

ZMZ-51432 ENGINE

Engine suspension

While operation, check the threaded joints tightness of front and rear engine suspensions (see Appendix 2), as well as supports condition. Delaminating and break of engine supports cushions are not allowed.

Variable Valve Event and Lift

Camshafts drive is chain, double-step. First step is from a crankshaft to a countershaft, second step – from a countershaft to distribution shafts. Every chain tension is made automatically by hydraulic tensioners.

Engine lubrication system

Do not operate your engine in case of any faults in the lubrication system.

There is a liquid-oil heat exchanger for the oil cooling in the lubrication system.

Filling of the lubrication system is done through an oil filler on the lid of cylinders head valves.

The oil level should be checked daily before the engine start (vehicle should be on the level ground). The oil level should be between "P" and "O" marks on the gauging rod of the 5th level (see fig. 9.12). While driving frequently across country, the oil level should be near to "P" mark but do not exceed it. After the engine stops, check the oil level no earlier than in 5 minutes.

During the oil refilling change the oil filter. The used oil should be drained from the engine crankcase immediately after the trip when it is still hot. Before it open the lid of the oil filler. The oil will drain for no less than 10 minutes.

Check the condition of sealing gasket while screwing a plug of the drain hole. Change a damaged gasket for a new one.

Fill fresh oil up to the top mark on the oil gauge, start the engine.

After the emergency oil pressure sensor is off, stop the engine and check the oil level in 5 minutes. Add oil if necessary.

Remember that there is always residue of oil (tankage) in the engine. Fill the oil by portions, increasing the oil level up to the top mark «P» on the gauge. There is about 1 liter of oil between "P" and "O" marks. Oil level above the «P» mark is not allowed.

Use only recommended oils.

It is not allowed to mix engine oils of different trade names and different companies.

When changing one oil grade to another one, it is recommended to flush the engine. In case you change mineral oil to synthetic one and back, it is obligatory to flush the engine.

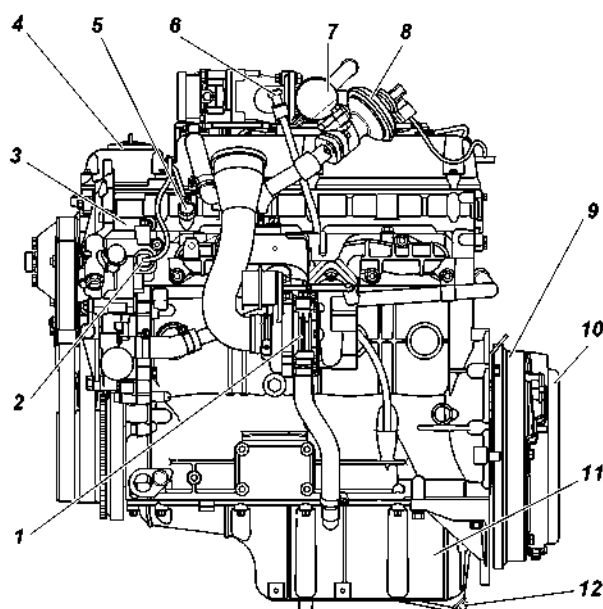


Fig. 9.12. ZMZ-51432 engine (left-side view): 1 - turbo-charger; 2 - coolant indicator of controlling system; 3 - thermostat body; 4 - oil filler lid; 5 - emergency oil pressure sensor; 6 - oil level gauge; 7 - recirculate gases coolant; 8 - EGR valve; 9 - flywheel; 10 - clutch; 11 - oil banjo; 12 - oil drain plug

For the engine lube oil flush you should:

- drain waste oil from the case of warm engine;
- top up with change oil or special flushing oil 2-4 mm higher of the top mark on the gauge;
- start the engine and let it run at minimum crankshaft speed for no less than 10 minutes;
- drain the change oil or special flushing oil;
- change the oil filter;
- top up with fresh oil, as specified above.

Oil filter. Upon changing install the oil filter 2101C-1012005-HK2 by "KOLAN" company or 406.1012005-02 by LLC "BIG-filter" company.

Upon change of oil filter, check the rundown of connector nut on the heat exchanger fixture and draw up it tight if necessary.

