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Air Heater PLANAR – 8DM –24

Operation Manual

ADVR.020.00.00.000 RE

TABLE OF CONTENTS

	Sheet
1 Introduction	3
2 Basic Parameters & Specifications	3
3 Safety Measures	4
4 Description of Heater Operation and Structure	5
5 Heater Control Unit	6
6 Control panel ПУ-8 Functions	9
7 Scope of Supply	15
8 Installation Requirements	17
9 Post-Assembly Testing	22
10 Recommendations	23
11 Possible malfunctions during operation and Remedial Procedure	24
12 Transportation and Storage	24
13 Warranty	24
14 Packing Certificate	25

1. Introduction

This Operation Manual is intended to familiarize the User with salient features, operation, assembly and operating procedures for PLANAR–8DM-24 (hereinafter called “the heater”) intended for regulated heating of various compartments of a motorized vehicles at atmospheric temperatures as low as -45°C (-113°F). Minor changes performed on the heater structure by the Manufacturer may not be documented in this Operation Manual.

When placing an order or referring to the heater in documents pertaining to other types of equipment, the heater codes will read as follows:

“Air Heater PLANAR–8DM-24 TU4591-008-40991176-2005”;

2. Basic Parameters & Specifications

The basic heater specifications are quoted in Table 1.

The basic parameters are quoted to a margin of $\pm 10\%$ tolerance at a temperature of 20°C (68°F) at a nominal voltage.

Table 1

Parameter Code	Version
	PLANAR–8DM– 24
Nominal Supply Voltage, V	24
Fuel Type	Diesel Oil in compliance with GOST 305, atmospheric temperature-dependent
Heating Efficiency: max, kW, min, kW,	7,5 2
Heated Air Volume: Max , m^3/h Min, m^3/h	235 79
Fuel Consumption at: Max power, l/h (gal/h) Min power, l/h (gal/h)	0.9 0.25
Start/Stop Mode	Manual
Maximum Weight, kg	12
Heater power consumption, W Doesn't exceed while heating mode Max, W Min, W	90 9

3. Safety Measures

3.1 The installation of the heater and its fittings shall be performed by authorized organizations only.

3.2 The heater may only be used for the purposes specified herein.

3.3 The fuel supply line shall not be installed inside the passenger compartment or cabin of a motor vehicle.

3.4 The vehicle electric harness shall not be installed near the fuel supply line

3.5 A vehicle that uses the 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 To prevent the possibility of exhaust gas poisoning, the heater shall not be used when the vehicle is in an enclosed area (garage, workshop, etc).

3.8 When refueling the vehicle, the heater shall be switched off.

3.9 When performing welding operations on the vehicle or repairs on the heater, disconnect the heater from the vehicle battery.

3.10 When assembling or dismantling the heater, observe the safety measures specified by electric work regulations for the fuel supply system and the vehicle's wiring system.

3.11 The heater shall not be connected to the vehicle electric circuit while the engine is running or the battery is switched off.

3.12 The heater's electric power supply must not be disconnected before the end of the purge cycle.

3.13 The heater is powered from the accumulator battery regardless of the availability of the vehicle frame connection.

3.14 The heater's connectors must not be connected or disconnected while the heater's electric power supply is turned on.

3.15 Wait 5 to 10 seconds before switching the heater back on.

3.16 In the event of two subsequent ignition failures, contact the maintenance department to report a malfunction.

3.17 In the event of a failure in heater operation, contact a designated repair organization authorized by the Manufacturer.

3.18 Manufacturer warranty shall not apply if the above requirements are not adequately met.

4. Description of Heater Structure and Operation

The heater operates independently from the vehicle engine.

The fuel and electric power supply is provided by the vehicle. See Figure 4.1 for the heater wiring diagram.

The heater is a self-contained heating device comprising the following:

- Heating device (See Figure 4.2 for basic components thereof);
- Fuel supply pump providing fuel for the combustion chamber;
- Ignition and indicator device (control panel);
- Wiring harness connecting heater fittings to the vehicle battery.
- Fuel tank

The heater's operating principle is based on heating air driven through the heater's heat exchange system.

The heat sources are fuel combustion gases from the combustion chamber. The resulting heat warms the walls of the heat exchanger, which is air-blown from the outside. Air passes through the ribbing of the heat exchanger and enters the passenger compartment or other compartments of the vehicle.

Upon ignition, control unit of the heater checks the heater to ascertain whether fittings such as the flame indicator, the overheat sensor, air pump motor, plugs, fuel supply pump and the electric circuits thereof are working properly.

If no problem is detected, the ignition process starts.

In accordance with the preset sequence, the combustion chamber is fore-purged and the glow plug warms up to the required temperature. Air and fuel starts to enter the combustion chamber under the same procedure, whereupon the ignition process is initiated. Once stable combustion is achieved, the heating plug switches off. Flame control is provided by the flame indicator. All processes involved in heater operation are monitored by the control unit.

The control unit controls heat exchanger temperature and halts the combustion process as soon as the temperature exceeds the specified limit. The heater may be switched off at any time.

Pressing the heater deactivation command stops the fuel entering and the combustion chamber is purged with air.

During automated operation control of the heater in emergency situations, bear in mind the following:

1) In the event of ignition failure, the process will be repeated. The heater will switch off following two consecutive ignition failures,

2) If a combustion failure occurs while the heater is in operation, the heater will switch off,

3) If the heat exchanger is overheated (maybe as a result of closure of the heater inlet/outlet vents), the heater will switch off automatically,

4) If voltage drops below 20 V or exceeds 30 V the heater will switch off.

5) In the event of emergency shutdown, the indicator will show the information according to the code of malfunction (see Table 2).

5. Heater Control Unit

The control unit and the control panel control the heater.

The control unit performs the following functions:

- a) initial diagnostics (serviceability check) of heater fittings during ignition,
- b) diagnostic of heater elements throughout operation,
- c) heater activation/deactivation by command from control panel;
- d) combustion process control;
- e) automated switching of ventilation after the combustion process stopped;
- f) automated deactivation of the heater occurs:
 - in the event of failure of one of the controlled elements,
 - when any parameter exceeds the specified limit (heat exchanger temperature, supply voltage)
 - combustion chamber flame failure.

