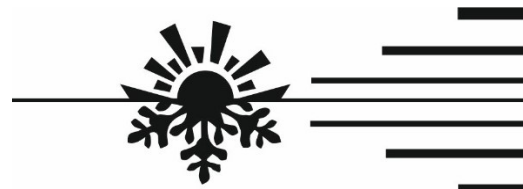


EN



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# Operation manual

Liquid pre-heaters

14TC-Mini-12

14TC-Mini-24

with installation kit

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## 1 Introduction

The present user manual gives information on set-up, operation and servicing of 14TC-Mini-24, 14TC-Mini-24-GP and 14TC-Mini-12-GP diesel engine pre-heater and their modifications (further on – pre-heater), which is used for start heating and warming – up of diesel engines of any trucks with liquid-cooling system at ambient temperature as low as minus 45°C (-113 F).

The functions of the pre-heater are the 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. Warming up passenger's compartment and windscreen (to remove icing) with engine running idle.
4. Possibility of installation of time (a choice of operating time of a heater of 40 minutes to 8 o'clock) and automatic completion of work.
5. Possibility to control the pre-heater from mobile phone (upon purchasing modem).

Pre-heater 14TC-Mini-24, 14TC-Mini-24-GP differ glow plug and control unit.

Pre-heater 14TC-Mini-24/12-GP, 14TC-Mini-24/12-GP-TM differ fuel pump.

Minor structural modifications, introduced by the manufacturer into the design after publication of the Manual, may be missing in the user manual.

## 2 Key features and characteristics

Main technical characteristics of heaters are shown in Table 1.

Technical characteristics are given with  $\pm 10\%$  tolerance at 20°C ambient temperature and nominal voltage.

Table 1

Nominal supply voltage, V	24	12
Fuel	diesel fuel meeting requirements of GOST305 Standard (depending on ambient air temperature)	
Heat carrier	antifreeze agent	
Heat productivity, kW		
- full duty	14,5	14,5
- medium duty	9,2	9,2
- low duty	4,0	4,0
Fuel consumption, l/h (gal/h)		
- full duty	1,9	1,9
- medium duty	1,2	1,2
- low duty	0,5	0,5
Power consumption, W		
- full duty	113	124
- medium duty	100	95
- low duty	76	74
- cooling down	46	46
at start-up during 90 min	155	144
Start up and switch off mode	manual or automatically	
Pre-heater mass in full configuration, kg (lb)	16	

### 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 controls and operates the work of the heater according to the program, heat indicators, etc.
- 3.2. The pre-heater shall be used only for purposes described in the present User Manual.
- 3.3. It is prohibited to use the pre-heater on special trucks used for transportation of dangerous cargo.
- 3.4. It is prohibited to lay the fuel pipe inside the passenger compartment or driver's cab.
- 3.5. Truck with the pre-heater shall be equipped with a fire extinguisher.
- 3.6. It is prohibited to use the pre-heater in areas, where highly inflammable vapors or ample quantity of dust may be generated or accumulated.
- 3.7. It is prohibited to use the pre-heater in enclosed spaces having no ventilation.
- 3.8. While fuelling the truck the pre-heater shall be switched off.
- 3.9. In case of malfunctioning, the pre-heater shall be repaired in service centers, authorized by the manufacturer.
- 3.10. The pre-heater shall be disconnected from the accumulator battery when being repaired or welding is performed with the truck.
- 3.11. It is prohibited to use the pre-heater with cooling liquid frozen.
- 3.12. During installation and dismantling of the pre-heater, there shall be observed safety measures applicable for activities with wiring harness, fuelling system and liquid system of the truck.
- 3.13. It is prohibited to connect the pre-heater to the electric circuit of the truck 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. The pre-heater is powered from the accumulator battery regardless of the availability of the truck frame connection.
- 3.16. It is prohibited to connect and disconnect the pre-heater plug when the pre-heater power is on.
- 3.17. It is recommended to restart the pre-heater after its switching off not earlier than in 5-10 sec.
- 3.18. In case of violation of the above-mentioned rules, the User is deprived of warranty service right.
- 3.19. To ensure the pre-heater operating safety, in case of three successive failures to start it, it is recommended to contact with the service center for trouble-shooting and fault handling.