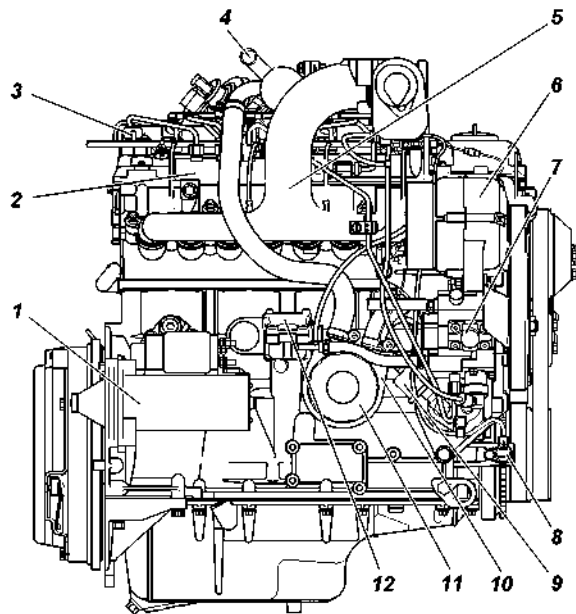


Fig. 9.13. ZMZ-51432 engine (right-side view): 1 -starter; 2 –fuel rail; 3 - phase pickup; 4 - discharge tube of cooling fluid into the heater; 5 - inlet tube; 6 -generator; 7 - high-pressure fuel pump (HPFP); 8 – synchronization sensor; 9 - pressure sensor; 10 –liquid-oil heat exchanger; 11 -oil filter; 12 –lid of oil pump drive

During installation a filter on the engine, check the sealing gasket, oil it and roll the filter up to the heat exchanger surface touching by the gasket, then make $\frac{3}{4}$ turns further. Make sure that there is no oil leak in the sealing joints.

CRANKCASE VENTILATION SYSTEM

The system maintenance consists of regular check of the joints leakproofness and system parts cleaning from gum residual.

In case of excessive oil consumption for burn-off loss and black smoke emission from the vehicle's discharge tube, it is necessary to check the operability (canals choking) of the crankcase ventilation system.

Operability of the crankcase ventilation system is checked using a water piezometer, connected to the engine crankcase through the oil level gauge tube.

In the crankcase of the engine, operating under no-load condition (at crankshaft speed from min to max), the depression should be 1-14 millibar (10 - 140 mm w.g.).

In case oil appears on the joints between the turbo-charger and intake pipe, you should check the oil samp gases pressure.

If the presser in a crankcase is more than 15 millibar (150 mm w.g.), you should check the leakproofness of the vehicle vacuum system (vacuum booster and exhaust gas recirculation systems). In case leakage appears, the vacuum pump pressurizes in the crankcase, which resulting in excess gases flow rate through the oil separator and carry-over of oil with gases.

High crankcase gases pressure can be also related to faults of cylinder- piston block and parts choking of crankcase ventilation system, in this case you should clean the parts.

Attention! *While operating, keep the ventilation system leak proof and do not allow the engine run with the open oil filler. It can result in turbo-charger breakdown, dirtying of engine oil chamber and increased carry-over of oil with crankcase gases and environment pollution.*

For cleaning the parts of the crankcase ventilation system remove valves cover, oil separator cover, ventilation hose and inlet pipe of turbo compressor. Flush the removed parts by kerosene and dry. The oil deflector should be flushed in assembly.

Cooling system

ATTENTION! *Coolant is toxic. Keep the liquid in a tight container. During operations with the coolant, the following safety precautions should be observed:*

- *Avoid any procedures as the result of which this liquid can enter mouth cavity;*
- *Do not allow the liquid, contacted skin, to dry out and flush it with warm water and soap;*

- *Awash spilled water, air the room;*

- *Put the dirtied clothes off, dry it outside, do the washing;*

Beware while opening a radiator cap of the engine cooling system to avoid scald.

As a coolant you can use low-freezing liquid TOSOL-A40M or OZH-40 "Lena", OZh-40 «TOSOL-TS».

At ambient temperatures lower than -40°C , you should use low-freezing liquid TOSOL-A65M or OZH-65 «Lena», OZH-65 «TOSOL_TS».

Operation temperature of coolant should be within 60°C - 100°C .

Short-time (no more than 5 minutes) engine running is allowed under an elevated temperature of the coolant up to 115°C .