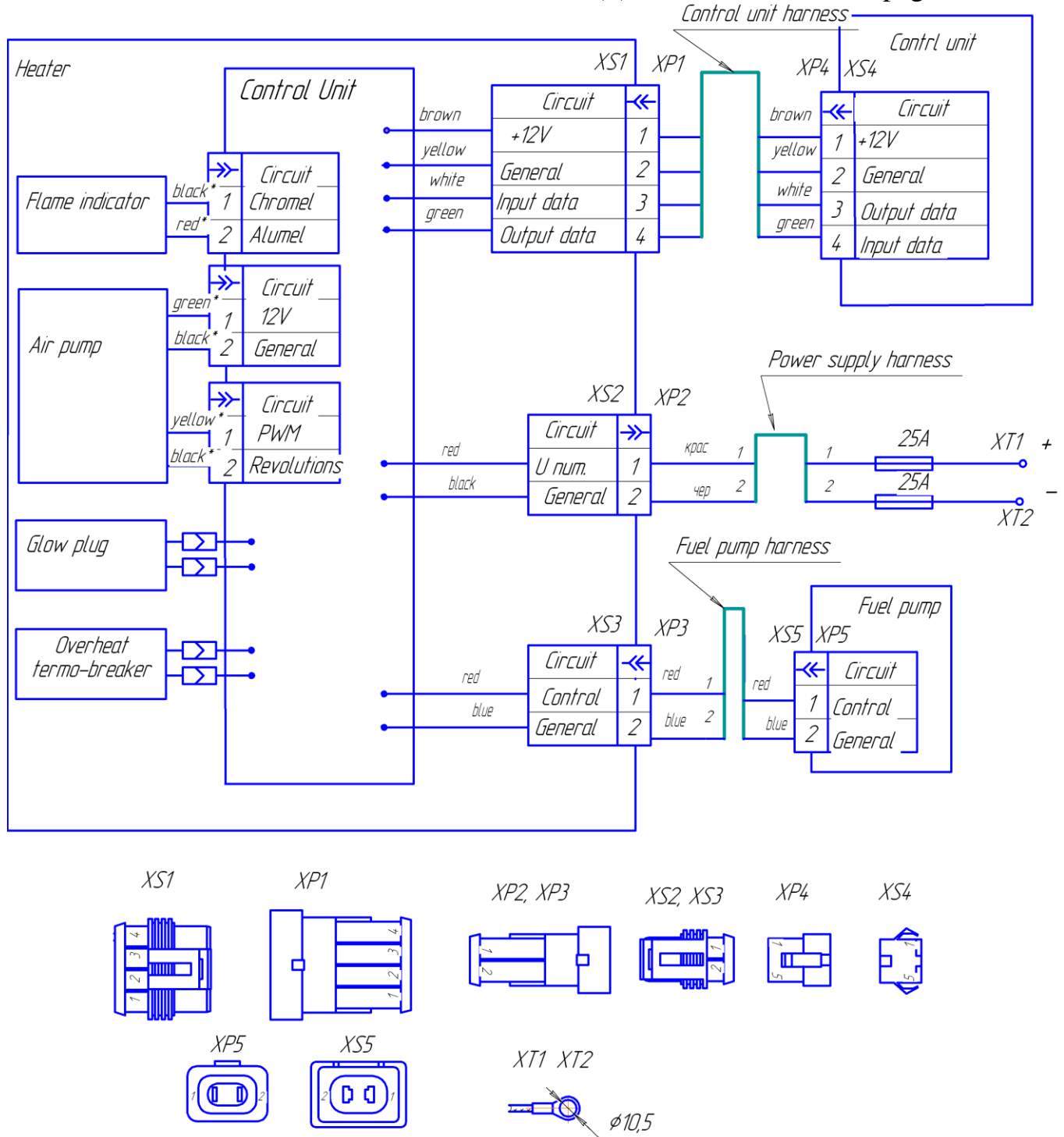


Figure. 4.1- Wiring diagram

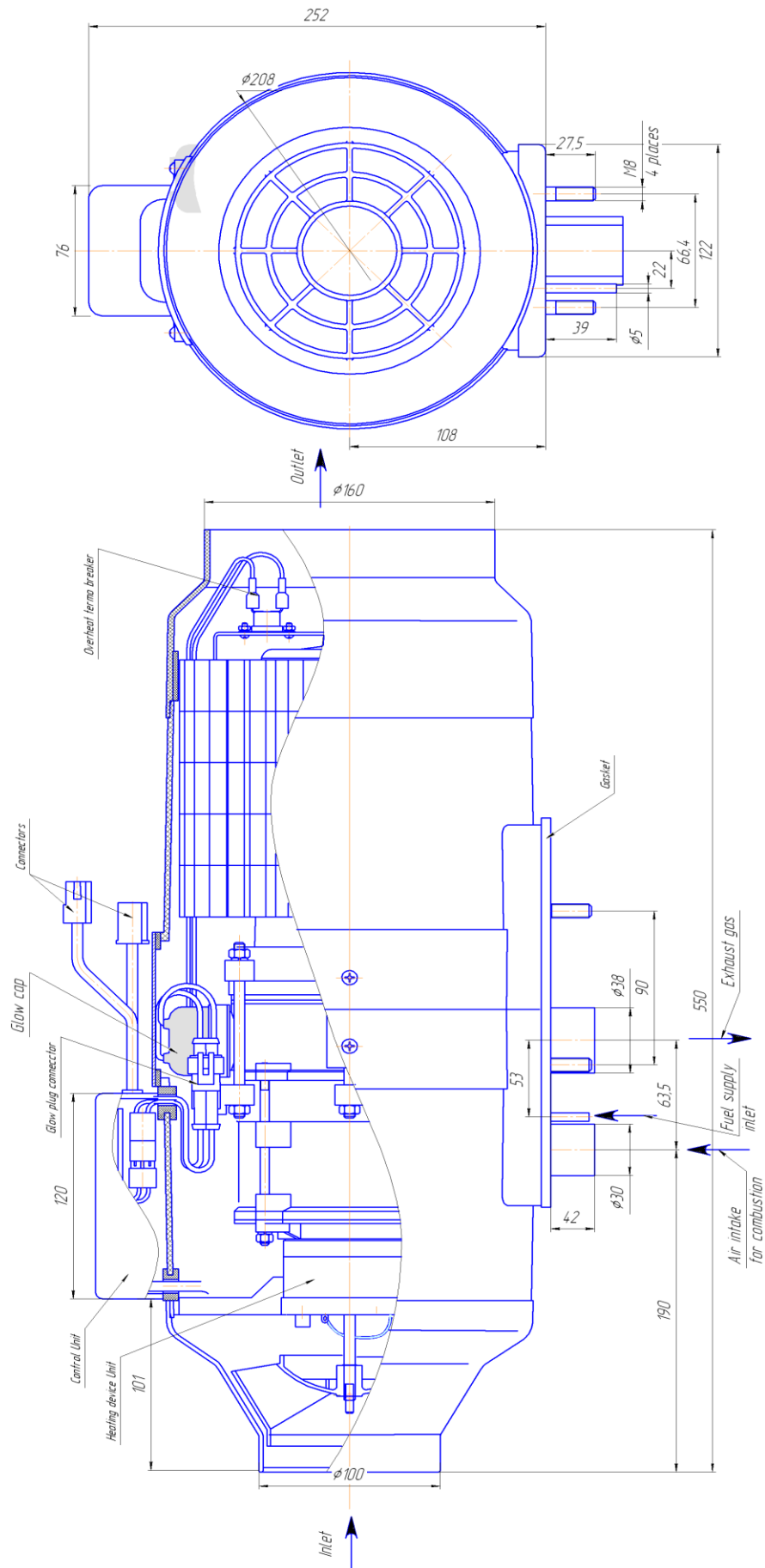


Figure. 4.2 – Basic heater components

6. Control Panel ИY-8 Functions

6.1 The control panel is intended for:

- heater activation and deactivation in manual mode;
- setting operation mode according to desired power or temperature;
- heater temperature indication from one of three sensors (from the sensor integrated in the heater, control panel unit or external sensor if connected);
- failure code indication in case of heater failure while operation.

