

## SUMMARY

The objective of this thesis was to analyze the current manual loading process of Crash Locking Tongue blanks onto galvanic racks at AS Norma and investigate the potential for an automated process. This topic presents the fundamentals for a solution that is beneficial to the Norma due to significant potential cost savings and competitive edge by lowering staff costs.

The first chapter gives an overview of the current manual loading process, the products involved in this study, as well as limitation associated with applying an automated solution to replace the manual one. The limitations include a cycle time of less than 0,44 s, and a robot reach of 2 m.

The second chapter deals with selection and review of components of the automation solution, such as robot and grippers, that can be used with the defined limitations. The benefits of Smart Grippers with IO-Link interface is discussed as a useful implementation of IoT and Industry 4.0. Gripper fingers and tool frame are designed and evaluated using CAD program SolidWorks and Fused deposition modeling prototype.

In the third chapter, the automation system components are loaded into ABB's RobotStudio for simulation to establish the cycle time and the power consumption. The cycle time achieved was approx. 9 minutes, or 0,8 s per part. An overview how the signal handling and coding was preformed is set forth.

In the final chapter, an analysis of the results is provided. The desired cycle time could not be attained with 1 robot. An approximate cost of about 105 TEUR for the automated solution consisting of 1 robot is estimated. Future work includes feeding solution and how to compensate for or eliminate variation in hook position.

With the increase in salary costs in Estonia, Norma could lose its advantage as a Best Cost Country, a risk that can be mitigated by investments in automation. Provided that the hurdles discussed for future work are overcome, this study has shown that there exists a clear benefit in developing an automated solution to replace the current manual loading process of the galvanic racks. To achieve the desired cycle time, more than one robot will need to be used. With an estimated return of investment of up to 600 TEUR over the estimated lifetime of the solution, assuming salary develops at its current stable pace, there is ample reason to invest in multiple robots.