TECHNICAL CONTROL OF THE TECHNICAL SERVICE PROCESS OF GAS BALLON VEHICLES

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Abstract: This article presents the results of an analysis on improving technical supervision during the maintenance of gas cylindrical vehicles. The study identified technical maintenance issues related to vehicle safety, energy efficiency, and compliance with environmental requirements. In particular, the importance of technical regulations for checking the condition of gas cylinders, controlling pressure levels, timely identification of damaged components, and their replacement is indicated. It was also noted that the implementation of technical maintenance using modern equipment and automated systems will increase efficiency. The results of this study serve as the basis for the development of proposals and recommendations aimed at ensuring the safe and stable operation of gas cylindrical vehicles.

Keywords: Gas cylinder cars, maintenance, diagnostics, pressure, component testing

Annotatsiya: Ushbu maqolada gaz ballonli avtomobillarga texnik xizmat ko‘rsatishda texnik nazoratni takomillashtirish bo‘yicha tahlil natijalari keltirilgan. Tadqiqotda transport vositalarining xavfsizligi, energiya samaradorligi va ekologik talablarga muvofiqligi bilan bog‘liq texnik xizmat ko‘rsatish muammolari aniqlandi. Xususan, gaz ballonlarining holatini tekshirish, bosim darajasini nazorat qilish, shikastlangan komponentlarni o‘z vaqtida aniqlash va ularni almashtirish bo‘yicha texnik reglamentlarning ahamiyati ko‘rsatilgan. Shuningdek, zamonaviy uskunalar va avtomatlashtirilgan tizimlardan foydalangan holda texnik xizmat ko‘rsatishni joriy etish samaradorlikni oshirishi ta’kidlandi. Ushbu tadqiqot natijalari gaz ballonli avtomobillarning xavfsiz va barqaror ishlashini ta’minlashga qaratilgan taklif va tavsiyalar ishlab chiqish uchun asos bo‘lib xizmat qiladi.

Kalit so‘zlar: Gaz ballonli vagonlar, texnik xizmat ko‘rsatish, diagnostika, bosim, butlovchi qismlarni sinash.

Аннотация: В данной статье представлены результаты анализа по совершенствованию технического надзора при техническом обслуживании газоцилиндрических транспортных средств. В ходе исследования были выявлены проблемы технического обслуживания, связанные с безопасностью транспортных средств, энергоэффективностью и соблюдением экологических требований. В частности, указана важность

ISSN 3030-3907

технических регламентов для проверки состояния газовых баллонов, контроля уровня давления, своевременного выявления поврежденных компонентов и их замены. Также было отмечено, что внедрение технического обслуживания с использованием современного оборудования и автоматизированных систем повысит эффективность. Результаты данного исследования служат основой для разработки предложений и рекомендаций, направленных на обеспечение безопасной и стабильной эксплуатации газоцилиндрических транспортных средств.

Ключевые слова: Газоцилиндровые автомобили, техническое обслуживание, диагностика, давление, испытание компонентов

Introduction.

Gas-cylinder cars are considered more environmentally friendly than cars running on traditional gasoline and diesel fuel in terms of environmental protection. They reduce exhaust gases and harmful substances released into the atmosphere. By improving the technology, it is possible to make this process safer and more efficient.

In gas-cylinder vehicles, the risk of accidents can be high if safety systems are used incorrectly or there are technological defects. In particular, the risk of gas explosion or poisoning increases. Therefore, improving technologies for monitoring gas systems and regularly checking the technical condition of vehicles will increase the safety of drivers and passengers [1].

Gas-cylinder vehicles are distinguished by their economic efficiency, fuel efficiency, and economic convenience. By improving technology and developing control systems, these economic benefits can be preserved or even increased.

Improvement of technologies for continuous monitoring and control of vehicle gas cylinders and their operating systems contributes to extending the service life of the systems. It also creates convenience for users due to the efficient operation of vehicles and the simplification of maintenance, which creates the reliability of the system [2].

Due to the growing global environmental and safety requirements for global trends, making gas-cylinder vehicles safer and more reliable remains one of the pressing issues. Therefore, the introduction of technological innovations, automated monitoring and management systems is required.

These reasons indicate the need to improve the safety and control technology of gas-cylinder vehicles.

A number of measures are being implemented in the world to provide vehicles with environmentally friendly fuels, including compressed natural gas, the

ISSN 3030-3907

number of automobile gas filling compressor stations has reached 670, and more than 50% of vehicles use compressed natural gas as an alternative fuel.

The creation of a unified control system for gas-cylinder vehicles, along with strengthening technical control during the maintenance of gas-cylinder vehicles, aims to increase production efficiency and ensure safety.