The front board of the panel contains: four-digit light emitting diode (LED) indicator, two LEDs and three knobs. Functionality of the knobs and LEDs. (fig.6.1)

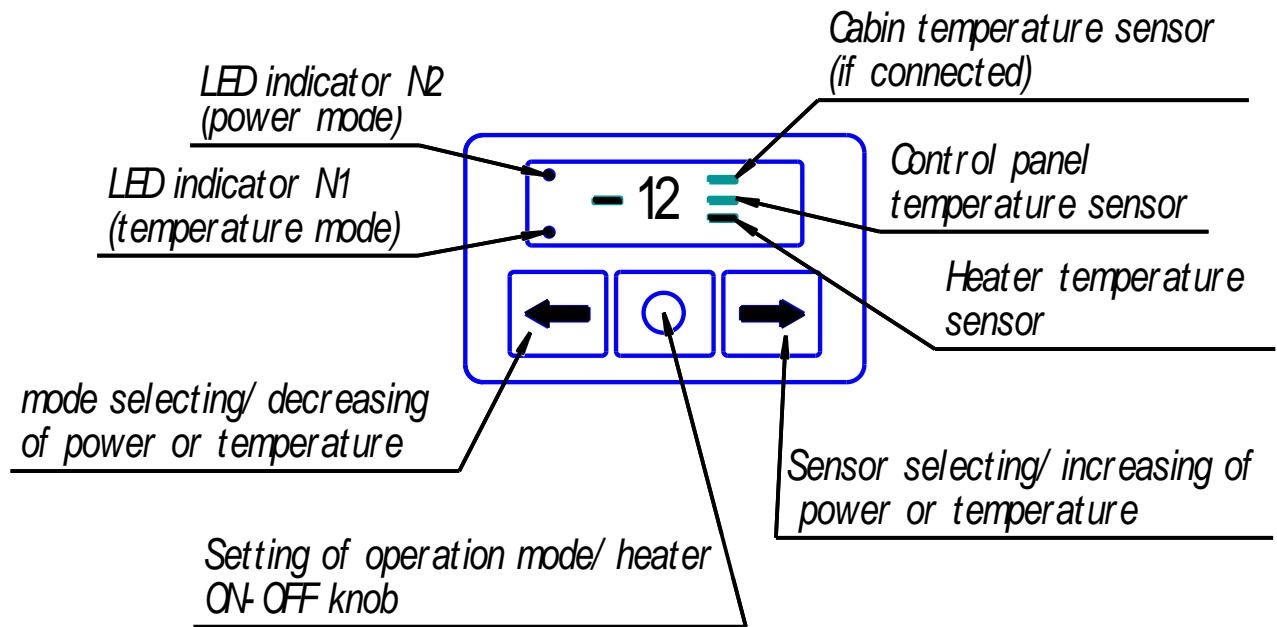


Fig. 6.1- Control panel

While first time the heater is connected to electric circuit of the car the temperature in the area where the sensor installed will be shown. If the temperature in the sensor's area is under zero, there will be "mines" before the figure.(fig.6.2)

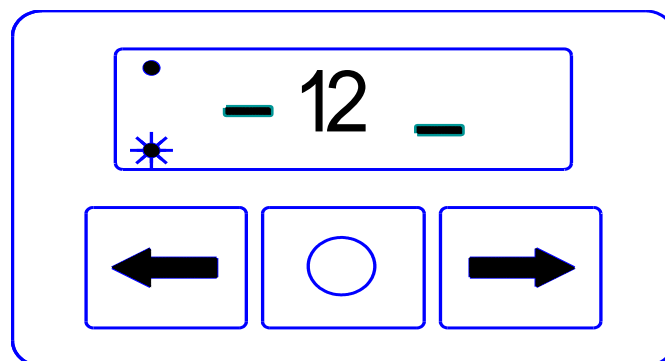


fig 6.2- View of the indicator after connection to electric circuit of the heater (initial stage of the indicator)

With the view to energy saving , the indicator stops glowing 20 seconds after the last pressing of any knob, while this LED#1 or LED#2 is :

- lightning constantly if the heater is activated;
- blinking rarely (1 time per 1,5 second) if the heater is not activated;
- blinking while fault (1 time per second);
- blinking frequently (5 times per second) while deactivation of the heater (while purging)

To restart the indication press any knob.

6.2 Succession of work with the control panel

6.2.1 Operation mode set up.

Before heater activation there's need to select operation mode. Pressing knob with the arrow “←” select operation mode of the heater according to desired power or temperature. According to the choice the LED#1 or LED#2 is lightning. After selecting the mode “according temperature” there's need to press knob with the arrow “→” and choose the sensor, according which the temperature of the heater will be controlled.

6.2.2 Activation and setting the power or temperature.

After mode selection there's need to press the knob “O”, while this the heater will start working and there's information on the indicator- the power mode or temperature mode according to your choice.(see fig. 6.3 or 6.4)

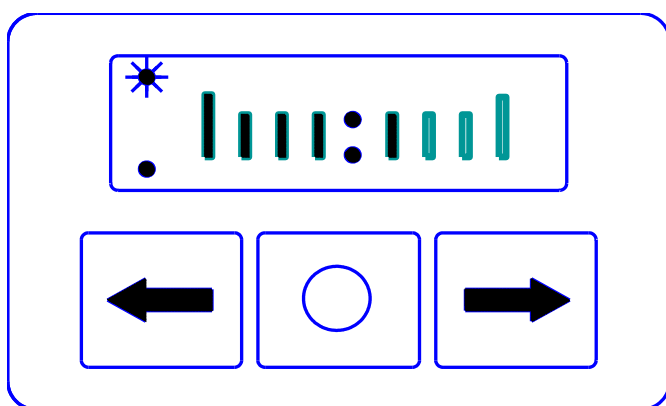


Fig. 6.3- Power mode

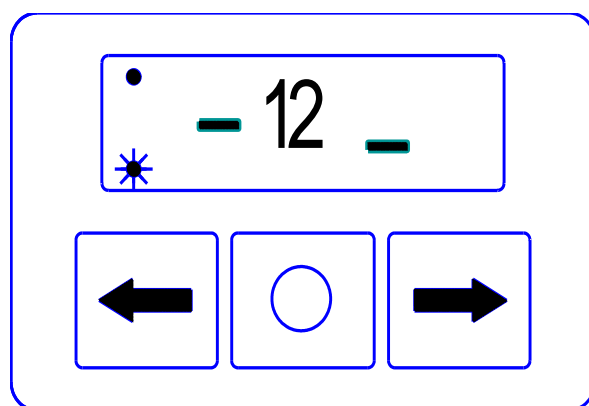


Fig. 6.4 -Temperature mode

If power mode is selected, pressing knobs with arrows “←” (decreasing), “→” (increasing) – you can set up the necessary power (see fig. 6.3) which can be set within 2 to 6 kW. The indicator shows the scale according which the power is set up.

If temperature mode is selected, pressing knobs with arrows “←” (decreasing), “→” (increasing) – you can set up the necessary temperature (see fig. 6.4). The temperature is set within 15° (59°F) to 30°C (86°F).

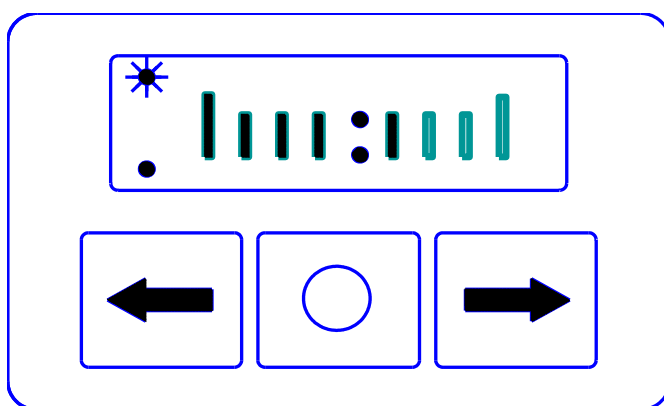
Attention!

