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Binar 5B, Binar 5B-C, Binar 5D, Binar 5D-C
engine pre-heater
for vehicles with liquid cooling system

User Manual
АДВР.048.00.00.000 РЭ

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1. Introduction

The present User Manual gives information on set-up, operation and servicing of Binar 5 and Binar 5D starting pre-heaters and their modifications (hereinafter referred to as— pre-heater), which are used for start heating and warming – up of vehicles with liquid cooling system and engine displacement up to 3.5l at ambient temperature as low as minus 45°C. Fuel used for Binar 5B starting pre-heater operation is petrol, for Binar 5D- diesel fuel is used. Binar 5B-C and Binar 5D-C have the lead for connection with vehicle alarm system or for GSM- modem mounting.

The pre-heater functions are following:

1. Fail-safe starting engine operation under low ambient temperature conditions.
2. Additional heating of engine and passenger compartment with the engine running under hard frost conditions.
3. Heating of passenger compartment and windshield at low subzero temperatures (to remove icing) with the engine inactive.

These functions are supported by the pre-heater basic hardware. Its modular structure makes it feasible to connect with devices supporting the other functions, thus improving functionality of the basic hardware purchased and installed initially. It is possible to operate by the heater with control panel with timer (hereinafter referred to as— control panel) installed on the car dashboard. It is possible to operate by the pre-heater Binar 5B-C and Binar 5D-C by the control panel or remotely with the help of GSM-modem by SMS sent by mobile phone. If there's alarm signaling system installed in the car one can use its free channel to operate by the pre-heater.

The pre-heater's activation time is possible to be programmed by control panel. While operating the control panel indicates the temperature of the cooling system and operation mode of the pre-heater. In case of failure the code of malfunction is indicated.

Minor changes performed on the heater structure by the Manufacturer may not be documented in this Operation Manual.

2. Technical data and characteristics.

Performance specifications are given with $\pm 10\%$ tolerance at 20°C ambient temperature and 12V nominal voltage.

Characteristic	model	
	Binar 5B Binar 5 B-C	Binar 5 D Binar 5D-C
Heat productivity, kW	5 $\pm$ 0.5	
Nominal supply voltage, V	12	
Acceptable deviation, V	9.5...16	
Fuel	petrol meeting requirements of GOST 51105	Diesel meeting requirements of GOST 305
Fuel consumption, l / h	0.7	0.6
Power consumption with the pump, max, W	80	
Power consumption on start mode (100 sec), W	100	
Maximum liquid heating temperature, C°	+85	
Cabin heater fan switching at liquid temperature	+40	
Start mode	Manual or automatic	
Time of one working cycle, min	40	
Pre-heater mass in full configuration, kg, max	8	

3. Safety measures.

3.1. The pre-heater and its components shall be installed **only by authorized companies** by reason of its complicated structure: there's a combustion chamber where fuel burns, a heat exchanger which provides heat transfer to the cooling liquid, fuel pump, air pump, control unit, which control and operate the work of the heater according to the program, heat sensors, etc.

3.2. While installation or dismantling the pre-heater, safety measures specified for activities with car wiring harness and fuel supply line must be observed.

3.3. The pre-heater shall be used only for purposes described in the present User Manual.

3.4. It is prohibited to lay the fuel pipe inside the passenger compartment or driver's cab.

3.5. It is prohibited to use the pre-heater in case of leaky fuel system.

3.6. Vehicle with the pre-heater shall be equipped with a fire extinguisher.

- 3.7. To avoid possibility of poisoning with the toxic exhaust gas generated by the operating pre-heater, the exhaust pipe shall be set in a manner preventing discharge gas ingress into the driver's cab or its intake by the heat exchanger fan.
- 3.8. To avoid possibility of poisoning with the toxic exhaust gas generated by the operating pre-heater, it is prohibited to use the pre-heater in enclosed car parks having no ventilation (garage, workshop and etc.)
- 3.9. It is prohibited to use the pre-heater in areas, where highly inflammable vapors or ample quantity of dust may be generated or accumulated.
- 3.10. While fueling the truck the pre-heater shall be switched off.
- 3.11. It is prohibited to se battery master switch in the pre-heater electric circuit.
- 3.12. The pre-heater shall be disconnected from the accumulator battery when welding is performed with the vehicle.
- 3.13. It is prohibited to connect the pre-heater to the electric circuit of the vehicle with the engine running and accumulator battery missing.
- 3.14. It is prohibited to switch off pre-heater power before ending of the purging cycle.
- 3.15. It is prohibited to connect and disconnect the pre-heater plug when the pre-heater power is on.
- 3.16. It is recommended to restart the pre-heater after it's switching off not earlier than in 5-10 sec.
- 3.17. In case of malfunctioning, the pre-heater shall be repaired in service centers, authorized by the manufacturer.

4 Description of pre-heater set-up and operation.

The pre-heater runs independently of the vehicle engine.

The pre-heater is fueled and powered from the vehicle. The pre-heater electric circuit is given in Figure 4.1.

The pre-heater is an autonomous heater (main components are given in Figure 4.2), consisting of:

- Heater (main components are given in Figure 4.3);
- Air pump for air supply to the heater combustion chamber;
- Fuel pump for fuel supply to the combustion chamber;
- Circulation pump for forced circulation of cooling system liquid through the heat-exchanging system of the pre-heater and the vehicle;
- Control unit (part of the heater) to coordinate operation of the above-mentioned systems;
- Pre-heater control panel with timer for manual or automatic start-up of the pre-heater;
- Wiring harness for connection of the pre-heater components to the vehicle systems.

The pre-heater is integrated to vehicle cooling system with its hydraulic frame so that the pre-heater's pump provides circulation of cooling liquid in the engine and in the heater.

The pre-heater principle of operation is based on warming-up of liquid in the engine cooling system with its further forced pumping through the heat-exchanging system of the heater.

Gases generated because of the fuel blend combustion in the combustion chamber warm up the liquid. The heat is transmitted through the walls of the heat exchanger to the coolant fluid, which in its turn is pumped through the cooling system of the vehicle engine.

When the pre-heater is switched on, first of all there is performed functional test of its components, such as: flame detector, heat and overheating sensors, pump, air pump motor, glow plugs, fuel pump and corresponding electric circuits. In case of nonfailed status, there starts ignition. Simultaneously the circulation pump is also activated.

In conformity with the preset program there is performed preliminary purging of the combustion chamber and glow plug warming-up to the desired temperature. Then, there starts fuel and air supply and combustion process is initiated in the combustion chamber. The flame detector controls combustion of the fuel blend in the combustion chamber. Hot gasses heat the walls of the heat-exchanger, which warm up the liquid in the engine cooling system.

The control unit controls temperature of the coolant fluid by two sensors. The sensors are installed close to inlet and outlet nozzles of the heat exchanger. The control unit sets operation mode for the pre-heater according to the temperatures: “full duty”, “low duty” or “cooling down”.

The full duty mode means that the coolant fluid is heated up to 75°C and in case of overheating the pre-heater is switched to the low duty mode. The low duty mode means that the coolant fluid is heated up to 85°C; in case of overheating more than 85°C the pre-heater is switched to the cooling-down mode. The cooling-down mode means that combustion stops, the pump continues its operation. When the temperature of the coolant fluid gets below 70°C and the total cycle (40 min) hasn't finished yet the pre-heater automatically starts the full duty mode.

When the coolant fluid has been heated more than 40°C the pre-heater control unit switches on the relay and the passenger cabin heater fan is activated (in case it is switched on). The air in the cabin is warming up and provides comfortable conditions for the passengers. When the coolant fluid temperature goes down 30°C the control unit switches the fan relay off.

Duration of the total cycle is 40 minutes. Moreover, there is a possibility to switch of the pre-heater any time during the cycle off.

When the pre-heater is switched off manually or automatically, as preset time expires, the fuel supply stops and the combustion chamber is purged with air.

Peculiarities of the pre-heater automatic control under emergency conditions and in contingencies:

- 1) If the pre-heater has not started for some reason, the starting process will be repeated automatically. After two successive failed starts the pre-heater is switched off;
- 2) If combustion stops when the pre-heater operates, the pre-heater stops its operation;
- 3) in case of the pre-heater overheating (ex.: abnormal coolant fluid circulation, air block, etc.) it automatically switches off;
- 4) in case of voltage drop below 9.5V or voltage surge above 16V, the pre-heater switches off;
- 5) In case of the pre- heater emergency shutdown, a corresponding code of malfunction is indicated on the control panel. Refer to table of malfunctions codes.

Attention!

- 1. It is allowable to operate the pre-heater with the passenger compartment heater control valve open to full;**
- 2. With the purpose of energy saving the heater fan speed switch shall be in “Minimal ventilation” position;**
- 3. It is advisable to direct the passenger compartment heater steam line in the face and not on the windshield.**

5 Pre-heater control unit.

Control unit operates the activity of the pre- heater according to the set program and fulfill the following functions:

- a) pre-heater starting and switching off according to control panel or other control devices(modem, remote control device) command;
- b) pre-heater basic components diagnostics before and during the operation;
- c) pre-heater work control and choice of the pre-heater operation mode according to the temperature of the cooling liquid;
- d) connection of control unit microprocessor with control devices, identification of active device and information transmission;
- e) pre-heater switching off:
 - when operation cycle is finished (40 min);
 - when one of the controlled basic components failed;
 - when the parameters are out off tolerable limits (temperature, voltage, flame blow off in combustion chamber).

