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THE SEQUENCE OF MAINTENANCE OF THE SUPPLY SYSTEM OF THE DIESEL ENGINE

Magdiyev Shovkat Pulatovich
associate professor of the "Automotive and automotive industry" department, Tashkent State Transport University, Tashkent, Republic of Uzbekistan
Rakhmatov Murodjon Iskandarovich
Senior teacher of the "Automotive and automotive industry" department, Tashkent State Transport University, Tashkent, Republic of Uzbekistan

Abstract: Function, structure and operation of the diesel engine supply system, Diesel supply system of modern cars, Diesel engine fuel supply system malfunctions, Diesel engine fuel supply system maintenance.

Key words: Diesel engine fuel supply system, diesel fuel and its properties, fuel suction and drive pump, fuel coarse and fine cleaners, high pressure fuel pump, low and high pressure fuel tubes and their location, injector and air cleaner, combustion compartments.

The function, structure and operation of the supply system of a diesel engine. The supply system ensures the operation of the engine at a variable frequency of rotations of the crankshaft and at different loads.

The equipment of the supply system in accordance with the working cycle of diesel implements the following: fuel injection into the engine cylinders at the end of the compression stroke; preparing fuel in the volume of the combustion chamber and vaporizing it, mixing it with air to form a working mixture; changing the amount of injected fuel by the driver; automatic change of the spray advance angle in accordance with the angular speed of the crankshaft; change the dose of injected fuel according to the load [1].

The supply system can be divided into pump sprinkler and accumulator systems. In the first system, fuel is injected into the cylinders through an injector under the pressure created by a high-pressure fuel pump at a certain time of the work cycle. In the second system, a high-pressure fuel pump delivers fuel to the batteries. A constant high pressure is maintained in the accumulators, and the injection of fuel into the cylinders is carried out periodically through the injector [2].

Dosing distribution devices are used in accumulator systems to dose and distribute the cyclic fuel amount to the cylinders. Their operation is synchronized with the operation of the engine with a valve or valve seat mechanism. Dosing devices connect the injectors installed in the cylinders with the accumulators of the supply system in accordance with the working order of the cylinders at a certain time of the work cycle. The supply system consists of the following main elements: fuel tank, fuel drive pump, filters and silencers, high pressure fuel pump, injectors, low and high pressure connecting tubes.

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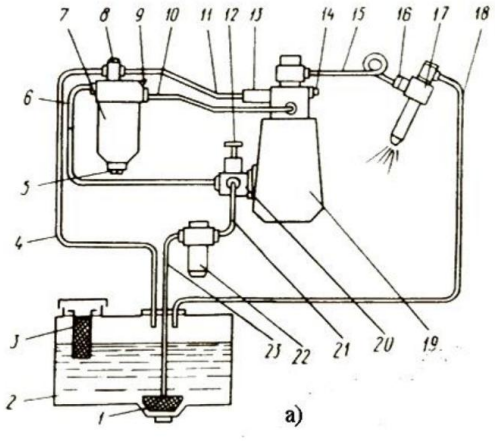

Figure 1. The general scheme of the diesel supply system.
1-fuel receiver; 2-fuel tank; 3-mesh wire cleaner; 4,11,18-return tubes; 5-place; 6,10,21,23-low pressure tubes; 7-soft cleaning filter; 8-nozzle; 9,14-plugs; 12-hand pump; 13-skip valve; 15-pressure tube; 16-nozzle; 17-forsunka; 19-high pressure fuel pump; 20-fuel drive pump; 22-coarse filter.

The supply network of diesel engines is fundamentally different from the method of preparation of the fuel mixture of carburetor engines discussed above. In diesels, the method of moving the air-work mixture in the cylinder cavity depends on the fuel injection devices and the design of the combustion compartment. In diesels, the fuel injection network consists of a high-pressure pump and an injector installed in a closed manner on each cylinder [1-3]. The supply network of these engines consists of two main units: low and high pressure. The low pressure unit transfers fuel from the tank to the high pressure pump. The high-pressure unit delivers a certain amount of fuel to the engine's cylinders at a certain time. Fuel from the tank is sent to the coarse filter under the influence of dilution created by the drive pump. From this filter, the fuel goes to the fine cleaning filter, and then through the fuel tube to the high pressure pump, and with the help of this pump, it is sent to the fuel injection nozzle under a pressure of about 15 MPa (150 kgk/sm^2). When the excess fuel accumulated in the high-pressure pump reaches a pressure of 15 MPa (150 kgk/sm^2), the bypass valve opens and flows into the fuel tank through the return pipes. The fuel that drips from the nozzle slots returns to the tank through a tube.