1. The heater Operation mode (according to power or temperature) is saved until new set up.

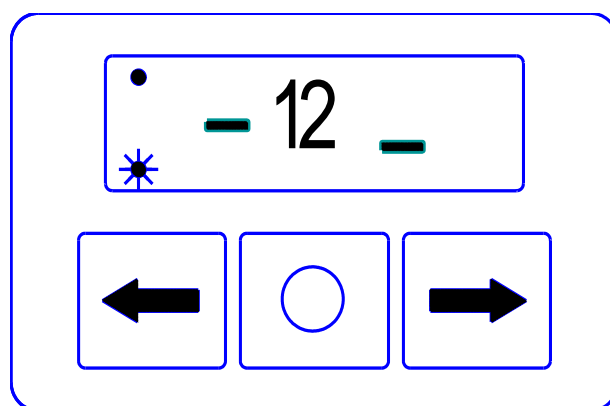
2. While heater activation without setting operation modes it is necessary to press the knob “O” one time if the indicator is lightning, and 2 times if the indicator is not lightning.

6.2.3 Heater deactivation.

To deactivate the heater press the knob “O”. While this the heater is in switching off mode, that means that the combustion process in combustion chamber is stopped and the process of purging is started for 3-5 min, the LED#1 or LED#2 will be blinking frequently until the process of purging is stopped.



Picture 6.5-Purging



Picture 6.6- Purging

Attention!

It is forbidden to switch off electric power supply before purge cycle is finished.

6.2.4 Indication of malfunction code while failures in heater operation

While heater activation and operation there can be malfunctions. In case of malfunction the control unit deactivates the heater automatically. Every malfunction is coded and automatically appears on the indicator (see fig 6.7). While this, malfunction's code and the LED showing the operation mode of the heater will blink rarely. The heater's malfunction codes are described in table 6.1. Pressing any knob on the control panel will switch off indication of the malfunction code and bring the control panel in initial state.

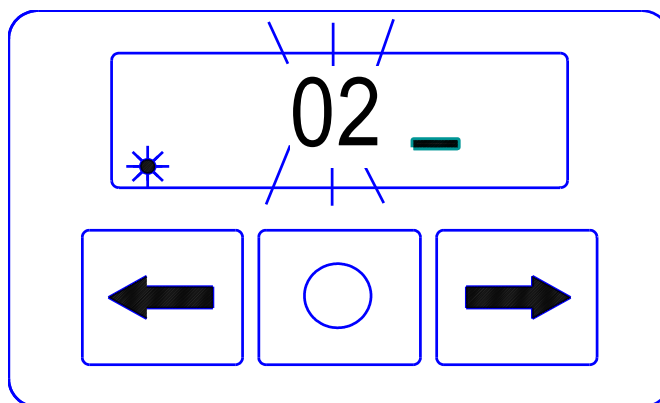


fig 6.7 The panel the indicator at heater malfunction

Table 2-Malfunction codes

Malfunction code	Problem description	Commentary Problem solution
01	Heat Exchanger overheating	Check the inlet/outlet pipe of the heater for unpumped heated air flow. Check the overheat sensor on the heat exchanger, replace if necessary.
02	Possible overheating on temperature sensor. The sensor temperature (control unit) is more than 55°C	While purging for 5 min before start the control unit is not cooled enough or control unit is overheated during operation. Check inlet/outlet pipe of the heater for unpumped heated air flow and repeat activation to cool the heater.
04	Built-in temperature sensor on control unit failure	Replace the control unit

05	Flame indicator failure	Check the flame indicator circuit for disconnection fault with sensor disconnected of its plate. Resistance between contacts should not exceed 10 Ohm. Replace the indicator if it is not operational.
08	Flame failure	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.
09	Glow plug failure	Check the plug and replace if necessary.
10	Air pump motor failure	Check the wiring of the air pump, replace motor if necessary.
12	Shutdown, voltage boost	Check the battery, regulator and power supply wiring. The voltage between 1 contact and 2 contact of connector XP2 (see connection layout picture 4.1) should not exceed 30V
13	No further activation attempt is possible	If possible quantity of activation attempts is used, check the heating plug, fuel level and fuel supply system. Check combustion air system and exhaust pipe line.
15	Shutdown, low voltage	Check the battery, regulator and power supply wiring. The voltage between 1 contact and 2 contact of connector XP2 (see connection layout picture 4.1) should be not less 20V

16	Ventilation period takes longer than usual	The heater is not cooled sufficiently during the purge. Check the combustion air supply system and exhaust pipe line. Check the flame indicator and replace if necessary.
17	Fuel pump failure	Check fuel pump wiring for short-circuit fault or disconnection fault. Replace the pump if necessary.
20	No connection between Control panel and the heater	Check wiring, connectors.
27	Air pump motor fault. Motor won't rotate	Check air pump motor wiring, connector, replace motor if necessary.
28	Air pump motor fault. Motor won't switch off, go on rotation	Check air pump motor wiring, replace motor if necessary.

7. Scope of Supply

See Figure 7.1 for scope of supply and connection diagram of basic heater components PLANAR-8DM-24. For list of basic heater components, see Table 3. True packing arrangement see in the packing list.

