

Optimising refrigeration cycle with two-stage centrifugal compressor and flash intercooler

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Abstract - The optimisation of a refrigeration process with a two-stage centrifugal compressor and flash intercooler is presented in this paper. The two-stage centrifugal compressor stages are on the same shaft and the electric motor is cooled with the refrigerant. The performance of the centrifugal compressor is evaluated based on semi-empirical specific-speed curves and the effect of the Reynolds number, surface roughness and tip clearance have also been taken into account. The thermodynamical and transport properties of the working fluids are modelled with a real-gas model, and two different working fluids, R134a and R245fa, are used. The condensing and evaporation temperatures, the temperature after the flash intercooler, and cooling power have been chosen as fixed values in the process. The intermediate pressure and the rotational speed of the compressor are varied. The required electric motor cooling power and power loss of the bearings have also been taken into account. The aim is to gain a maximum coefficient of performance (COP). The method of optimisation, the operation of the compressor and flash intercooler, and the method for estimating the electric motor cooling are also discussed in the article