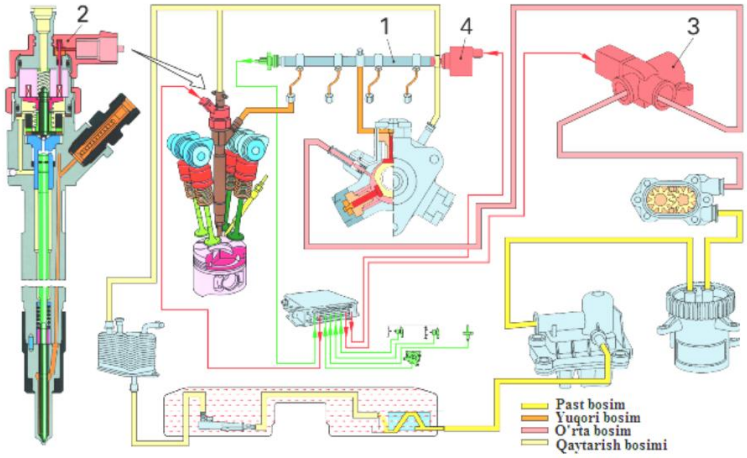

Figure 2. The scheme of the diesel supply system of modern cars.

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1-accumulator pipe; 2-forsunka; 3-YUBYON; 4-sensor.

Malfunctions of the fuel supply system of diesel engines. The supply system of diesel engines (Fig. 3) accounts for 9% of the main failures of cars.

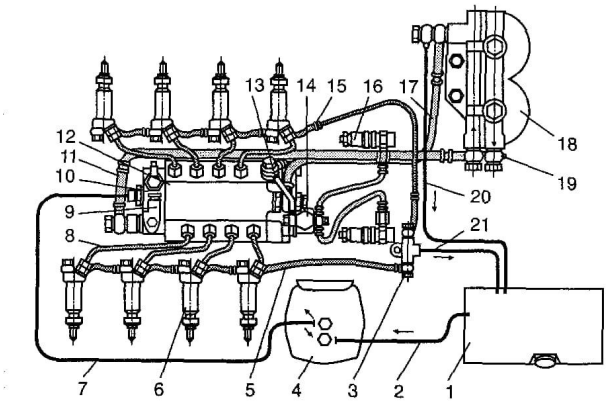

Figure 3. Structure of the diesel engine supply system.

1-fuel tank, 2-pipe connecting the coarse filter to the tank, 3-three-way switch, 4-coarse filter, 5-fuel supply pipe to the left injectors, 6-injector, 7-low pressure fuel supply pipe to the filter, 8-high pressure pipe, 9-hand fuel drive pump, 10-low pressure fuel pump, 11-fuel supply pipe to the fine filter, 12-high pressure fuel pump, 13-fuel supply pipe to the solenoid valve, 14-electromagnetic valve, 15-fuel supply pipe to the right injectors, 16-spark plug, 17-fuel pipe from the high-pressure pump, 18-fuel i fine filter, 19-high pressure pump fuel delivery pipe, 20-fine filter and fuel tank connecting pipe, excess fuel delivery tank pipe.

Examples of these malfunctions are high-pressure fuel pump and injector adhesion breakdown, contamination of air and fuel filters, corrosion and misalignment of the plunger pair, clogging of the injector injection hole, change in the start time of fuel injection [4-5]. These malfunctions cause fuel pumps to malfunction, that is, their production capacity and the quality of fuel injection decrease, which, in turn, causes the engine to stop working and its power to decrease by 3...5%.

The external symptoms of diesel engine fuel supply system failure and failure are difficulty in starting it, uneven, hard knocking, misfiring, reduced power and increased fuel consumption.

