

## Development of a high-flow regulator series - Summary

I wrote my bachelor thesis, at the R&D department of Rotarex which is a Luxembourgish company focusing on pressure regulators and gas equipment. During half a year the objective was to develop a high-flow pressure regulator series for ultra-high purity applications which should compete against the current market leader, a high-end manufacturer from the US. Therefore, I analyzed the current available regulator, optimized the functional parts based on analytic calculations, implemented the components in an improved design and finally supervised the prototype manufacturing process based on my technical drawings. In my bachelor thesis I summarized this process of investigating and solving all challenges and uncertainties.

The most challenging aspect was determining the correct sealing mechanism. My design included a solid part that compressed two separate, concentric seals with variations in size and material. Due to the ultra-high purity requirements, a sophisticated finite element analysis was necessary. I used Ansys to precisely calculate the compression needed to generate sufficient contact pressure to ensure tightness. Given the plastic deformation involved, I applied a bilinear material model for both seals, requiring thorough literature research to source all necessary data. In consequence I had to use a nonlinear analysis and therefore had to understand the general procedure such as the solving process using the Newton-Raphson Method, to make the best possible validation and assessment of my results, which exceeded the methods typically taught at university.

At the end my prototype glanced at better performance, a lower part variety through the series and a drastically improved machinability and assembly in comparison to the competitor regulators. Besides earning a score of 20/20 for my thesis, I was authorized to order 10 prototypes for further testing, which not only expanded my learning experience but also demonstrated that my work was acknowledged and praised by experienced engineers.