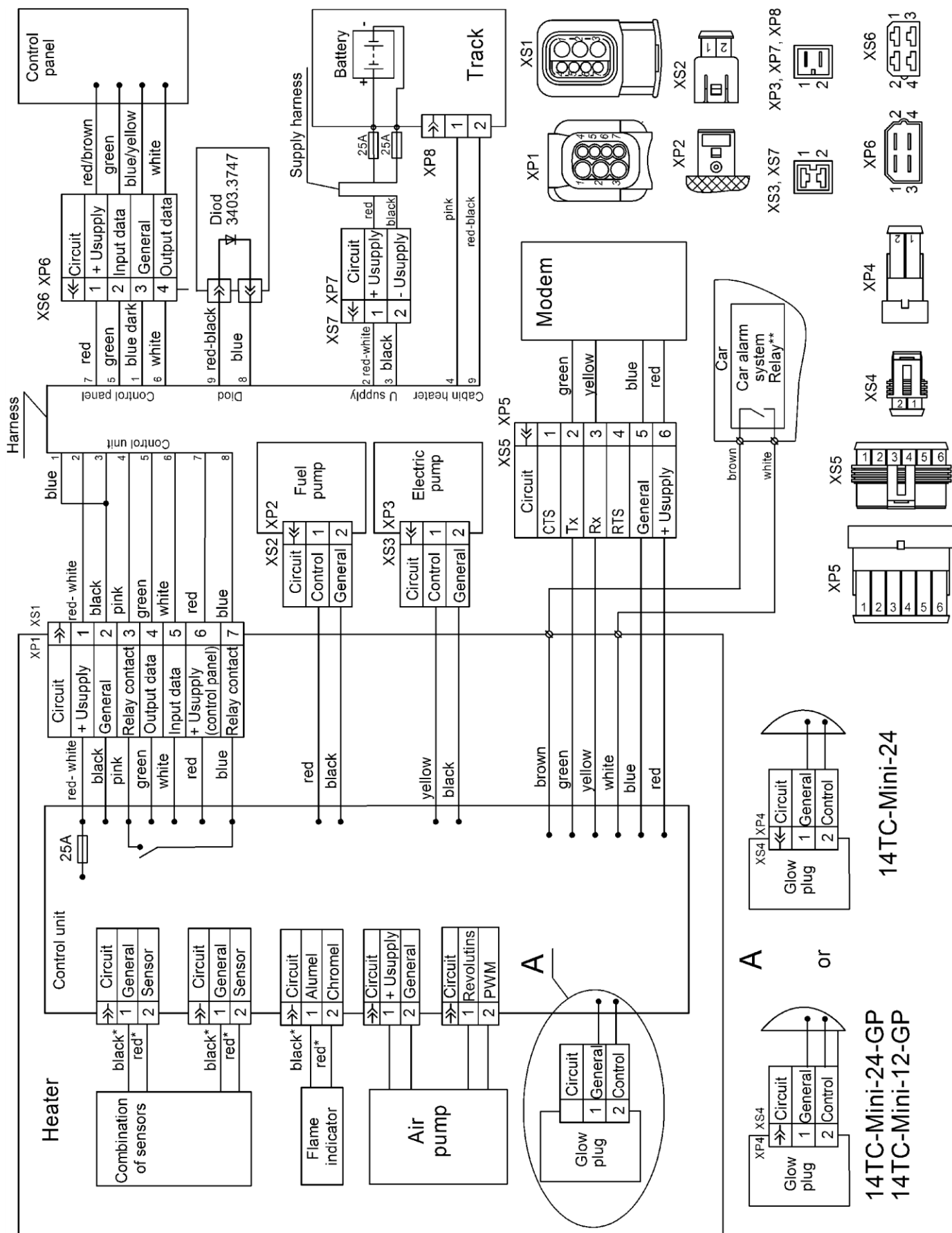


Figure 4.1- Electric circuit

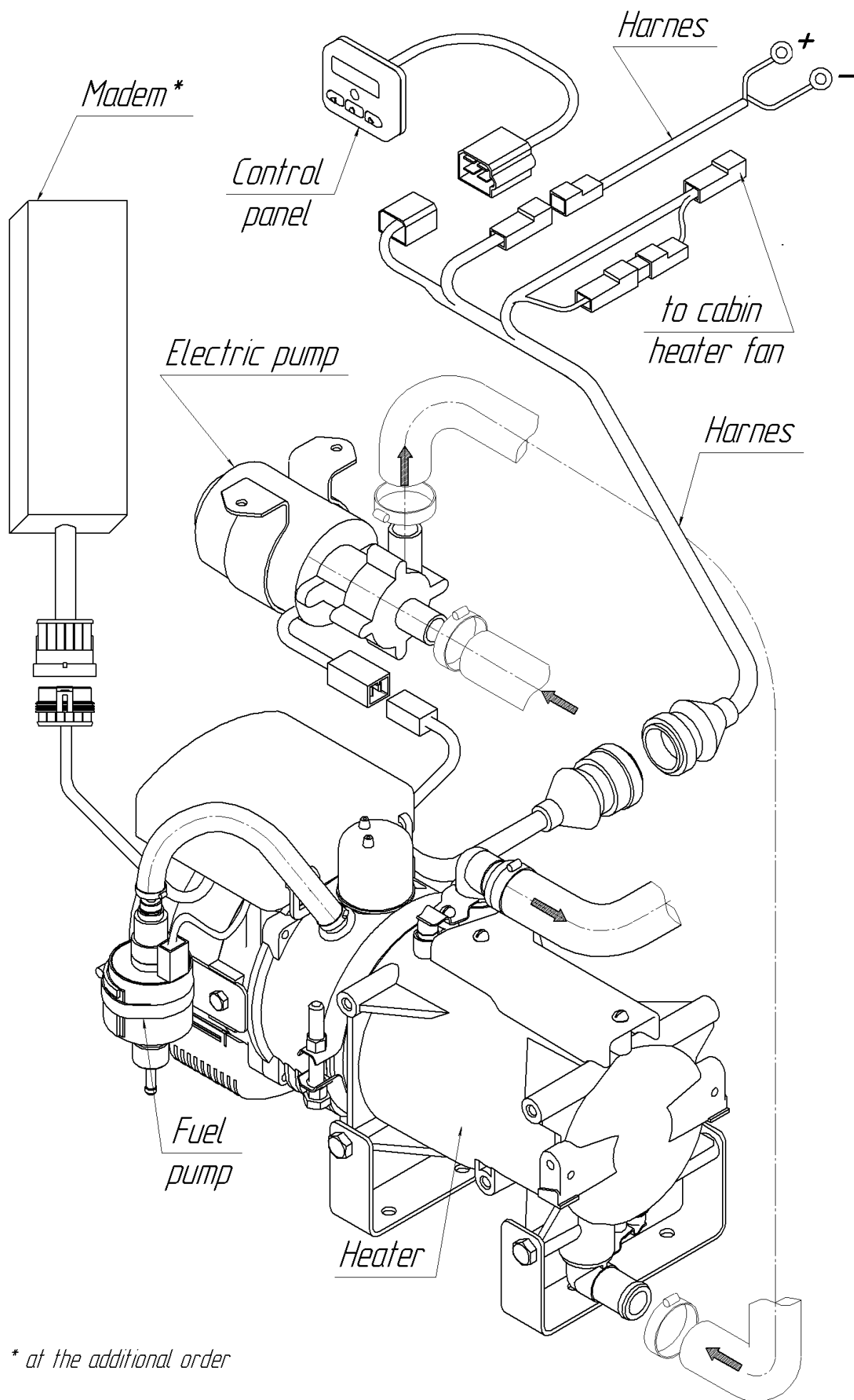


Figure 4.2 – Pre-heater main components

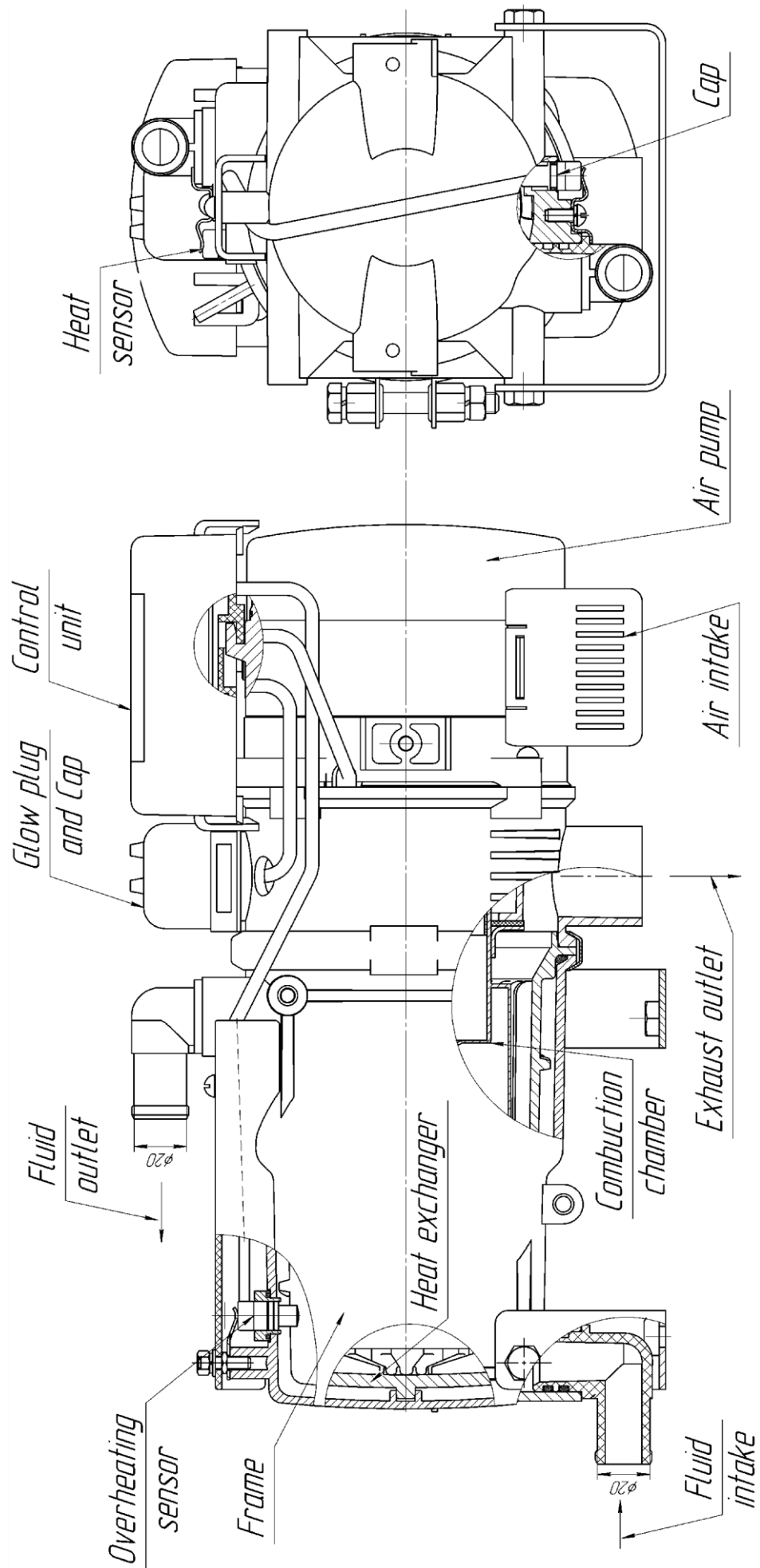


Figure 4.3 – Pre-heater basic components

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

The pre-heater runs independently of the truck engine.

The pre-heater is fueled and powered from the truck. 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);
- fuel pump for fuel supply to the combustion chamber;
- circulation pump for forced circulation of liquid in cooling system through the heat-exchanging system of the pre-heater;
- control unit to coordinate operation of the above-mentioned systems;
- control panel;
- wiring harness for connection of the pre-heater components to the truck systems;
- modem, (by the additional order) for remote management of a pre-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 truck 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.

The pre-heater may work in two modes (programs): «economic» and «nominal». The «economic» mode is characterized by less power consumption.

At start pre-heater there is performed purging of the combustion chamber and glow plug warming-up to the desired temperature (the glow plug is on for 90sec). 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. Operation of the pre-heater is controlled by the control unit.

The control unit controls temperature of the coolant fluid and depending on this parameter, there is chosen full, medium or low duty mode of the pre-heater. The full duty mode means that the coolant fluid is heated up to 70°C (158°F) in “nominal” program, and up to 55°C (131°F) in “economic” program; in case of overheating more than 70°C (158°F) or 55°C (131°F) the pre-heater is switched to the medium duty mode. The medium duty mode means that in both programs the coolant fluid is heated up to 75°C (167°F); in case of overheating more than 75°C (167°F) the pre-heater is switched to the low duty mode. The low duty mode means that in both programs the coolant fluid is heated up to 80°C (176°F); in case of overheating more than 80°C (176°F) the pre-heater is switched to the cooling-down mode. At the same time combustion stops, the pump continues its operation and the passenger compartment heating is continued as well. When the temperature of the coolant fluid gets below 55°C (131°F) the pre-heater automatically starts either the full duty mode if the “nominal” program is selected, or medium duty mode, if the “economic” program is selected.