Upon lighting of coolant overheating warning device you should not stop the engine immediately to avoid its break down. It is necessary to change the engine mode to idle running at crank shaft speed $1500\dots2000\text{ min}^{-1}$ for 3...5 min. for smooth temperature reduction and only after that to stop the engine, to diagnose and eliminate a cause of the coolant overheating.

Periodically check the coolant level in the expansion tank. The liquid level should be 3-4 cm higher of the «min.» mark. As the coolant has high temperature expansion coefficient and its level in the expansion tank changes significantly depending on the temperature, the level is checked at a temperature of $+15\text{-}20^{\circ}\text{C}$ in the system.

In the cases when the coolant level in the expansion tank lowers for a short period of time or after short runs (less than 500 km), check the leakproofness of the cooling system and, having eliminated the leakage, fill up the same coolant into the radiator or expansion tank.

In extraordinary circumstances, for example, in case of considerable coolant leakage, it is allowed to fill the cooling system with pure, fresh water for a short period

of time. It is not allowed to use sea water as well as alkali for water softening as it eats dirt of engine aluminum components. Before usage filter water by means of creative resources. At the earliest possible opportunity drain all the water off, flush the cooling system and fill in the coolant specified in Appendix 3.

ATTENTION! *In case the parts have broken down as a result of water freezing in the cooling system, manufacturing plant does not bear responsibility.*

Flush the cooling system in the following way:

- Fill the system with pure water, start-up the engine, allow the engine to operate till warming, shut-off the engine and drain water,
- Repeat the operation, specified above.

Due to air content in heaters, start heater and connection hoses, fill the cooling system in the following order:

- Close the coolant drain plug;
- Set actuating lever of heater control valve to a position «Open»
- Fill the radiator with coolant 10-15 mm lower than the filler and the expansion tank 3-4 cm above the «MIN» mark.
- Start the engine, after lowering of the liquid level in the radiator top tank, fill the coolant in it up and close the radiator cap;
- Kill the engine, cool it, bring up the coolant level in the expansion tank to normal one and close the plug of expansion tank;
- Run 2-3 cycles of engine warming-up and cooling and bring up the coolant level in the expansion tank to normal again.

Coolant from the cooling system is drained through two holes, closed with plugs 13 and 17 (fig. 9.14). For coolant removal from the heat exchanger 16 you need to blow the heat exchanger chamber with compressed air through the coolant outlet hose from the heat exchanger, having disconnected it from the T-connector beforehand.

ATTENTION! *It is prohibited to run the engine without thermostat. (Engine without thermostat runs under reduced temperature of coolant. As a result the engine parts wear faster and the fuel consumption increases).*

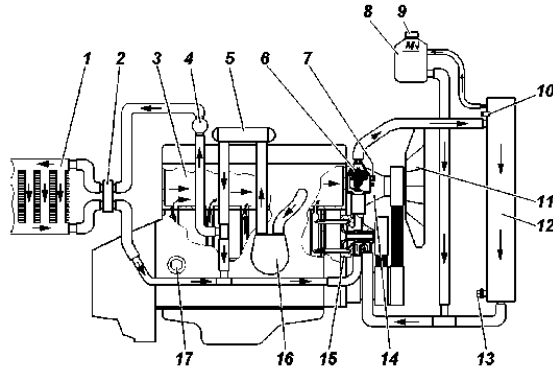


Fig. 9.14. Scheme of engine cooling system:

1 – heater radiator; 2 – heater tap; 3 - engine; 4 –auxiliary pump of the heating system; 5 cooler of recirculated gases; 6 –thermostat ; 7 - coolant temperature sensor; 8 –expansion tank; 9 - expansion tank cap; 10 – coolant emergency temperature sensor; 11 -fan; 12 –radiator of the cooling system; 13 – drain plug; 14 - fan drive group; 15 -pump; 16 –liquid-oil heat exchanger; 17 – drain plug on the cylinder block group

Change and tensioning of drive belts of fan and steering pump, generator, coolant pump and HPFP (high-pressure fuel pump)

Check the belts tension and condition periodically. Change the belts if they appeared to be damaged or in case of their over stretch.

Drive belt of fan and steering pump tensioning is to be made in the following order:

- Ease bolt 4 (fig. 9.15);
 - Turning one of the two tension pulleys 3, bring the belt tension up to standard (the standard see in a table "Technical specification");
- Tighten bolt 4.

