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STRESZCZENIE ROZPRAWY DOKTORSKIEJ

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DIAGNOSTYKA EKSPLOATACYJNA POMP PRÓŻNIOWYCH

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Summary

This thesis presents the results of works aimed at developing a method of operational diagnostics of rotary vane vacuum pumps, which are widely used in industry. The research work, as well as the description of the course of their implementation, has been divided into a theoretical part, an experimental part and a part covering the practical verification of the developed method.

In the theoretical part, an analysis of the construction and the principles of operation of rotary vane vacuum pumps were carried out. In addition, the most common failures and faults and their effects have been characterized. An analysis of the impact of damaged vanes, occurring during the operation of these pumps, on the pressure signal and its selected features, was also carried out. Using the obtained results of theoretical research, a method of analyzing the pressure signal generated by rotary vane vacuum pumps was proposed, allowing for the assessment and classification of their condition.

In the experimental part of the thesis, active and passive diagnostic experiment was carried out. Research conducted during an active diagnostic experiment, were aimed at the analysis and verification of the proposed, in the theoretical part, diagnostic method. For this purpose, a laboratory stand was prepared and configured. The obtained results showed that the developed method allows for the detection of damages of the rotary vane vacuum pump, and in particular for the identification and location of damaged vanes installed in it.

The tests carried out during the passive diagnostic experiment included a series of measurements and recording of the pressure signal generated by various rotary vane wet vacuum pumps. These devices were of the same construction type, but they were in a different technical condition and were characterized by a different degree of wear. The set of signals obtained in this way, after carrying out the analyzes described in the thesis, was adopted as input data for the initial works related to the construction of an automatic classifier, allowing for the assessment of the condition of the rotary vane vacuum pump and early detection of progressive damage.

In the verification part of the work, a successful attempt to apply the developed method was carried out. The applied methods of analyzing the pressure signal and the proposed way of inferring the condition of the rotary vane vacuum pump, made it possible to detect failures and direct the device to carry out renovation and repair works.

In the final part of the thesis, conclusions of a general and specific nature were formulated. Directions for further research and development were also outlined.