Air Heaters

PLANAR-9D-24/12

Operating Manual

АДВР.216.00.00.000 РЭ

English

Contents

1 Introduction

This operating manual (the “OM”) describes the design as well as principles and rules of operation of the PLANAR-9D-24 air heaters (the “heaters”) designed for controlled warming-up of vehicle interiors at ambient air temperatures down to minus 45°C.

This OM may not include information about minor design alterations made by the manufacturer after the publication date of this OM. The manufacturer may modify the design of the product provided its technical characteristics are not impaired.

An example of designation of the heater for ordering and in documentation for other products:

Air heater, PLANAR-9D-24 TU4591-008-40991176-2005

2 Main parameters and characteristics

See Table 1 for main technical characteristics of the heater.

Technical characteristics include a ±10% tolerance and are specified for operating under the rated power supply voltage and an air temperature of 20°C.

Table 1

Characteristic	PLANAR-9D-24	
Rated power voltage, V	24	
Fuel type	Diesel fuel under GOST 305, depending on ambient air temperature	
Heat capacity	max., kW	min., kW
	8	3.2
Heated air flow	max., m^3/h	min., m^3/h
	290	70
Fuel consumption	max., l/h	min., l/h
	1.0	0.42
Power consumption	max., W	min., W
	180	12
Ignition/shutdown	manual	
Mass, kg, max.	18	

3 Safety

3.1 The heater and its parts must be installed by a specialist company.

3.2 The heater is to be used only for the purposes specified in this operating manual.

3.3 Do not install the fuel line inside the vehicle interior.

3.4 Do not install electric wiring (harnesses) near the fuel line.

3.5 A vehicle equipped with the heater must be provided with a fire extinguisher.

3.6 Do not use the heater in environments where combustible vapors or gases, or large amounts of dust may appear or aggregate.

3.7 Due to danger of exhaust gas poisoning, do not operate the heater when the vehicle is parked inside a confined space (a garage, a repair shop, etc.).

3.8 The heater must be switched off during vehicle fueling.

3.9 Disconnect the heater from the battery before starting any welding work on the vehicle or heater repair.

3.10 During installation and dismantling of the heater, safety rules envisaged by regulations for works performed on electric networks and fuel systems of vehicles must be observed.

3.11 Do not connect the heater to the electric circuit of the vehicle with running engine and the battery removed.

3.12 **Do not switch off heater electric power before the purging cycle is completed.**

3.13 The heater must be powered from the **battery** independently of the vehicle **ground**.

3.14 Do not connect/disconnect electric power plugs when the heater is on.

3.15 Do not step on the heater, do not place objects onto it.

3.16 Do not cover the heater with clothes, rugs, etc. Do not obstruct the hot air outlet hole with clothes and rugs either.

3.17 After the heater is switched off, do not switch it on again for at least 5–10 seconds.

3.18 For safe heater operation, after two unsuccessful attempts to start the heater in a row, contact the service department for troubleshooting information.

3.19 In case of a heater fault, contact a specialized maintenance organization authorized by the manufacturer.

3.20 Failure to observe the above requirements makes the warranty void.

4 Heater design and operation

The heater operates independently from the vehicle engine.

The power is supplied to the heater from the vehicle battery or an independent power source. Electric circuit diagram of the heater is shown on Fig. 4.1.

The heater is an autonomous heating device containing:

- a heating element (see main units on Fig. 4.2)
- a fuel pump used for fuel supply to the combustion chamber
- a launch-and-indication device (control panel)
- wire harnesses connecting the heater units and the vehicle battery
- a fuel tank.

The heater heats up air pumped through the heat-exchanging system of the heater with gases produced as a result of combustion of gas/air mixture in the combustion chamber. Air is blown over heated fins of the heat exchanger; the air heats up and then is exhausted into the vehicle cabin.

At launch, operation of the following heater parts is checked: flame detector, overheating sensor, air blower electric motor, glow plug, fuel pump, and electric circuits of the above parts. If the units are operational, ignition starts by purging the combustion chamber and heating the glow plug up to the required temperature. After that, air and fuel are supplied. Combustion begins in the combustion chamber. When combustion is stable, the glow plug is de-energized. Combustion process is controlled by means of a flame detector. The control unit (the “CU”) controls all processes of heater operation.