If the specified tension is not achieved by one pulley turning, use the second pulley.

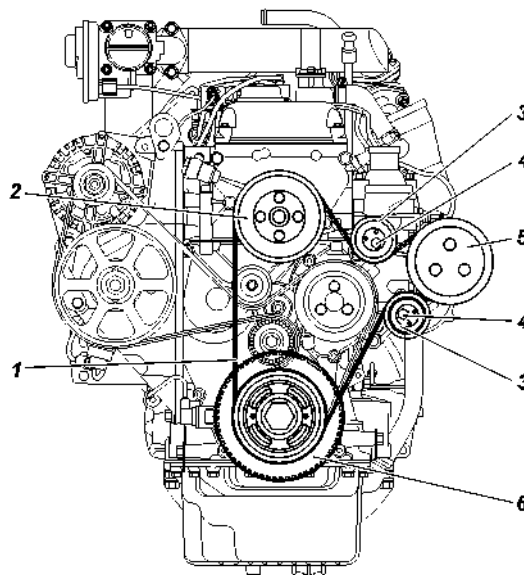


Fig. 9.15. Drive belt of fan and steering pump:

1 -belt; 2 –fan pulley; 3 -tension pulley; 4 -bolt; 5 –steering pump pulley; 6 –crankshaft damper pulley

Change the belt in the following sequence:

- ease bolts 4;
- turning pulley 3, ease the belt tension;
- change the belt and tension it as specified above.

Tension of belt 2 (fig. 9.16) of generator drive, coolant pump and HPFP (high-pressure fuel pump) is provided by automatic tensioner 1. While operating the automatic tensioner does not require maintenance and adjustment. The automatic tensioner allows to lengthen the drive belt life of units, water pump bearing and generator.

Change the belt in the following sequence:

- socket a hexagon into a pulley of the automatic tensioner 1;
- having eased the belt, turn the tensioner lever;
- holding down the lever in this position, change the belt.

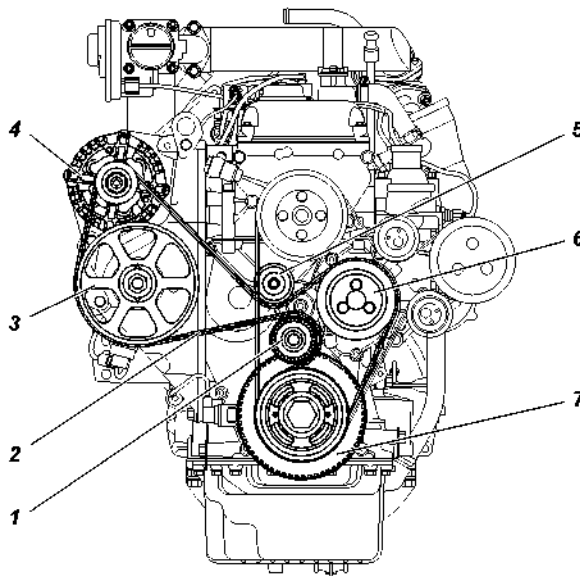


Fig. 9.16. Belt of generator drive, coolant pump and HPFP:

1 - automatic tensioner; 2 -belt; 3 - high-pressure fuel pump (HPFP) pulley; 4 -generator pulley; 5 - bypass roller; 6 - water pump pulley; 7 - water pump pulley

Gas exhaust system

ATTENTION! *The catalytic converter service temperature is 400-600°C. Do not use the vehicle without a catalytic converter protective shield. When driving and shutting-down, watch the gas exhaust system avoids any contacts with flammable materials (e.g. dried grass).*

It is unacceptable to bypass exhaust gases in conjunctions of gas exhaust system with gasket seals. All such faults must be removed. Draw up stuck nuts tight (see Appendix 2), using breakaway penetrant or kerosene for dampening threaded connections.

Vehicles operations wherein unburnt fuel falling within a launch system is possible are not allowed.

Special care should be taken with fuel, gas distribution and engine intake systems.

Exhaust gas recirculation

An exhaust gas recirculation (Fig. 9.17) is designed to reduce nitrogen oxide emission with exhaust gases by some exhaust gases launching from an engine exhaust manifold into engine cylinder.

System operation control is performed by microprocessor control unit wherefore it uses sensor values of coolant temperature, accelerator pedal position, crank position and speed, and values written to its memory.

