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REPAIR AND MAINTENANCE OF FUEL SUPPLY SYSTEMS FOR VEHICLES RUNNING ON COMPRESSED GAS

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Abstract: Converting cars to gas operation today, the principle of operation of II-generation equipment, the principle of operation of IV-generation gas cylinder equipment, the technology of maintenance of the fuel system of engines running on gas fuel, diagnosing the gas reducer, Maintenance of the supply system of gas cylinder cars.

Key words: There are 4 generations of equipment (5th and 6th generations are currently being tested). A gas cylinder is filled with methane under a pressure of 200 ATM, Lambda control system.

After our republic gained independence, the automobile industry began to develop rapidly in our country. The number of cars is increasing day by day. This, in turn, imposes on the automotive industry, which is considered one of the main directions of the economic and social development of our country, the task of increasing and improving the production structure of cars that meet all the requirements of the national economy and emit less harmful substances to the environment, as well as with high fuel efficiency [1].

The increase in the demand for gasoline and diesel fuels, which are used as vehicle fuel, requires the use of alternative fuels. Nowadays, cheap natural gas is widely used as fuel for cars. Our republic has many reserves of natural gas, and these reserves contain high-quality natural gases that can be used as fuel for automobile engines directly without the use of excess gas processing or chemical treatment technologies. can be used as fuel. In addition, natural gas used as motor fuel is much cheaper compared to other types of fuel. Therefore, approximately 70-80% of cars in our republic run on natural gas fuel.

Today, there are 4 generations of equipment for converting cars to gas operation (the 5th and 6th generations are currently being tested). The most common of them are II and IV generation gas cylinder equipment. The principle of operation of gas cylinder equipment of the 1st generation is as follows. The gas cylinder is filled with methane under a pressure of 200 ATM and it is connected with a reducer through a steel pipe. In the reducer, the gas is reduced to 1 ATM and comes to the mixer and the combustion chamber. A mechanical pressure regulator is installed before the mixer. "Gasoline-gas" coupler separates two electromagnetic valves [2].

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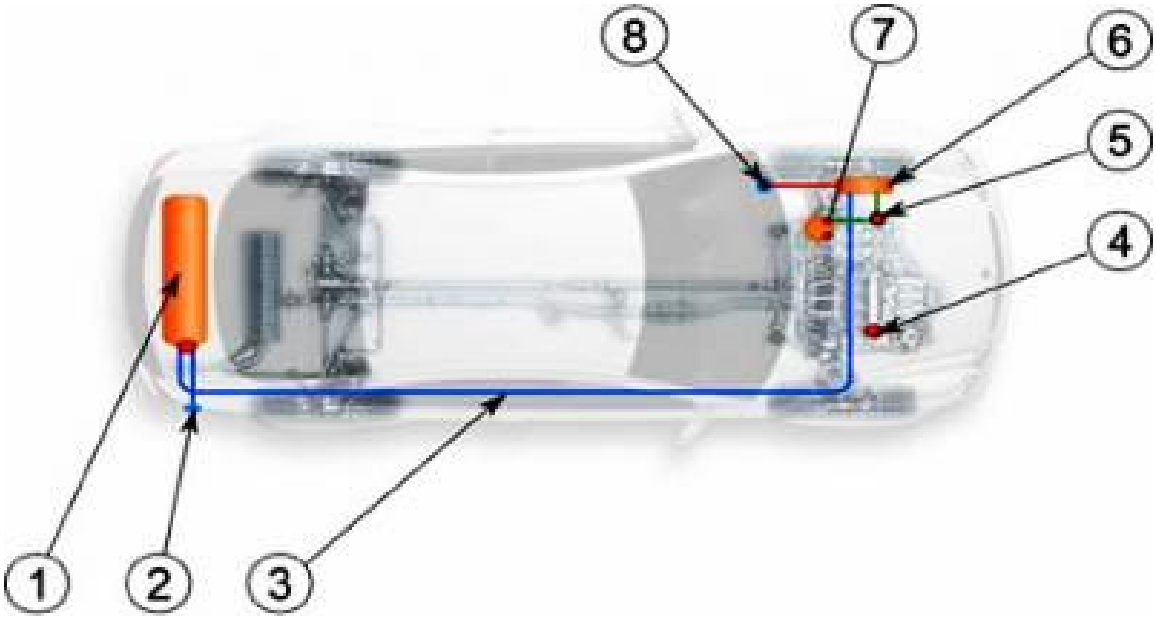

Figure 1. Scheme of installation of gas cylinder equipment of the 1st generation.
1-gas cylinder; 2-fuel injection unit; 3-metal gas pipe; 4-solenoid valve;
5-power register; 6-reducer; 7-mixer; 8-fuel type connector.
The scheme of gas cylinder equipment of the II generation is presented in
Fig. 2.