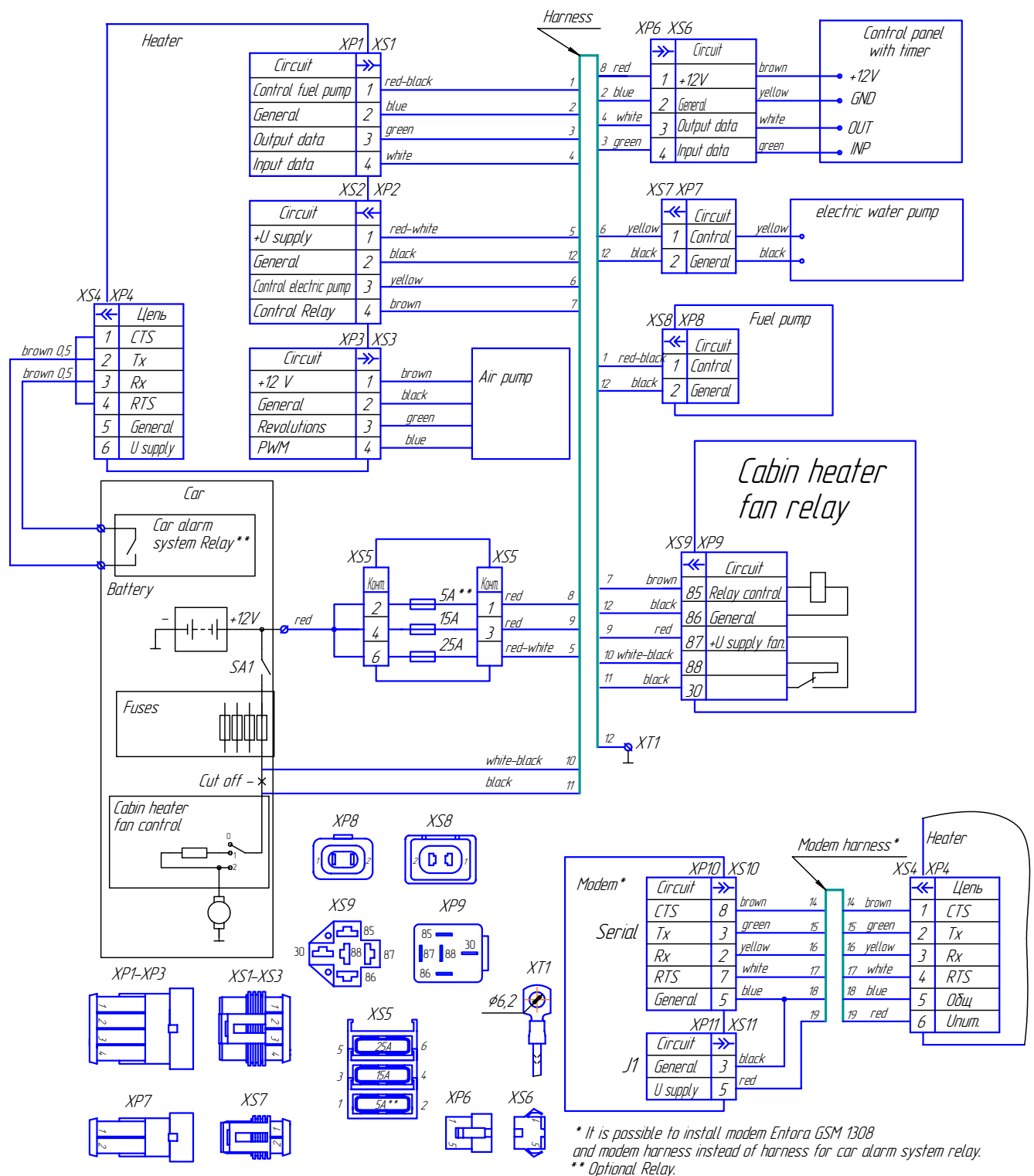


Figure 4.1 – Electric circuit

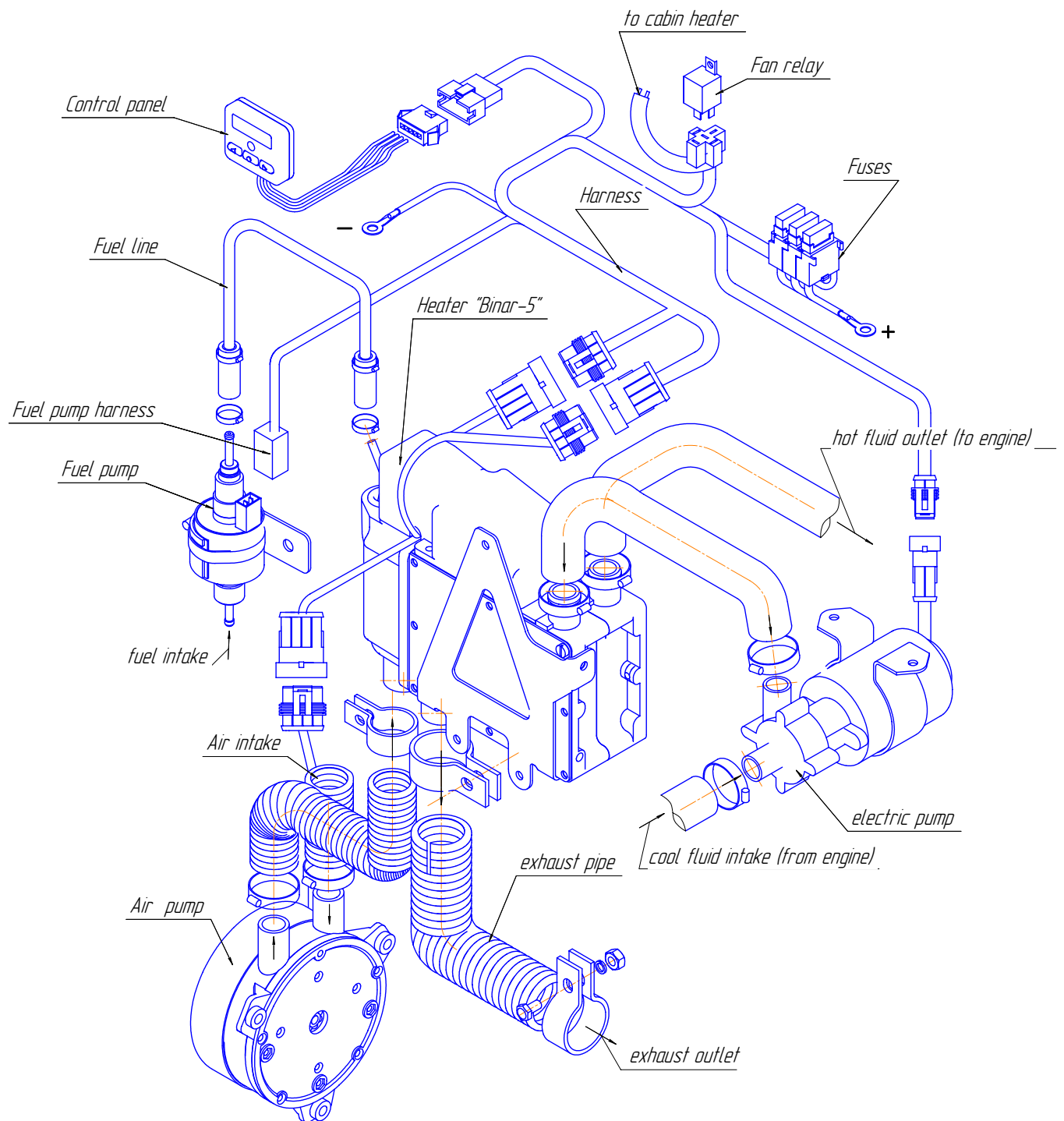


Figure 4.2 – Pre-heater basic components

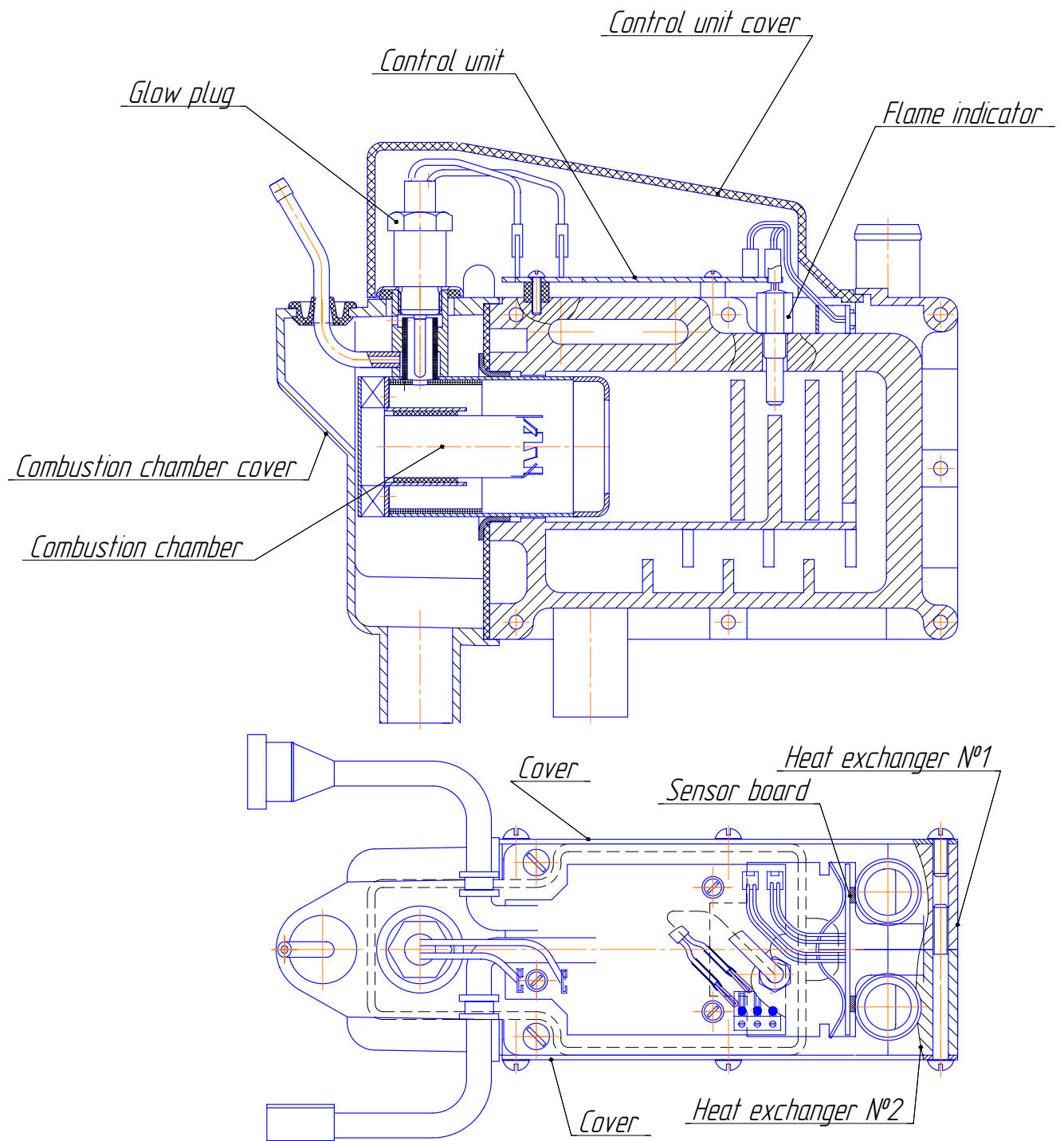


Figure 4.3 – Heater basic components

6 The pre-heater Control devices (according to the choice of the consumer).

6.1 Control panel with timer (is in set with pre-heater).

6.1.1 Control panel is provided for:

- indication of running time;
- the pre-heater switch off and switch on in manual mode;
- operation mode indication (ignition, full mode, low mode, cooling down mode, purging) and time of the pre-heater operation;
- set up of the timer for starting up the pre-heater in automatic mode;
- vehicle cooling liquid temperature indication;
- malfunction code indication during the pre-heater operation;
- parameters view (version number of the set program)

On the surface of the timer there are: four-digit LED indicator, four LEDs and three knobs. Functionality of the knobs and LEDs see on the figure 6.1.

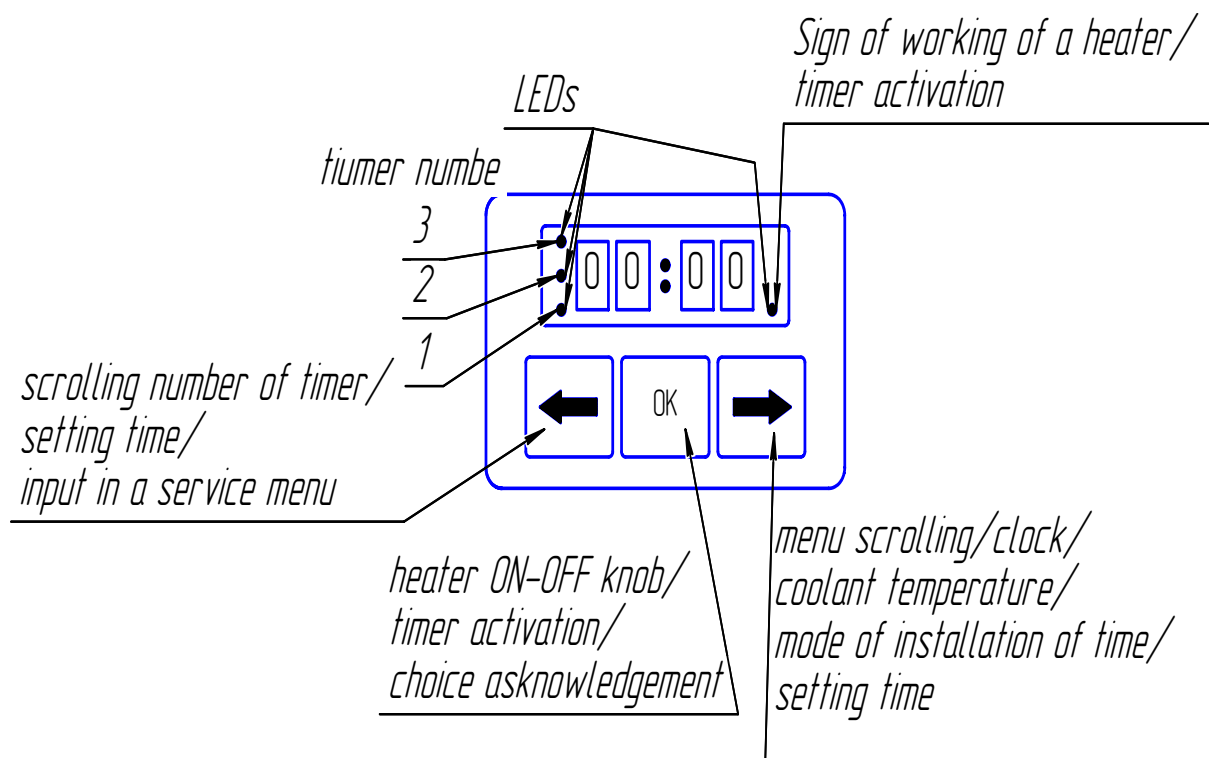


Figure 6.1-Control panel

6.1.2 Setting “running time” on the control panel.

While first time pre-heater is connected to the vehicle electric circuit or after breaks in power supply there's zeroing of the running time on the control panel.

The indicator looks like (fig. 6.1)

In view of energy saving 30 sec after the last press of the knob the indicator stops lightning. To restart lightning it is necessary to press any knob.

To set or change the running time (hour or min) it's necessary to press and hold on the knob “⇒” more than 2 sec, two first digits of the indicator start blinking. Then with continuous or interrupted pressing the knobs “⇒” or “⇐” set the necessary time. Pressing the knob “⇒” leads to time increasing to one hour. Pressing the knob “⇐” leads to time decreasing to one hour. After setting the necessary time press the knob “OK”, digits 3 and 4 start blinking. With help of the knobs “⇒” or “⇐” set necessary minutes.

