 | 0.764 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.896 | 3.97 | 7.959 | 8.056 | 8.089 | 8.046 |
| | 39.96 | 19.986 | 17.171 | 44.54 | 72.969 | 116.974 | 2.52 | 1.624 | 35.986 | 75.941 | 3.874 | 0.781 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.986 | 4.009 | 7.974 | 8.026 | 7.986 | 8.007 |
| | 39.08 | 20.02 | 17.086 | 44.8 | 73.046 | 117.021 | 2.541 | 1.63 | 36.014 | 75.974 | 3.941 | 0.774 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.091 | 4.037 | 8.026 | 7.984 | 8.031 | 8.031 |
| | 39.04 | 20.0644 | 16.946 | 44.56 | 73.046 | 117.049 | 2.489 | 1.619 | 36.026 | 76.041 | 3.946 | 0.756 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.109 | 3.986 | 8.049 | 7.989 | 8.049 | 8.029 |
| | 39.08 | 19.974 | 17.046 | 44.51 | 73.071 | 117.074 | 2.526 | 1.622 | 36.009 | 76.041 | 3.949 | 0.769 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.041 | 3.994 | 8.031 | 7.97 | 8.022 | 8.049 |
| | 39.07 | 19.946 | 17.08 | 44.49 | 72.98 | 116.946 | 2.531 | 1.64 | 36.041 | 75.979 | 3.956 | 0.784 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.974 | 3.977 | 8.026 | 7.991 | 8.016 | 8.036 |
| | 38.96 | 20.031 | 17.021 | 44.49 | 73.086 | 116.899 | 2.549 | 1.624 | 36.074 | 76.026 | 3.929 | 0.789 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.991 | 4.036 | 8.019 | 7.976 | 8.036 | 7.979 |
| | 38.98 | 20.057 | 17.009 | 44.54 | 72.949 | 116.931 | 2.322 | 1.629 | 35.986 | 76.046 | 3.894 | 0.772 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.021 | 4.033 | 7.899 | 7.989 | 7.984 | 7.981 |
| | 39.04 | 20.039 | 17.047 | 44.46 | 73.04 | 117.039 | 2.522 | 1.622 | 36.078 | 76.014 | 3.894 | 0.754 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.004 | 3.974 | 8.061 | 8.027 | 7.981 | 7.989 |
| | 38.98 | 19.974 | 17.021 | 44.69 | 73.109 | 117.234 | 2.666 | 1.65 | 36.022 | 75.964 | 3.874 | 0.764 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.891 | 3.983 | 7.769 | 8.009 | 8.019 | 7.918 |
| | 39.05 | 20.045 | 16.982 | 44.5 | 73.009 | 116961 | 2.489 | 1.65 | 36.022 | 75.964 | 3.929 | 0.774 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.891 | 3.983 | 7.769 | 8.009 | 8.019 | 7.918 |
| | 36.1 | 20.039 | 16.986 | 44.49 | 73.025 | 116.989 | 2.481 | 1.654 | 36.089 | 76.02 | 3.949 | 0.769 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.041 | 3.994 | 8.031 | 7.97 | 8.022 | 8.049 |
| | 36.04 | 19.984 | 16.979 | 44.47 | 72.969 | 116.974 | 2.52 | 1.624 | 35.986 | 75.941 | 3.929 | 0.823 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.974 | 3.977 | 8.026 | 7.991 | 8.016 | 8.036 |
| | 39.05 | 20.045 | 16.982 | 44.5 | 73.04 | 116.964 | 2.541 | 1.636 | 35.584 | 75.994 | 3.89 | 0.716 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.029 | 4.036 | 7.994 | 8.046 | 7.977 | 7.986 |