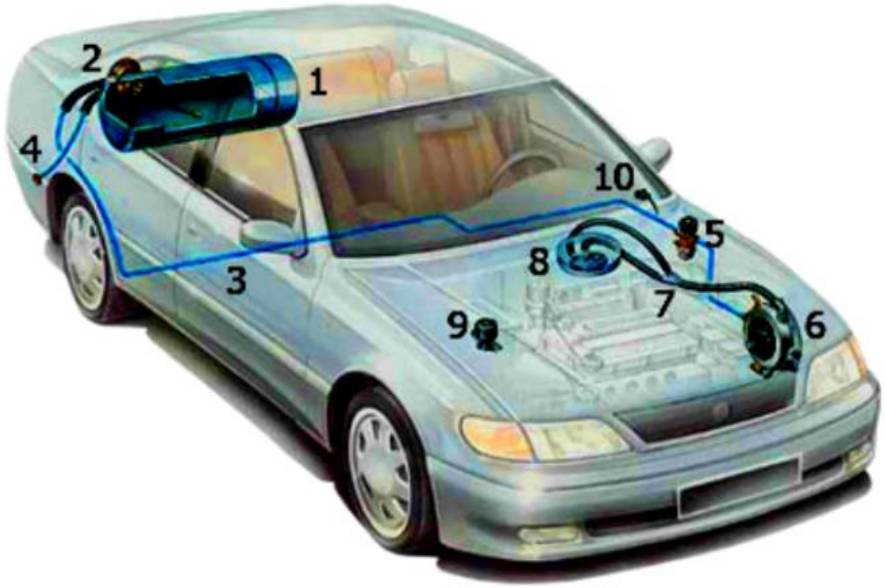

Figure 2. Overview of gas equipment of the II generation.
1-cylinder; 2-multivalve; 3-high pressure gas main; 4-removed fuel injection device; 5-gas electromagnetic valve-filter; 6-thickness reducer; 7-dispenser; 8-gas-air mixer; 9-gasoline electromagnetic valve; 10-gas-petrol connector.

Compressed gas comes under pressure from cylinder 1 to high-pressure gas main 3. Gas consumption from the cylinder is carried out through the multivalve 2, and fuel is also injected through this valve with the help of the fuel injection device 4. Through the gas line coming out of the cylinder, the gas comes to the valve-filter 5, where it is cleaned of various additives and tar residues in the gas. Also, the valve-filter closes the incoming gas when the engine stops working and when running on gasoline.

Further, the purified gas enters the first stage of the two-stage reducer-condenser 6 through the pipelines. Here, the gas pressure decreases to 0.2 MPa, and then, passing to the second stage,

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the gas pressure decreases to the value of atmospheric pressure. At the expense of the reducer and the condenser, as well as the cooling liquids, the gas changes from the liquid phase to the gaseous state [3].

In the suction effect created in the intake manifold by the operation of the car engine, the reducer-choke comes from the second stage to the gas dosing device. Then it flows through the small pressure hose through the dispenser 7 and comes to the air filter and the mixer 8 installed on the throttle of the carburetor. Control of the engine operation in gas or gasoline mode is carried out using the fuel type switch 10 installed on the instrument panel.

When the gas position is selected, the voltage drops in the solenoid gas valve 5 and closes the solenoid gasoline valve, and vice versa, when switching from gas to gasoline, the switch closes the gas valve and opens the gasoline valve. With the help of light diodes, the engine is controlled on what kind of fuel it is running on. Also, the mixer has a special button that controls the enrichment of the gas mixture [3-4].

The III-generation scheme (lambda-control system) preserves the principle of operation of the II-generation equipment, with the difference that the power register is controlled by an electronic circuit on the basis of the lambda-probe indicators in the engine output collector. This automatically adjusts the optimal composition of the mixture in the combustion chamber for the current operating mode of the engine. This allows you to save fuel and reduce power loss. The lambda-control system is used in injector cars equipped with a lambda-probe.

