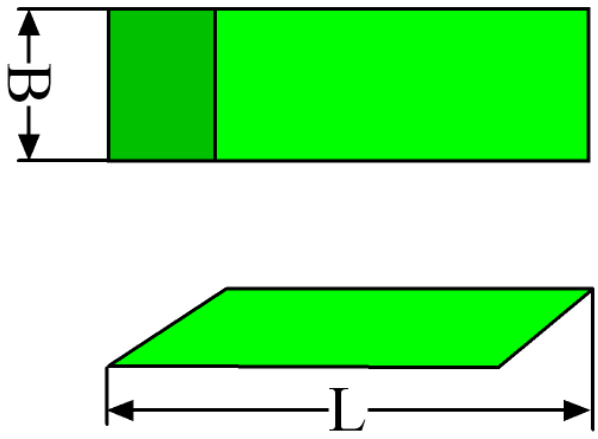
Statistical quality control 2007

Measurement systems analysis

Obligatory. Approved exercies gives one bonus point on the ordinary exam. Last day: 13 December 2007.
The assignment shall be done in groups and be reported in written with one report per group. The size of the group should be 2-5 persons. All members in the group must participate in the work.

Background

You work at a company, Rubber AB, that manufactures rubber erasers. The production is made by machines in an automatized production process which is monitored with aid of statistical process control. An eraser has a number of important characteristics and two measures critical for the production is the width B and the length L which are shown in Figure 1.



Figur 1: Two important dimensions of a rubber eraser.

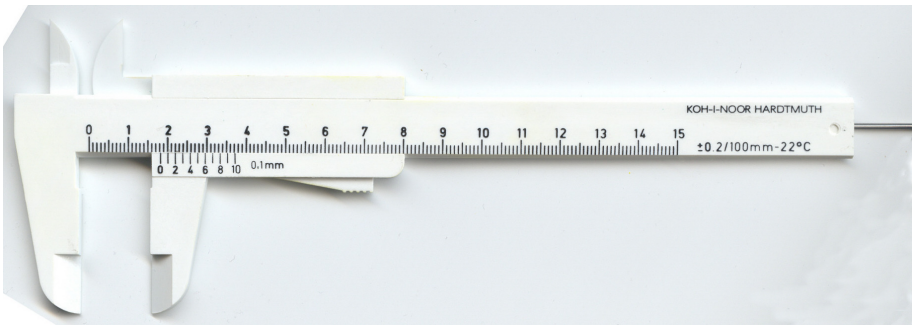
According to the drawing, the measures B and L are specified as

$$\begin{array}{l} L{=}39.6 \pm 1.0mm \\ B{=}14.0 \pm 1.0mm \end{array} \tag{1}$$

Measurement systems analysis

In order to control the process and estimate the capability the measurement error should be low enough compared to the process variation and the tolerance width.

A slide caliper (skjutmått) is used to measure the width B and the length L that is shown in Figure 2.



Figur 2: Mätinstrumentet

Your assignment is to decide whether this (cheap) instrument has low enough measurement variation to assure the product quality. The variation can come from either product, instrument or operator.

Each group may borrow a slide caliper and 10 rubber erasers. Each person in the group is an operator and shall participate in the measurement systems analysis.

- Make a simple Fishbone diagram (cause and effects diagram) of the causes of the measurement variation.
- Perform a measurement systems analysis of the slide caliper on measurement B.
- Perform a measurement systems analysis of the slide caliper on measurement L.

- Write a short report with your conclusions. How large were the variance components? What was $\hat{\sigma}^2_{Gauge}, \hat{\sigma}^2_{Reproducibility}, \hat{\sigma}^2_{Repeatability}$ and $\hat{\sigma}^2_{Product}$?
- Is the slide caliper a good measurement instrument for B and L?