



## Implementation of Online SPC for Six Sigma Strategy

### Case Study: Mahle Componentes de Motores Ltda, Itajubá, Minas Gerias, Brasil

With the objective of improving competitive position and product quality, Mahle Componentes de Motores Ltda, located at Itajuba, MG, Brazil, is increasing the use of statistical tools for developing and managing production processes in its piston ring manufacturing operation.

Since 2004 Mahle has been seeking a six sigma excellence level for every product characteristic considered as critical or special. In order to achieve that level, Mahle began implementation of online statistical process control (SPC) as the fundamental tool.

Mahle has applied the basic steps of six sigma strategy in the implementation and management of this project. These steps are:

1. Define
2. Measure
3. Analyze
4. Improve
5. Control

#### 1. Define

Based on the concept of minimization of cost evaluation and maximization of cost prevention, the Statistical Quality Department defined elimination of sampling inspection in the final control of the process as an important issue.

The factory functional areas were next integrated into the project organization in order to search the hierarchy of the processes according to PFMEA documentation, customer requirements and safety concerns.

After defining the work structure, Mahle chose SPC online software that met its needs for high software customization capacity. Applied Stats software from ASI DataMyte was a perfect match for the company's needs.

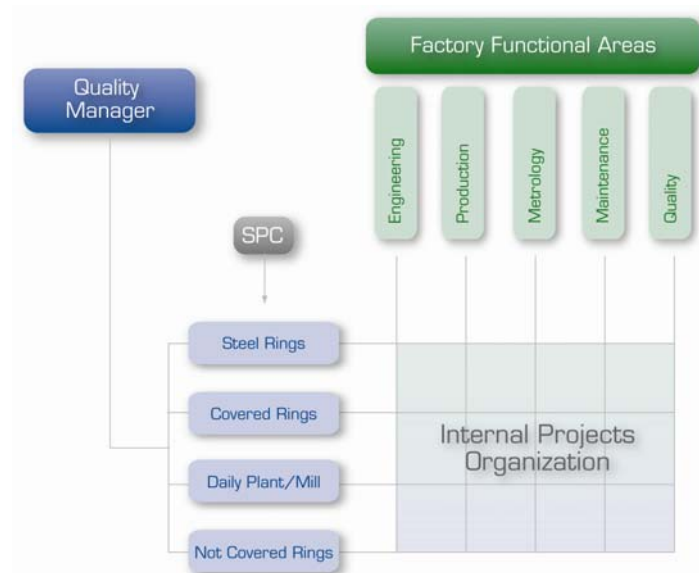


Figure 1. Project integration.

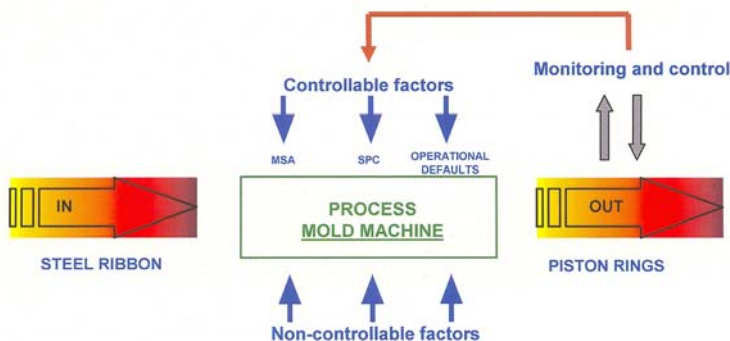


Figure 2. Evaluation of controllable factors.

#### 2. Measure

Each Factory Functional Area evaluated the controllable factors (measurement systems analysis, machine capacity and operational standardization) to verify the system's robustness.

#### 3. Analyze and Improve

After that, results were filtered to determine the process precision along with the unsatisfactory cases that required initial action to raise their quality levels. The Mahle team compiled a complete list with improvement suggestions and after that actions were taken.

#### 4. Control

Based on the results, the project team and the statistics department delineated the control graphics natural limits for continuous/discrete data and the Out-of-Control Process Action Plan. These were divided into local and system actions.

In addition, the CMS (Sequential Average Length) and TMA (Average Time of Alert) were analyzed to specify frequency, sampling, charts and standards defaults. Statistical training focused on SPC completed the project.

#### Project Impact and Benefits

After a period of four months of online SPC implementation, Mahle realized these benefits:

- a) 50% reduction in production process variability
- b) Elimination of characteristics controlled by sampling inspection
- c) 3.8% reduction in scrap
- d) Increase in productivity

Based on operational results optimization, the company adjusted the annual investment to maintain the project, which currently has 23 data collection stations implemented throughout the plant.

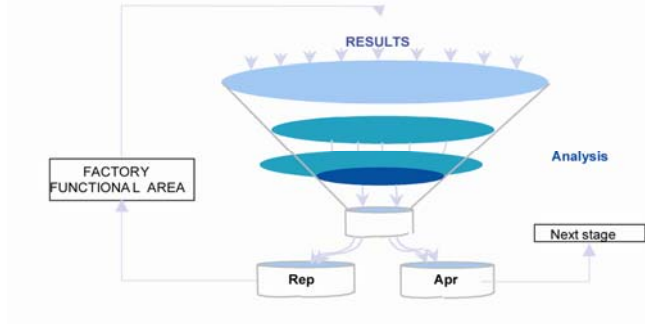


Figure 3. Filtering the results.



Figure 4. An operator inspects a piston ring using Applied Stats.



Figure 5. The project team.