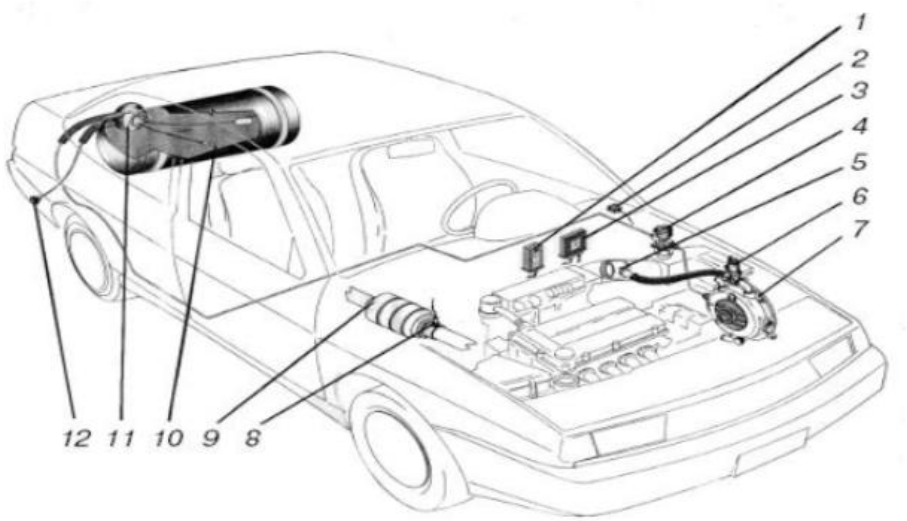

Figure 3. Installation of III-generation gas cylinder equipment in a car.

1-injector emulator; 2-fuel type adder; 3-control electronic unit; 4-electromagnetic gas valve; 5-gas mixer device; 6-dispenser; 7-reductor-choke; 8-lambda probe; 9- neutralizer; 10-gas cylinder;

11-armature; 12-casting device.

Gas cylinder equipment for cars IV generation. Even more perfect, feeding is done in series, in parallel thanks to the installation of electromagnetic nozzles. Their work is controlled by an electronic control unit. In addition, gas pressure, fuel and reducer temperature, and indicators of the vacuum level in the manifold are taken into account when forming the "portion" of gas. Thus, the control takes place thanks to the information received from the standard electronic control unit. At the same time, by disrupting the signal from the gas electronic control unit to the gasoline injectors, the supply of gasoline is blocked [5].

Here, both gas and gasoline are controlled and controlled at the same time. In such cases, the supply of gasoline to the injectors does not stop, but only decreases. As a rule, the ratio is 20/80%, where 80% is gas, respectively.

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The principle of operation of the IV generation gas cylinder equipment is similar to the principle of operation of the gasoline fuel system. As with any injection system, fuel is supplied to the intake manifold through pressurized injectors. In the gasoline system, pressure is created by an electric fuel pump located in the gas tank. Gas fuel is initially stored under excess pressure in the cylinder, so the gas cylinder equipment set uses a reducer that reduces the pressure to the required level before it is delivered to the engine [6].

Technology of maintenance of the fuel system of engines running on gas fuel. Maintenance of gas equipment designed for cars running on liquefied and compressed gases has many things in common. Because their structure and operation procedure are very similar to each other. When the fuel supply system (Fig. 4) equipped with third-generation gas-cylinder devices of carburetor cars work, liquefied petroleum gas (propane-butane) from the cylinder (1) passes under pressure to the high-pressure gas main (3). Gas consumption in the cylinder takes place through the multivalve (2), in turn, gas filling is carried out through the filling device (4) connected to the multivalve. Through the trunk, the liquid gas comes to the filter gas valve (5), which serves to clean the gas, turn off the gas when the engine is turned off or when switching to gasoline. Then the purified gas goes to the reducing evaporator (6), where the gas pressure drops from 1.6 MPa to 0.1 MPa. It is connected to the engine cooling system because the gas evaporates and cools the reducer. The constant movement of the coolant keeps the reducer and its membrane from freezing [7-8].