The CU regulates temperature of the heat exchanger of the heater and the heated air; in case a set point is overreached, combustion stops.

The heater may be switched off at any moment.

If the heater is switched off, gas supply stops and the combustion chamber is purged with air.

Automatic mode of heater operation includes the following safety features for emergency situations:

1) If the heater does not start for some reason, the starting procedure repeats automatically. If two attempts are unsuccessful, the heater switches off.
2) If combustion stops during heater operation, the starting procedure repeats. Up to three flame blowoffs are allowed during operation.
3) In case of overheating of the heat exchanger (e. g. if the intake/outlet of the heater is blocked), the heater switches off automatically.
4) In case the heated air temperature is exceeded (e. g. if the outlet of the heater is blocked), the heater switches off automatically.
5) If voltage falls below 20 V or raises above 30 V, the heater switches off.
6) In case the heater is switched off due to a failure, an LED blinks on the control panel. The number of blinks indicates the malfunction code specified in the OM for the panel.

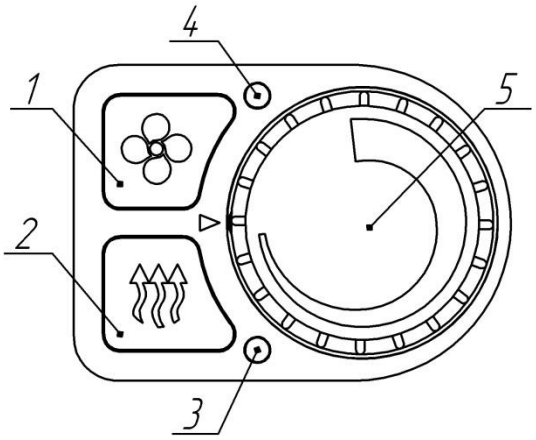
5 Heater control unit (CU)

Together with the control panel, the CU is used to control the heater. The CU performs the following functions:

a) functional diagnostics of heater units prior to startup
b) functional diagnostics of heater units during operation
c) switching the heater on and off by a signal from the control panel
d) control of the combustion process
e) automatic switching ventilation on and off after the end of combustion
f) automatic shutoff of the heater:

- upon failure of one of the controlled units
- upon exceeding allowable heat exchanger temperature, heated air temperature, or supply voltage limits; upon flame blowoff in the combustion chamber (over three times).

6 Control Panel



The following are located on the front of the panel:

1 ventilation mode on/off button
2 heater on/off button
3 operation LED
4 ventilation mode LED 5 potentiometer handle.