After setting minutes press the knob “OK”, the indicator will show “C” in first digit (correction of the clock rate) and the 3d and 4th digit of the indicator will be blinking see figure 6.2. Maximum correction of the clock rate is +10...-10 sec a min. With the knobs “⇒” or “⇐” set the necessary correction of the clock rate.

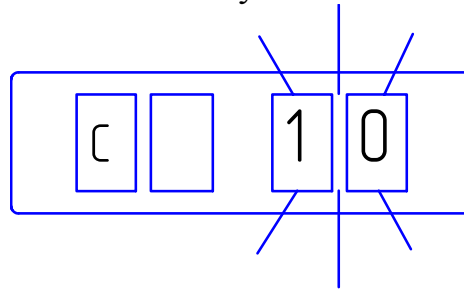


Figure 6.2- Clock rate correction

After clock rate correction press the knob “OK” to come back to the mode of clock setting see figure 6.3.

6.1.3 Manual pre-heater start up.

Initial state of the indicator see figure 6.3 (shows running time or the temperature of the cooling liquid)

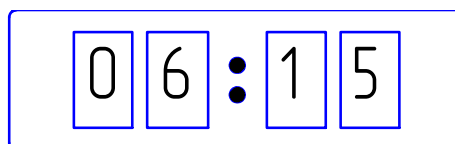


Figure 6.3 Running time on the indicator

When pressing the knob “OK” the pre-heater is activated, the indicator shows operation mode “P”- ignition, counting time of operation in minutes on the 3d and 4th digits, the LED is lightning constantly see fig.6.4(the indicator shows that since the moment of start up the pre-heater is in operation for 2 minutes).

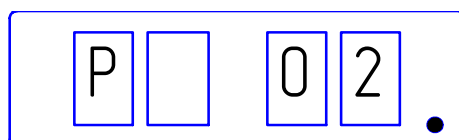


Figure 6.4

When the pre-heater is activated the first digit shows the mode of operation see figure 6.5, 6.6, 6.7, 6.8, 6.9.

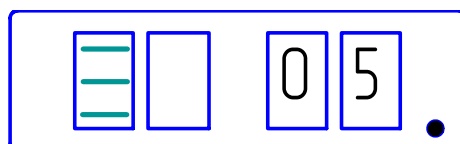


Figure 6.5 Full mode

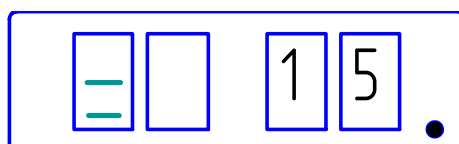


Figure 6.6 Middle mode

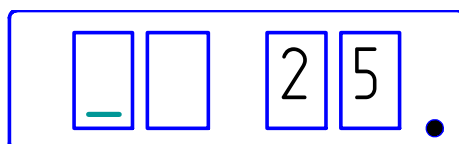


Figure 6.7 Low mode

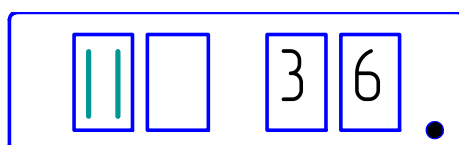


Figure 6.8 Cooling down mode

To switch off the pre-heater press the knob “OK”, the indicator will show operation mode “П”-purging, time counting of the pre-heater operation and frequent blinking of the LED see figure 6.9.

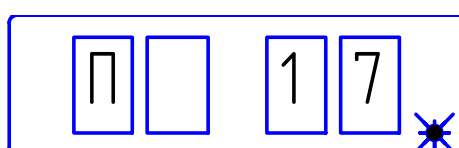


Figure 6.9-Indicator after the pre-heater switching off.

Attention! Any information is on the indicator for 30 sec, and then the digits will go out, the LED is lightning or blinking till the pre-heater is switched off. To restart indication of the information presses any knob.