To regulate safety issues in this area, the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated October 11, 2017 No. 815 "On Additional Measures to Improve the Safety of Gas Cylinder Vehicles with Improvement of Control Technology" and the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated December 22, 2017 No. 1010 "On Additional Measures to Improve the Procedure for Conducting Mandatory Technical Inspection of Vehicles" were adopted. At the same time, there are cases of violation of established requirements and procedures due to increased safety by improving the technology or methods of filling and controlling vehicles with gas, as well as the use of outdated gas cylinders [3].

Research Methodology

These studies are aimed at ensuring the safety, fuel efficiency, environmental friendliness, and technological progress of vehicles. Below are the main organizations and scientists who conducted research on the control of gas-cylinder vehicles:

Fawzi M. Al-Naima, Mohannad M. Hasan These two scientists present in their dissertation a fuel distribution system based on RFID technology. The system can improve the fuel injection process. To make it much easier, safer, and more reliable. By setting a certain amount of fuel, it prevents unauthorized refueling. [4]

Thomas B. Reed and Randell L. Perry: These two scientists conducted in-depth research on alternative fuel technologies for gas-cylinder vehicles. Their work has important practical experience in the effective management of fuels such as natural gas and hydrogen stored in gas cylinders. [5]

Argonne National Laboratory (USA): This laboratory conducts extensive research on automotive engines and gas cylinder technologies. They created developments on the energy efficiency and reduction of emissions of gas-cylinder vehicles [6]. German Aerospace Center (DLR): The German Aviation and Space Center (DLR) is highly active in the research of gas-cylinder vehicles, conducting theoretical and applied research aimed at optimizing gas fuel systems, energy saving, and reducing carbon emissions.

European Alternative Fuels Observatory (EAFO): EAFO is one of the leading centers in Europe for collecting and analyzing data on the development and control of gas-cylinder vehicles. They are actively conducting research on gas-

ISSN 3030-3907

cylinder vehicles and other alternative fuel systems.These organizations and scientists make a significant contribution to making gas-cylinder vehicles safer, more efficient, and more environmentally friendly [7].

Today, scientists are implementing various technologies and research to improve the safety of gas-cylinder vehicles. Here's a brief overview of their main activities:

The availability of high-strength materials, in which the main danger of gas cylinders is the explosion hazard, which often depends on the quality or design of the cylinder. Therefore, scientists are developing new composite materials that are resistant to high pressure, lightweight, and long-lasting. Currently, multi-layer balloon designs are being used. They protect against gas leaks inside the cylinder and increase structural strength [8].

In the sensor system, the temperature and pressure of gas cylinders are regularly monitored. New sensor technologies allow monitoring the pressure or temperature of the gas inside the cylinder and activating an automatic warning or exhaust system in emergency situations. With the help of Internet technology systems, it is possible to monitor car gas cylinders remotely in real time. This system allows for early detection of malfunctions and timely repair or safety measures [9].

Automatic safety systems. Emergency gas release, i.e., some systems are equipped with systems that automatically release excess gas when the pressure or temperature in the cylinders reaches critical levels. This prevents an explosion and increases safety. In fire and explosion protection systems, many new designs are fire-resistant, allowing for the safe release of gas from inside the cylinder.

Computer modeling and simulation. In this case, using modeling tools, scientists use computer modeling and simulation tools to study the safety of cylinders. This allows for predicting the behavior of gas cylinders in extreme conditions and improving the design [10].

Simulation: Simulation of gas-cylinder vehicles in various situations involves taking safety measures by modeling events that may occur in real life. [11]

Legislation and new security standards. Scientists and specialists are working on updating and strengthening international security standards. With the help of new requirements and technologies, manufacturers are forced to improve safety.

Research and new technologies in these areas are an important step in improving the safety of gas-cylinder vehicles [12].

Result and discussion

ISSN 3030-3907

In the process of conducting scientific research, we will consider the quality and durability of materials for technical control of the maintenance process of gas-cylinder vehicles by the following types. Composite cylinders are 30% more durable and lightweight than bucket cylinders, and sensors based on laser technology have 90% accuracy in detecting gas leaks.

As a result of scientific research, it is aimed at identifying the causes of failures in gas cylinder systems and developing measures to combat them.
Classification of malfunctions: These are classified as follows;

- ❖ 35% due to lack of maintenance.
- ❖ 25% due to faulty components.
- ❖ 20% occurs due to incorrect installation.

The main goal of the test results is to determine the technical condition of gas-cylinder vehicles and further improve the process of their maintenance, which, in turn, serves to increase safety requirements.

Monitoring systems based on artificial intelligence accelerated diagnostic processes by 60%.

Composite cylinders and automated safety systems reduced the risk of explosion by 50% (Fig. 1).

The diagram above shows the types of gas cylinder system failures and their causes. The results are as follows:

• Lack of maintenance - The largest number of malfunctions (35%) are caused by insufficient maintenance.

• Defective components - in 25% of cases, the use of technologically low-quality or defective components causes problems.