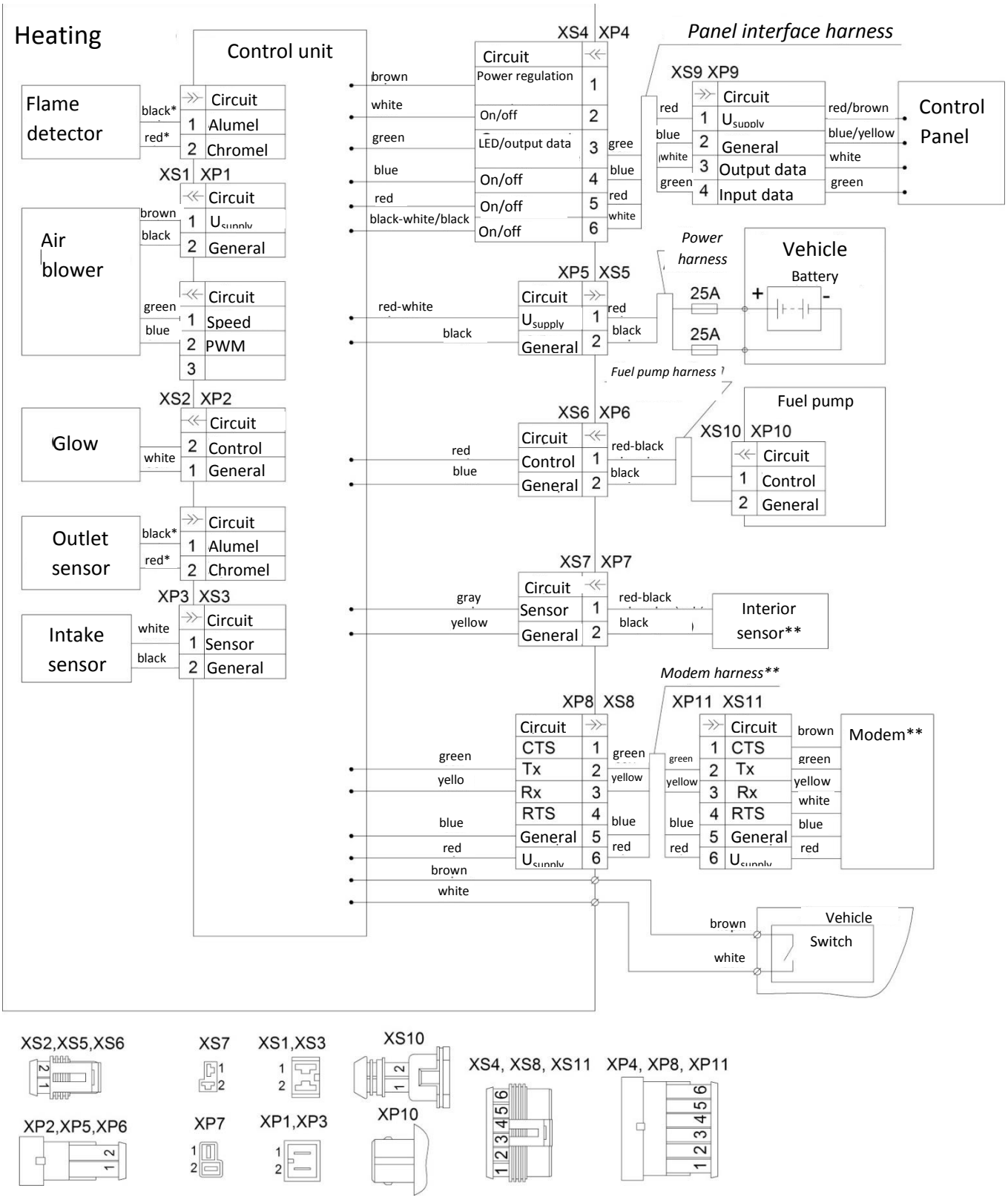
The LED in Pos. 3 indicates the heater status:

- yellow light—heating mode
- fast blinking yellow—purging
- slowly blinking red—malfunction; off—heater is not operational.

The LED in Pos. 4 indicates the ventilation mode status:

- green light—interior sensor is not connected and heater operates in ventilation mode
- green blink—ventilation mode off
- yellow light—the interior sensor is connected and the heater operates in heating mode with ventilation
- off—heater is not operational, with ventilation mode off.

Operation of the control panel is described in its OM.



1. Terminal blocks XS1, XS3, XS7, XP1, XP3, XP7 viewed from the terminal side (not from the wire side)
2. * wire tag color
3. ** optional part