While the pre-heater operation pressing the knob “⇨” will show the information about the temperature of the cooling liquid “t”- temperature, 76 - is the temperature, repeat pressing of the knob will show the operation mode of the pre-heater. See figure 6.10.

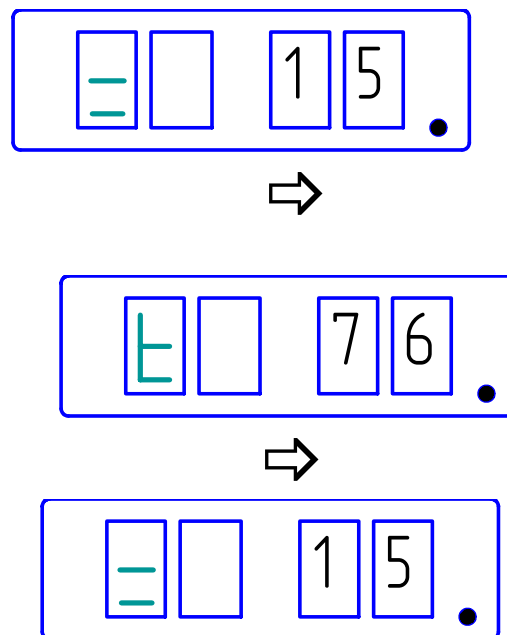


Figure 6.10- Information after pressing the knob “⇨”.

6.1.4 Malfunction code indication in case of the pre-heater failure

During start up or operation of the pre-heater there may be malfunctions.

In case of malfunctions the control unit automatically sends command to switch off the pre-heater. Every malfunction is coded and is shown on the indicator see figure 6.11. While this the code of the malfunction and the LED indicating the activity of the pre-heater are blinking rarely. See the codes of malfunctions in table 6.1.

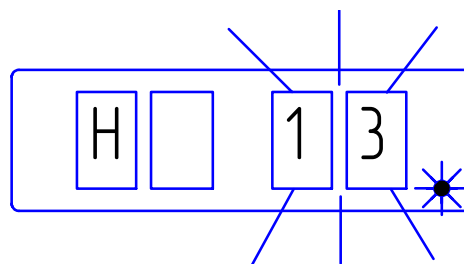


Figure 6.11- indicator shows the pre-heater fault.

6.1.5 The pre-heater automatic activation.

To activate the pre-heater automatically it's necessary to set up time of automatic start up. Control panel lets to record three automatic starts. Any of the three will be initiated on condition of activation. One may set up the pre-heater activation time from the mode "Running time" pressing the knob "←". The indicator will look like on the figure 6.12.

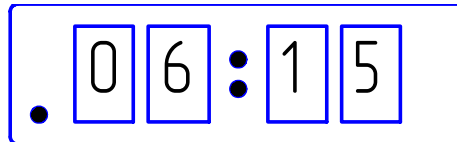


Figure 6.12 setting the 1st timer

To correct start up time it's necessary to press the knob "⇒", while this two first digits will be blinking (hours). After the necessary time setting with the help of the knobs "⇒" and "←" press the knob "OK", after this digits 3 and 4 will be blinking and it's possible to set the necessary time in minutes and then to press the knob "OK" to confirm the time set.

To set or correct time in the second timer it's necessary to press the knob "←", the indicator will look like on the figure 6.13. Set time for the pre-heater automatic start up in sequence described for the 1st timer.

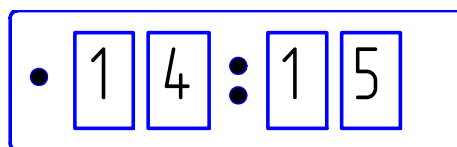


Figure 6.13- Setting the 2d timer

To set or correct time for the 3d timer it's necessary to press the knob "←" and the indicator will look like on the figure 6.14. Set time for the pre-heater automatic start up in sequence described for the 1st timer.

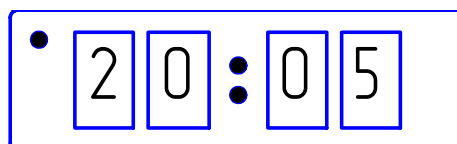


Figure 6.14 – setting the 3d timer

To activate one of the three automatic starts (only one start up may be active, for example timer №2) it's necessary to choose the number of the timer pressing the knob “←=” and the knob “OK”. While this timer will be switched over to the mode of preparation to the pre-heater automatic starts up. The indicator will be looked like on the figure 6.15. The LED of the activated timer in time mode will be blinking rarely.

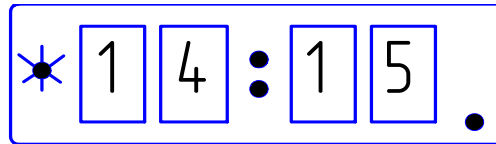


Figure 6.15- The 2d timer activation.

Repeated pressing of the knob “OK” will cancel a command of activation.

Malfunction codes.

Table 6.1

codes	Malfunction description	Notes / Troubleshooting
01	Overheating	1.Check thoroughly the liquid circuit 2.Check circulation pump, replace if necessary 3.Check temperature sensor and overheating sensor ,replace if necessary
02	Overheating is detected. Difference between temperatures measured by the heat sensor and overheating sensor is too big.	1.Check thoroughly the liquid circuit 2.Check circulation pump, replace if necessary 3.Check temperature sensor and overheating sensor ,replace if necessary
03	Faulty temperature sensor №1 on the board sensors	Check connecting leads. Output signal and voltage are in linear dependence from temperature (0°C corresponds to 2.73 V; 1°C temperature rise corresponds 10μV output signal increase).Check the sensors and replace the sensor board with a new one, if necessary.
04	Faulty temperature sensor №2 on the board sensors	Check connecting leads. Output signal and voltage are in linear dependence from temperature (0°C corresponds to 2.73 V; 1°C temperature rise corresponds 10μV output signal increase).Check the sensors and replace the sensor board with a new one, if necessary.
05	Faulty flame indicator	Check connecting leads. Check ohmic resistance between indicator contacts, it must be not more 10 Ohm. Replace the indicator if necessary.

06	Faulty temperature sensor on the control unit	Replace control unite of the pre-heater
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Table 6.1

07	Flame failure in low mode	See the description of malfunction code 08
08	Flame failure in full mode	Check air duct, exhaust gas-escape channel and fuel supply, correct troubles, replace fuel pump and flame indicator if necessary.
09	Glow plug malfunction	Check the glow plug, replace if necessary.
10	Air pump motor malfunction	Check the electric wiring of the air pump motor, replace the air pump, if necessary.
11	Overheating. Heating rate is too high	1.Check thoroughly the liquid circuit (airlock is possible before the air pump, cooling liquid cannot be pumped through the heater) 2. Check cooling liquid for fluidity at low temperatures. 3.Check the pump, replace if necessary
12	Shutdown, voltage boost	This malfunction is possible if the pre-heater is switched on when vehicle engine is running. The possible reason of the trouble is vehicle voltage regulator failure
13	No more tries to start the pre-heater are left	In case there are no more tries to start the pre-heater left check fuel supply and amount of fuel supplied. Check the air supply system to the combustion and exhaust gas-escape channel, check ignition plug.
14	Circulation pump malfunction	Check circulation pump wiring for short-circuit fault or disconnection fault. Replace the pump if necessary.
15	Shutdown, low voltage less then 9.5 V	Check voltage on XS2 connector of the pre-heater. Check the battery, regulator and power supply wiring.
16	Excessive ventilation time	The pre-heater is not cooled enough during purging. Check the air duct and exhaust gas-escape channel. Check the combustion detector and replace, if necessary.
17	Fuel pump malfunction	Check the electric wiring of the fuel pump for the short circuit check the pumping capacity and replace the fuel pump if necessary.
20	No connection between control unit ant control panel	Check fuses 5A. Check wiring and connectors.
21	Flame failure at “warming up” mode	See the description of malfunction code 08
27	Air pump failure. Motor won’t rotate	Check the wiring of the air pump. Control unite and motor replace if necessary.

28	Air pump failure. The motor rotates without control	Check the wiring of the air pump, control unite, replace if necessary.
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6.2 Use and connection to the vehicle remote alarm system for activation and switching off the pre-heater with the help of transmitter.

You can use vehicle remote alarm system to control the pre-heater operation if there is an additional channel. The relay with normally open contact is connected to output of the channel, contacts must be connected with harness XS4 which is connected to six-pins connector XP4 on the pre-heater control unit board (see figure 4.1). There's a wire in the harness connecting contacts 1 and 4 of the connector. It's necessary for the control unit to identify connected harness of the remote alarm system and to receive its operation signals.

On closing the relay contacts according to the signal of vehicle alarm system transmitter the command "start up" is formed, when relay contacts are opening the command "switch off" is formed. The operation of the pre-heater in this case doesn't differ from starting up by others control devices. After start up the pre-heater is working for 40 min and then switches off. It is possible to stop the operation of the pre-heater with the help of the transmitter and from the control panel.

To start up the pre-heater next time with the transmitter it's necessary to switch off the relay and switch it on again.

If there's a channel of feedback control in the transmitter there will be mark confirming the relay is switched on.

Type of the transmitter has no significant meaning; the only requirement is that the relay current consumption must not exceed current capacity of the remote alarm system channel.

Connector XS4 which is connected with the harness is used for modem connection. The harness XS4 must be disconnected from the control unit and connected with modem.

Simultaneous use of modem and remote control system is impossible!

6.3 The use and installation of modem for the pre-heater activation.

You can operate the pre-heater by the mobile phone! In the easiest case you can send SMS with command "start up". Activation of the pre-hater will be fulfilled automatically. The car will be warmed up by your coming.

To control the pre-heater operation remotely there's possibility to connect GSM modem to the control unit. Activated SIM card is necessary to operate the pre-heater with the modem.

IMPORTANT! It is necessary to cancel the protection of the SIM with PIN.