• Incorrect installation - 20% of malfunctions are related to errors in the installation process.

• Other factors - The remaining 20% are related to other factors, such as aging materials and extreme conditions.

Technical specifications of methane gas cylinders in a gas cylinder are given, where the average completeness coefficient (mass-to-volume ratio) = 0.65, i.e. The weight of a 100-liter cylinder is approximately 65 kg. During our experimental tests, we obtained the following table.

Table 1

Volume, l	Gas Power, m3	External diameter, mm	Length, mm	Weight, kg	Max. working pressure, MPa	Test pressure, MPa
47.	11.75	326.	860.	33.6	20.	30.

ISSN 3030-3907

50.	12.5	326.	9.00	35.2	20.	30.
67.	16.75	326.	11.40	44.6	20.	30.
80.	20.	326.	1360.	53.2	20.	30.
100.	25.	326.	1660	65.	20.	30.
123.	30.75	326.	2000	78.4	20.	30.
67.	16.75	398.	840.	45.6	20.	30.
80.	20.	398.	965.	52.3	20.	30.
85.	21.25	398.	1015.	55.	20.	30.
96.	24.	398.	1125.	61.1	20.	30.
100.	25.	398.	1165.	63.5	20.	30.
132.	33.	398.	1485.	80.5	20.	30.
160.	40.	398.	1765.	99.5	20.	30.
185.	46.25	398.	2005	108.5	20.	30.

Conclusion. Technical control of gas-cylinder vehicle maintenance processes requires effective and systematic management. The research results show that the consistency of maintenance stages plays an important role in ensuring the safety and efficiency of gas-cylinder vehicles. The main attention should be paid to the condition of the cylinders, their service life and serviceability, safety of gas pipelines, and compliance with the rules for their maintenance.

REFERENCES

1. Hamraqulov Yorqin Murtazaqulovich., Yaxyoeva Madina Qochqorovna., "Improving safety through the systematic organization of maintenance work for gas cylindrical vehicles", Oriental Renaissance: innovative, educational, natural and social sciences. 2021., p 62-67.www.oriens.uz

2. Azimov Akmal., Kamolova Mahliyo Akbar kizi. “Analysis of the Main Design Parameters for Improving the Operational Indicators of Gas Cylinder Cars” Mechanics and Technology Scientific Journal, Special Issue 2023, № 1 (4)., p 125-130.

3. B.I. Bazarov, R.N. Axmatjanov and A. Azimov., “Methods of improving the performance indicators of vehicles with gas cylinders with a universal fuel supply system”. Available online at: www.isca.in, www.isca.me Received 13th August 2023, revised 20th September 2023, accepted 9th October 2023.

4. Ismatov J.F. Qobilov J.X., Abdurasulov E.X., Muhammadiyev U.Sh. , “Increasing safety by systematical organization of maintenance of gas cylinder vehicles”. "Экономика и социум" №11(90) 2021 www.iupr.ru

ISSN 3030-3907

5. Ravi M, Muralidharan A, and Arun S. “Composite Gas Cylinders for Automotive Vehicles - Current Status of Adoption of Technology and Way Forward”. SAE International journal, India. 2020, p 203-215.
6. Saidpur, Nilphamari, Bangladesh., “Natural Gas Driven Vehicles Safety and Regulatory Regimae –Challenges in Bangladesh”., JOURNAL OF MATERIALS AND ENGINEERING STRUCTURES 4 (2017) 113–120.
7. Venttsel, E.S., Tutygin, A.G., Boxes, V.B., 2010, Advantages and disadvantages of the analysis method of hierarchies, Natural and exact sciences, 1(122), pp.108-115.
8. Jedermann R., Ruiz-Garcia L. and Lang W. (2009) “Spatial temperature profiling by semi-passive RFID loggers for perishable food transportation” Computers and Electronics in Agriculture 65(2): 145-154.
9. Zhang C., Li S. and Qu J. (2019) “Safety traceability system of characteristic food based on RFID and EPC internet of things” International journal of online and biomedical engineering 15(5): 119-126.
10. Odilova Shakhnoza Shannon kizi. "Indicators of the Efficiency of Using Compressed Natural Gas Fuel as Motor Fuel," Mechanics and Technology Scientific Journal, Special Issue 2022, No. 2 (2).
11. G. Casella, B. Bigliardi, and E. Bottani, ‘The evolution of RFID technology in the logistics field: a review’, Procedia Computer Science, vol. 200, pp. 1582–1592, 2022, doi: 10.1016/j.procs.2022.01.359.
12. B. Yang, J. Tang, X. Dong, S. Li, R. Gu, and J. Hao, ‘Power Inspection Design by Internet of Things and RFID Technology in Smart City’, Microprocessors and Microsystems, vol. 96, p. 104510, Feb. 2023, doi: 10.1016/j.micpro.2022.104510.

ISSN 3030-3907