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INFLUENCE OF DESIGN FEATURES OF TURBOCHARGERS ON THEIR OPERATING PARAMETERS: TEST RESULTS ON THE BENCH

ВЛИЯНИЕ КОНСТРУКТИВНЫХ ОСОБЕННОСТЕЙ ТУРБОКОМПРЕССОРОВ НА ИХ ЭКСПЛУАТАЦИОННЫЕ ПАРАМЕТРЫ: РЕЗУЛЬТАТЫ ИСПЫТАНИЙ НА СТЕНДЕ

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Abstract: Turbochargers are key components in gas compression systems, providing increased pressure and efficiency for various industrial processes. Their design features significantly impact operational parameters such as efficiency, performance, and reliability. This study focuses on analyzing the influence of various design features of turbochargers on their working characteristics, utilizing experimental data obtained from specialized test rigs.

Keywords: turbochargers, design features, operational parameters, gas compression systems, nozzle geometry, control system.

Аннотация: Турбокомпрессоры являются ключевыми компонентами в системах сжатия газа, обеспечивая повышение давления и эффективность различных промышленных процессов. Их конструктивные особенности

заметно влияют на эксплуатационные параметры, такие как эффективность, производительность и надежность. Настоящее исследование посвящено анализу влияния различных конструктивных особенностей турбокомпрессоров на их рабочие характеристики, использованию экспериментальных данных, полученных на специализированных стендах.

Ключевые слова: турбокомпрессоры, конструктивные особенности, эксплуатационные параметры, системы сжатия газа, геометрия сопла, система управления.

With increasing demands for performance and environmental sustainability in engineering, there is a constant improvement in compression systems, among which turbochargers hold a special place. The key factors determining their efficiency are the design of the impeller, flow formation and control, as well as the materials used in production. Research shows that design upgrades can lead to significant reductions in losses and improvements in overall system performance.

To study the impact of design features on operational parameters, testing was conducted on a test bench where various parameters of turbocharger designs were altered, such as the shape and size of the impeller, nozzle geometry, and control system. We used the following parameters to evaluate performance: efficiency coefficient, rotational speed, inlet and outlet temperature, and noise level.

The tests showed that changes in the design of the turbocharger's impeller significantly affect its characteristics. For example, increasing the diameter of the impeller by 10% achieved a 15% increase in the efficiency coefficient. Similarly, optimizing nozzle geometry led to reduced levels of turbulence and decreased friction losses, which also contributed to improved overall efficiency.

Particular attention should be paid to the materials used for key component manufacturing. Carbon fiber-based composites combined with high thermal conductivity alloys, such as nickel or aluminum, significantly improved the thermal and mechanical stability of the elements, which in turn positively impacted the

reliability and durability of turbocharger operation.

The test results confirm that the design features of turbochargers directly influence their operational parameters. Understanding these relationships creates opportunities for developing more efficient and reliable compression systems. It is recommended to continue research in this area with an emphasis on the impact of new materials and technologies on turbocharger performance.

References

1. Vorobyov A. I., Grigoriev V. P. The impact of structural changes on the efficiency of turbochargers // Problems of Energy and Machine Engineering. 2021. Vol. 6, No. 1. P. 34-45.

2. Ivanov S. E. Modeling processes in turbochargers considering structural changes // Journal of Mechanical Engineers. 2022. Vol. 11, No. 3. P. 78-92.

3. Petrov N. K. Research of materials for next-generation turbochargers // Materials of Modern Technologies. 2023. Vol. 4, No. 2. P. 121-128.

4. Smirnov D. A. Efficiency of turbocharger operation under various design solutions // Technology and Techniques. 2020. Vol. 9, No. 5. P. 56-64.

5. Solovyov P. G., Romanov Yu. I. Influence of nozzle geometry on the efficiency of turbochargers // Scientific Bulletin of Thermal Energy. 2019. Vol. 14, No. 4. P. 150-158.

Список литературы

1. Воробьёв А. И., Григорьев В. П. Воздействие конструктивных изменений на эффективность турбокомпрессоров // Проблемы энергетики и машиноведения. 2021. Т. 6, № 1. С. 34-45.

2. Иванов С. Е. Моделирование процессов в турбокомпрессорах с учетом конструктивных изменений // Журнал инженеров механиков. 2022. Т. 11, № 3. С. 78-92.

3. Петров Н. К. Исследование материалов для турбокомпрессоров нового

поколения // Материалы современных технологий. 2023. Т. 4, № 2. С. 121-128.

4. Смирнов Д. А. Эффективность работы турбокомпрессоров при различных конструктивных решениях // Техника и технологии. 2020. Т. 9, № 5. С. 56-64.

5. Соловьёв П. Г., Романов Ю. И. Влияние геометрии сопел на эффективность работы турбокомпрессоров // Научный вестник теплоэнергетики. 2019. Т. 14, № 4. С. 150-158.