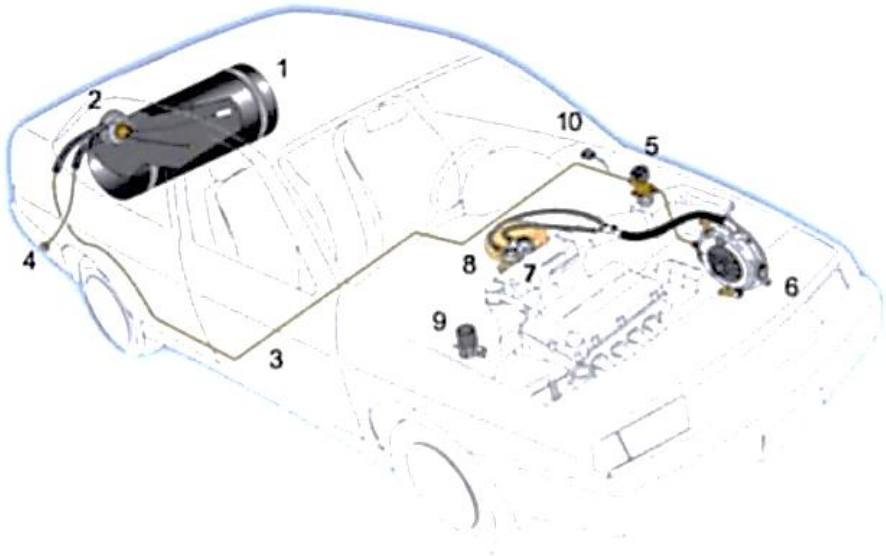

Figure 4. Appearance of third-generation gas-cylinder equipment of carbureted cars:
1-cylinder; 2- multivalve; 3-high pressure gas main; 4-gas filling device; 5-gas valve; 6-reductor evaporator; 7th dispenser; 8- gas and air mixer; 9-gasoline valve; 10-connector of fuel types.

Due to the rarefaction of air in the intake manifold of the working engine, the gas reaches the mixer (8) located between the throttle valve of the carburetor and the air filter through the low-pressure hose dispenser (7) from the reducer. Changing the mode of operation (switching to gas or gasoline) is carried out through the fuel type connector (10) installed on the instrument panel. If the connector is moved to the "GAS" position, the gas solenoid valve (5) opens, the gasoline solenoid valve (9) closes. Or it could be the other way around.

Depending on the status of the LEDs, it is possible to determine what kind of fuel the engine is running on. In the 3-generation gas cylinder equipment used in injector cars, injector emulators are used instead of the gasoline valve. When switching to gas, this emulator shows the operation of gasoline injectors, which, in turn, prevents the computer from going into an emergency state. Therefore, it is necessary to use lambda-probe emulators. When using gas

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cylinder equipment of the 4th generation (Fig. 5), gas is delivered directly to the input collectors through special nozzles. They have their own electronic control unit, alternate their work procedures through the controller and also play the role of an emulator. Separate sprinkler systems are designed for universal and injector cars [7]. A car equipped with such a system does not lose its power. The toxicity of exhaust gases is much lower than when running on gasoline. Most of the cars with gas cylinders currently in use in the Republic of Uzbekistan were equipped with a gas fuel system developed by "Russia" before 2000. Therefore, we will get acquainted with the technical maintenance of the fuel-gas system of the ZIL-138 car running on compressed and liquefied gas. First of all, let's get acquainted with the malfunctions that appear in the system during operation and their symptoms. Fault finding and maintenance of gas cylinder equipment can be carried out by qualified auto mechanics who have undergone special training and have the appropriate certificate. 4th generation gas cylinder equipment has the following advantages: 1- low fuel consumption; 2- low loss of engine power on gas fuel (1-2%); 3- Fulfillment of EBPO-2, EBPO-3, EBPO-4 ecological standards; 4- the absence of knocking in the engines; 5- flawless operation with the self-diagnosis device installed in the car (no additional emulators are required); 6- making less mistakes and requiring less labor during installation; 7- Cost uniformity with legacy lambda checking systems [8-9].

Figure 5. The main equipment of a separate gas delivery system called Longas (4th generation gas cylinder equipment) operating on methane fuel:

1-reducer; 2-gas injector electronic control unit; 3-gas filter; 4-gas injector (Matrix); 5-gas valve; 6-filling valve; 7-connector; 8-pressure sensors.