A recirculation valve's operational life is 80 000 km run. It is recommended to change the valve if run is more.

For functional tests of a solenoid recirculation valve operation and its circuit at stopped engine while the power supply is turned on push a fuel pump lever of high pressure fuel pump until bumping and then ease it. A solenoid recirculation valve switching and a token sound ("snap") should occur.

ATTENTION! *The engine operation with unconnected or leaky vacuum hose of recirculation valve of exhaust gases and brake booster is prohibited because it leads to crankcase pressure increase and fuel penalty per charcoal raise.*

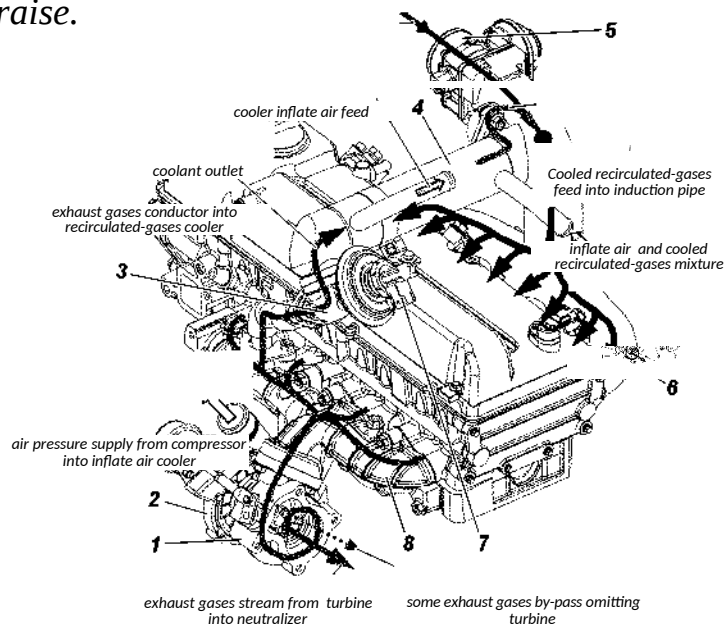


Fig. 9.17 System exhaust gas recirculation diagram

1 – turbine, 2 – compressor, 3 – recirculation valve, 4 – recirculated-gases cooler, 5 – air feeder with throttle blade, 6 – induction pipe, 7 – valve rodposition sensor, 8 – discharge manifold

Exhaust gases smoke test

Exhaust gases smoke test is performed only at vehicle service station.

ATTENTION! *When using substandard quality fuel a soot subsiding on block may occur, that can cause uneven running or deterioration of vehicle performance.*

In the presence of these signs you should:

1. Change the fuel to recommended one.
2. Sustain the engine rpm speed at no less than 3000 RPM within 10 minutes.

In the case where dynamics has not changed, it is necessary to apply to vehicle service station.

Fuel induction system with microprocessor control

ATTENTION! Use only diesel fuel approved by GOST R52368 and TR 0251-01200044434-2002 (Lukoil diesel fuel EN590). Any dilution (which includes petrol, kerosene etc.) is strictly prohibited. When violating above requirements PJSC «UAZ» is under no warranty obligation if a failure of fuel system occurs.

Precautionary measures:

1. Before disassembly or assembly of any operating system elements or conductors it is necessary to disconnect the accumulator battery weight conductor.
2. It is prohibited to run the engine without the accumulator battery and engine to body weight conductor reliable connection.
3. It is prohibited to disconnect the accumulator battery from vehicle embedded network while engine operation.
4. When charging from external reference source switch the accumulator battery off from vehicle embedded network.
5. It is prohibited to expose the control block to temperatures in excess of 80°C, e.g. in dry kiln.
6. Before welding in is necessary to disconnect the accumulator conductor and the control block connector.
7. To avoid contact corrosion when stream engine cleaning do not direct nozzle to the system components.

ATTENTION! It is prohibited to loosen or tighten fuel lines connections when engine operating or right after its stop.

Fuel system

ATTENTION! It is prohibited to consume all the fuel out of the fuel system, because lubrication of a high pressure fuel pump components friction is fulfilled by fuel.

Fuel comes from the right tank to the high-pressure fuel pump through a fine filter. As fuel consuming, the right tank fills up from the left one automatically. Fillers plugs of tank filling pipes are blind and provide tight seal.

