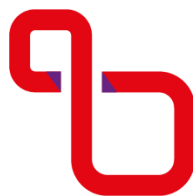




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INICJATYWA DOSKONAŁOŚCI

Analiza techniczno-ekonomiczna zastosowania
pomp ciepła w systemach ogrzewania
i chłodzenia samochodów.

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Abstract

The PhD thesis presents a technical and economic evaluation of heat pump applications in car heating and cooling systems. In the dissertation, the author developed a methodology for testing heating and cooling systems and their individual components, ensuring that reliable data is obtained under actual or near-actual operating conditions, while limiting the number and duration of individual tests. The concept of a test stand for carrying out these measurements is described. The current state of technology for heating and cooling systems in battery-powered cars is presented. An overview of car propulsion systems with detailed characteristics of combustion cars and with different levels of electrification is presented. The review indicates the multifunctionality and complexity of heating and cooling systems in battery-powered vehicles. The energy and cost intensity of the systems is indicated due to the additional functions that must be fulfilled by such systems.

Heating and cooling systems are presented, including the characteristics of heat pump solutions. In the paper, the author considered the influence of the use of different refrigerants, including so-called natural refrigerants. The author indicated the material characteristics of the individual components including a division into steel, elastomers and aluminium. Standard tests that are performed at the design stage of heating and cooling systems are described. Deficiencies in the adopted methodologies are pointed out, indicating the author's modifications of the applied test procedures. The results of the author's experimental tests using fixed geometry samples are described. Tests concerning, among other things, leakage, permeability and pressure drop are presented. The conclusions described on the basis of the tests served as input guidelines for proposing a conceptual test rig for heating and cooling systems.

The author presented concepts including, among other things, innovative measurement of pressure drop over defined sections under different operating conditions using refrigerant and lubricating oil, the possibility of determining the actual permeability value based on weight measurements of the entire system, the possibility of measuring the actual displacement of components and the possibility of measuring under actual operating conditions. Experimental and theoretical conceptual studies are

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Streszczenie

characterised with their detailed description. An economic analysis for the presented components is also presented. The author presented correlations of technological changes and their impact on reducing the loss of working medium, and limiting the length of flexible elements.