The main malfunctions of the system depend on the violation of the system density and gas leakage. The main failure of the high-pressure reducer is the lack of tightness of the joints of the system valves and body parts. A sharp drop in pressure at the outlet of the reducer when the throttle valves are opened indicates that the filter is dirty. The main problems with a low-pressure gas reducer are that it releases gas through the valves when the engine is not running and does not transfer gas at all or not enough. Leakage of the first stage valve can be detected by a low-pressure manometer or hearing. The lack of tightness of the second stage valve makes it difficult for the engine to ignite, worsens the engine performance in the idle mode, after the engine stops, gas leaks into the space under the hood. As a result of the violation of the density of the diaphragm of the first stage, gas leaks through the hole in the adjusting nut of the spring. When the density of the diaphragm of the second stage is disturbed, the gas leaks through the cover of the adjusting nipple of this stage [9].

Technical service. During daily maintenance, the tightness of gas cylinders and the tightness of all connections of the gas system are visually checked. At the end of the working day, the

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tightness of the cylinder fittings and flow valves is checked. Condensation is poured from the low-pressure gas reducer. It is checked whether there is a drop of gasoline in the gasoline transfer joints and the electromagnetic valve-filter. In periodic maintenance, in addition to the work performed in daily maintenance, the operation of the high-pressure gas reducer storage valve is also checked. The grooves in the trunks of the main, filling and exhaust valves are lubricated. Elements of main and high-pressure reducer filters are removed, cleaned and installed in their place. The density of the gas system is checked with compressed nitrogen and compressed air. How the engine works in ignition and idle mode is checked, both on gas and gasoline. The tightness of the low- and high-pressure reducers is checked and, if necessary, the outlet pressure and the starting pressure of the storage valve are adjusted (in the case of the high-pressure reducer). The pressure value of the first and second stage of the low-pressure reducer is adjusted [10]. The operation of the gas cylinder's storage valve and high- and low-pressure gauges is checked. The fastening of the carburetor and the fastening of the mixer pipe to the carburetor are checked. The heater is removed, washed and checked for tightness, check the operation of the shutter and its guide, and then install it in i ts place. The air filter is removed and washed; clean oil is poured into its bath. The mixer is checked and, if necessary, adjusted to the minimum amount of carbon monoxide in the used gas. Seasonal maintenance includes disassembly, cleaning and adjustment of the carburetor-mixer, reducers, filters and electromagnetic shut-off valves. It is also necessary to check the starting pressure of the high-pressure reducer storage valve. Gas cylinders are inspected every three years. When preparing for winter use, sediments are poured and the gas tank of the car is washed.

Diagnosing and servicing the gas reducer during the 2nd, 3rd, and 4th technical service, gas pressure is checked and adjusted through the operation of the valve of the first and second stage reducer. Adjustment work is carried out after sending compressed air to the reducer or connecting the gas line of the car. The gas pressure in the first stage of the reducer (by first loosening the lock nut) is adjusted from the nut, that is, when it is turned, the tension of the spring in the diaphragm changes. During adjustment, the gas pressure (from the hood inside the car cabin) is controlled by a low-pressure manometer. For liquefied gas, the pressure of the first stage is from 0.1 to 0.2 MPa. The pressure of the second stage of the reducer changes due to turning the adjusting nipple: if the nipple is turned, the pressure increases, on the contrary, if it is released, the pressure decreases. To check gas pressure of the second stage on the pezometer, a nozzle is connected to the loading device of the reducer or a special cover is installed on the nozzle (instead of the hole of the second stage cover). When the engine is running, the pressure in the second stage of the reducer is 0.05÷0.1kPa. Depending on the gas pressure in the cylinder, increasing the loading (preload), the pressure in the second stage is up to atmospheric pressure or up to 0.01:0.02 kPa, and at full loading (preload) up to 0.16:0.25 kPa is reduced. The correct installation of the second stage valve is determined by checking the travel path of the diaphragm rod (it should be 5:6 mm). To adjust the valve travel, the main valve is opened and the counter nut of the valve adjustment screw is loosened (until the valve begins to release gas). After that (until the gas leakage from the valve stops, until the sound fades), the adjustment screw is turned in the ratio 1/8:1/4 and the counter nut is tightened. The main valve is closed and the valve travel (as stated above) is checked as is the diaphragm rod travel [11].