Fig. 4.1 Electric circuit diagram

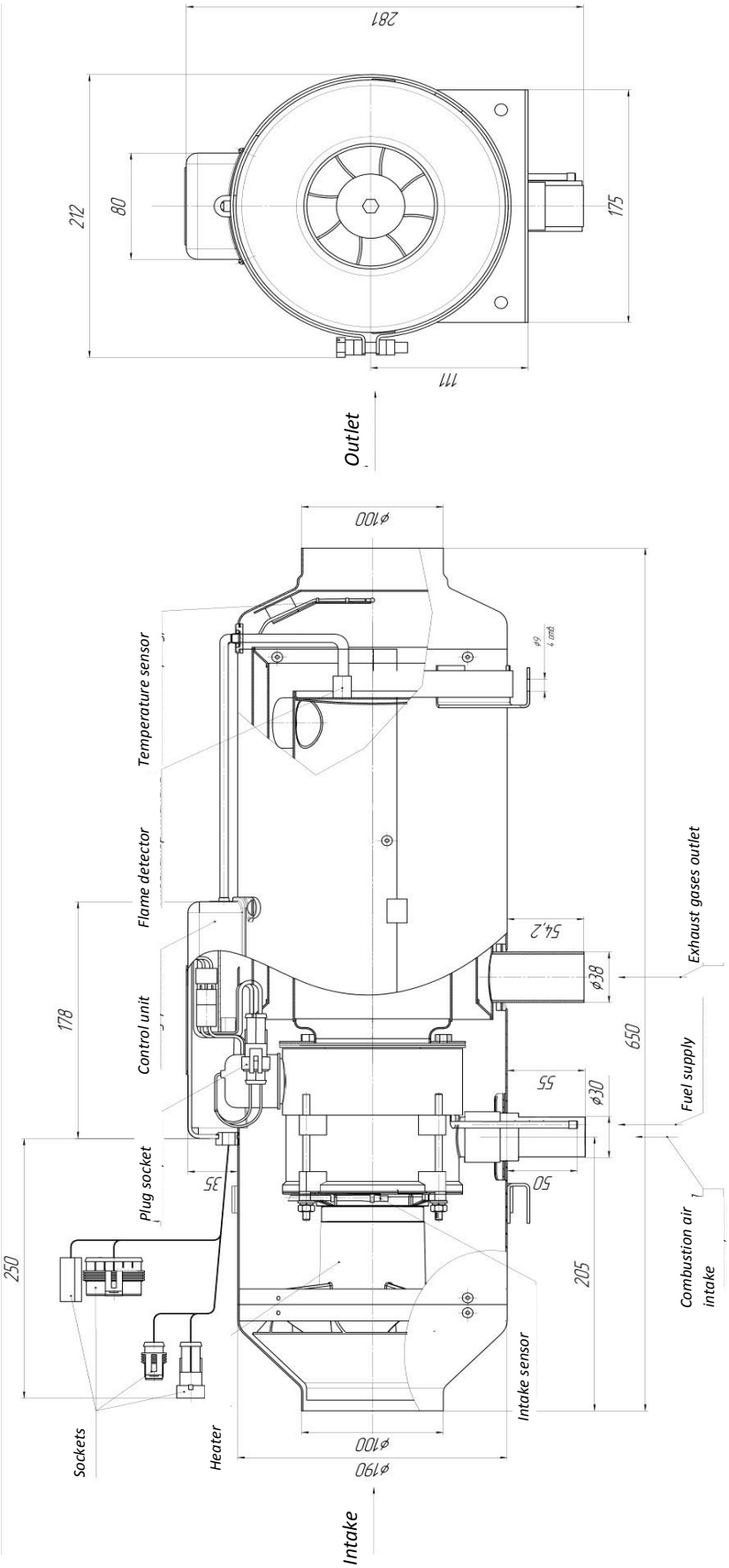


Fig. 4.2 Main units of the heater

7 Scope of supply

Scope of supply and connections of main parts of a PLANAR-9D heater are shown on Fig. 7.1.