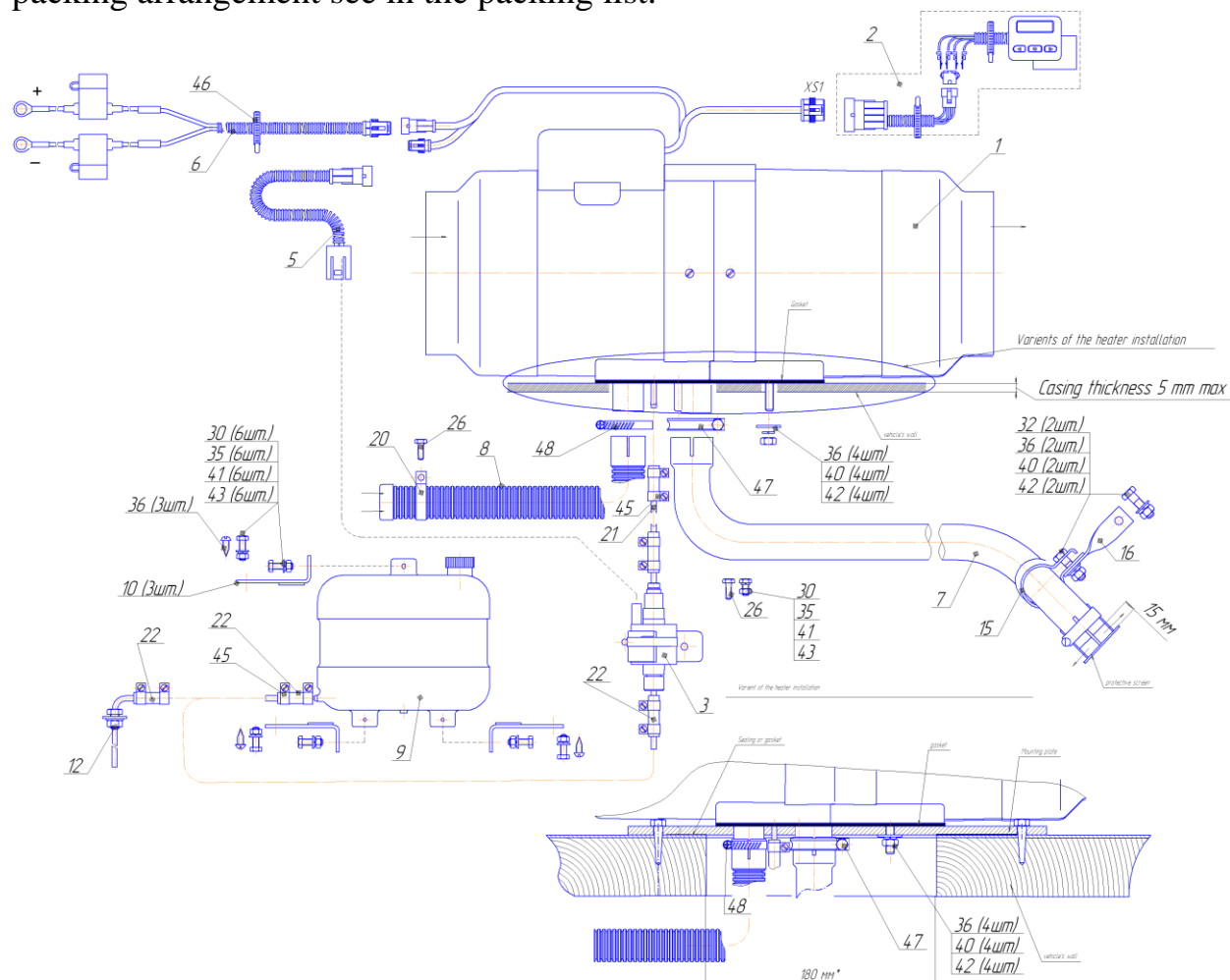


Figure 7.1 – Connection Diagram of Basic Heater Components

Table 3

No.	Designation	Pieces Per Set
1	Heater	1
2	Control panel ПУ-8 with harness	1
3	Fuel Supply Pump, Bracket, Clamp (Set)	1
5	Fuel Supply Pump Harness	1
6	Power Supply Harness	1
7	Exhaust Pipe with screen	1
8	Air Intake	1
9	Fuel tank	1
10	Angle bar with gasket	3
12	Fuel supply intake	1
15	Exhaust Pipe Clamp	1
16	Bracket	1
18	Connecting Tube (polyamide) L = 1000 mm (dm=4mm)	1
20	Air Intake clamp	1
21	Connecting Tube (polyamide) L = 4000 mm (dm=2mm)	1
22	Joint box (L=min 70mm)	4
23*	Mounting plate	1
26	Screw (6.4×16)	5
30	Bolt M6×20	8
32	Bolt M8×35	2
35	Nut M6	8
36	Nut M8	2
40	Washer 8	6
41	Washer 6	6
42	Retaining washer 8	6
43	Retaining washer 6	8
45	Clamp ABA min 10/9	8
46	Plastic clamp	8
47	Clamp PC42	1
48	Clamp 19×44(¾"-1¾")	

* available with additional order

8 Installation Requirements

8.1 Heater Installation

Install the heater according to fig.8.1. Bearing face for the heater should be flat. Position the heater's inlet vent in such a way to prevent absorption of vehicle/heater exhaust gas in normal operating conditions. The distance between the walls/partitions and the edge of the inlet vent shall be at least 50 mm (see Figure 8.1). When assembling or operating the heater, ensure that no foreign objects enter the inlet/outlet vents. Prior to assembly, ensure availability dismantlement requirements, as this will permit easier maintenance in future. See Figure 8.2 how to position mounting holes to install the heater into the motor vehicle casing(the motor vehicle casing thickness is 3mm max).

ATTENTION!! To ensure reliable performance, follow the above recommendations carefully. Install the heater horizontally as shown on the Figure 8.1.

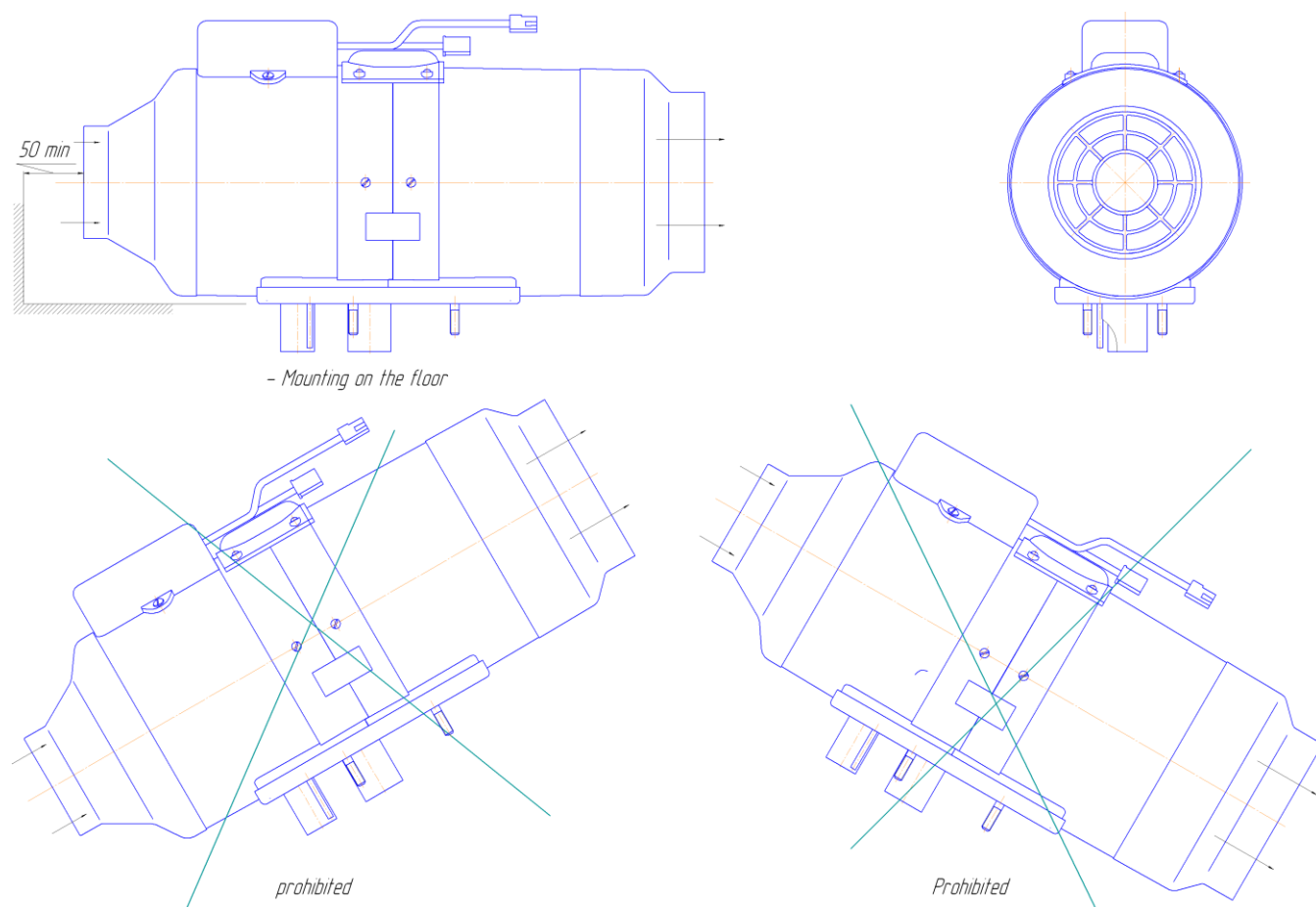


Figure 8.1 – Variants of installation of a heater.

