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INVESTIGATION OF DISCHARGE FLOW AND FORCE COEFFICIENTS IN HERMETIC RECIPROCATING COMPRESSORS

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Low energy consuming products are eternal target of all household appliance manufacturers. To acquire desired energy index, high efficiency variable capacity compressors have started to be used widely on refrigerators. Reed valves and valve plate designs are the most critical issues in the development of reciprocating compressors in terms of coefficient of performance (COP). The stiffness of the reed valves and the port geometries play an important role on reducing the losses at various speeds and operating conditions. In the last decade, Fluid-Structure Interaction (FSI) method has started to be used in order to investigate valve dynamics. Because of the complexity and high computational cost of FSI method, system simulation tools are still preferred for faster and simpler solutions.
In-house developed simulation tool uses flow and force coefficients to calculate valve dynamics and mass flow rate. Those are calculated with the Computational Fluid Dynamics (CFD) analyses with respect to the valve lift. In the present study, flow and force coefficients at different piston positions were investigated. Piston pin which is used to reduce dead volume was also considered as a parameter. CFD calculations were established for steady state conditions at different valve positions with Ansys Fluent. The calculated flow and force coefficients were implemented into the simulation tool and the effect of piston position was presented in terms of COP, cooling capacity and compared with the experimental results.

Keywords: reciprocating refrigeration compressor, valves, pressure coefficient, flow coefficient, CFD analysis, simulation model, experiment, verification.

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