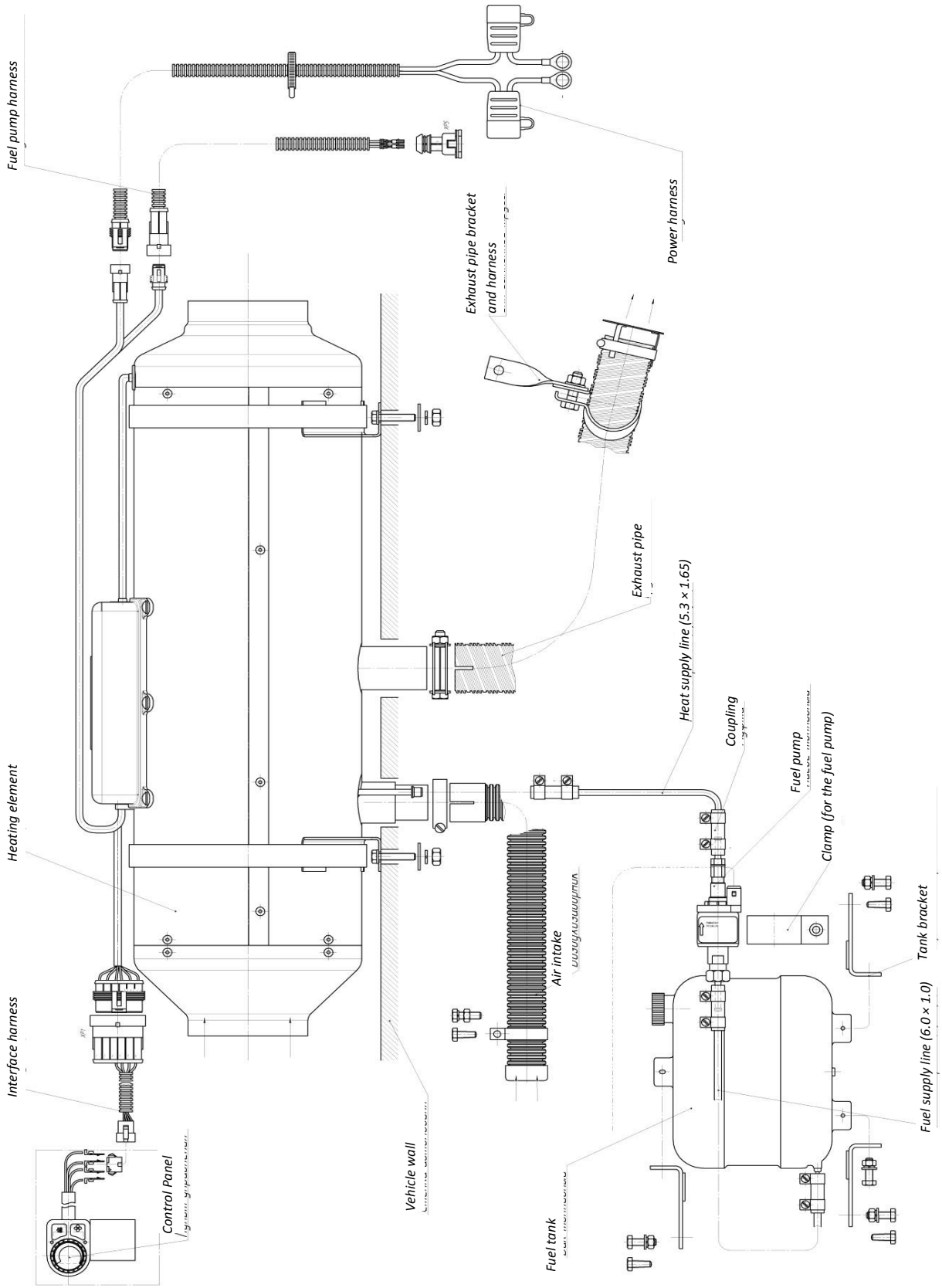


Fig. 7.1 Connections of main parts of the heater

8 Requirements for installation of heater units

8.1 Heater installation

Installation of the heater must be performed as shown on Fig. 8.1. The heater must be installed onto level surface. Its intake must be oriented in such a way so no exhaust gases of the vehicle and the heater itself could enter the intake during normal operation. Walls and baffles may not be located closer than 100 mm from the intake and 250 mm from the outlet. The intake and outlet must be provided with suitable protection against foreign objects falling inside. To facilitate maintenance, install the heater in a way that allows easy dismantling. During installation, ensure the heater casing does not contact either the floor or other parts of the vehicle interior.

Attention! Operation of the heater depends on correct installation of the heating element. The heating element must be installed horizontally as shown on Fig. 8.1.