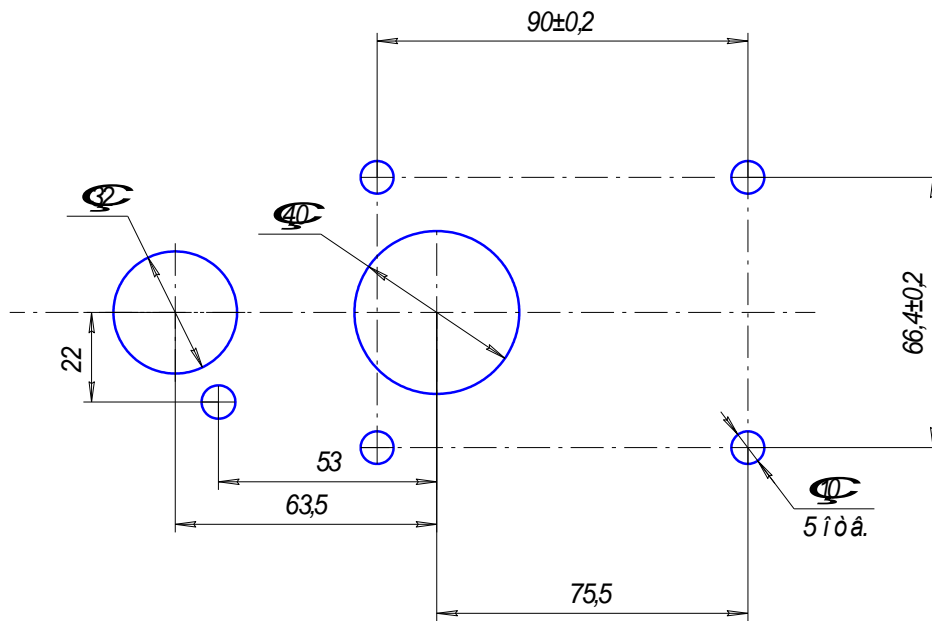


Figure 8.2– Mounting Holes Used for Heater Installation

If the motor vehicle casing thickness is more than 3mm it is necessary:

1. to make holes in figure-of-rectangle shape with sides dimensions 180×95 mm;
2. to attach sealing plate to the heater see fig.7.1 (this plate is possible to be made of steel sheet with min thickness 2.5 mm see figure 8.3)
3. to connect exhausting pipe, air intake, fuel supply harness to the heater and fix the heater with screws to the vehicle casing see fig.7.1.

When fixing the heater to the vehicle casing provide the leaktightness.

To isolate the driver's compartment from exhausting gases one may install rubber plate under the sealing plate or to fix the sealing plate with sealant.

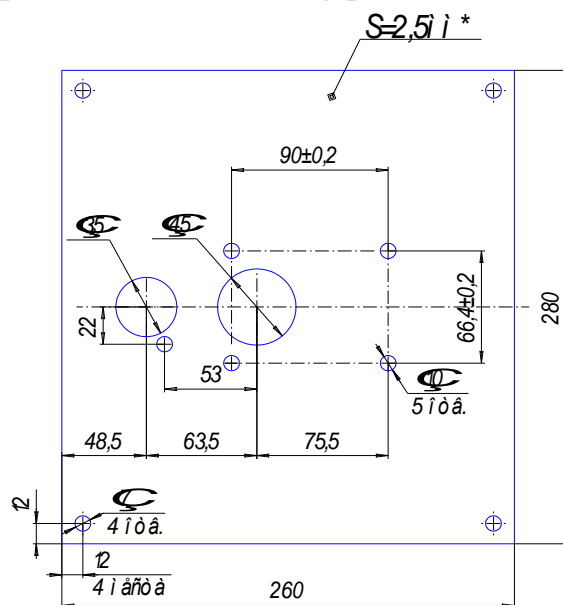


Fig.8.3 Mounting plate

8.2 Air Inlet Installation

Air necessary for burning, should not be soaked up from salon or a cabin and a car luggage space. Position the pipe's air inlet vent to prevent snow entering or choking the pipe and to allow incoming water to run off. The entrance aperture of an air inlet is forbidden to have against a running air stream at car movement.

8.3 Exhaust Pipe Installation

When installing the exhaust pipe, be mindful of its high operating temperature. Exhaust pipe is fixed with clamps.

Direct exhaust gas outside. Position the gas outlet vent and the air inlet vent in such a way as to prevent exhaust gas from entering the combustion chamber.

Ensure that exhaust gas does not enter the passenger compartment of the vehicle and that it does not get sucked in through the vehicle fan. Do not allow exhaust gas to affect the performance of vehicle components. Position the exhaust pipe outlet vent so as to prevent snow entering or choking the pipe and to allow incoming water to run off. The exhaust outlet of an exhaust pipe is forbidden to have against a running air stream at car movement.

At the vent of the exhaust pipe the screen is installed, this is necessary for stable operation of the heater while working low idle.

8.4 Installation of Heater Fuel Supply System

To prevent emergency situations, follow these instructions carefully

8.4.1 installation of Heater fuel pump and fuel tank

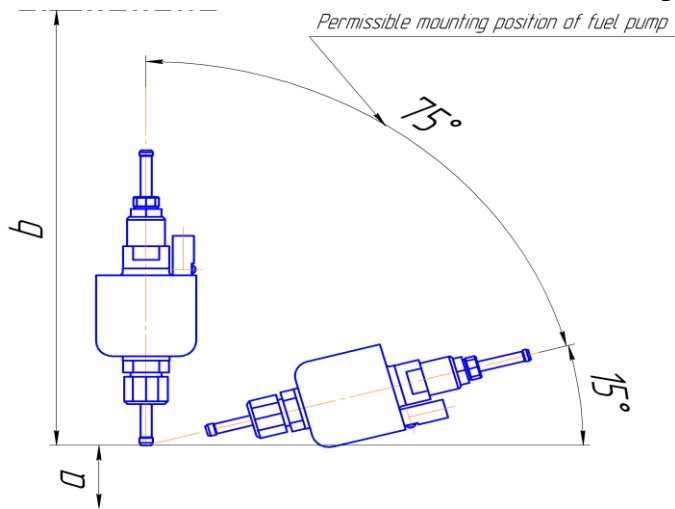
A fuel tank it is necessary to fix so that the exit of fuel which can flow out from its bulk mouth, on the earth was provided.

The bulk mouth of a fuel tank should not be in salon, a luggage carrier, in a motor compartment. If the bulk mouth is located on a vehicle lateral face the filler cap in the closed position should not support car's body dimensions. Fuel which can spill at filling of a fuel tank, should not get on exhaust systems and electro wires. It should be taken away on a ground.

The fuel supply pump should be mounted as close to the fuel tank as possible and positioned below the tank's lower fuel level.