Peculiarities of maintenance of the supply system of cars with gas cylinders. Every day, before the car goes on the road, the gas engine, gas pipelines, tubes are checked for tightness, gas equipment is not damaged from the outside, the operation of the main valve in the cabin and the supply system in the reserve are checked. After the car returns from work, it is necessary to close the gas valve in the cylinder and expel the remaining gas in the gas system (by burning it).

During the 1st technical service (in addition to daily service), the reducer is removed, the filter element is cleaned, the shaft groove of the main and steam, liquid and filler valves is lubricated with consistent oil, and the gas system is hermetic (at a pressure of 1.6 MPa of air). checked and gas leakage is eliminated with inert gas. During the 2nd, 3rd, 4th technical service

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(in addition to the above), the fixing of gas appliances, the correct setting of the ignition moment (angle) are checked. In addition, the gas reducer, mixer and vaporizer are checked and adjusted. Gas equipment is inspected once a year. The valve and valve seat (working surfaces) are cleaned of dirt, and if necessary, these surfaces are lubricated and rubbed (priming). The evaporator and the gas filter are washed with acetone, the tension of the valves and the reducer spring is adjusted. If necessary, unusable parts will be replaced [10-11].

References

1. Sh.P. Magdiyev "Technical operation and service of automobiles" Tashkent, 2021.
2. Pulatovich, Magdiyev Shovkat, and Rakhmatov Murodjon Iskandarovich. "STRUCTURE AND OPERATING PRINCIPLES OF THE FUEL SUPPLY SYSTEM OF INJECTOR ENGINES." Shokh Articles Library 1.2 (2026).
3. Riskulov Alimjon Akhmadjanovich and Murodjon Iskandarovich Rakhmatov "MAINTENANCE AND REPAIR OF CAR CARDAN SHAFT." CENTRAL ASIAN JOURNAL OF MATHEMATICAL THEORY AND COMPUTER SCIENCES 3.12 (2022): 342-345.
4. Baxtiyerovna, Xaydarova Gulnoza, and Murodjon Iskandarovich Rakhmatov. "METHODS OF MAINTENANCE OF AUTOMOBILE TRANSPORT ENGINES." *SHOKH LIBRARY* 1.11 (2025).
5. Rakhmatov M. I., Zayniddinovich S. Z. & Tuygunovich B. M. (2023). Maintenance and Repair of the Steering Mechanisms of the Car. CENTRAL ASIAN JOURNAL OF MATHEMATICAL THEORY AND COMPUTER SCIENCES, 4(2), 108-112.
6. Rakhmatov Murodjon Iskandarovich, Sharopov Zavqiddin Zayniddinovich, and Boliyev Mansur Tuygunovich. "Methods of Maintenance of Automobile Transport Engines." Nexus: Journal of Advances Studies of Engineering Science 1.4 (2022): 90-92.
7. Avliyokulov J. S., Nurmetov K. I., Rakhmatov M. I. TECHNOLOGIES FOR MODIFICATION OF FRICTION PARTS FROM VULCANIZED RUBBERS. – 2021.
8. Magdiyev, S. P., Kadirshayev, T., & Rakhmatov, M. I. (2023). CAR ENGINE LUBRICATION SYSTEM MAINTENANCE AND REPAIR. Modern Scientific Research International Scientific Journal, 1(2), 250-260.
9. Avliyokulov, J. S., Pulatovich, M. S., & Rakhmatov, M. I. (2023). MAIN FAILURES OF THE VEHICLE BRAKE SYSTEM, MAINTENANCE AND REPAIR. CENTRAL ASIAN JOURNAL OF MATHEMATICAL THEORY AND COMPUTER SCIENCES, 4(3), 63-69.
10. Magdiyev, Shovkat Pulatovich, and Murodjon Iskandarovich Rakhmatov. "MALFUNCTIONS OF INJECTION ENGINES THAT OCCURRED ON THE ROADS AND THEIR PREVENTION." Modern Scientific Research International Scientific Journal 1.7 (2023): 95-100.
11. Magdiyev Shovkat Pulatovich, Rakhmatov Murodjon Iskandarovich, & Sharopov Zavqiddin Zayniddinovich. (2023). MAINTENANCE AND REPAIR OF TRANSMISSION UNITS AND MECHANISMS. Modern Scientific Research International Scientific Journal, 1(4), 181–191.