Lid Lifter

Development of a lifting device for use in the semiconductor industry

Graduate

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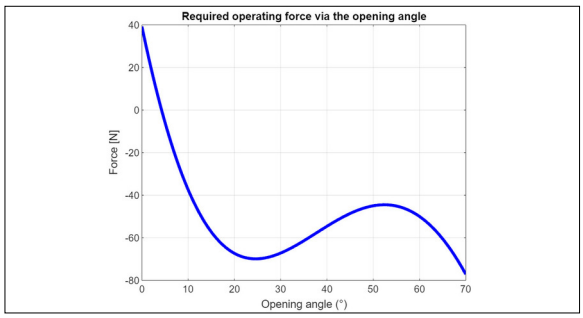
Initial Situation: In the semiconductor industry, complex production systems are used for coating silicon wafers, in which numerous attachments from industry partner VAT Vakuumventile AG are used. During the maintenance and cleaning processes of these systems, it is necessary to lift covers that can weigh up to 75kg. To achieve this, specific lifting devices are used, with VAT providing its own well-established solution for such tasks. The objective of this bachelor thesis is to develop a cost-optimized concept for the lifting device that has been previously utilized and to transform this concept into a working prototype capable of lifting a lid weighing 75kg. Throughout the course of this work, it was essential to consider the common norms and guidelines of the semiconductor industry. These include requirements related to safety and ergonomics, as well as the selection of appropriate materials suitable for use in a cleanroom environment.

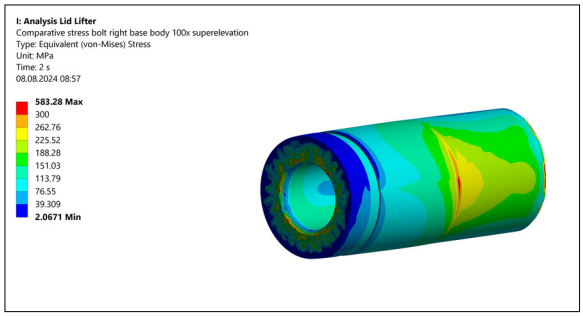
Approach: Initially, preliminary work was carried out, which included an in-depth analysis of the competition and relevant patents, a review of the current state of the art, and the development of new concepts. This foundational work led to the creation of a concept where the opening movement of the lid is aided by gas pressure springs. The required operating force for this mechanism was visualized and analyzed using MATLAB, providing an understanding of the force dynamics involved. To ensure a user-friendly assembly process, a concept for an assembly device was also developed. The realisation of the new lifting device with gas pressure springs and the assembly device required a structural redesign and a strength analysis using the finite element method. Finally, all components were manufactured and assembled into a prototype.

Result: The functional test was successfully completed and all fixed requirements were considered to have been achieved. The new concept is characterised by ergonomic operation and can be adapted to different lid sizes. Key findings from the functional test and potential improvements to the prototype were passed on to the industrial partner as recommendations for future developments.

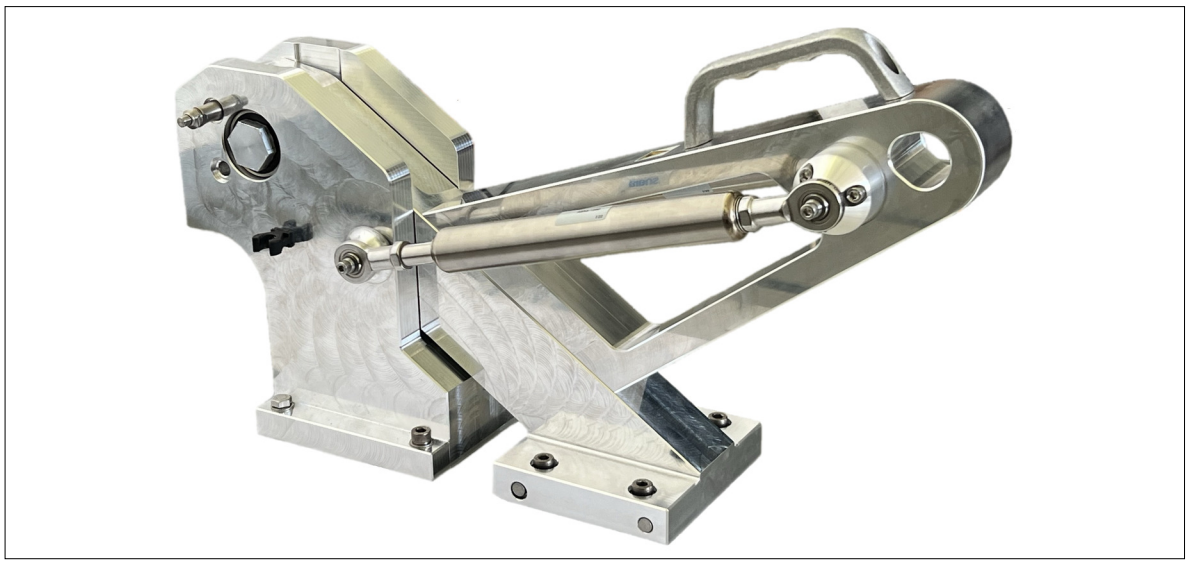
Calculated force curve using MATLAB
Own presentment



Strength verification of critical components using the finite element method
Own presentment



Realised prototype of the developed concept
Own presentment



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Subject Area
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