# Quality control of the 3 lathe machines

|  | **Efficiency (%)** | **σAVERAGE (mm)** | **Cp (-)** | **Cpk (-)** |
| --- | --- | --- | --- | --- |
| **Machine 1** | 95 | 1.31 | 0.51 | 0.49 |
| **Machine 2** | 99 | 0.73 | 0.92 | 0.71 |
| **Machine 3** | 71 | 1.76 | 0.38 | 0.34 |

## Machine 1

For the first machine most failures are on the lower boundary, as seen in the histogram. Even though the machine's efficiency is 95%, the precision is low and most parts are not showing up at the expected average length of 600mm. This is also confirmed by the control chart that shows the standard deviation per batch, which is never lower than 1. This value is too high and should be adjusted. Even though the standard deviation itself is too high, it appears that the standard deviation remains somewhat constant throughout the batches. This is shown by the trendline. Therefore the machine’s parameters should be adjusted accordingly to decrease the standard deviation and increase the precision of the machine. This could be fixed with maintenance. When looking at the Cp and Cpk values we see that the process is by far incapable of producing the products. Therefore not only maintenance but also fine tuning of the NC process is needed.

## Machine 2

For the second machine the histogram shows both high precision and high accuracy. There is only one failure only off by 0.2mm,this magnitude is debatable. This gives the machine an efficiency of 99%. Looking at the control chart a decreasing trendline throughout the batches can be seen, which means the performance of the machine is only increasing. This could be due to wear of a tool that had just been replaced. Therefore this machine does not need any more maintenance. The only failure was in batch 11 which, according to the control chart, is a one-time peak. Therefore it is believed that this was coincidence due to for example human error or weather circumstances or an error from a previous machine. The Cp and Cpk values show that the machine could still use finetuning of parameters to increase its precision. The Cp value seems close, but the Cpk value indicates that the machine should be more precise.

## 

## Machine 3

Machine 3 has a very bad precision. The efficiency of the machine is only 71%. In the histogram the failures on the lower end and upper end are approximately the same, which in contrast to machine 1, indicates that it’s not only machine parameters that need to be changed. The machine needs maintenance. The control chart for machine 3 also shows an increasing standard deviation over time, which indicates the continuation of wear. After maintenance optional finetuning of the NC process is needed, as in machine 1 and 2.

**FMEA analysis:**

Failure Modes and Effects Analysis (FMEA) is a systematic, proactive method for evaluating a process to identify where and how it might fail and to assess the relative impact of different failures, in order to identify the parts of the process that are most in need of change[1].FMEA analysis is done depending on what is analyzed and we are focusing on the Process type which is an analysis of manufacturing and assembly processes. Both quality and reliability may be affected from process faults. The input for this FMEA is amongst others a work process / task breakdown[2].it is usually created within a spreadsheet, to help practitioners anticipate what might go wrong with a [product](https://www.isixsigma.com/dictionary/product/) or process. In addition to identifying how a product or process might fail and the effects of that failure, FMEA also helps find the possible causes of failures and the likelihood of failures being detected before occurrence.[3]Used across many industries, FMEA is one of the best ways of analyzing potential reliability problems early in the development cycle, making it easier for manufacturers to take quick action and mitigate failure. The ability to anticipate issues early allows practitioners to design out failures and design in reliable, safe and [customer](https://www.isixsigma.com/dictionary/customer/)-pleasing features.[3]

The first category consists of, **potential failure effects;** which describes what is the impact on the customer if failure mode is not prevented, The **SEV number;** indicates how severe the effect is on customers.

The second category consists of **potential causes;** which discusses the causes for the failure mode to occur (what causes the step to go wrong) **, OCC;** which indicateshow frequent the cause that leads to failure occurs

The third category consists of  **current process controls;** discusses the existing measures taken to prevent the cause that leads to the step failing or detect it before it