Due to specified features of fuel system design the following is recommended:

- When fillers plugs of tank filling pipes blanking to make yourself sure that plugs are faultless, a gasket seal is integral, an appropriate force exertion for bubble tight shutoff gasket seal is provided.
- When partial refueling the vehicle to fuel the right tank first.
- To control fuel consumption due to fuel amount changings in both tanks.

Fuel tanks 4,22 (fig. 9.18). The fuel tanks maintenance is repetitive flushing of receiver tube filter of fuel-level indicator (right and left tanks) and tanks flushing.

Repetitively drain the sump of a fuel tank, unscrewing plug at the bottom of the tank.

Repetitively check the security of tanks mounting and tighten bolts of their mounting.

Fuel tanks should be removed for flushing.

Before removing:

- Turn the accumulator battery off;
- Discard fuel, unscrewing the plug at the bottom of the tank;
- Open the floor board battery cover and disconnect the shoe from the fuel-level indicator sensor.
- Disconnect all the fuel pipe hoses and tubes.

Then unscrew bolts of binding screw clamps, bend the clamps down so they don't interfere with tank lowering.

A tank mounting is performed inversely.

Pay particular attention to the fuel system leakage and the reliability of weight attachment.

It is not recommended to operate the vehicle when the fuel in the right tank is less than 5 liters.

When sharp climbing, the minimum fuel amount in the supply tank should be no less than 20 liters.

A final fuel filter clogging, a filth or mechanical impurity occurrence in a fuel tank results in the deterioration of fuel pumpability from left tank into right one, the unstable engine operation within severe loads and the deterioration of the vehicle performance.

Note. When the ambient air temperature is below 0°C clogging sings may be spelled by water content and its freezing inside the fuel system. If water is found the fuel should be drained and tanks should be washed with clear fuel.

Jet pump. Periodically check pump and its assemblage leakproofness. If there is no left to right tank fuel leakage, disassemble the pump (reverse the jet), wash it and blow it with air.

The Jet pump is fixed at the fuel tank by the right frame girder.

An assemblage leakage is eliminated by a worm clips assemblage tightening or a faulty unit changing.

After any fuel supply maintenance that includes any clips assemblage tightening, parts and units removing or changing, it is necessary to perform the system integrity check:

- Make sure that the tank fillers plugs are reliably tightened;

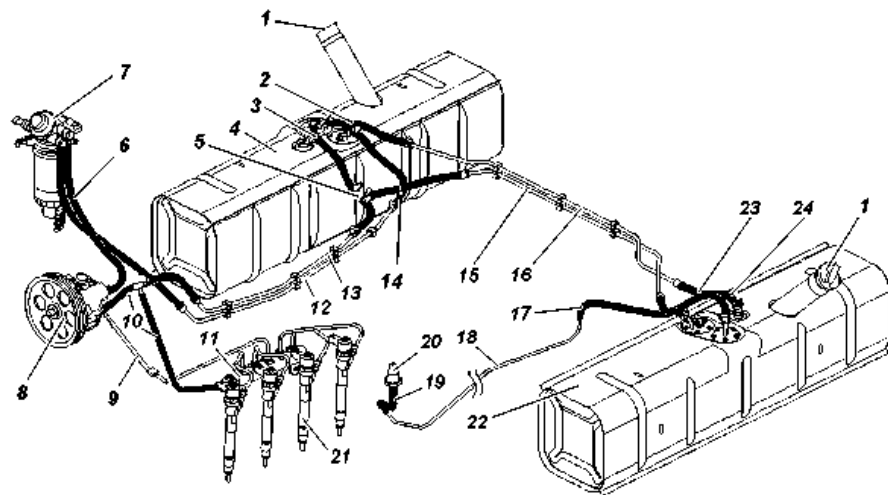


Fig. 9.18 Scheme of engine fuel feeding; 1 –fuel tank plug; 2, 17, 19, 23, 24 - air-vapor hoses; 3 - fuel drain hose into the right tank; 4 –right fuel tank; 5 -jet pump; 6, 14 - fuel feeding hoses; 7 –fine fuel filter; 8 - high pressure fuel pump; 9 –fuel tube; 10 - fuel drain hose; 11 - fuel rail; 12 - fuel feeding tube; 13 - fuel drain tube; 15 –left tank to jet pump tube; 16, 18 - air-vapor tubes; 20 - tank valve; 21 -jets; 22 -left fuel tank

- Tighten the clips and connecting threads to perform leakproofness;
- Perform the first feeding system filling with a priming pump at the fine fuel filter. Air drain is performed through the screw at the fine fuel system 7 (Fig. 9.19).
- Start the engine and examine the system at idle operation. Fuel leakage or fuel system parts' dampening is prohibited.