The main reason for the difficulty of starting the engine is the low amount of fuel delivered to the combustion chamber. Fuel injection becomes worse as a result of air entering the system, contamination of the filter elements, low or high pressure fuel pump failure, reduced pressure due to corrosion of the plunger pair, and corrosion of the injector nozzle head hole or its blockage.

Unsteady operation of the engine (at a low number of crankshaft revolutions) is caused by air intake into the supply system, uneven delivery of fuel from the fuel pump sections, and a malfunction of the injector. Reasons for the engine to smoke (emitting black smoke): incomplete combustion due to early or late delivery of fuel from the high-pressure fuel pump, reduced injection pressure due to expansion or contamination of the nozzle injection hole, late delivery of fuel, leakage from the injector leakage, contamination of the air filter, deterioration of spraying as a result of dirt filling of the spray hole, accumulation of water in the fuel [5].

A decrease in engine power can be caused by air intake into the supply system, contamination of the air filter, insufficient supply of fuel, violation of the injection angle adjustment,

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deterioration of fuel injection from the injector, uneven and insufficient fuel supply from the high-pressure fuel pump. due to low compression and not using the appropriate (specified) fuel.
Diesel engine fuel supply system maintenance. In the maintenance of the fuel supply system, diagnostics, adjustment, determination of system density, condition of fuel and air cleaners, operation of the fuel drive pump and high pressure pump are checked and adjusted.
The tightness of the system is of particular importance, if it fails, air will be sucked into the system from the tank to the fuel pump, and it will lead to more fuel consumption and malfunction of the equipment. This part is checked with the help of a special tool container, and the remaining part is checked by eye, and fuel and air filters - by inspection.
The technical condition of the fuel drive pump and high pressure pump is checked and adjusted in the car itself or by removing it using special equipment (Fig. 4). The performance of the fuel drive pump at a given resistance and the pressure it produces when the fuel channel is fully closed is checked [5-6].

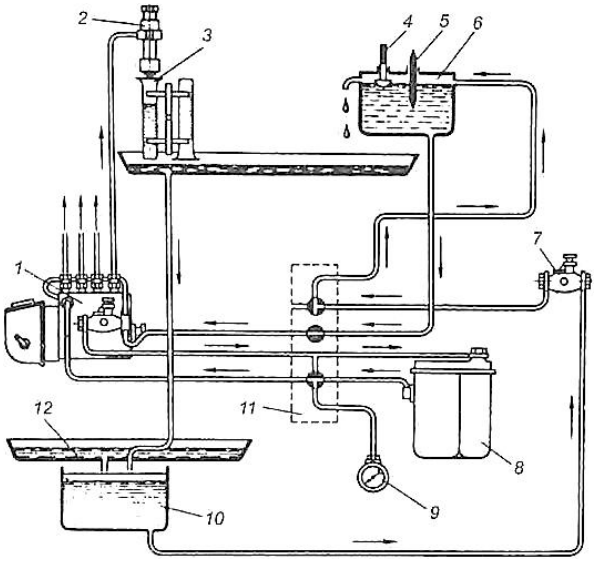

Figure 4. The basic form of high pressure pump equipment.
1-high pressure fuel pump; 2-reference nozzle; 3-beaker; 4- fuel level indicator; 5-thermometer; 6, 10-fuel tanks; 7-fuel pump of the device; 8-filter; 9-manometer; 11-cranes; 12-fuel tank; 13-inspected fuel drive pump.

To check the pump, the pipe from it to the filter is lowered into the measuring tank, and the fuel exit from the pump is slightly closed by means of a tap so that the pressure at the exit rises to 60...80 Kpa. KamAZ-740 engine's low-pressure pump and fuel drive pump should supply 2.5 l/min of fuel to the metering tank at a frequency of 1300 rpm of the crankshaft. At the frequency of these revolutions, the pressure exerted by the fuel pump is determined by the indication of the manometer (9). If the pump exerts a pressure of less than 0.4 Mpa, then it is necessary to check the tightness of the valves, worn pistons and free movement of the pusher. The high pressure fuel pump is checked for the initial timing, uniformity and amount of fuel delivered to each injector.
In order to determine and adjust the start time of fuel supply, momentoscopes (1.5...2.0 mm) glass tubes (1.5...2.0 mm) installed at the outlet nozzle of each section (Fig. 5) are used in STDA equipment. The punched shaft of the pump is rotated, half of the volume of the glass tubes is filled with fuel, then the shaft guide is slowly rotated clockwise, and the fuel level in the tubes is observed. The start of fuel supply from the pump sections is determined by the start of the movement of fuel in the glass tubes of the momentoscopes [6].