| | 38.96 | 20.07 | 17.021 | 44.52 | 72.979 | 116.988 | 2.53 | 1.622 | 35.984 | 75.977 | 3.949 | 0.769 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.029 | 4.039 | 7.984 | 7.976 | 8.022 | 8.016 |
| | 39.08 | 19.974 | 16.991 | 44.45 | 72.986 | 116.991 | 2.522 | 1.629 | 36.019 | 76.986 | 3.922 | 0.774 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.009 | 3.991 | 8.02 | 7.991 | 8.022 | 7.977 |
| | 39.04 | 20.019 | 27.012 | 44.48 | 73.064 | 116.979 | 2.536 | 1.63 | 36.039 | 76.02 | 3.92 | 0.78 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 4.017 | 3.974 | 7.986 | 7.969 | 7.949 | 8.039 |
| LSL | 38.7 | 19 | 16 | 44.2 | 72 | 116 | 2.3 | 1.4 | 35 | 75 | 3.7 | 0.7 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 3.5 | 3.5 | 7 | 7 | 7 | 7 |
| USL | 39.3 | 21 | 18 | 44.8 | 74 | 118 | 2.7 | 1.8 | 37 | 77 | 4.1 | 0.9 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 4.5 | 4.5 | 9 | 9 | 9 | 9 |
| UCL | 39.2167 | 20.2839 | 17.1602 | 44.7048 | 73.1575 | 117.21 | 2.6459 | 1.66876 | 36.1695 | 76.1374 | 4.0135 | 0.8464 | 2.50783 | 2.50924 | 2.50931 | 2.5078 | 2.50454 | 2.50627 | 2.50958 | 2.50935 | 2.50899 | 2.51606 | 2.5109 | 2.51075 | 4.1563 | 4.139 | 8.129 | 8.1163 | 8.1606 | 8.1752 |
| Mean | 39.0719 | 19.991 | 17.0205 | 44.5674 | 73.0337 | 117.069 | 2.5521 | 1.63169 | 36.043 | 75.9979 | 3.9247 | 0.7801 | 2.49821 | 2.49738 | 2.4981 | 2.49795 | 2.49845 | 2.49762 | 2.49964 | 2.49845 | 2.4981 | 2.50036 | 2.49905 | 2.49857 | 3.9924 | 4.0162 | 7.9736 | 7.9961 | 8.0187 | 8.0049 |
| LCL | 38.9271 | 19.698 | 16.8807 | 44.4299 | 72.9098 | 116.928 | 2.4583 | 1.59462 | 35.9166 | 75.8584 | 3.8359 | 0.7138 | 2.4886 | 2.48553 | 2.48668 | 2.4881 | 2.49236 | 2.48897 | 2.48971 | 2.48756 | 2.4872 | 2.48466 | 2.48719 | 2.4864 | 3.8284 | 3.8934 | 7.8182 | 7.8759 | 7.8768 | 7.8345 |
| Sigma | 0.07082 | 0.1381 | 0.04612 | 0.09263 | 0.04647 | 0.04705 | 0.05989 | 0.0127 | 0.05713 | 0.0536 | 0.02923 | 0.02541 | 0.00563 | 0.00623 | 0.00702 | 0.00579 | 0.00503 | 0.00594 | 0.00648 | 0.00736 | 0.00685 | 0.01023 | 0.00652 | 0.00661 | 0.05845 | 0.05219 | 0.06775 | 0.04982 | 0.06475 | 0.05943 |
| Cp | 2.07 | 3.41 | 7.16 | 2.18 | 8.07 | 7.08 | 2.13 | 5.39 | 7.91 | 7.17 | 2.25 | 1.51 | 20.81 | 16.87 | 17.83 | 20.3 | 32.85 | 23.12 | 20.13 | 18.36 | 18.36 | 12.74 | 16.87 | 16.43 | 3.05 | 4.07 | 6.44 | 8.32 | 7.05 | 5.87 |
| Cpk | 1.57 | 3.38 | 7.01 | 1.69 | 7.8 | 6.6 | 1.58 | 4.54 | 7.57 | 7.15 | 1.97 | 1.21 | 20.62 | 16.65 | 17.66 | 20.1 | 32.6 | 22.84 | 20.1 | 18.12 | 18.18 | 12.72 | 16.79 | 16.31 | 3 | 3.94 | 6.27 | 8.29 | 6.92 | 5.84 |

