

## **Master program Biomedical Engineering**

Thesis Title: Development and evaluation of a test setup for the performance of air infusion tests during dialysis treatment simulation

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Date of submission: 31.01.2023

## **Summary**

In medical technology specifications and standards are established that manufacturers must adhere to. The International Electrotechnical Commission is an organization for the preparation and publication of international standards. They have written requirements for dialysis air infusion and air leakage to ensure patient safety. To monitor air infusion a standard describes a test setup for air infusion tests during dialysis treatment simulation. This setup was subjected to an optimization in order to increase aspects such as work safety and handling of the test stand. Therefore, an optical measurement system is integrated, and pneumatic valve technology is implemented to operate the test stand easily. Investigations of the built test stand prototype were performed regarding functional and metrological aspects. Functional different venous pressure conditions in relation to the parameters hematocrit and blood flow were tested, which results in a good performance. During treatment, issues such as cleanability after blood tests and air bubble accumulation come up as disadvantage. A validation was performed in order to test the measurement accuracy. Influences such as operator influence, hematocrit and different injected air volumes were investigated in this test. After performance of a measurement system analysis, it results in a high measurement error which led to the failure of the validation. Future weak points and opportunities for improvement were therefore identified, which includes adjustment of the design of the valve blocks, implementation of tubes with smaller inner diameter for resolution increase and the use of face sealing for better cleanability.