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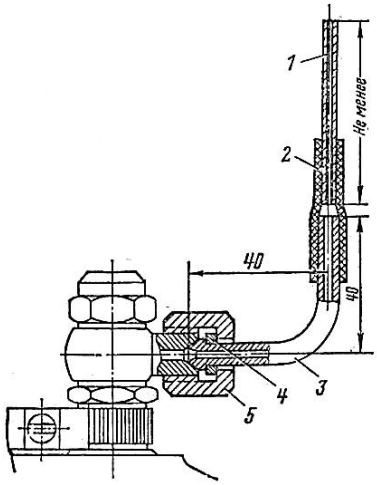

Figure 5. Momentoscope.
1-glass tube; 2-plastic tube; 3-steel pipe; 4-washer, 5-nut.

When the pump is tested in the unit, the amount of fuel supplied by each section is determined by means of beakers (3) using a device that automatically removes a special barrier from under the nozzles (2) installed in the unit. The test is carried out together with a set of tuned and adjusted injectors. The nozzles are attached to the pump sections by means of high-pressure tubes of the same length (600±2 mm).

Checking the start of fuel injection is performed by disconnecting the fuel injection advance clutch. The peculiarity of the high-pressure fuel pump is that the sections are made separately from the pump body and the section can be replaced with its body assembled. Depending on the angle of rotation of the punched shaft, the start of fueling from each section is adjusted by changing the thickness of the thrust heel; 0.05 mm of heel thickness. change to corresponds to a turning angle of 0°12'.

The amount of fuel supplied by the section in one way of the plunger (cyclic transmission) should be 75.0...77.5 mm3/cycle for the KamAZ-740 engine. The unevenness of the fuel delivered by the pump sections should not exceed ±5%. The difference in section performance (V_f) is determined as follows [7]:

$$V_f = \frac{(V_{max} - V_{min})^2}{V_{max} + V_{min}} \cdot 100\% \quad mm^3$$

bu yerda:

V_{max} – the indicator of the section with the most productivity, mm^3;

V_{min} – the indicator of the section with the least productivity, mm^3

Fuel delivery of each section in the pump is adjusted by turning the section housing relative to the pump housing. If the sections of the KamAZ-740 engine pump are turned counterclockwise, the cyclic fuel transfer will increase, if they are turned clockwise, it will decrease.

Diesel injectors are checked for tightness, the pressure at which the needle starts to rise, and the quality of fuel dusting.

A faulty injector can be detected by slightly loosening the limiting nut of the tested injector on a working diesel. It is necessary to loosen the injector nut alternately and observe the frequency of rotations of the crankshaft. If the nozzle is disconnected, then the diesel will work unevenly. If a faulty injector is disconnected, the engine performance will not change.

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The condition of the injectors can be checked with special tools (Fig. 6). These devices consist of a fuel tank, a fuel pump operated by a handle, and a manometer. After the nozzle is installed on the tool, the pressure is gradually increased by means of a lever [8].

The density of the closed filter housing in the KamAZ-740 diesel injector is determined by keeping the pressure in the range of 17...17.5 MPa for one minute (minute). If more than two drops of fuel are collected from the nozzle of the nozzle for one minute, such a nozzle is considered unusable. In this case, the plunger pair must be replaced with a new one.

Figure 6. Injector inspection tool.

The spray pressure of the nozzle in the KamAZ-740 engine is adjusted by removing the adjuster nut, the intermediate part and the rod, and using washers. If the total thickness of the washers is increased by 0.05 mm, the pressure at which spraying starts increases by 0.03...0.35 MPa.

It is necessary to adjust the engine nozzles to the pressure at which spraying begins (the beginning of the rise of the needle). This pressure is equal to 18...0.5 MPa for KamAZ-740 injectors and 16.5...0.5 MPa for YAMZ-236 injectors.