Figure 26: Cp and Cpk Values of 10A

# Chapter 5

# CONCLUSION

# CONCLUSION

## 5.1CONCLUSION

### A. DATA COLLECTION

**1. Purpose:**

Baseline data collection helps the stake holders to have a solid foundation of data to evaluate andcompare it with different conditions and also observe the trend which will help in identifying thebottlenecks.

I. **Scope:**

This document Is an instruction to the operators on the steps that needs to be taken while collecting baseline data. It also gives the operators guidelines to follow and potential pitfalls whiledoing the operation.

3. **Procedure:**

   3.1 Manufacture 1000 parts and arrange it accordingly in sequence.

   3.2 A 100% inspection is carried out on these parts.

   3.3 Ensure that the variability in operators is removed by having the same operator measurethe parts on the same machine.

   3.4 It is vital to ensure that the parts have been arranged in the order of production.

   3.5 The machine variation can be reduced by having al the parts manufactured on the samemachine.

   3.6 Ensure to follow the same measuring procedure for all the parts according to the standard operating procedure for measurement.

   3.7 Do not discard bad parts as it will affect the whole procedure.

4. **Analysis**

After all the data has been inputted, plot a run chart to see if there is a trend in the graph. The trend in the graph will help give information on the variations during production. This data canbe used to determine the control limits and sampling plan for later inspection.

### B. PROCESS CAPABILITY

1. **Purpose:**

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Process Capability is a measure of the output of a stable process to its specification limits. There are different Indices that are used to measure process capability and are called process capability Index (Cpk. Ppk).

2. **Scope:**

This document is an instruction for the operator to follow to conduct the Process Capability study. This study will give an insight into the capability of the process as sometimes the processcan produce 100% of output within the specification limits and otherwise not. It is Importantto conduct this study after the process is stable.

3. **Terms and Definitions:**

   **3.1 Cpk (Process Capability Index)**: It is the ratio between permissible deviation, measured from the mean value to the nearest specific limit or acceptability, and the actual one-sided three times sigma spread or the process. Cpk of at least 1.33 is desirable. Cpk accounts for variability within a subgroup.

   **3.2 Ppk (Process Performance Index):** It represents the overall variability. Ppk measures both the part to part variability as well as shift and drift between them.

4. **Procedure:**

   **4.1** Make a note of the operating conditions that the study is being conducted in.

   **4.2** Ensure that there is sufficient raw material available and choose an operator toconduct the study.

$$Cpk = \min\left\{ \frac{USL - \bar{x}}{3\sigma}, \frac{\bar{x} - LSL}{3\sigma} \right\}$$

   **4.3** The process capability study needs to be conducted only after the measurement system is confirmed to be acceptable.

   **4.4** Run the process and tart collecting data to ensure that the process is stable.

   **4.5** If the process is not stable then conduct root cause analysis and resume thestudy only after stabilizing the process.

**4.6** Collect as many data points as possible (minimum **100** points) to get a betteraccuracy of the process capability.

## C. SAMPLING PLAN

### 1. Purpose:

Sampling plan is determined to make the operator's life easier. By having the correct sampling plan, 100% inspection is eliminated and the operator can check according tothe sampling plan to determine if the products are confirming to specification or not.

### 2. Scope:

This document is for all machining operations personnel involved in creating, Maintainingand modifying sampling plans. The intent behind having a sampling plan Is to enhance the real time **SPC** inspection procedures and maintain high quality standards.

### 3. Terms and Definitions:

**3.1 Confidence level:** Indicates the reliability of the estimate. Typically, **95%** confidence interval is used.

**3.2 Sigma:** Standard deviation

Type I error (Producer's risk): Rejecting a lot with acceptable quality

Type II error (Consumer's risk): Accepting a lot with unacceptable quality

Acceptable quality level **(**AQL):It is a percent defective that is the baseline requirementfor the quality of the product

### 4. Procedure:

**4.1** The sampling plan is determined after collection of baseline data. Thesampling plan can be chosen only after the process is stable.

**4.2** While choosing a sampling plan, it should be kept in mind about thefeasibility of inspection by the operator.

**4.3** The timeframe to measure the necessary dimensions on the various measurement devices to prove that the part being produced isacceptable should be measured.

**4.4** From the run chart of the collected baseline data, trial and error methodshould be used to determine the sampling plan.

**4.5** If **1** out of **10** parts is the sampling plan that is chosen, then thissampling plan should be applied on another order of data to ensure thatit is able to pick up the variations of the process.