Duration of a full cycle of work can be established in the range from 40 minutes up to 8 hours. (refer to Section 6). Moreover, there is a possibility to switch of the pre-heater any time during the cycle.

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 in heater operating time burning stops, the heater will go for repeated ignition. If ignition doesn't take place, it will give out a mistake 13 if ignition took place, work will be continued. If in operating time more than 3 failures of a flame are recorded, the heater will give out a mistake 78;
- 3) in case of the pre-heater over-heating (for example, abnormal coolant fluid circulation, air bloc, etc.) it automatically switches off;
- 4) in case of voltage drop lower than 20V (10,5V) or voltage surge higher than 30V (16V), the pre-heater switches off; the values in brackets are for the device with nominal voltage supply 12V.
- 5) in case of the pre-heater emergency shut-down, a corresponding LED starts blinking on the control panel. Certain blinking indicates type of malfunction. Refer to User Manual Section 8 for interpretation of malfunctions.

**Note.** Heating of the passenger compartment is possible only with the passenger compartment heater cock in open position and frame connection available.

## 5 Pre-heater control unit

Jointly with the control panel, the control unit is used to control the pre-heater operation

The control functions of the pre-heater are the following:

- a) start and heater stop on command from the control panel;
- b) initial health check of the pre-heater units at start;
- c) health check of the pre-heater units during operation;
- d) switching over to different modes depending on temperature of the coolant fluid;
- e) pre-heater switch off:
  - when the preset cycle finishes;
  - when one of the controlled units fails;
  - when the preset parameters (temperature, voltage, blowout) are out of the limits.

## 6 The pre-heater control devices

### 6.1. Control panel with timer

Control panel PU-11M (further on – the control panel ) is intended for use in the 14TC-Mini heaters. Control panel provides manual and automatic control of the heater, as well as output to display the necessary information to the user.

Control panel is mounted in the cabin or in the car (on the dashboard ). Control panel is mounted using 2 sides adhesive tape, one side of which is glued to the back surface of the control panel or by a bracket (with securing screws ) The harness output from the control panel can be carried out of control panel through the rear cover, or through the side surface of the control panel, removing the part of side surface.

Before installing, you must first degrease the surface on which the control panel must be install and, remove the protective film from adhesive tape, set the control panel to the prepared surface. Connection of control panel to the heater is made in accordance with wiring diagrams (Figure 4.1).

Positions of contacts in the connector is shown in Fig. 6.1 (a view is given from the connection part, and not from the wires).

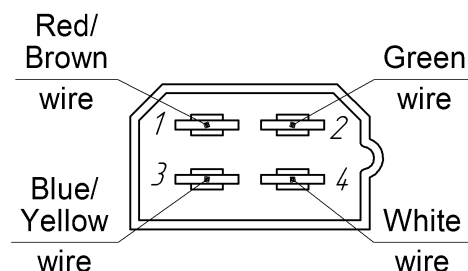


Figure. 6.1 – Installation contacts in the connector

#### 6.1.1 Control panel controls the heater

On the surface of the timer there are: four-digit LED indicator, four LEDs - three on the left (lower, middle, upper) and one on the right and three buttons (left, middle, right). Location of digits, LEDs and buttons shown in figure 6.2.

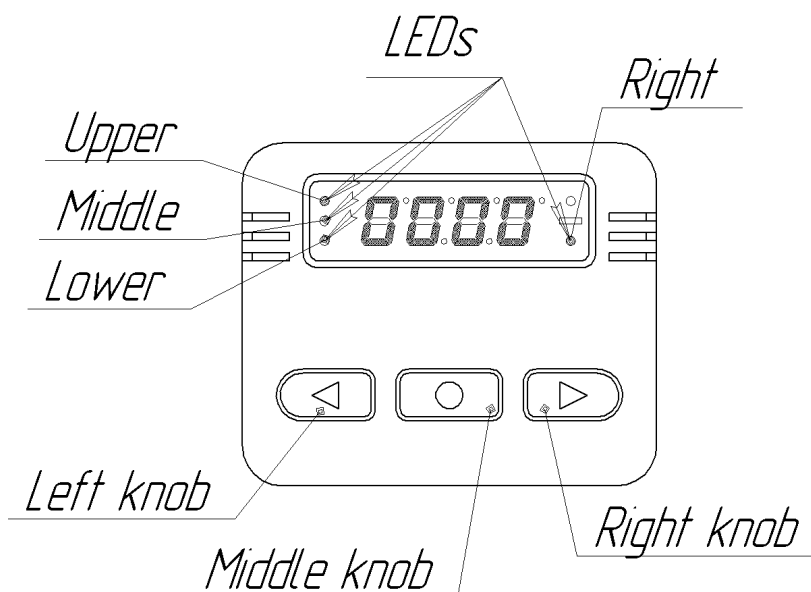


Figure 6.2-Control panel

Clicking on the button in the control panel may be short (less than 2 seconds) and long (more than 2 seconds). It is possible to perform the following operations:

- set the clock;
- start the heater;
- stop the heater;
- set the timer run № 1, № 2 and № 3;
- activation of only one of 3-timers;
- deactivation set the timer;
- adjustment of the clock;
- view on the display:
  - a) the current time;
  - b) the temperature of the coolant;
  - c) modes of the heater;
  - d) the time of working the heater;
  - e) malfunction code

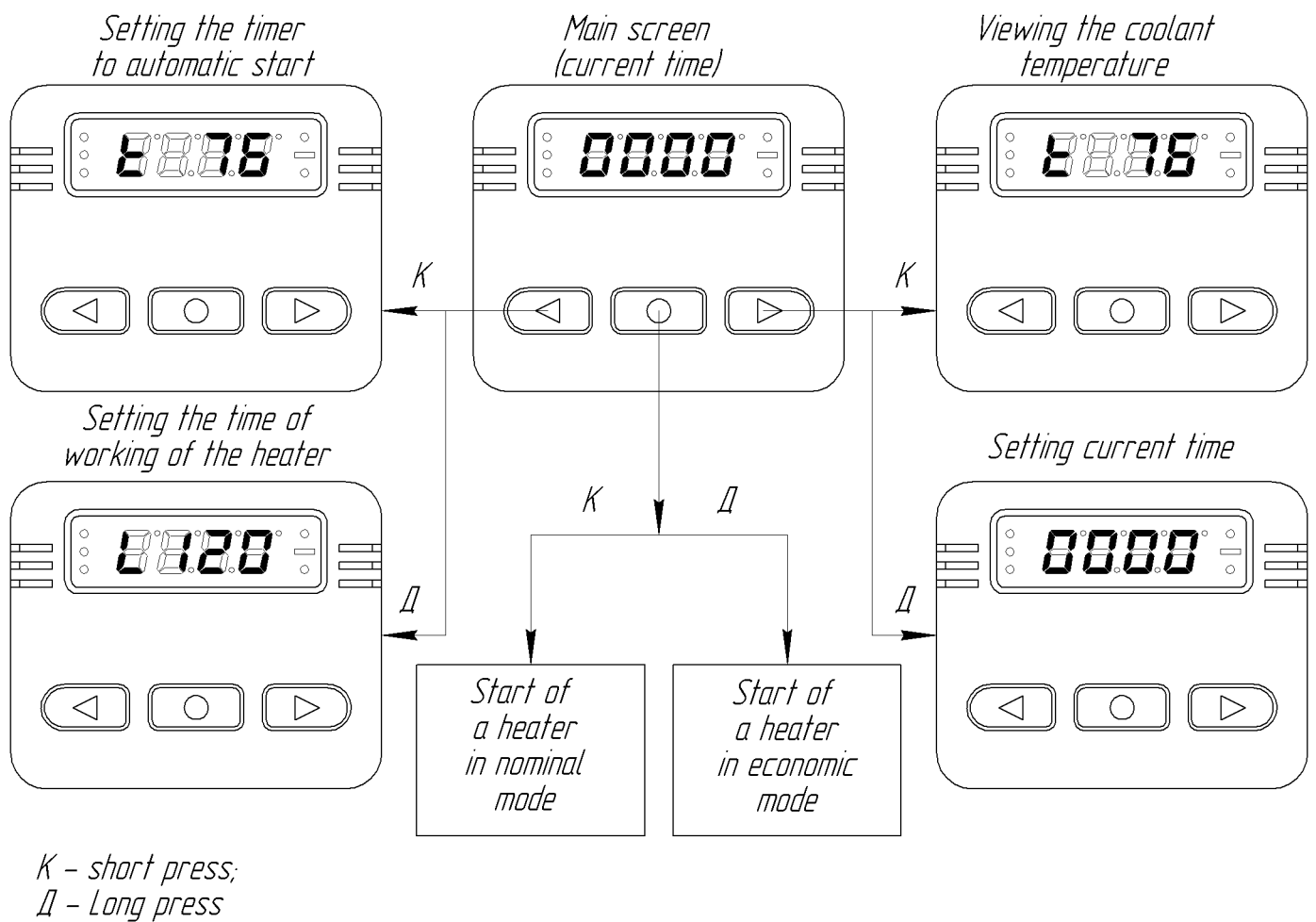


Figure 6.3 - Algorithm of operation of the control panel.