There are three commands: "start up", "switch off", "state request". There are 4 variants of the 1st command: command without answer, command with answer request and failure note, command with answer, and command with failure note request.

There are 2 variants of the second command. Command with answer and command without answer. The 3d command is a request of the answer.

When the pre-heater receives the command “start up without answer” it is activated and if there’s no malfunctions it will be switched off in 40 min. When the pre-heater receives the command “start up with answer” it will start working cycle and after checking of the equipment sends SMS about the pre-heater state. When the pre-heater receives the command “start up with failure note request” it will be ready to send SMS with malfunction code in case of malfunction during the operation. When the pre-heater receives the command “start up with answer and failure note request” it will start working cycle and send SMS about its state and will be ready to send SMS with malfunction code in case of malfunction.

Activated pre-heater doesn’t accept the command “start up” and the switched off pre-heater doesn’t accept the command “switch off”, SMS answer if requested will contain information about the pre-heater state.

To protect the pre-heater from unauthorized operation, SMS must contain password, 4 last figures of IMEI are used for this purpose.

Command format: @C.A.NNNN

C-command: 1-“start up”, 3-“switch off”, 8-“state request”

A-parameters: 0-command without answer, 1- with answer, 2- with failure note, 3-with answer and failure note.

NNNN- 4 last figures of IMEI.

The list of commands

Start up without answer: @1.0.NNNN

Start up with answer: @1.1.NNNN

Start up with SMS failure note request: @1.2.NNNN

Start up with answer and SMS failure note request: @1.3.NNNN

Switch off without answer: @3.0.NNNN

Switch off with answer: @3.1.NNNN

State of the pre-heater: @8.0.NNNN

Pre-heater answer: temperature(C°), operation mode.

Operation modes:

Stop- switched off, doesn’t work

R- ignition

Lo- low mode

Hi- full mode

Prod- purging

Wait- waiting mode

V- Burning out

Examples of the answers:

Answer	Answer decoding
T=-7.stop.	Temperature =-7°C, the pre-heater is switched off
T=-3.R.Time=0:25.	Temperature =-3°C.Ignition.Time of operation 25 sec.
T=15.Hi.Time=6.	Temperature =15°C.Full mode. Time of operation 6 min.
T=63.Prod.Time=35.	Temperature =63°C.Pyrging.Time of operation 35 min.
T=75.Prod.Time=35.Error=17(10:20)	Temperature =75°C.Pyrging.Time of operation 35 min. Malfunction code 17. Time of malfunction origin in 10 min 20 sec after start up of the pre-heater.

The modem is put in case with dimensions 70*70*25mm. There are 2 connectors on the back wall, power supply connector and information connector, on the front wall there's a socket for SIM, antenna connector and LED indicator.

There's harness for connection with the pre-heater, from one end of the harness there are 2 connectors which are connected to the modem, from the other end there's flat six-pin connector for connection with control unit of the pre-heater. Remove plastic cover from the pre-heater to connect the harness.

There's XP4 connector on the control unit board, it is with harness XS4 to be connected with relay, operated by remote alarm system. This harness must be disconnected.

There's detachable antenna witch is fixed to the windscreen of the vehicle. This antenna provides the connection with cellular operator.

After installation and fixation of SIM, antenna and cable, the modem must be installed in car cabin, in the glove compartment or under the dashboard.

After connection of the pre-heater to the source of power, the modem start the search of the cellular net, the indicator is blinking. When the connection is set the indicator is lightning constantly.

Commands to start up and switch off the pre-heater are send from the control panel and from the modem independently. The pre-heater switched on by SMS can be switched off pressing the middle knob on the control panel, and vice versa.

Attention!

Please be aware of the fact that SMS can be received with delay because of technical problems of cellular operator. To be sure that command is received by the pre-heater in time, adjust your mobile phone so to get the note about SMS delivery or use command with answer.

If SMS with start up command is not delivered (because of cellular **connection operator fault**) send SMS to switch off the device. It will prevent the pre-heater start up when you don't need it.

7 Installation specification for pre-heater and its assemblies.

7.1 General.

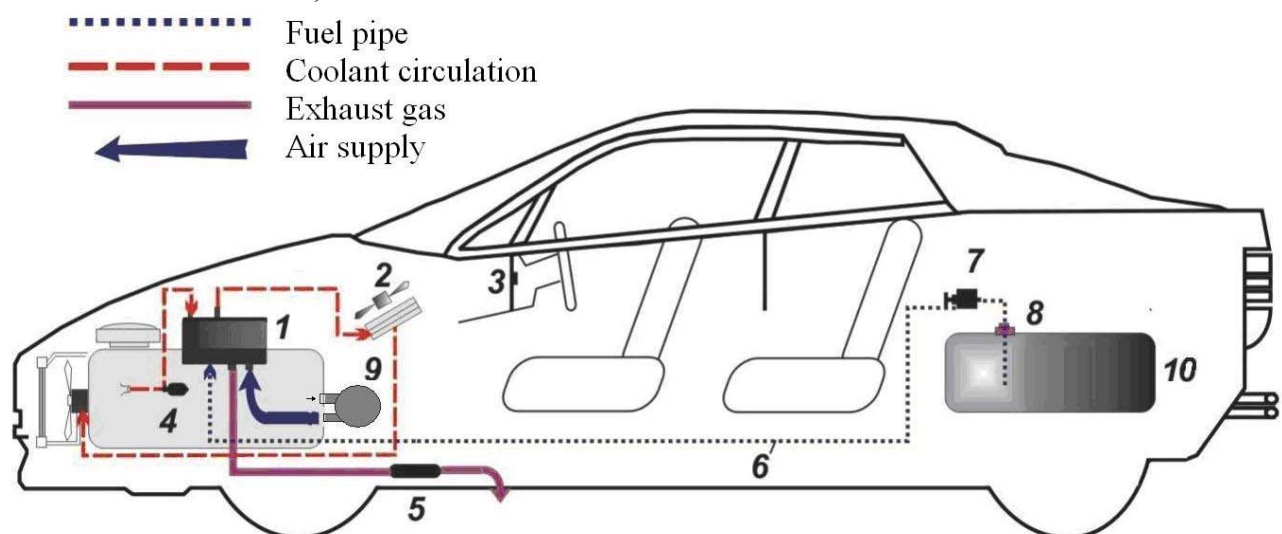
- 7.1.5 Heater shall be located lower the radiator overflow tank. Motor air pump shall be installed lower the radiator overflow tank and the heater.
- 7.1.6 Check up fluid flow in the heater and the engine cooling system; be sure it has the same direction.
- 7.1.7 Remove air blocks from the engine cooling system and the heater on completion of the heater installation. All the pipe junctions shall be leak-proof.
- 7.1.8 Fuel and coolant pipes shall be assembled in a way avoiding their contact with hot or vibrating components of the vehicle.
- 7.1.9 It is unacceptable to operate the pre-heater with the cooling fluid frozen.
- 7.1.10 On completion of any activities with the cooling system (repair work, cooling fluid replacement) it shall be purged to remove air blocks as per

7.2 Installation of the pre-heater units and assemblies.

7.2.1 Installation of the heater.

The heater shall be installed under the bonnet as shown in Figure 4. It is unacceptable to install the heater on the engine, passenger compartment or cab of a vehicle.

The heater shall be installed with account of its operating positions (ref, Fig. 7.2, items 7.1.1 and 7.1.2).



- 1 Heater
- 2 Parking heater
- 3 Control panel

- 6 Fuel pipe
- 7 Fuel pump
- 8 Fuel intake

4 Motor pump
5 Exhaust pipe

9 Air pump
10 Fuel tank

Figure 4 - Pre-heater installation diagram

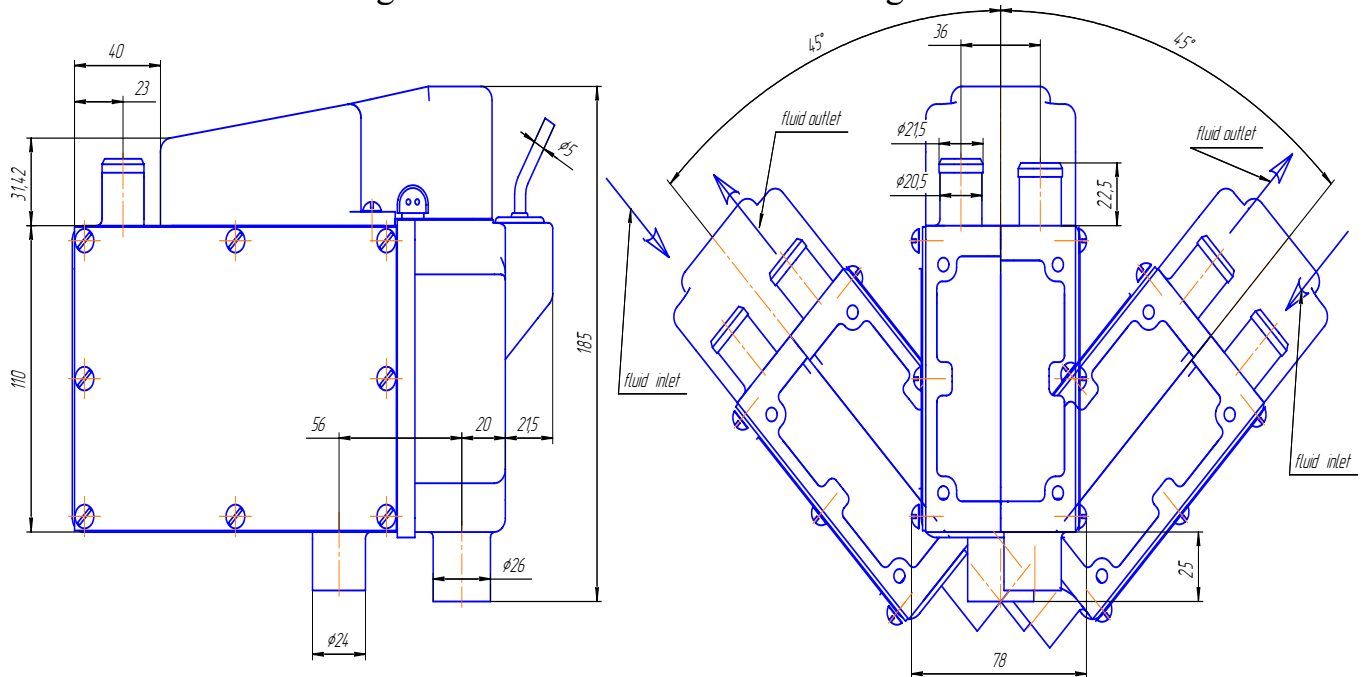


Figure 7.2 – Heater acceptable operating positions

Attention! In case the heater is tilted to be installed on the vehicle, fluid hoses shall be connected to the heater adapters as shown in Figure 7.2.