**4.6** If it not able to pick up the variations of the process, then a differentsampling plan needs to be chosen.

**4.7** The process should then be run and the operators are asked to followthe sampling plan that has been chosen.

**4.8** This data should be analyzed and feedback from the operators noted tocheck on the feasibility of the chosen sampling plan[4].

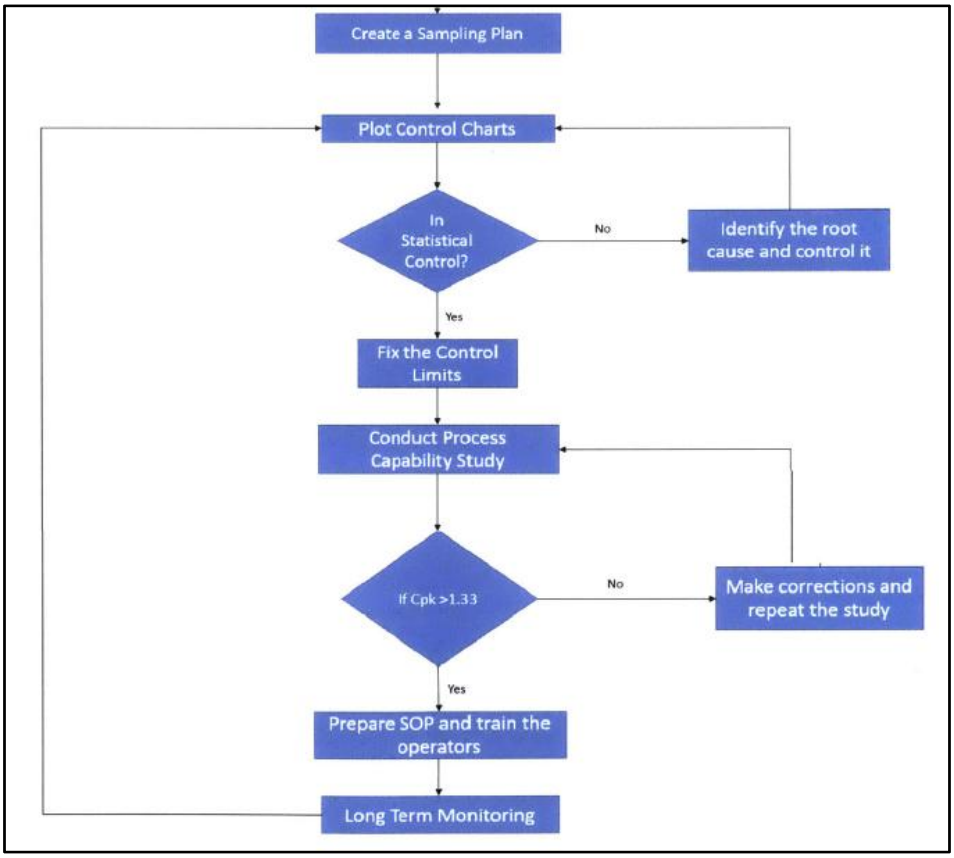


Figure: Process Flow

## 5.2 FUTURE SCOPE

Statistical process control is a tried and tested method. The key to SPC is action. The valuegained by implementing SPC are shown in Figure. Nowadays, manufacturers

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have become dependent on a range of machinery and technology to produce parts at a rapid rate. Loss of
productivity and losses due to scrap can affect the company's progress in this world of deadly
competition. Real time SPC gathers process and product information and gives the operators and supervisors alarms and triggers to rectify the problem immediately. SPC is an iterative process, and the methodology should be upgraded time and again to ensure high quality standards[4].