### 6.1.2 Setting «current time» on the control panel.

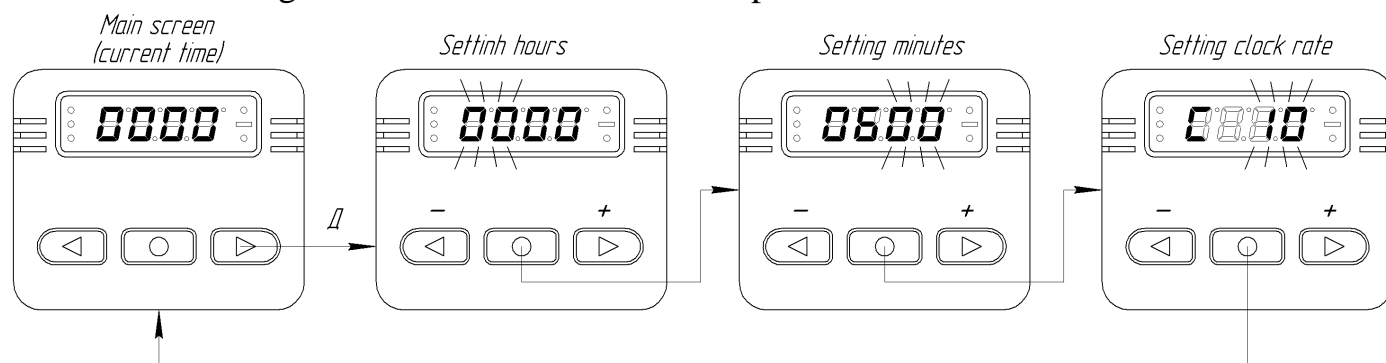


Figure 6.4 setting current time

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

The indicator looks like (figure 6.4)

To set or change the current time (hour or min) it's necessary to press and hold on the right knob more than 2 sec, two first digits of the indicator start blinking (figure 6.3).

Then with continuous or interrupted pressing the right or left knobs set the necessary time. Pressing right knob leads to time increasing to one hour. Pressing the left knob leads to time decreasing to one hour. After setting the necessary time press the middle knob, digits 3 and 4 start blinking (figure 6.4). With help of right or left knobs set necessary minutes.

After setting minutes press the middle knob, the indicator will show «C» in first digit (correction of the clock rate) and the 3d and 4<sup>th</sup> digit of the indicator will be blinking see figure 6.5. By pressing the right or left buttons set the desired value of the clock correction in the range of +10 ... -10 sec. per day.

After setting the current time press the middle knob to come back to the mode display the main screen.

### 6.1.3 Viewing the coolant temperature

When the indicator is displayed the current time or working of heater, briefly pressing the right button displayed on the indicator value of the coolant temperature at the outlet of the heater. In the first digits of the display will show the sign E, the second digit sign « — » (minus), if the temperature is negative, and 3, and 4 bits value of the temperature in degrees Celsius (figure 6.5).

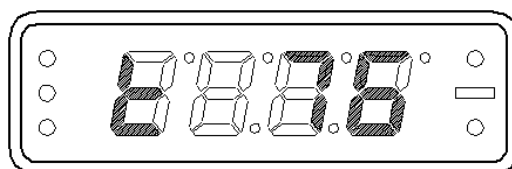


Figure 6.5 temperature of coolant

The next short press the right button on the remote control returns to the display mode «current time».

#### 6.1.4 Setting the time of working of the heater

From mode «current time» long press the left button allows you to adjust the time of continuous operation the heater. The first digit of indicator displays the Latin letter «L», and in 2, 3 and 4 digits LED indicates the duration of the heater in minutes (figure 6.6). By pressing the left or right buttons, this time can be changed with each press changes the time by 5 minutes. The right button increases the time, the left - reduces. The adjustment range of 40 minutes to 8 hour.

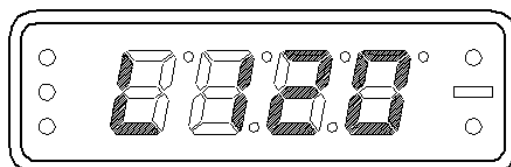


Figure 6.6 setting time of working cycle of heater

By setting time, press the middle button. Information will be memorized and the indicator switches to display the current time.

#### 6.1.5 Manual pre-heater start up.

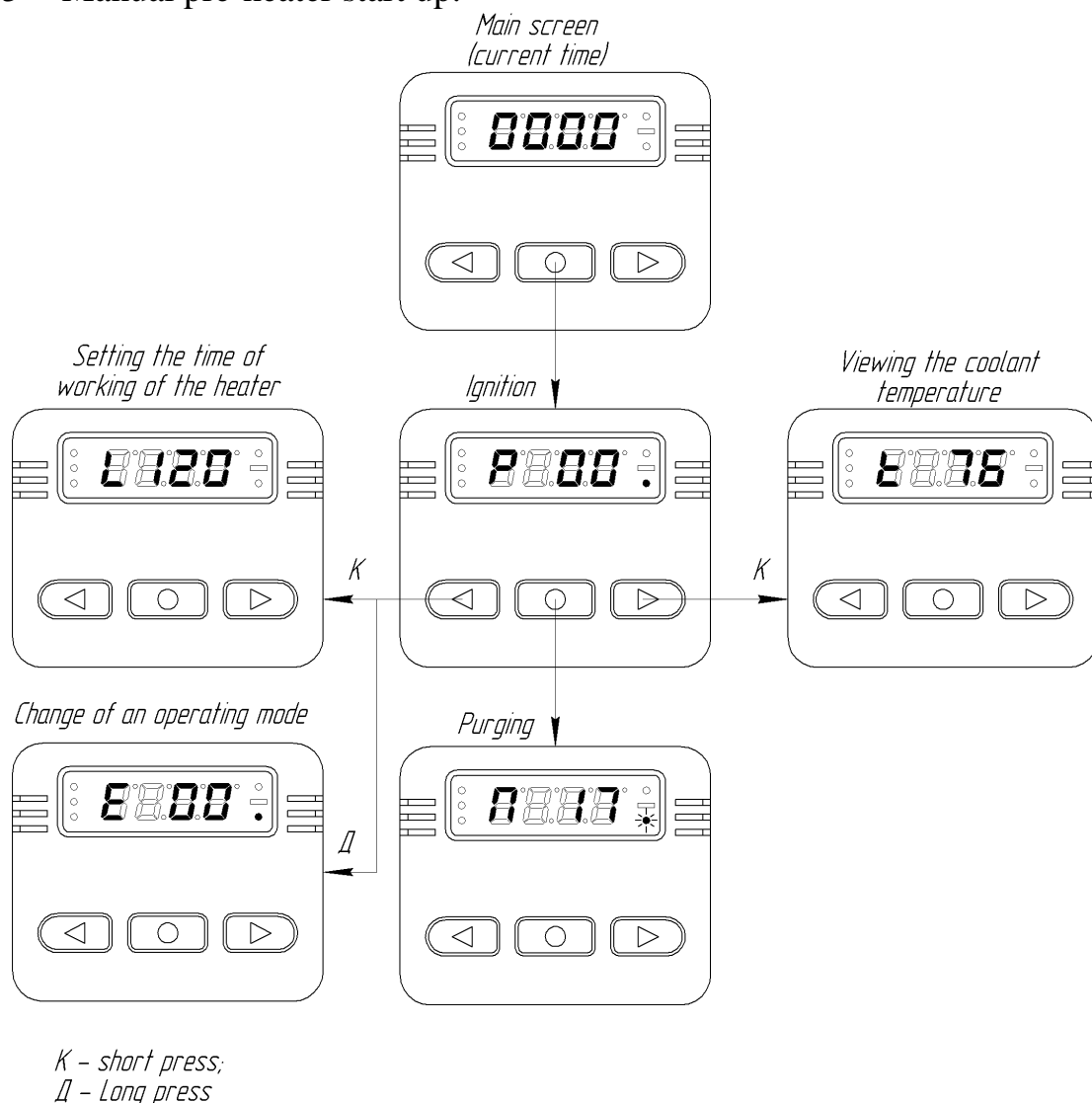


Figure 6.7 Start of a heater in nominal mode.

