Application of the Modular Function Deployment Tool on a pressure regulator

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Due to the fast changing technology during the last decades, products are getting more complex and the costumer needs more particular. To stay competitive on the market, the companies have to react faster on the continuous changing of the customer needs and have to reduce the cost for development and production. A modular product will shorten the design cycle time and production costs by using already developed elements as a common unit from different products. Furthermore, the demand of the customer is to purchase a tailor-made product. Many variants are realisable in a modularised design.

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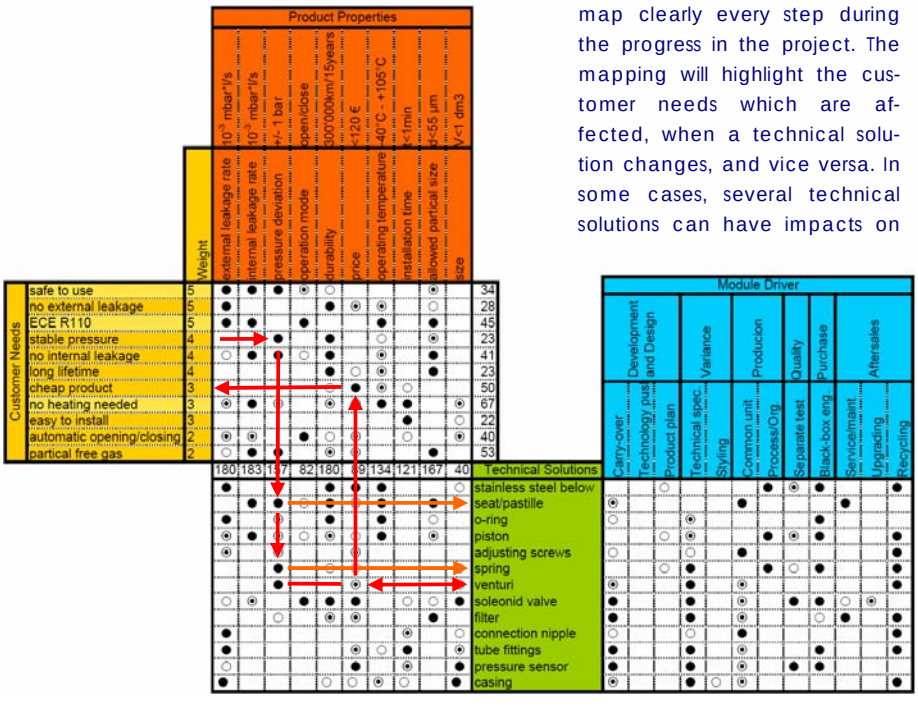
In this thesis, a prototype of a pressure regulator for automotive applications is improved and redesigned for mass production. The product must fulfil several technical specifications defined by the customers and the regulations. To improve the functionality of the product, tests with prototypes are done in the laboratory and with a test vehicle. The step by step acquired improvements bring the product to a stage were a pre-series can be launched. After having a working prototype, it has to be designed to be produced in high volumes.

The improvement for mass production can be quantified with the Design For Assembly (DFA-) index, which gives an evaluation of the efficiency of design during the assembly of the product. After the modularisation, the DFA-index will show the amelioration of the product and the assembly costs which can be saved.

The Modular Function Deployment (MFD) method is applied to redesign the prototype and to make it ready for mass production. To develop an efficient product, the requirements of the customer must be fulfilled. Technical solutions have to be worked out to satisfy these requirements. The method is a systematic approach to develop a modular product and to document the development process. Furthermore the method helps to map clearly every step during the progress in the project. The mapping will highlight the customer needs which are affected, when a technical solution changes, and vice versa. In some cases, several technical solutions can have impacts on more than one requirement of the customer. E.g. the customer wants a product which provides a stable pressure. The technical solutions which fulfil this requirement are, amongst others, seat, spring and the venturi. Changing the venturi, will not only affect the stability of the pressure, but also have an impact on providing the customer a cheap product. The interrelations between the solutions and the different customer needs must be clearly defined and documented. Furthermore, a non-involved engineer is capable, in a short time, to understand every decision already made on the project and to continue the project work.



Product Managment Map: Overview of the development process

The technical solutions are grouped to modules by use of grouping criteria, the Module Driver. Modules are interchangeable sub-assemblies and allow the creation of variances of the product. E.g. by changing the spring module, different pressure ranges can be offered to the customer. Furthermore, modules can be used as a common part in other products.

With the modularisation, 648 variances of the product can be composed. The redesign leads to an amelioration of the assembly time, which can be measured with the DFA-index. The index quantifies the efficiency of the design. After applying the MFD tool, an index improvement of 76% is reached. Furthermore a cost reduction of 22% during assembly is achieved.