For the purpose of an exception of leak of fuel from a fuel tank by gravity at infringement of tightness of the fuel pump, a fuel tank it is preferable to have so that the fuel maximum level was below a cut of a fuel tube of a heater.

The spatial position of the fuel supply pump must comply with Figure 8.4 (preferably in a vertical position).



a – lift height up to 700 mm (2 ft); b – delivery lift between fuel supply pump and heater up to 1500 mm (5 ft).

Figure 8.4- Permissible Mounting Position of Fuel Pump

8.4.2 Installation a fuel supply intake in a regular tank of the car
Fuel supply intake must be installed into regular fuel tank of the car according to fig. 8.5. Perform installation of special washer with fuel supply intake to the tank inlet according to fig.8.5 Perform installation of the fuel supply line from fuel supply intake to the heater according to fig.8.6.

Attention!!! While manufacturing a hole in a regular fuel tank of the car it is necessary to fulfill safety requirements for works with tank which was filled with combustible and explosive fuel.

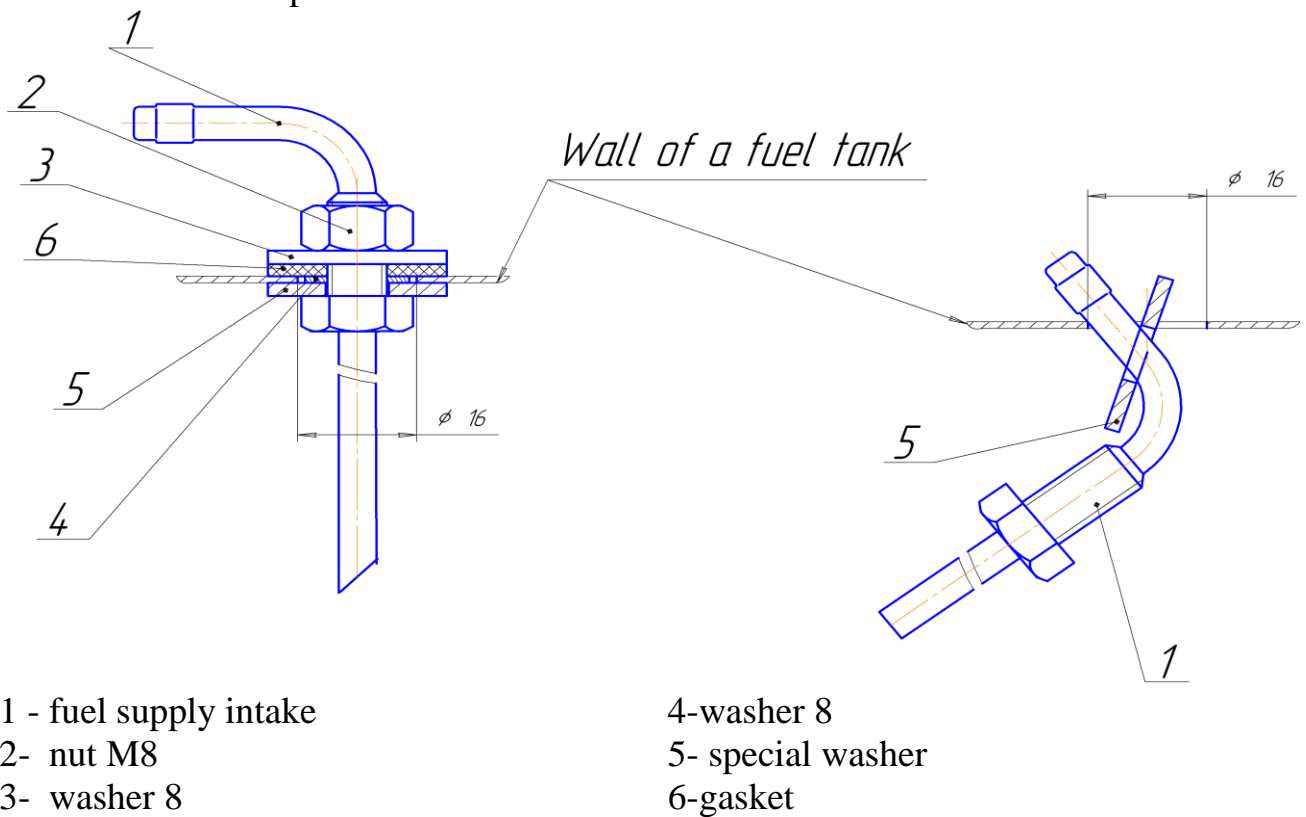
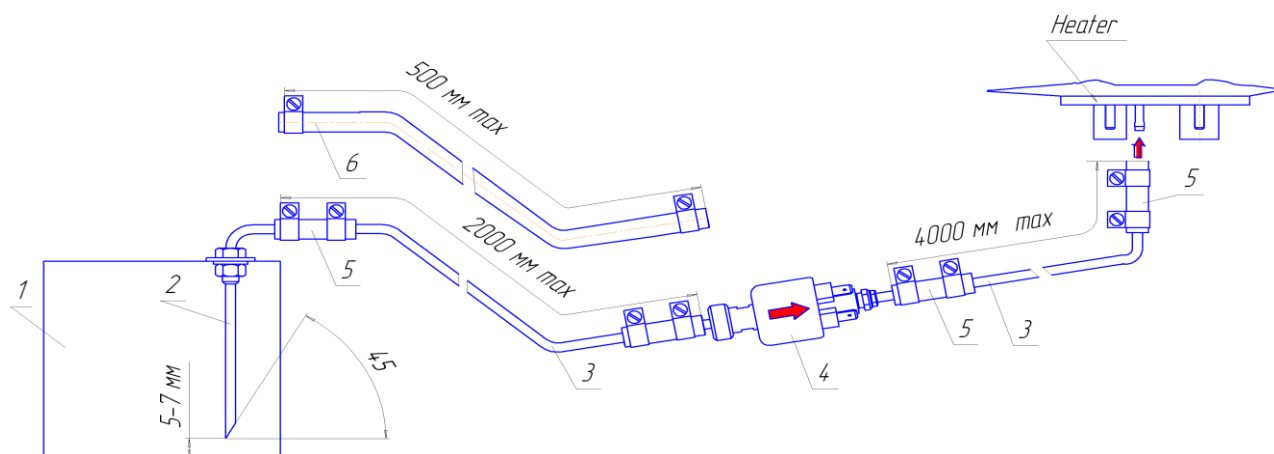


Figure 8.5 – Fuel supply intake installation in a regular tank of the car



1 – regular fuel tank of the car

4 - fuel pump

2 - fuel supply intake

5 - joint box

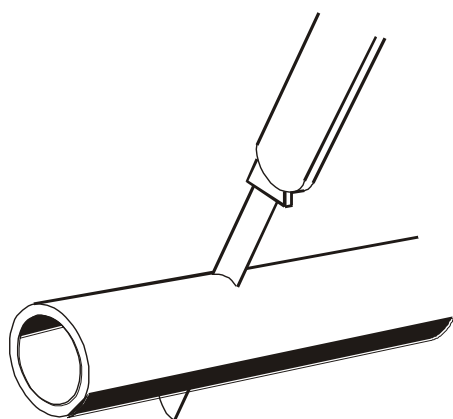
3 – fuel supply line $d=4$ mm

6 – fuel supply line $d=5$ mm

7- fuel supply line $d=2$ mm

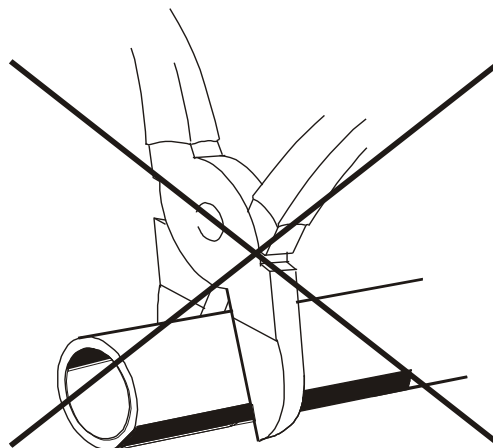
Figure 8.7 – Installation Diagram for Heater Fuel Supply System Using a fuel supply intake

When installing the fuel supply line, do not allow connecting sleeves to bend. Use a sharp knife to cut the fuel tube as in Figure 8.8. The cutting location shall be free of indentations, hairs and must not restrict flow through the tube.