7.2.2 Installation of the air pump

It is advisable to install the air pump as close as possible to the heater with the air duct having no unnecessary bends. It is unacceptable to install the air pump on the engine.

Position of the air pump is free. Overall and mounting dimensions are given in Figure 7.3.

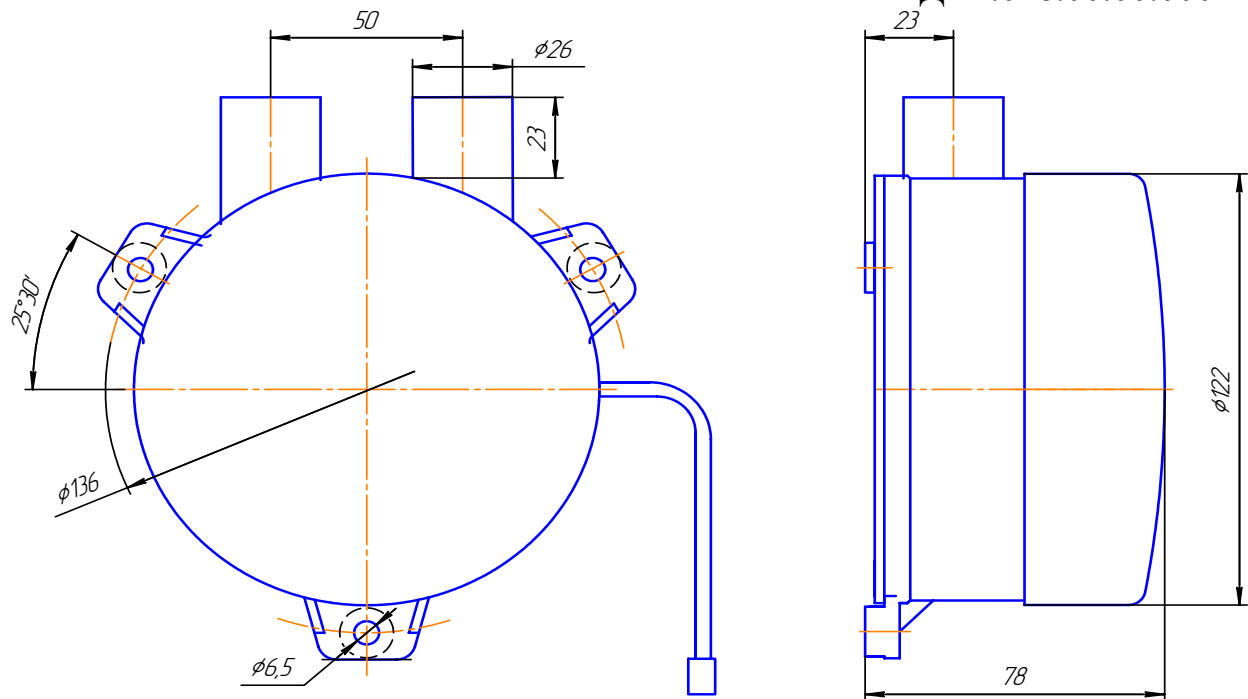


Figure 7.3 – Overall and mounting dimensions

7.2.3 Installation of the air intake.

The air intake shall be installed on the air pump as per Figure 4.2. Air for combustion shall not be absorbed from the passenger compartment, vehicle cab or baggage compartment. Suction inlet of the intake shall be assembled so that to avoid its blockage, ingress of snow and free drain of water. It is prohibited to locate the inlet against the incident flow.

7.2.4 Installation of the motor pump.

The motor pump shall be located in conformity with recommendations given in items 7.1.1 and 7.1.2.

Operating position of motor pipe is whatever from horizontal to vertical with the outlet fitting up.

7.2.5 Installation of pipes.

Pipes shall be connected with the pump, pre-heater and engine as shown in Figures 4.2, 7.1 and 7.2. Pipes shall not run in vicinity with the exhaust pipe and engine components having high temperature. Pipe junctions with other components shall be fixed with clamps. Pipe interconnections shall be fixed with fittings.

7.2.6 Installation of the exhaust pipe.

Note that exhaust pipe has high operating temperature. The exhaust pipe (flexible corrugated metal hose) shall be cut to necessary length.

The exhaust pipe is fixed with clamps slightly downwards in the direction of exhaust. Round holes 3mm in diameter for moisture drain shall be made at bends in the lowest points of the pipe.

To optimize connection with the heater fitting and to guarantee better sealing there shall be done a lengthwise cut (about 15mm long) on the exhaust pipe. The cut shall be the same length as the male fitting. The exhaust pipe shall not transcend the overall dimensions of the vehicle. Discharge gas shall be vented out. The exhaust outlet and combustion air inlet shall be located so that to avoid resuction of discharge gas. As well, there shall be taken measures to avoid penetration of this gas inside the passenger compartment or their absorption by the fan. Moreover discharge gas shall not affect operation of the other assemblies of the vehicle.

The exhaust outlet shall be assembled so that to avoid its blockage, ingress of snow and free drain of water. It is prohibited to locate the outlet against the incident flow.

7.2.7 Installation of the fuel supply system of the pre-heater.

Failure to comply with the following recommendation will cause to malfunctions.

Fuel supply of the pre-heater with fuel intake.

Fuel intake is installed to the fuel tank according to figure 7.5.

- a) fuel intake and special washer installation in the fuel tank is performed according to figure 7.5,
- b) installation of fuel supply line from fuel intake to the pre-heater is performed according to figure 7.6

The fuel pipe from the fuel pump to the heater shall have no slope.

Attention!!! While making the inlet in the fuel tank follow safety measures for activities with tanks which were used for inflammable and explosive fuel.

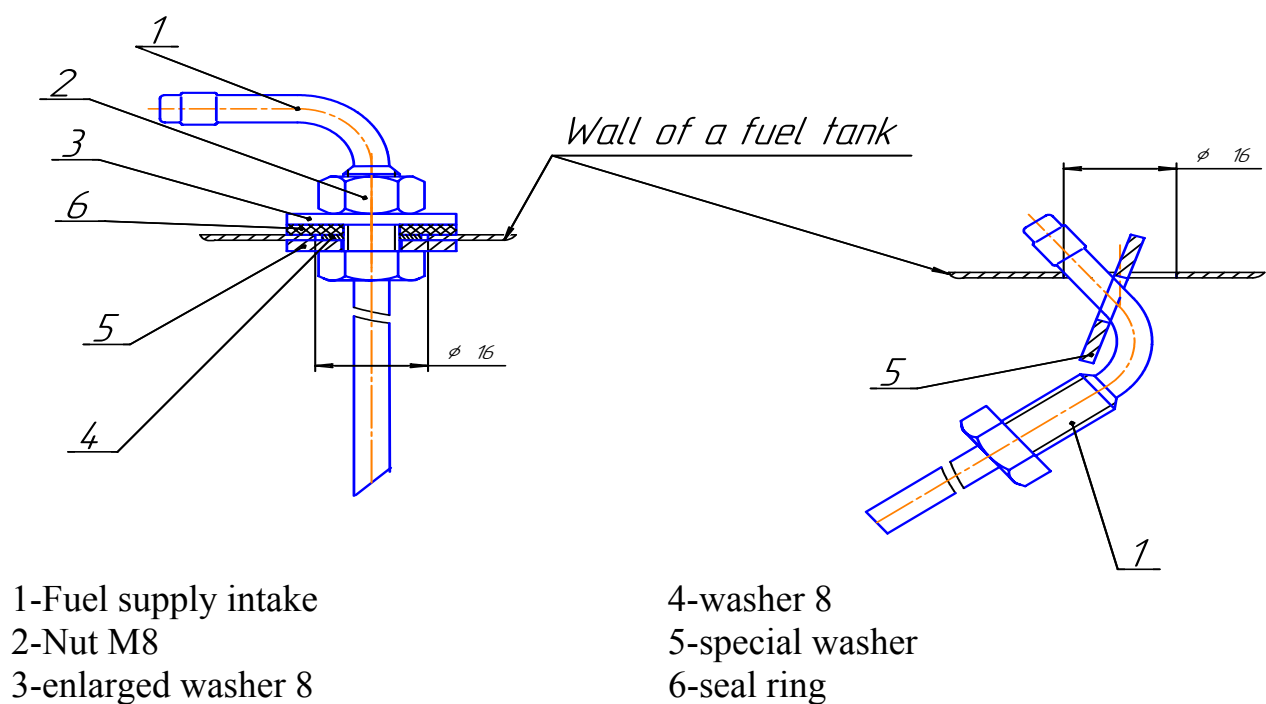
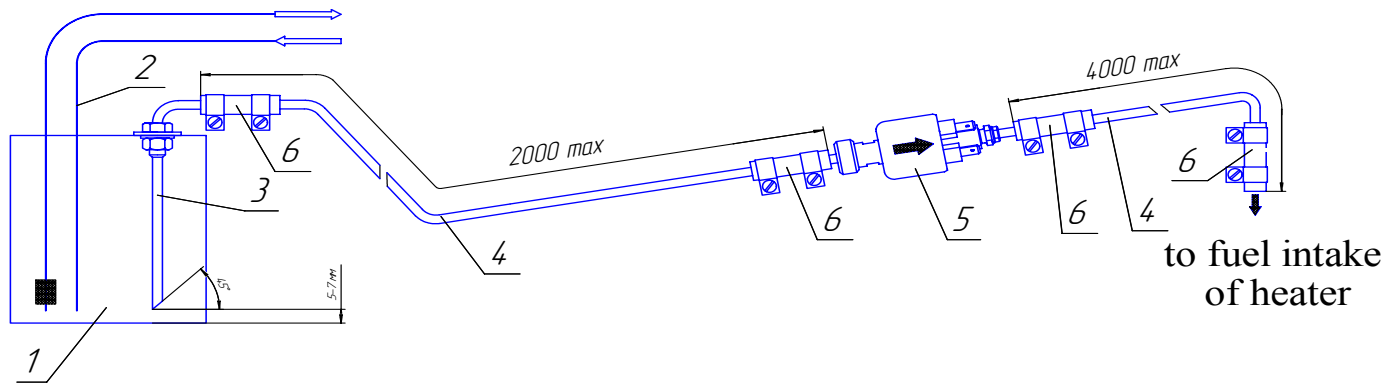