Fine fuel filter (BOSCH, A 450 085 725), showed at Fig. 9.19.

The heating control is performed automatically with sensor 6 of fuel temperature.

Remove sediment out of the filter every 5000 km run (unscrew plug 5, drain sediment until clear fuel jet occurs).

Change a filter insert every 15000 km run.

Before change clear the filter's external surface from dirt. When filter insert changing do not let dirt fall within filter chamber.

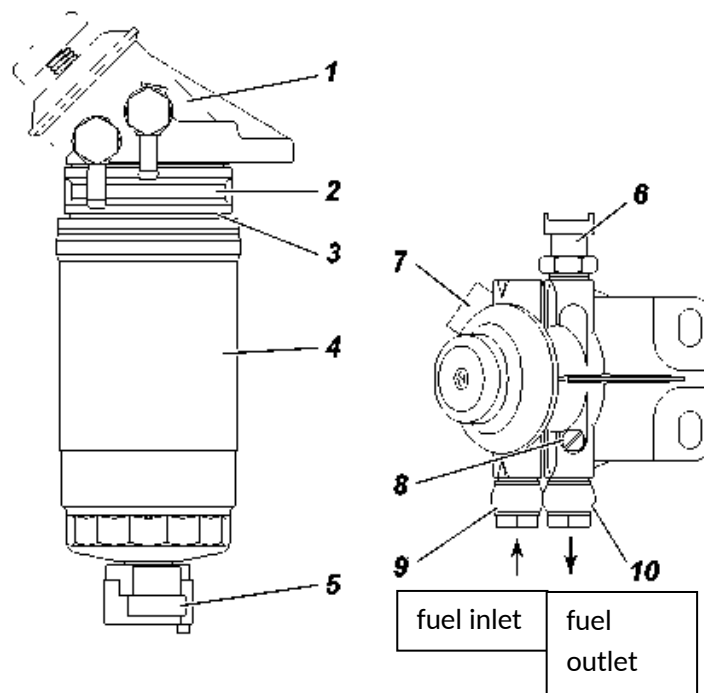


Fig. 9.19. Fine fuel filter with priming pump and sensor of water content in fuel at sediment draining plug: 1 -hand operated priming pump; 2 -heater; 3 - gasket seal; 4 - filter material; 5 -sediment drain plug with water content sensor; 6 -fuel temperature sensor; 7 -heater pin connector; 8 -air outlet screw; 9 -fuel inlet union; 10 -fuel outlet union

Use 1 457 434 310 “BOSCH” filter insert when changing.

Filter insert changing:

- Drain fuel out of the filter by unscrewing for few turns water-drain plug 5;
- Unscrew filter insert 4;
- Lubricate gasket seal 3 at the new filter insert body with clean diesel fuel;
- Screw a new filter insert and tighten it to torque of 20-25 Nm (2-2,5 kgf-m).

Air outlet from the fuel inlet system.

Air outlet should be performed:

- when tubing, filter or pump disassembly;
- after filter insert changing;
- after complete fuel using from the system;

It is necessary to perform the following for air outlet and filling the system:

1. Make sure that fuel tanks plugs are reliably tightened. Fillers plugs of tank filling pipes are blind and provide pressure-tight seal.
2. Ease plug 5 of air outlet at fine fuel filter. Use priming pump 1 fine fuel filter to fill a header pipe until air bubbles eliminating in fuel outgoing from under the plug for air outlet;
3. Tighten air outlet plug 5;
4. Start the engine with a starter until a stable engine operating occurs.
5. If the engine has not started as a result of non-filling of high-pressure pipes, you should:
 - ease nuts piping clips at jets;
 - when turning the crankshaft with a starter fill the tubes with fuel (the continuous operation time is no longer than 15 seconds). It is necessary to provide full fuel feeding by pushing down the accelerator as far as it can go while turning the shaft with a starter and keeping air overpressure within the tanks;
 - stop turning the crankshaft when fuel occurring from under the high-pressure pipes nuts;
 - tighten the nuts;
 - start the engine.