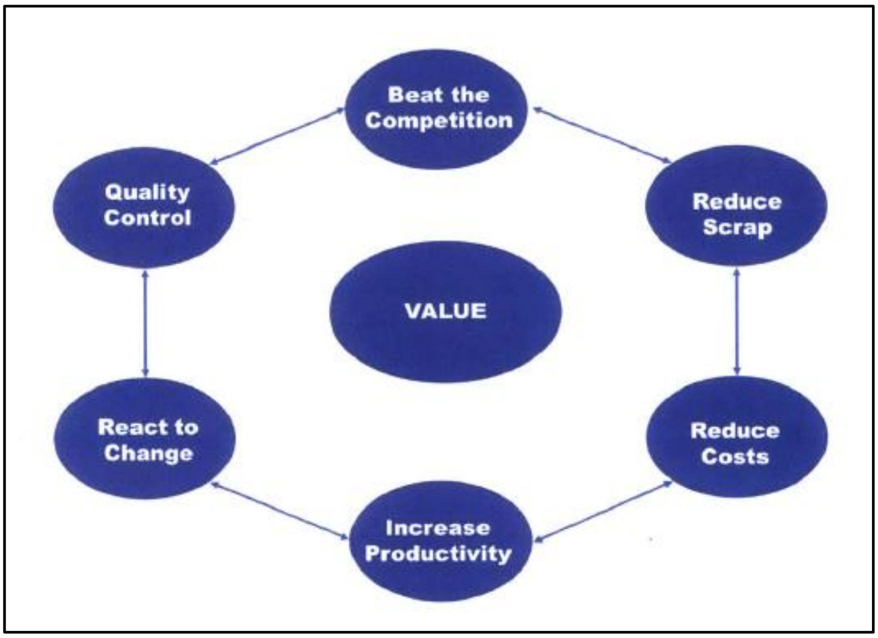


Figure: Future Scope

# Chapter 5

# REFERENCES

## REFERENCES

# Works Cited

[1] I. Madanhire and C. Mbohwa, "Application of Statistical Process Control (SPC) in Manufacturing," *Elsevier,* p. 4, 2016.

[2] R. Kaye and M. Macleod, "Tutorial Guide Monitoring Quality in Healthcare," National Services Scotland, Scotland.

[3] M. K. R. B. A. HALIM, "IMPLEMENTATION OF STATISTICAL PROCESS CONTROL IN SMALL AND MEDIUM ENTERPRISE INDUSTRY," UNIVERSITI MALAYSIA PAHANG.

[4] S. Udayshankar, "Statistical Process Control (SPC) in a High Volume Machining Center: Value," MASSACHUSETTS INSTITUTE OF TECHNOLOGY, 2015.

[5] M. 19, Minitab Inc., 1972. [Online]. Available: https://support.minitab.com/en-us/minitab/20/help-and-how-to/quality-and-process-improvement/control-charts/how-to/variables-charts-for-individuals/individuals-chart/before-you-start/overview/. [Accessed March 2020].

[6] "Minitab 19," Minitab Inc., 1972. [Online]. Available: https://support.minitab.com/en-us/minitab/20/help-and-how-to/quality-and-process-improvement/control-charts/how-to/variables-charts-for-individuals/moving-range-chart/before-you-start/overview/. [Accessed March 2020].

[7] M. 19, Minitab Inc., 1972. [Online]. Available: https://support.minitab.com/en-us/minitab/19/help-and-how-to/quality-and-process-improvement/capability-analysis/how-to/capability-sixpack/normal-capability-sixpack/interpret-the-results/all-statistics-and-graphs/graphs/#capability-histogram. [Accessed March 2020].

[8] S. Sousa, N. Rodrigues and E. Nunes, "Application of SPC and quality tools for process improvement," *Elsevier,* p. 8, 2017.

[9] P. S. Parmar and V. A. Deshpande, "Implementation of Statistical Process Control," *Journal of Emerging Technologies and Innovative Research (JETIR),* vol. 1, no. 6, p. 5, Nov 2014.

[10] B. S. Jogi, L. R. Gour and N. Turkar, "Process Improvement Using Statistical Pocess Control in a Small Scale Industry," *International Journal of Trend in Scientific Research and Development (IJTSRD),* vol. 2, no. 5, p. 8, Aug-2018.

[11] P. V. V. Atre, "Process Capability Analysis in Single and Multiple Batch Manufacturing Systems," *International Journal of Engineering and Management Research,* vol. 8, no. 4, p. 18, Aug 2018.

[12] "Overview for Normal Capability Sixpack," Minitab Inc., 1932. [Online]. Available: https://support.minitab.com/en-us/minitab/18/help-and-how-to/quality-and-process-improvement/capability-analysis/how-to/capability-sixpack/normal-capability-sixpack/before-you-start/overview/. [Accessed March 2020].