Figure 7.5- Fuel intake installation



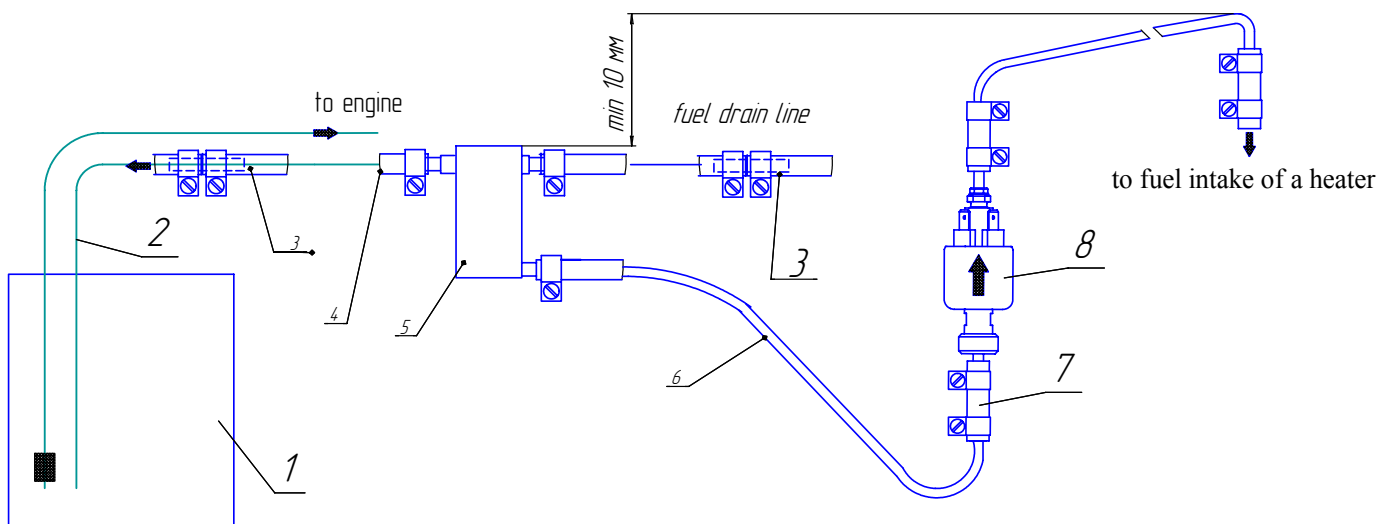
- 1-fuel tank of the vehicle
- 2- fuel supply line of the vehicle
- 3-fuel supply intake

- 4-connecting pipe(fuel supply line)
- 5-fuel pump
- 6-rubber or polyurethane sleeve

Figure 7.6- Installation diagram for the pre-heater connection with fuel supply line

Intake of the fuel for the pre-heater is allowable to perform from fuel drain line from engine to tank on condition that storage tank is installed. Fuel drain line shall have end at the bottom of the fuel tank.

It is advisable to install the tank in engine area close to the pre-heater fuel pump. Installation shall be performed according to figure 7.7.



- 1 - vehicle fuel tank
- 2 - fuel drain line from the vehicle engine to the tank
- 3 - adapter
- 4 - fuel supply line

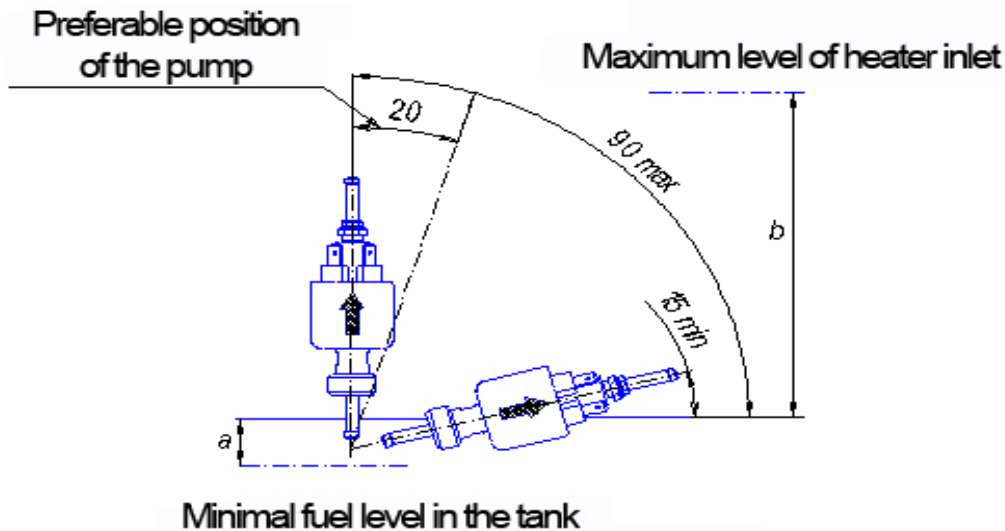
- 5 - storage tank
- 6 - connecting pipe (fuel pipe line)
- 7 - rubber or polyurethane sleeve
- 8 -fuel pump

Figure 7.7-Installation diagram of storage tank to the fuel drain line and its connection with fuel pump.

7.2.8 Fuel pump and fuel pipe installation.

It is advisable to install fuel pump close to the fuel tank and lower fuel level in the tank.

Position of the fuel pump is given in Figure 7.8.



- a – lifting capacity: up to 500 mm in a free-flow tank при безнапорном баке;
up to 150 mm, in case of underpressure in the tank.
- b – pump head between the fuel pump and heater: up to 1500mm

Figure 7.8- Fuel pump acceptable assembling position

While assembling, the fuel pipe shall be cut only with a sharp knife, as shown in Figure 7.9. Cutoffs shall be free of restriction, dents and burrs.

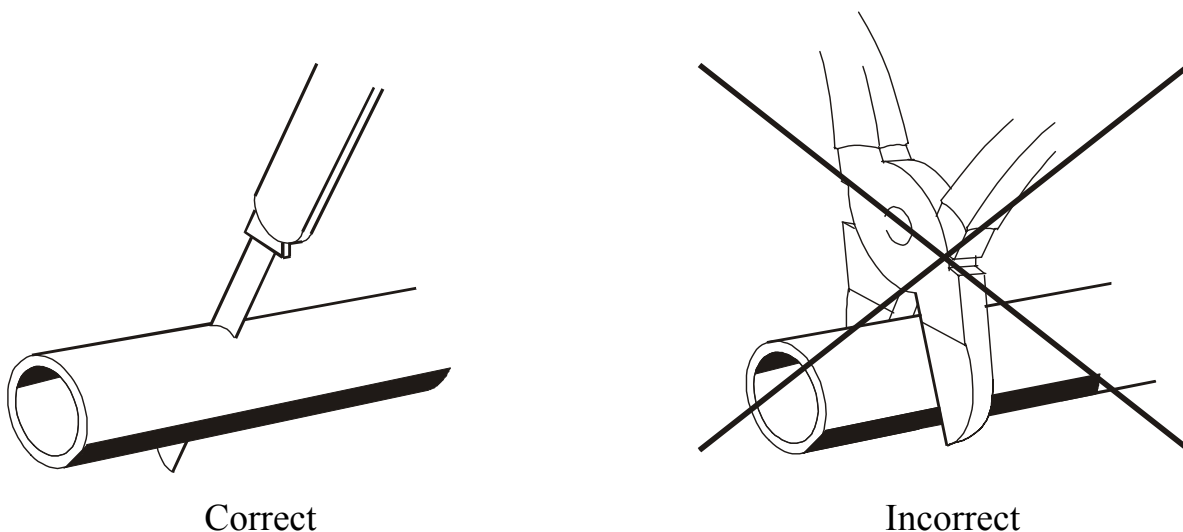


Figure 7.9 – Cutting the fuel pipe before installation

Attention! The fuel pipe and fuel pump shall be protected from heating. It is prohibited to install them close to the exhaust pipe or on the engine.

7.2.9 Assembling of the pre-heater electrical harness.

The pre-heater wiring harness shall be connected as shown in Figure 1 (pre-heater electric circuit) and Figure 1.

While assembling note that heating, deformation or displacement of harness during operation of the vehicle is unacceptable. The wiring harness shall be fixed with plastic clamps to the components of the vehicle.

Attention! Assembling shall be performed with the safety devices dismantled.

7.2.10 Installation of the control panel.

Control panel is installed in the cabin on the dashboard or any other comfortable for the driver place. The control panel is fixed by adhesive tape. Degrease the surface before installation of the panel, remove protective film from the tape.