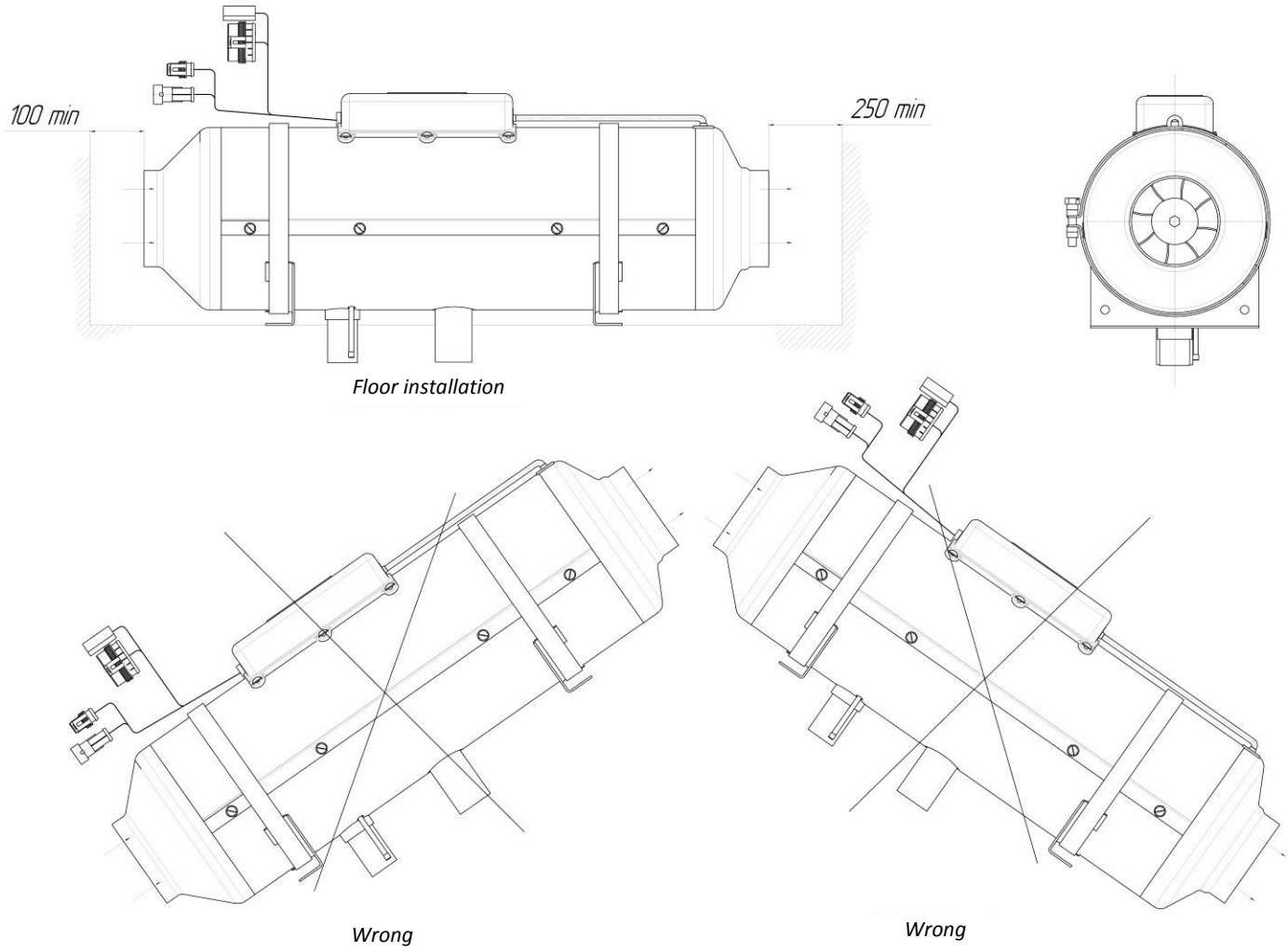


Fig. 8.1 Heater installation

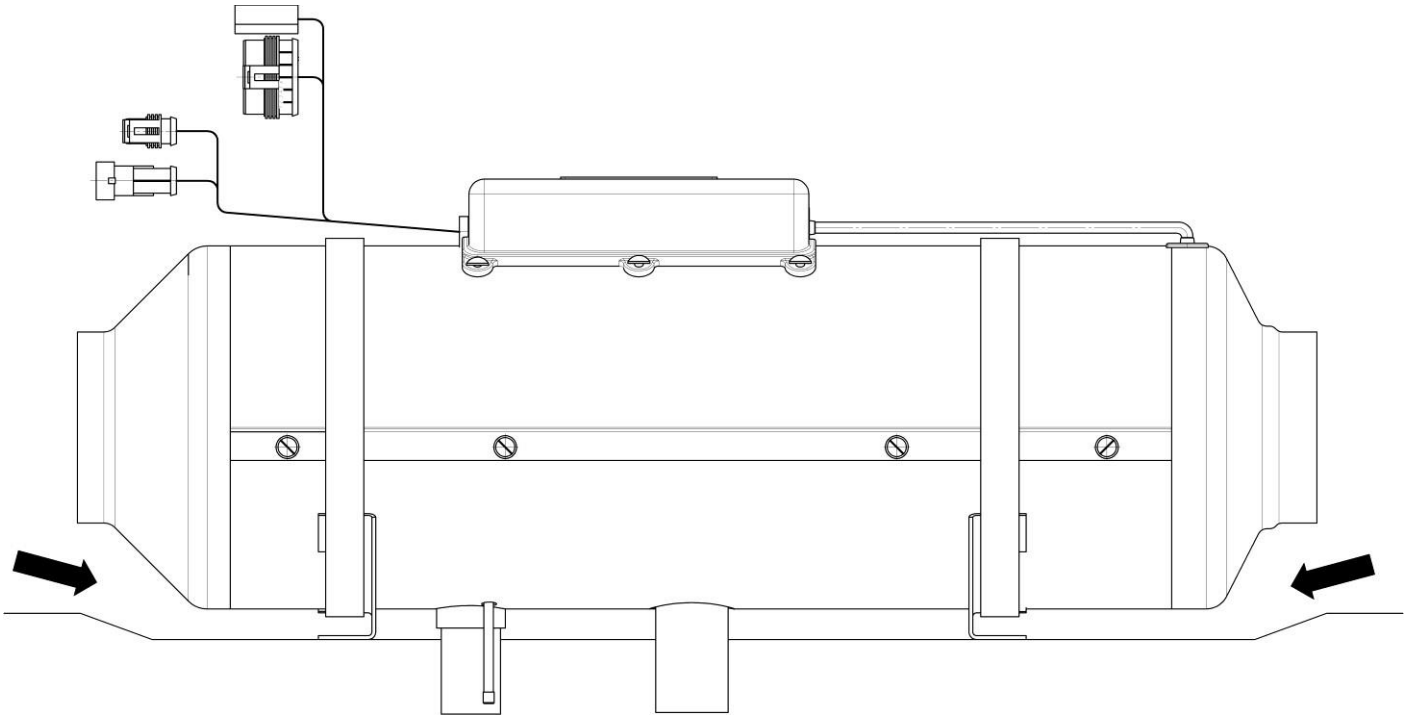


Fig. 8.1a Leave a gap

Failure to observe this requirement may lead to casing deformation, air blower fan jamming, and possible overheating.

8.2 Air intake installation

Combustion air must not be sucked from the driver's compartment, passenger cabin, or luggage compartment. Install the air intake opening in a way that prevents clogging, ingress of snow, and facilitates free draining of trapped water. Do not install the air intake opening against incoming airflow during vehicle movement.

8.3 Exhaust pipe installation

Choose a place for installation considering high temperatures during operation of the exhaust pipe. Fasten the exhaust pipe with clamps.

Exhaust gases must be directed outwards. Install the exhaust pipe and the combustion air intake in a way that prevents suction of exhaust gases into the air intake.

During installation of the exhaust pipe, ensure no exhaust gases enter the interior or the fan through the heater radiator. Moreover, exhaust gases must not hinder operation of other vehicle units.

Install the exhaust pipe outlet in a way that prevents clogging, ingress of snow and facilitates free draining of trapped water. Do not install it against the airflow during vehicle movement. The exhaust pipe is provided with a screen required for stable operation of the heater at low duty.

Attention! In case the heater is installed inside large vans (isothermal shelters etc.), do not install exhaust and intake pipe openings on the opposite sides of the vehicles. They may

only be installed on one side not less than 200 mm from one another, to exclude suction of exhaust gases into the intake opening.

Failure to observe the above recommendations may, during extreme weather conditions (strong wind, pressure difference), not only prevent exhaust but also create additional underpressure in the air intake area. This leads to abnormal burner operation; the burner gets sooted and the heater is subject to rapid wear.

Rarely, failure to observe this recommendation may lead to suction of flame into the air blower.