Manual start of the heater can be done by briefly pressing the middle button if the indicator is displayed the current time, temperature of fluid or power supply.

Short pressing the button starts a heater in the nominal mode, long pressing - in the economic mode.

The heater starts to work, with the first digit is mode of working, and 3, and 4 digits displayed time in minutes, and the right LED is lit continuously (figure 6.8), the indicator shows that the heater works in the «ignition mode» and time of running 2 minutes).

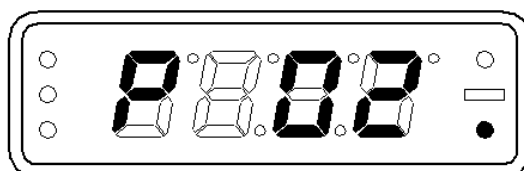


Figure 6.8 heater in «ignition mode»

**Attention!** During the work of a heater in the "economic" mode in the first digit of the indicator the symbol " E " is displayed, and in 3 and 4 digits operating time in minutes is shown.

When the pre-heater is activated the first digit shows the current mode of operation see figure 6.9 – 6.12.

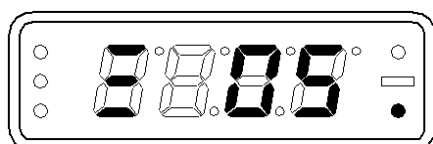


Рис.6.9 – Full mode.

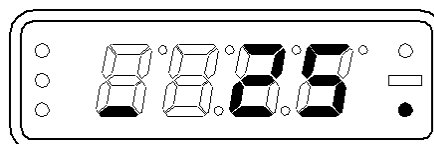


Рис.6.11 – Low mode.

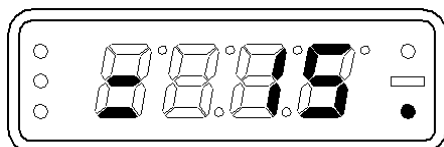


Рис.6.10 – Medium mode.

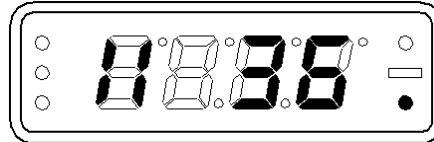


Рис.6.12 – Cooling-down mode.

To switch off the pre-heater press the middle knob, the indicator will show operation mode «П»-purging, time counting of the pre-heater operation and frequent blinking of the LED see figure 6.13.

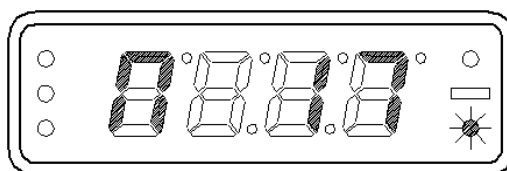


Figure 6.13 Purging mode

When the pre-heater is working you can press the right knob - heater will show the information about the temperature of the cooling liquid, next pressing of the right knob heater will show the voltage and next pressing heater will show mode of working.

### 6.1.6 The pre-heater automatic activation.

To automatically start the heater must be installed on startup. Control panel allows you to program three automatic start-up, for this there are three independent timer. Any of the three automatic starts will be made only when it is activated. You can activate only one timer. To set the automatic startup of the heater from the regime "current time" you have to short press the left button. The indicator will be of the form figure 6.14.

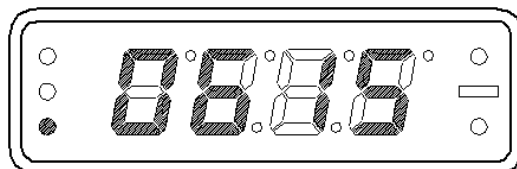


Figure 6.14 setting the 1st timer

Timer number is changed by pressing the left knob and indicated by a LED indicator on the left side. To activate the timer, you have to press the middle button. At the same time illuminates the right LED (see figure 6.15, start at 14 hours 15 minutes). Pressing the middle button you can cancel the activation timer.

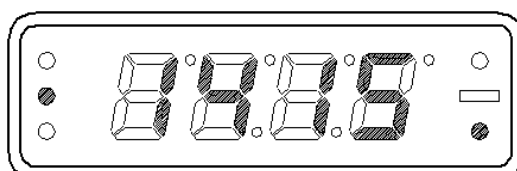


Figure 6.15- activation the 2d timer

In order to correct any run-time timer, press the right button, this will blink first two digits (hours). After setting the desired value, hours of the left or right buttons to press the middle button, and then will be flashing digits 3 and 4, which set the desired value minutes. By pressing the middle button confirms the value of the set time, and at the same time on the display will show the information (see figure 6.16)

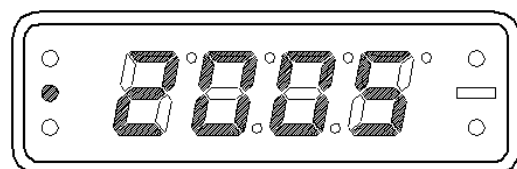


Figure 6.16 – setting the 2d timer

**After each run the heater (automatic or manual), the activation timer is reset.**

### 6.1.7 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 6.18. 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 3**.

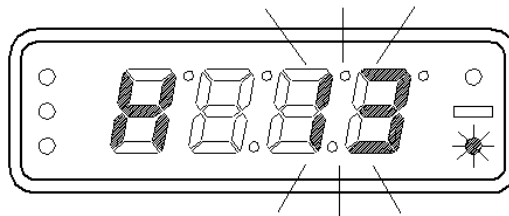


Figure 6.18- indicator shows the pre-heater fault.

## 6.2. *The use and installation of the modem to run the heater.*

Operation of the heater can be controlled over the phone using a modem and a special application. For remote control operation of the heater is possible to connect the control unit to the GSM modem, which is designed for use in harsh conditions (cold, vibration, etc.). In modem as in your phone, the SIM card can be installed. On account of this SIM card should be a small amount to make the modem work correctly. Just do not forget to replenish the account. Set the modem at any convenient, clean place. Connect the antenna to the modem and bring antenna to the open space (for example, on the windshield) . Connect the modem to the heater (according o Figure 4.1 ) and test it .

Heater control is carried out using an application installed on the mobile phone (refer to the modem).

Parameters of work can be changed by means of the SMS command.

Set the modem at any convenient, clean place. Connect the antenna to the modem and bring antenna to the open space (for example, on the windshield) . Connect the modem to the heater (according to fig. 4.1 and fig. 7.1 ) and test it .

You watch the detailed instruction on work with the modem in "The instruction of the user for the TeplostarSMS application" (in a modem set).



### *6.3. 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 having normally opened contacts is connected to an exit of this channel (the relay isn't included in the delivery package). Contacts of the relay should be connected to wires of the modem harness before XS5 connector (see fig. 4.1).

The ends of wires are closed by a thermoshrinkable tube. For connection of a pre-heater it is necessary to strip out the ends of wires and to connect them (to solder) to the car relay (if necessary to extend wires).

Control of the pre-heater can be done in two ways: short-circuit contacts of relay (time of the closed state 0.5 to 3 seconds), and long-circuit closure (more than 3 seconds). Short first impulse will starts the heater, next short impulse stops the heater.

With long impulse of the contacts of relay a command "Start" will be formed. When contacts will be open - the command "Stop" will be formed.

After start the heater will work within 120 minutes. It is possible to stop the operation of the pre-heater with the help of the transmitter of vehicle remote alarm system 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.

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.

## **7      Faults**

Faults that the User can eliminate on his own.

7.1. If the heater does not start.

Check the voltage on connector 1.2-XP7 (see figure 4.1). If the voltage on the XP7 connector is missing, you need to check and if necessary replace the 25A fuse on the supply harness.

Check the voltage on connector 4,7-XS1. If the voltage on connector XS1 is available, check and if necessary replace the 25A fuse in the control unit.

7.2. All the other faults of the pre-heater are coded and shown on the control panel.

7.3. Refer to Section 8 for typical faults of the pre-heater and trouble-shooting procedures.

7.4. In case of faults, but for those described in item 7.1, it is recommended to contact a service center.

## 8 Pre-heater control system faults

8.1 Trouble-shooting shall be started with checking the connector terminals and corresponding circuits (refer to Table 2 and Electric circuit in Figure 1).