If the lever is oscillated 70-80 times per minute, and the fuel does not drip from each hole of the fuel filter, it comes out uniformly along the cross-section of the flow cone and sprays in a fog-like state, then the quality of dusting is considered satisfactory. The beginning and end of spraying (burning off) should be clear. In a new injector, fuel injection is observed along with a sharp sound. The absence of such a sound from used injectors is not a sign of their poor performance [9-10].

When the holes of the cleaner are clogged with dirt, they should be cleaned (after disassembling the injector) with a thin steel wire and washed in unleaded gasoline.

The combustion of exhaust gases is determined on the scale of the smoke meter (6) (Fig. 7). Gas is removed for analysis using a gas receiver (2). It is installed on the measuring pipe (3) connected with the outlet pipe (4) through the receiver (5). In order to increase the pressure in the measuring pipe, if necessary, the barrier is equipped with a cover (1).

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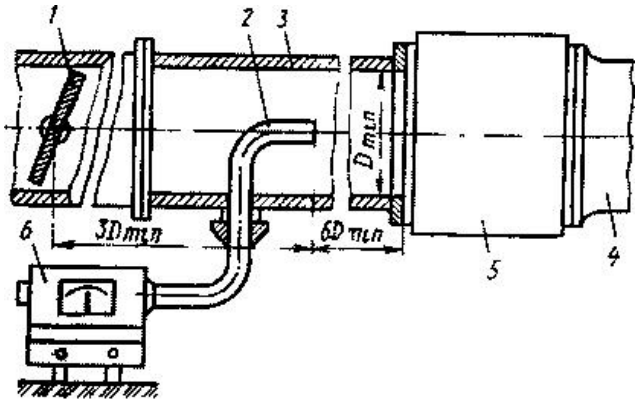

Figure 7. Measuring the ignition of diesel exhaust gases.
1-barrier cover (screen); 2-gas receiver; 3-measuring pipeline; 4-diesel exhaust pipe; 5-receiver; 6-smoke meter.

Ignition measurement is carried out during maintenance and after repair or during adjustment of the fuel equipment, in two different modes during the engine operation of a stationary car: free acceleration (acceleration of crankshaft rotations from the minimum frequency to the maximum frequency) and is performed at the highest maximum frequency rotations of the shaft. The combustion of waste gases is evaluated according to their optical density and is expressed in percentages. The amount of gases used in the engines of their cars should not exceed 40 percent in free acceleration mode, and 15 percent in the highest (maximum) frequency rotations [11-12].

References:

1. Sh.P. Magdiyev "Technical operation and service of automobiles" Tashkent, 2021.
2. Sh.P. Magdiyev "Car construction, service and repair of car engines" Tashkent, 2021.
3. Rakhamatov, Murodjon. "Standardization of the Motor Oil Change Frequency in Automobiles in the Mountainous Conditions." ICTEA: International Conference on Thermal Engineering. Vol. 1. No. 1. 2024.
4. Pulatovich, Magdiyev Shovkat, Rakhmatov Murodjon Iskandarovich, and Jovliyev Vasik Ulashevich. "CONSTRUCTION AND MAINTENANCE OF TIRES USED IN AUTOMOBILES."
5. Iskandarovich, Rakhmatov Murodjon, Sharopov Zavqiddin Zayniddinovich, and Boliyev Mansur Tuygunovich. "CONSTRUCTION OF A FUEL SUPPLY SYSTEM FOR VEHICLES RUNNING ON COMPRESSED GAS AND THEIR MAINTENANCE." Nexus: World of Scientific news in Science International Journal 1.1 (2023): 54-65.
6. 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.
7. 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.
8. 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.
9. Avliyokulov J. S., Nurmetov K. I., Rakhmatov M. I. TECHNOLOGIES FOR MODIFICATION OF FRICTION PARTS FROM VULCANIZED RUBBERS. – 2021.

ISSN: 2692-5206, Impact Factor: 12,23
American Academic publishers, volume 05, issue 11,2025
Journal: https://www.academicpublishers.org/journals/index.php/ijai

10. 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.
11. 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.
12. Rakhmatov, M., A. Riskulov, and K. Nurmetov. "Composite Materials with Enhanced Abrasion Resistance and Certain Functional Characteristics Based on Thermoplastics." Editorial board of the journal.