Правильно

Correct



Неправильно

Incorrect

Figure 8.8 – Pipe Cutting Prior to Installation

ATTENTION. 1. Do not allow the fuel supply line or fuel supply pump to overheat. Do not install the fuel supply line and fuel supply pump near the exhaust pipe or on the engine.

2 The fuel supply line connecting the fuel supply pump to the heater should be installed at the same lifting angle.

8.5 Installation of Heater Electric Circuit

Heater wire harnesses shall be installed in compliance with the heater wiring system as shown in Figure 2. When installing, do not allow the wire harnesses to become overheated, deformed or dislodged during vehicle use. Attach the harnesses to the vehicle fittings using plastic clamps.

Attention! Installation should be performed with the fuse disconnected.

8.6 Control Panel Installation

Install the control panel on the place accessible for operation in the cabin or passenger compartment of the vehicle. Fix the control panel by screws or with the help of double-faced adhesive tape. Connect the control panel with wire harness according the electric circuit.

9. Post-installation Testing

9.1 When installing, ensure that:

- the fuel supply system is leak-proof
- the electric contacts of the harnesses and heater elements are securely installed

9.2 Install fuse 25A .

9.3 Fill the fuel pipe system with fuel with the help of fuel pumping device (fuel pumping device VIIT can be ordered at manufacturer). After filling the system check that the fuel pump system is not leaking.

9.4 Check that the heater is working :

- in ventilating mode,
- in heating mode.

The process of activation begins with purging of the combustion chamber. After purging the process of combustion begins and the heater goes on working in operation mode.

9.5 Deactivate the heater. While switching off the heater the fuel stops entering and the process of ventilation of the combustion chamber and heat exchanger starts.

9.6 Activate the heater while the vehicle engine is running and ensure that the heater is operational.

ATTENTION! 1. When performing initial ignition following installation, the fuel supply line should be filled with fuel using a fuel pumping device until the fuel level reaches the inlet plug of the heater. If there is no pumping device, restart the heater as many times as necessary to fill the fuel supply line.

2. Remember that each time the heater fails to start at the first attempt, the heater will be restarted automatically by the control unit.

10. Recommendations

10.1 To ensure consistent performance, the heater should be switched on for up to 5-10 minutes each month throughout the year (warm seasons included). This will prevent the moving parts of the fuel supply pump from sticking. Failure to comply with this advice may cause malfunctions in heater operation.

10.2 Reliable performance depends on the type of fuel used depending on the atmospheric temperature.

10.3 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:

- 1) 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 12). Do not fix the pump in place using surfaces other than Surface A when removing and installing the pipe stub;
- 2) rinse the filter in gasoline and blast it with compressed air;
- 3) install the filter into the fuel supply pump; use sealant when installing the pipe stub;
- 4) install the fuel supply pump and check if the heater works.

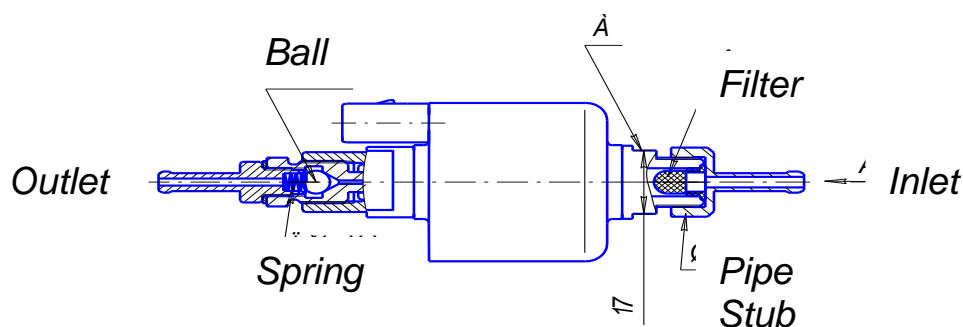


Figure 12. Fuel pump

10.4 Check **the battery charge level** on a regular basis.

10.5 It is recommended to switch on the heater with vehicle ground breaker closed.

10.6 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).

11. Possible malfunction during operations and Remedial Procedure for Heater Ignition Problems

11.1 Certain problems may be solved without contacting a maintenance station.

If the heater does not operate when switched on, proceed to the following steps:

- 1) Check the fuel level in the tank and in the fuel supply line beyond the fuel supply pump,
- 2) Check fuse 25A,
- 3) Check to see that all the contacts of the connectors and the fuse block are securely joined (contact corrosion is possible),

11.2 All other types of heater malfunction will be indicated automatically on the control panel according to the malfunction code (see Table 6.1).

11.3 If there are malfunctions except those specified in 11.1, please contact an authorized maintenance station.

12 Transportation & Storage

12.1 The heaters are safe to transport and may be transported by any means of transport, including air and rail transport providing the packed products are protected from atmospheric precipitations and climatic factors as per requirements specified in Section 5 of GOST 15150-69 and mechanical effects as per requirements specified in Category C of GOST 23216-78.

12.2 As far as climatic factors are concerned, transportation and storage conditions shall comply with storage requirements set out in Section 5 of GOST 15150-69.

13 Warranty

13.1 The heaters carry a warranty period of 24 months from the date.

13.2 If there is no organization stamp specifying the date of sale, the warranty period begins from the date of the heater's manufacturing.

13.3 During the warranty period, all defects occurring through the Manufacturer's fault will be repaired by the personnel of authorized car-care centers, using the necessary spare parts provided free of charge by the Manufacturer.

13.4 The Manufacturer does not accept any liability for incomplete delivery or any mechanical damage occurring after sale.

13.5 The following defects and damages are excluded from warranty coverage:
- all defects and damages caused by force-majeure such as lightning strike, fire, flood, excessive voltage fluctuations, car accident, etc.,

- all defects and damages caused by violation of rules of installation, use, storage and transportation specified herein,
- all defects and damages caused by installation, repairs or commissioning of the heater performed by persons or organizations unauthorized by the Manufacturer to perform the said operations,
- improper use of the heater.

14 Packing Certificate

The PLANAR – 8DM-24 heater
serial No. _____
has been manufactured and packed in compliance with the technical requirements TY
4591-008-40991176-2005 and effective technical documentations set out serviceable.

Date of Manufacturing _____

Packed by _____ Signature

Stamp here
Technical Inspection Department