8 Post-installation checkout.

8.2 On completion of the assembling, the following shall be guaranteed:

- leak proof of the fluid system;
- leak proof of the fuel pipes;
- security of the pre-heater electric contacts attachment

8.3 Open the heater control valve to full. Remove air blocks from the fluid system of the vehicle following instructions of the vehicle manufacturer. Put vehicle heater fan switch in position of min rotation.

8.4 Install 15A, 25A and 5A safety devices, control panel indicator will light.

8.5 To perform the pre-heater operation test press the middle button. The pre-heater shall start combustion; the information will be on the indicator. Further on the pre-heater operates automatically. In 40-45minutes the pre-heater stops its operation automatically. To stop the work of the pre-heater is possible at any time pressing the middle knob on the control panel.

- 8.6 While performing the pre-heater operation test it is necessary to check if the heater fan switches on. Normally the fan is activated when the cooling liquid reaches 40°C.
- 8.7 If the pre-heater demonstrates faulty operation during its switching on or in the process of operation, malfunction code will be on the indicator.
- 8.8 The productivity of the fuel pump is not big, that's why when the fuel line is empty, and it is filled slowly. The pre-heater performs 2 tries of ignition and if there's no fuel yet stops the activity with malfunction code 13- "No more tries to start the pre-heater are left". There's need to switch on the pre-heater until the fuel fills the fuel pipe line.
- 8.9 Start the pre-heater with the vehicle engine on and verify its operation.

Attention! Note that cooling fluid temperature readings displayed on the vehicle instrument panel and control panel may vary, as temperature is measured in different parts of the fluid system of the vehicle.

9 Recommendations.

- 9.2 If the pre-heater won't start after switching on, check the fuel in the tank, the battery charged, connectors and fuse 25A are in order.
- 9.3 If control panel won't work (indicator is not lighting) check fuse 5A
- 9.4 If vehicle heater fan won't start automatically when the temperature of cooling liquid over 40°C, check fuse 15A and relay.
- 9.5 If the pre-heater won't switch on and switch off or after purging of the combustion chamber the fan motor will rotate, take off fuses 5A, 25A and then install them again in sequence first 25A, then 5A.
- 9.6 All the rest malfunctions are identified automatically and are shown on the control panel indicator.
- 9.7 See the list of malfunctions and troubleshooting in the Table 6.1 of the present manual.
- 9.8 In case of malfunction while operation except those described in item 9.1, 9.2, and 9.3. consult with repair centers
- 9.9 To ensure consistent performance, the heater should be switched on for up to 5 minutes each month throughout the year (warm seasons included). This procedure is necessary to remove sticky film deposited on moving parts of the fuel pump and other units. Ignoring this operation may cause the pre-heater failure.
- 9.10 Safe performance of the pre-heater depends on the fuel that shall correspond to the season of the year and ambient temperature. See recommended fuel types for diesel pre-heater in the table 6.2

Table 6.2

Ambient temperature, °C	Fuel type or blend
-------------------------	--------------------

0°C and above 0°C	Diesel Л-0, 2-40 Or Л-02-62 ГОСТ 305-82
0°C - 5°C	Diesel 3-0,2 mines 45 ГОСТ 305-82
-5°C - 20°C	Blend diesel 3-0,2 mines 45 ГОСТ305-82(50%) with petrol ГОСТ P511050-97(50%)
Lower then -20°C	Diesel А-0.4 ГОСТ 305-82 or blend diesel 3-0,2 mines 45 ГОСТ 305-82 (50%) and petrol ГОСТ P51105-97(50%)

9.11 An untimely switch to a winter type of fuel may cause a paraffin blockage in the fuel inlet tube filter (if applicable) located in the fuel tank and in the fuel supply pump filter, which may prevent the heater from starting or cause it to stall in mid-operation.

To fix breakdowns, proceed to the following steps:

- a) change the fuel in the fuel tank as according to the ambient temperature,
- b) If the heater does not operate properly once the fuel was changed according to the temperature , check the fuel supply pump filter as follows:
 - remove the fuel supply pump from the vehicle; using a wrench (F/A 17), fix the pump in place, unscrew the pipe stub and remove the filter (see Figure 10.1). Do not fix the pump in place using surfaces other than Surface A when removing and installing the pipe stub,
 - rinse the filter in gasoline and blast it with compressed air,
 - install the filter into the fuel supply pump; use sealant when installing the pipe stub,
 - install the fuel supply pump and check if the heater works.

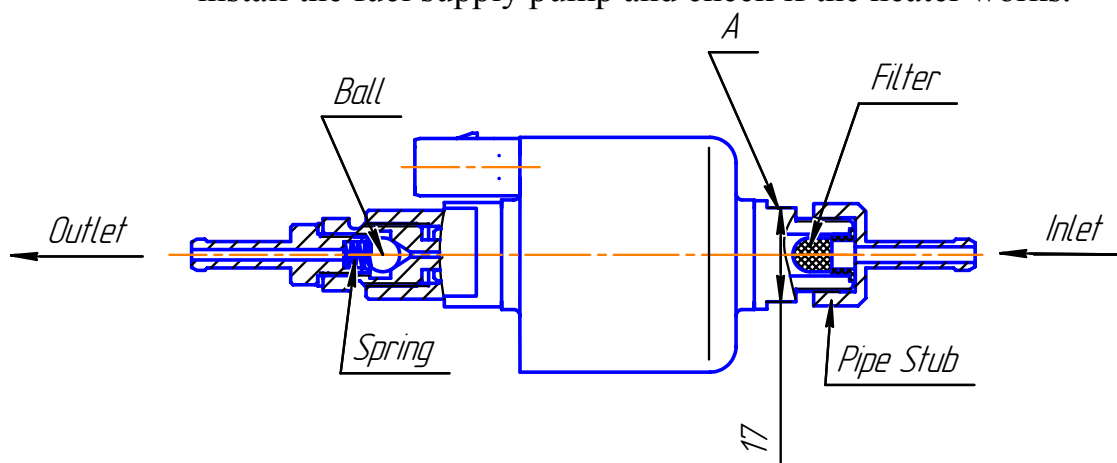


Figure10.1

9.12 Use engine oil, cooling fluid that correspond to the season of the year and ambient temperature.

9.13 Check the battery charge level on a regular basis.

- 9.14 While long storage of the vehicle it is recommended to switch off the heater from the vehicle battery to avoid its discharging (current consumption in non operation mode 30-40 mA).

10 Transportation and storage.

- 10.2 The pre-heaters are safe for transportation and may be transported with any vehicles, including air and rail transport, provided that the packaged products are protected from atmospheric precipitation and climatic factors in conformity with requirements 5 GOST 15150-69, and from mechanical effects in conformity with category C requirements GOST 23216 -78.
- 10.3 As concerns the climatic factors, transportation and storage conditions of the pre-heaters shall correspond to those specified in 5 GOST 15150-69.

11 Warranty.

- 11.2 The pre-heater warranty life is 18 months from the date of sale, i.e. 500h or 50000km haul, provided that the User followed the operating rules, transportation rules and storage rules, foreseen by the present Manual.
- 11.3 In case the vendor stamp and date of sale is missing, the warranty life starts from the pre-heater date of manufacture.
- 11.4 Production malfunctions that may occur during the warranty life are handled by authorized specialists, spare parts are provided by the manufacturer at his expense.
- 11.5 The manufacturer acts on no complaints regarding incompleteness or mechanical damage of the pre-heater.
- 11.6 The present warranty does not cover defects occurred as a result of:
- force majeure – lightning stroke, fire, flood, inadmissible voltage oscillation, traffic accident;
 - violation of installation, operational, transportation and storage rules foreseen by the present Manual;
 - installation, repair or setup of the pre-heater performed by personnel or company, not authorized by the manufacturer;
 - pre-heater non-dedicated usage.

12 Pre-heater delivery configuration

Pre-heater delivery configuration corresponds to that specified in the packing list.

13 Packing and acceptance certificate.

Бинар 5 pre-heater serial number _____

Program code....., manufactured and accepted in conformity with Specification TY 4591-012-40991176-2009, design documentation in force declared serviceable.

Date of packing _____

Packed by _____

Signature

Packed product accepted by _____

Signature

Quality Department Stamp

14 Sale and installation certificate.

Бинар 5 pre-heater serial number

Place and date of sale

.....

stamp

(vendor signature)

Familiarized with the warranty conditions and operating rules, no complaints regarding configuration and outward appearance:

.....

(buyer signature)

Бинар 5 pre-heater serial number _____ was installed and tested on a vehicle (class / model / registration number).

Belonging to -

by (company) -

Stamp (signature of a person in charge)

Limited Liability Company
ADVERS

11, Lesnaya str., Samara, Russia 443100
tel.: (846) 270-65-09, fax: 270-68-65



Stub of warranty service coupon № 2
на Бинар 5 warranty repair

Performed by
(Name, signature)

Withdrawn
(date)



Stub of warranty service coupon № 1
на Бинар 5 warranty repair

Performed by
(Name, signature)

Withdrawn
(date)

Warranty service coupon № 2
Бинар 5 pre-heater warranty repair

Serial No..... date of manufacturing.....

Date and place of sale

stamp
(signature of a person in charge)

Date and place of installation

stamp
(signature of a person in charge)

The following fault handling activities were performed:

Performed by
(Name, signature)

stamp Manager
(maintenance organization)

.....
(signature of a person in charge)

Owner
(signature)

Warranty service coupon № 1
Бинар 5 pre-heater warranty repair

Serial No..... date of manufacturing.....

Date and place of sale

stamp
(signature of a person in charge)

Date and place of installation

stamp
(signature of a person in charge)

The following fault handling activities were performed:

Performed by
(Name, signature)

stamp Manager
(maintenance organization)

.....
(signature of a person in charge)

Owner
(signature)