Table 2

<b>Circuit</b>	<b>Heater</b>	<b>Pump</b>	<b>Control panel</b>
<b>Pump</b>	1,2 – XS3	1,2-XP3	-
<b>Fuel pump</b>	1,2- XS2	-	-
<b>+ Usupply</b>	4 –XP1	2-XS3	1-XS6
<b>- Common</b>	7 –XP1	1-XS3	3-XS6

8.2 Other faults are listed in Table 3.

Table 3

<b>Codes</b>	<b>Fault</b>	<b>Notes / Troubleshooting</b>
<b>01</b>	Overheating	1. Check thoroughly the liquid circuit 2. Check circulation pump, replace if necessary 3. Check temperature sensor and overheating sensor ,replace if necessary 4. Check the quality of antifreeze to be applied depending on the ambient temperature.
<b>02</b>	The risk of overheating. Temperature difference between the readings of the overheating sensor and heat sensor is too big	
<b>03</b>	Faults overheating sensor	Check connecting wires. The output signal and voltage are in linear dependence on temperature (0 °C correspond 2,73 V and at increase in temperature at 1 °C, respectively, the output signal increases by 10 mV). Check the overheating sensor and replace it, if necessary.
<b>04</b>	Faults heat sensor	Check connecting wires. The output signal and voltage are in linear dependence on temperature (0 °C correspond 2,73 V and at increase in temperature at 1 °C, respectively, the output signal increases by 10 mV). Check the heat sensor and replace it, if necessary.
<b>05</b>	Faulty flame indicator	Check connecting leads. Check ohmic resistance between indicator contacts, it must be not more 10 Ohm. Replace the indicator if necessary.
<b>06</b>	Faulty temperature sensor on the control unit	Replace control unite of the pre-heater
<b>09</b>	Glow plug malfunction	Check the glow plug, replace if necessary.

Table 3

<b>10</b>	Air pump motor malfunction	Check the electric wiring of the air pump motor, replace the air pump, if necessary.
<b>12</b>	Shutdown, voltage boost 30V (16V) more	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. Check voltage on XS1 connector of the pre-heater
<b>13</b>	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. Check a lining and a hole of Ø 1,5 mm in the glow plug union of the combustion chamber on a dirt and a deposit. Clean a hole of Ø 1,5 mm, replace a lining, if necessary.
<b>14</b>	Pump malfunction	Check circulation pump wiring for short-circuit fault or disconnection fault. Replace the pump if necessary.
<b>15</b>	Shutdown, low voltage less than 20V (10,5V).	Check voltage on XS1 connector of the pre-heater. Check the battery, regulator and power supply wiring.
<b>16</b>	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.
<b>17</b>	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.
<b>20</b>	No connection between Control panel and the heater	Check wiring, connectors.
<b>27</b>	Air pump failure. Motor won't rotate	Check the wiring of the air pump, control unit, replace if necessary.
<b>28</b>	Air pump failure. The motor rotates without control	
<b>29</b>	The admissible number of breakdowns of a flame in operating time is exceeded	Check the fuel level and fuel supply system. Check combustion air system and the exhaust pipe line. If the heater can be started, check fuel pump and replace if necessary.
<b>78</b>	Fixed the flame failure when the time of pre-heater work.	Check fuel supply and amount of fuel supplied. Check the air supply system to the combustion and exhaust gas-escape channel. If the pre-heater starts, check the combustion detector and replace, if necessary. Check the fine fuel filter for clogging up.

## 9 Maintenance

The pre-heater maintenance includes the following:

- periodic maintenance;
- seasonal maintenance (preparation for winter-time operation).

Periodic maintenance of a heater needs to be carried out during a heating season. The list of the works performed at EO, is provided in table 4.

Seasonal maintenance of the pre-heater is done before the heating season.

Table 4

Service object, description of activities and maintenance technique	Requirement specification	Instruments , materials, tools	Type of maintenance	
			periodic	seasonal
<b>Electrical equipment</b> Check of security of attachment of the pre-heater electrical contacts. In case of dirt or oil deposit on the contacts, remove with suede moistened in benzene. In case of carbon deposit on the operating interface of contacts, smooth it out with fine glasspaper № 150 GOST 6456-82 and wipe with petrol.	Visual inspection	petrol, white spirit	Every 1000h	+
<b>Air intake</b> Dismantle the air intake, rinse with benzene and clean out the net by blowing with compressed air	Visual inspection	petrol (acetone)	Every 1000h	+
<b>Glow plug</b> - Dismantle the air intake, rubber cap protecting the glow plug, disconnect the leads, unscrew the ignition plug and remove carbon deposit from it. - check the glow plug rubber cap for mechanical damage, and in case of detection, replace the glow plug.	Visual inspection	S=17 wrench, clean rags, benzene (acetone), screwdriver	Every 1000h	+
<b>Combustion chamber</b> Clean up the Ø 1.5 mm hole for air supply to the ignition plug	Visual inspection	S=17 wrench, screwdriver	Every 1000h	+
<b>Fuel pump</b> Prevention of formation of viscous film deposits on driving parts of the fuel pump.	Start heater	-	Monthly	+
<b>Fluid system</b> Clean up the heat exchanger	Visual inspection	screwdriver, brush, tank for cooling liquid	Every 1000h	-
<b>Fuel system</b> Check the fuel pipe for leakage; tighten up clamp connections, if necessary.	Visual inspection	screwdriver	Every 1000h	+
Check the fluid system for leakage; tighten up clamp connections, if necessary.	Visual inspection	screwdriver	Every 1000h	+

## 10 Installation specification for pre-heater and its assemblies

The pre-heater 14TC-Mini with installation kit are performed for installation on any trucks with liquid cooling system.

### 10.1. General instructions for installing the heater.

- 10.1.1 Heater and Motor air pump shall be located lower the radiator overflow tank.
- 10.1.2 Check up fluid flow in the heater and the engine cooling system; be sure it has the same direction.
- 10.1.3 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.
- 10.1.4 Fuel and coolant pipes shall be assembled in a way avoiding their contact with hot or vibrating components of the vehicle.
- 10.1.5 It is unacceptable to operate the pre-heater with the cooling fluid frozen.
- 10.1.6 On completion of any activities with the cooling system (repair work, cooling fluid changeout) it shall be purged to remove air blocks as per 10.1.3.

### 10.2. Heater installation

The heater is recommended to install in the area under the bonnet of the vehicle on the frame. The pre-heater installation on engine, in cabin or passengers compartment is prohibited.

Installation shall be performed taking into consideration permissible working positions of the pre-heater according to figure 7 and item 10.1. and 10.1.2.

Install the pre-heater taking into consideration the accessibility to main assemblies- electronic control unit, temperature and overheating sensors, air intake, fuel pump.

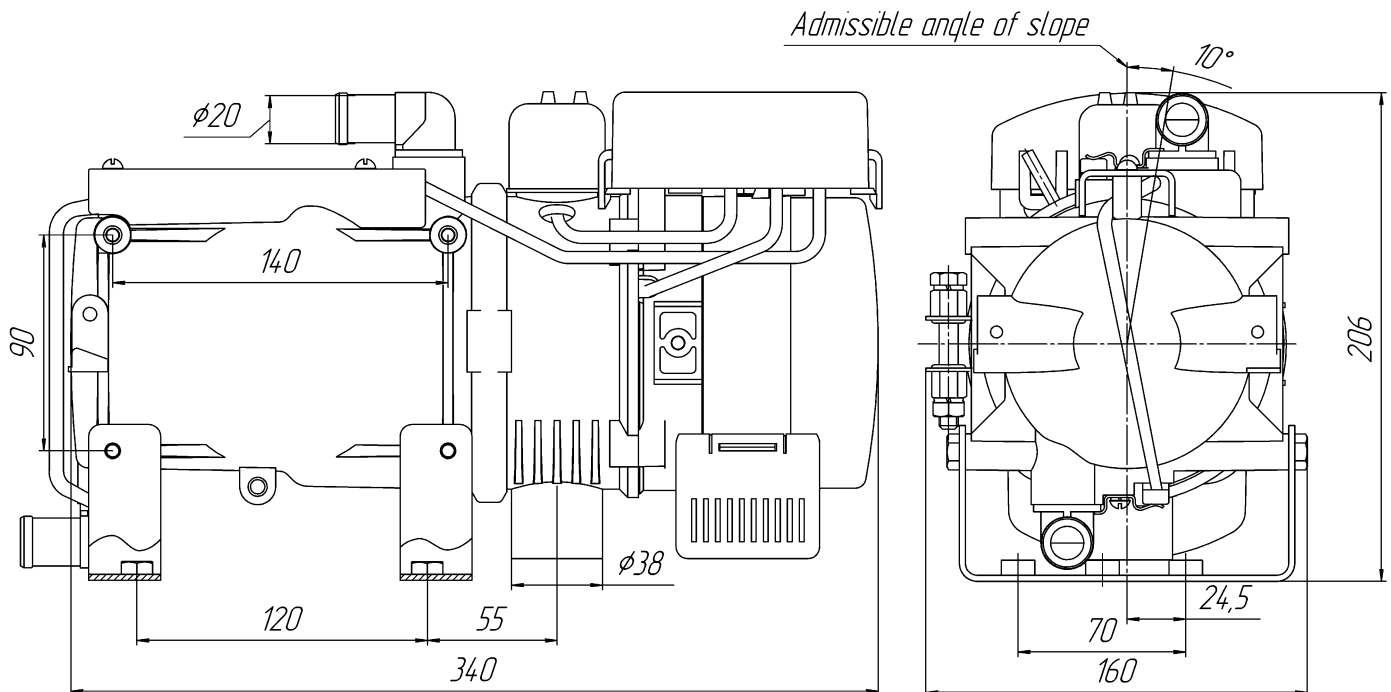


Figure 7- Allowable working positions of the pre-heater

### 10.3 Installation of the motor pump

The motor pump shall be located in conformity with recommendations given in items 10.1.1 and 10.1.2.