High-pressure pipes are recommended to be installed at an engine only once. Reinstallation does not guarantee reliable leakproofness of joints and fuel long-term operation.

High pressure fuel pump.

Maintenance, adjustment, checking and service of a high pressure fuel pump and jets is recommended to be performed at “BOSCH” authorized centers. Self-adjustment, partial or full dismantling of high pressure fuel pump is prohibited.

***ATTENTION!** It is prohibited to unscrew the center-lock nut of a high pressure fuel pump pulley hub or to remove a high pressure fuel pump hub with a pulley. After removing it is impossible to mount the pulley rightly again. This will cause the reduced engine operation and can result in the engine’s breakage.*

Accelerator conductor. At UAZ-315148 vehicle the circuit module of an accelerator is installed. It does not require any adjustment.

Air filter. Filter maintenance see at field “ZMZ-40905 engine”.

Turbocompressor

Engine operation without an air filter or with a faulted one is prohibited as it can result in turbocompressor breakage.

When engine operation with recommended liquid lubricant turbocompressor life time equals to engine life time.

After cold engine start and until starting driving it is necessary to allow engine to run at idle time for 1-2 minutes for the purpose of turbocompressor heating and its parts increased wear exception.

***ATTENTION!** When engine shutdown after a long operation at high rpm or severe load it is necessary to operate the engine at minimum rpm of an idle run for 3-5 minutes to avoid turbocompressor premature failure.*

***ATTENTION!** It is not recommended to operate the engine more than 10 minutes at minimum rpm of an idle run, because of sleeve assembly exhaustion the air pressure within compressor chamber of turbocompressor is below atmospheric pressure. Some of the turbocompressor bearing body lubricate comes to the inlet engine system through pressure breakdown labyrinth of the compressor wheel, spelling increased fuming.*

It is prohibited to adjust turbocompressor bypass valve in order to avoid engine damage.

It is prohibited to adjust the pneumatic cell rod length with a nut. The rod length is strictly adjusted by the turbocompressor manufacturer and its change will cause either reduce of engine capacity, or sharp load increase at the circulation system and engine premature failure.

Turbocharged diesel system maintenance is periodic testing of air reserve tank to compensator joints leakproofness along the charge of a high pressure fuel pump. If the compensator is idle the engine loses 30% of its capacity.

It is also important to conduct a control and change a filter insert of an air-jet filter in a timely manner.

Engine control system

Engine control system is meant for engine starting, its control when driving and stopping.

The main functions of the system are:

- fuel supply control;
- heating plug operation control – for engine start and its heating;
- exhaust gases circulation control – for nitrogen oxide content reducing in exhaust emissions;
- Control of a heating plug switching indicator light at the dashboard;
- Engine control system-fault indicator lights control at the dashboard;
- Engine control system diagnostics.

Engine control system and its diagnostics.

The main system part which realizes the controlling process is a microprocessor control unit. The control unit produces control signals based on the data, received from system sensors, controlling engine, vehicle and surrounding conditions. The control unit is set in driver's cabin on the right at the front end panel.

A diagnostic outlet is set under the cowl at the front end panel for external automatized diagnostics and programming of an engine control system (fig. 9.20).

The control unit is able to diagnose the engine control system parts in a certain capacity. If a fault is found the control unit lights pilot fault-lamps V and X (see fig. 3.1) at the vehicle dashboard and a code of this fault is written in its memory.

ATTENTION! *When pilot fault-lamp “EDC” lights up intermittently, engine operation is prohibited. It is necessary to stop the vehicle and kill the engine. Vehicle operation is allowed only after maintaining and repairing.*

A pilot fault-lamp “OBD” lighting permanently shows that there are faults of engine parts or outlet system which affects on toxicity level of exhaust gases. When pilot lamp lighting it is possible to continue driving at a low speed to the nearest PJSC «UAZ» authorized service station for diagnostics if there is no driving quality deterioration.

A long-term operation with a pilot lamp on can spell a failure of engine control system parts.

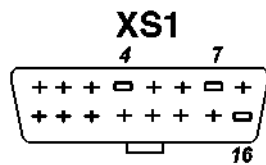


Fig. 9.20. Diagnostic outlet (XS1): 4 -"weigh"; 7 -K-line of external diagnostics; 16 -"12B"