Operating position of motor pipe is whatever from horizontal to vertical with the pump down.

### 10.4 Installation of the exhaust pipe

Note that exhaust pipe has high operating temperature.

The exhaust pipe is fixed with clamps slightly downwards in the direction of exhaust. Round holes 3 mm 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 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.

### 10.5 Fuel tank installation

Fuel tank is installed according to figure 8. The filler of the tank shall not be installed in the cabin, motor area, luggage rack of the vehicle. If the filler of the tank on the side of the vehicle, the plug in close position shall not project the vehicle dimensions. Fuel that could be spilled while filling the fuel tank shall not fall on the exhaust system or electric circuit. It shall be drained on the ground.

To exclude leakage of the fuel from the tank if fuel pump leak tightness is failed, the fuel tank shall be installed so that max fuel level is lower than the pre-heater fuel pipe cut.

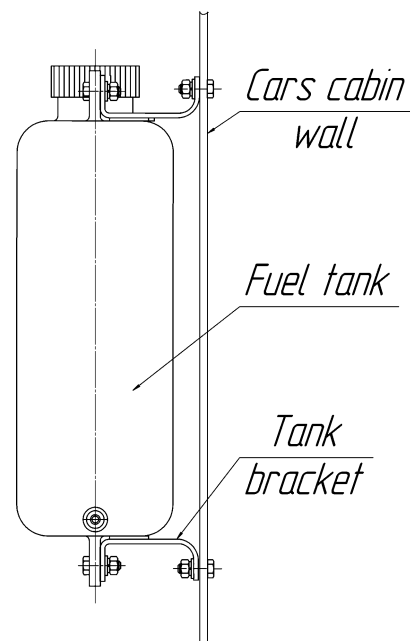


Figure 8-Fuel tank installation on vehicle

### ATTENTION!

Before a heating season it is necessary to check a fuel tank. If the fuel was stored long time in a tank (for example from last heating season), it needs to be removed! To wash out a tank with gasoline or kerosene and to fill in new diesel fuel. This procedure is intended for removal of a deposit in fuel at long storage. Not performance of this procedure can lead to a contamination or failure of the fuel pump and the raised sooting in the combustion chamber.

## 10.6 Fuel pump and fuel pipe installation

10.6.1. It is advisable to install fuel pump close to the fuel tank and lower fuel level in the tank. To provide this recommendation it's possible to disconnect fuel pump from the heater and cut rubber pipes to pieces 70 mm length and use the as connecting pipes. It is necessary to improve the harness to the fuel pump from the control unit that is to change connector and use extender. Connect fuel pump, fuel supply line and fuel tank according to figure 9.

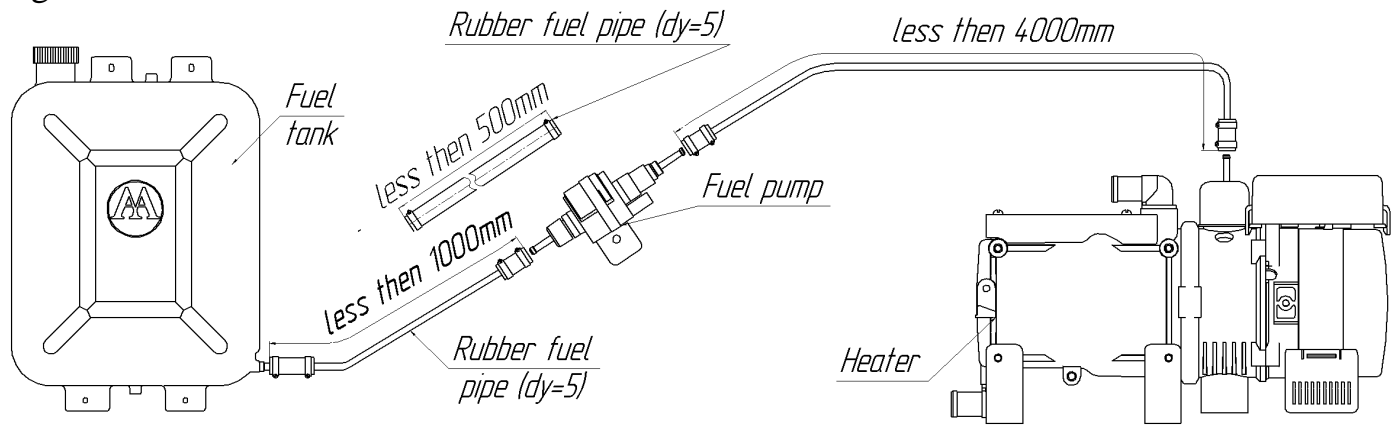


Figure 9. Diagram of connection fuel line with the pre-heater

The scope of supply heaters 14TC-Mini-24 and 14TC-Mini-24/12-GP enters fuel pump manufacturing ADVERS company. The spatial position of the fuel supply pump must comply with figure 10 (preferably in a vertical position).

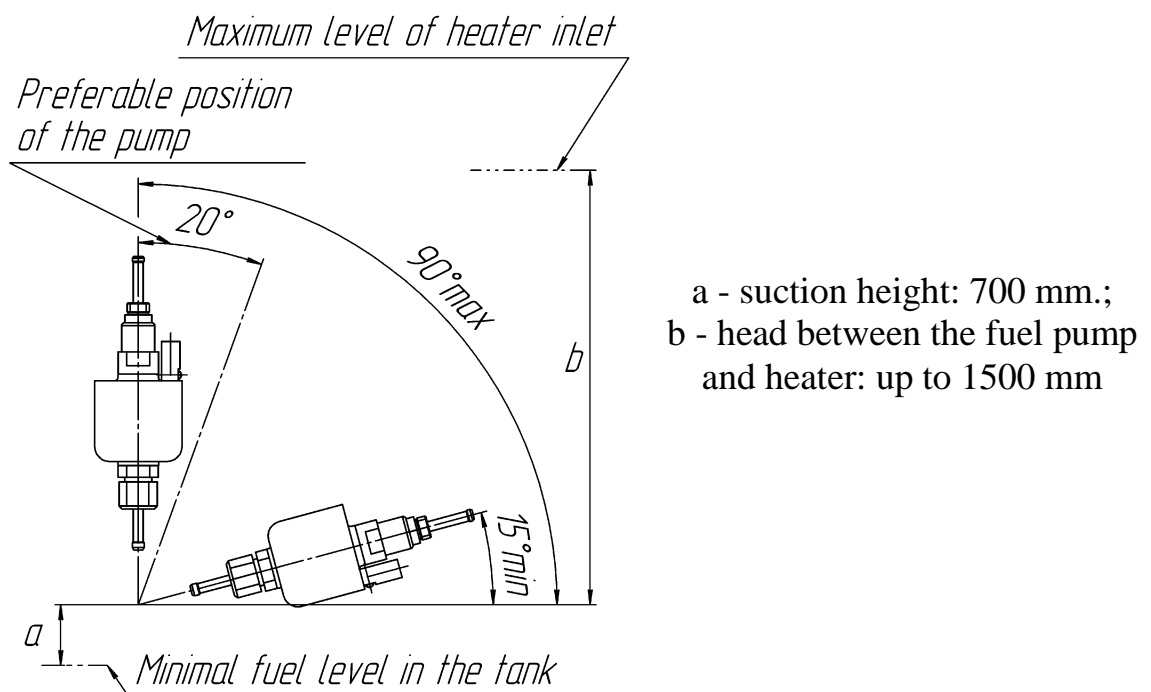


Figure 10 – Allowable installation position of the fuel pump

The scope of supply heaters 14TC-Mini-24/12-GP-TM (marked «TM»), enters fuel pump manufacturing Thomas Magnete company. The spatial position of the fuel supply pump must comply with figure 10a,  $\pm 5^\circ$  from the horizontal.

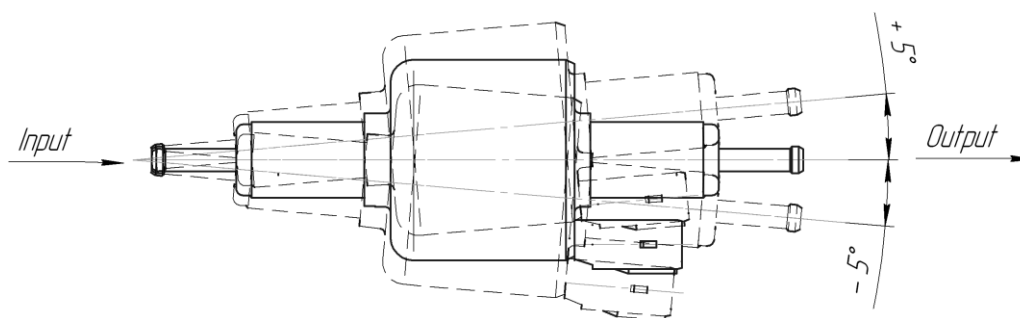


Figure 10a- Permissible mounting position of fuel pump

10.6.2 While assembling the fuel pipe shall be cut only with a sharp knife, as shown in Figure 11. Cutoffs shall be free of restriction, dents and burrs.

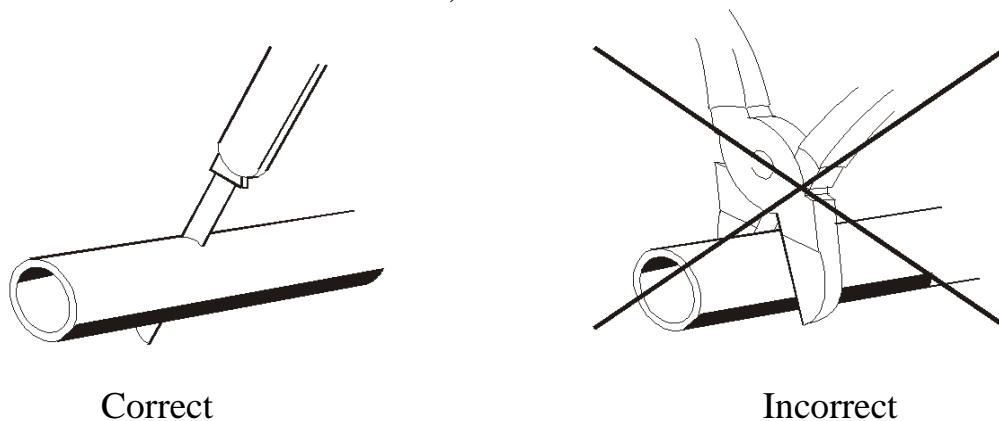


Figure 11 – Cutting the fuel pipe before installation

**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.

#### 10.7 Assembling of the pre-heater electrical harness

The pre-heater wiring harness shall be connected as shown in Figure 4.1 (pre-heater electric circuit). 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**

#### 10.8. Installation of the control panel

Control panel is installed in the cabin on the dashboard or any other comfortable for the driver place.

#### 10.9 Modem installation

The modem is installed in a car cabin – in the "pure" place protected from external influence. The antenna finishes and brought to "open space" (on a windshield).



## 11 Post-installation checkout

- 11.1. 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
- 11.2. 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.
- 11.3. To check a heater on working capacity having pressed the middle button of the control panel. Heater start has to follow. Further work of a heater takes place in an automatic mode.

During the test the pre-heater will go through all the modes («full», «medium», «low», «cooling down», switching on cabin heater fan at cooling liquid temperature 55°C (131°F).

At the request of the user the heater can be switched off earlier, having pressed the central button of the control panel.

If in the course of start or work of a heater on any reason there was a failure, on the control panel the malfunction code will be displayed. You can watch interpretation of a code of malfunction in section 8 of this manual.

- 11.4. Start the heater with working engine of car and check how the heater works.

## 12 Recommendations

- 12.1. In case the device is not used, to guarantee safe performance of the pre-heater it is recommended to switch it on once per month for 5-10min (even during the warm period of the year). This procedure is necessary to remove sticky film deposited on moving parts of the fuel pump and other units (the mentioned deposit may occur due to low-quality fuel and moving parts and units contacting with it for a long time). Ignoring this operation may cause the pre-heater failure.
- 12.2. Reliable operation of heater depends on the type of fuel used. Type of fuel should be in accordance with GOST 305-82, depending on the ambient temperature (see Table 5). May be used and the mixture of fuel according to Figure 12.
- 12.3. 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)

### ATTENTION!

The heaters having marking of "GP" in the name are completed with glow plug with a glow pin of production of Japan. This glow plug need to be checked for working capacity giving on it voltage 9V (*for heaters with voltage 12V*) or 18V (*for heaters with voltage 24V*).

Table 5

Ambient temperature, °C	Fuel type or blend
0°C and above 0°C	Diesel L-0, 2-40 Or L-02-62 GOST 305-82
0°C – -5°C (32°F – 23°F)	Diesel 3-0,2 mines 45 GOST 305-82
-5°C - - 20°C (23°F - -4°F)	Blend diesel 3-0,2 mines 45 GOST 305-82(50%) with petrol GOST P511050-97(50%)
Lower then -20°C (-4°F)	Diesel A-0.4 GOST 305-82 or blend diesel 3-0,2 mines 45 GOST 305-82 (50%) and petrol GOST P51105-97(50%)

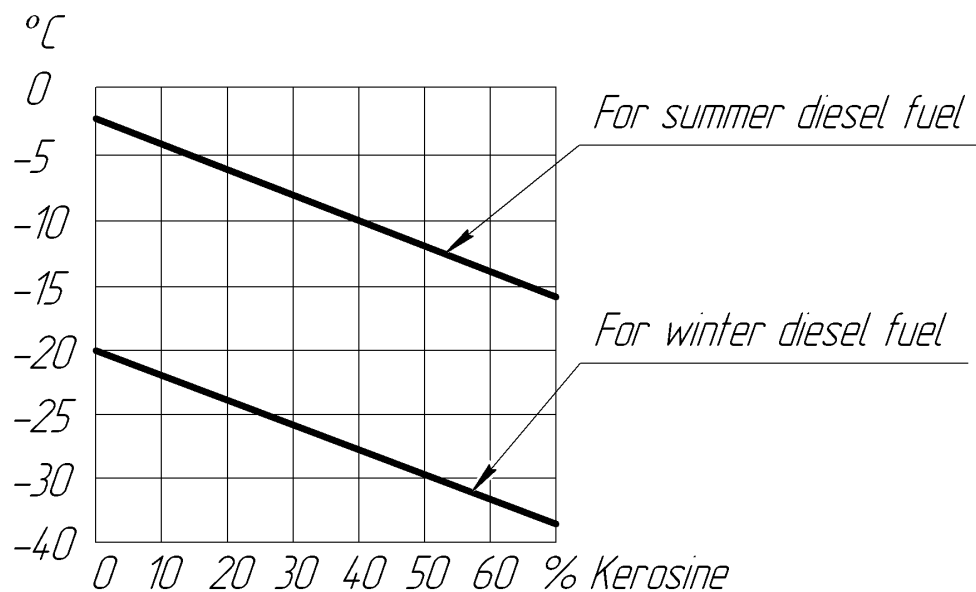


Figure 12 - Amount of kerosene mixed with diesel fuel, depending on the ambient temperature.

### 13 Transportation and storage

- 13.1. 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.
- 13.2. Storage conditions of heaters in packing of manufacturer have to correspond to storage conditions of 2 GOST 15150-69.
- 13.3. The period of storage heaters in packing of manufacturer order of 24 months.

## **14 Warranty**

- 14.1. Warranty period - 24 months from the date of sale or 1000 hours of working of a heater (depending on what will come earlier).
- 14.2. In default of stamp of organization with naming the date of sale a warranty term is calculated from the date of making of heater.
- 14.3. A manufacturer does not accept claim on incompleteness and mechanical damages after sale of heater.
- 14.4. A producer guarantees normal work of the heater on condition of observance by the consumer of all rules of exploitation, transportage and storage, indicated in this guidance. If a malfunction was found out during a warranty term, then she will be set free of charge. Installation of heater the organizations authorized by a producer must conduct. In this case, the warranty card is filled column «Information on installation.»

Warranty obligations do not spread to the defects arising up as a result :

- force-majeure circumstances: shots of lightning, fire, flood, impermissible violations of supply voltage,
- road a transport incident;
- failures to observe of rules of exploitation, storage and transporting;
- repair or adjusting, if they are conducted by the organizations, not authorized by a producer on installation of the heater and warranty repairing;
- refuse of work of heater by reason of contamination of combustion chamber;
- violations of work of electrical equipment of car;
- independent repair of heater or the use of unoriginal spare parts.

## **15 Pre-heater delivery configuration**

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