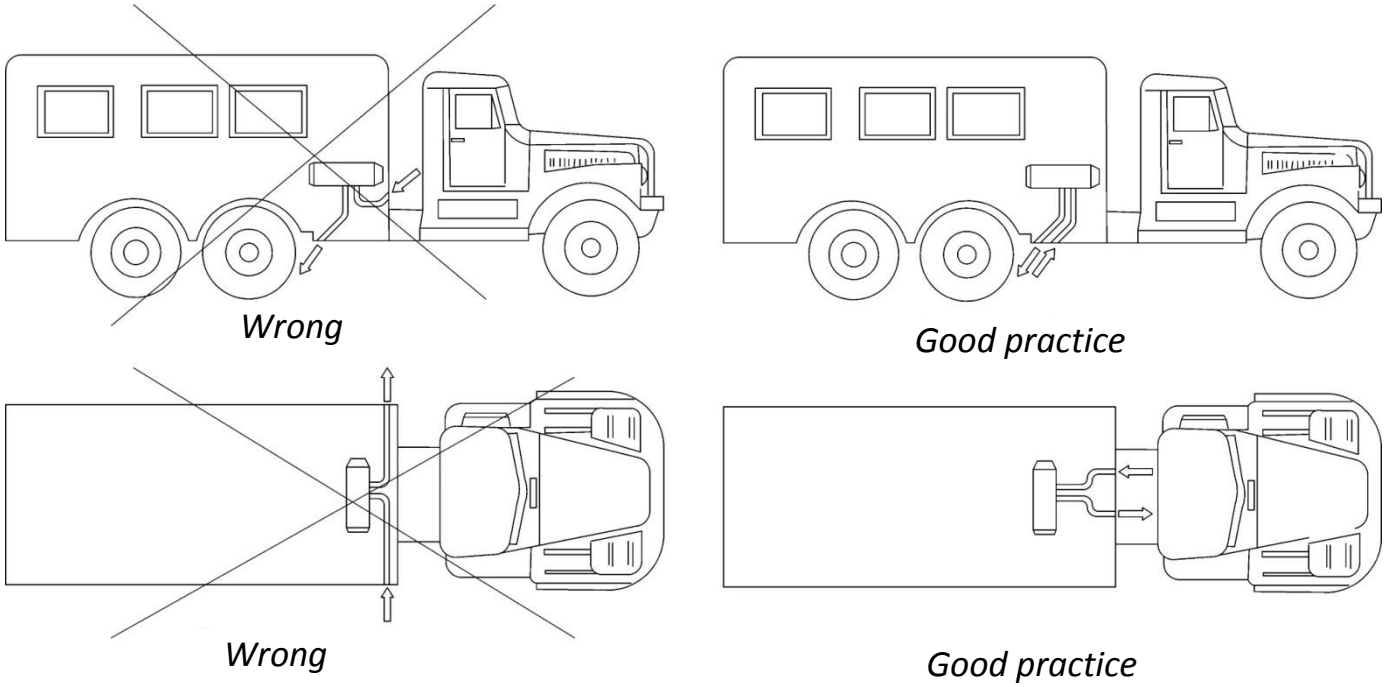


Fig. 8.3a Recommended position

8.4 Installation of the heater fuel system

Observe the following instructions carefully to avoid emergencies.

8.4.1 Installation of the tank and the fuel pump

The fuel tank must be installed onto proper supports in such a way so that fuel leaking from the tank, its filling hole, and connections would be spilled onto ground.

Do not position the filling hole in the cabin, trunk, or the engine compartment. If the filling hole is positioned on vehicle side, the installed plug must not protrude beyond outer dimensions of the vehicle. Fuel that may leak during the tank filling, must not be spilled onto the exhaust system and electric wiring. Only spillage to the ground is allowed. Good practice is to install the fuel pump as close to the tank as possible and below the minimal fuel level in the tank.

To exclude fuel leakage from the tank by gravity in case of failure of fuel pump sealing, it is recommended to position the tank in such a way so that the maximal fuel level would be below the lower edge of the heater fuel pipe end.

Attention!

Check the fuel tank before the heating season starts. In case fuel was stored in the tank for a long time (e.g. from the last heating season), **drain** it. Flush the tank with gasoline or kerosene and fill with **new diesel fuel**. This is needed to remove deposits that tend to build up during long storage of the fuel in the tank. Failure to observe this requirement may lead to **clogging** or **failure of the fuel pump** or increased sooting of the combustion chamber.

Scope of supply of a PLANAR-9D-24 heater includes the fuel pump that must be installed in the position shown on Fig. 8.4a, i.e. ± 5° from the horizontal level.

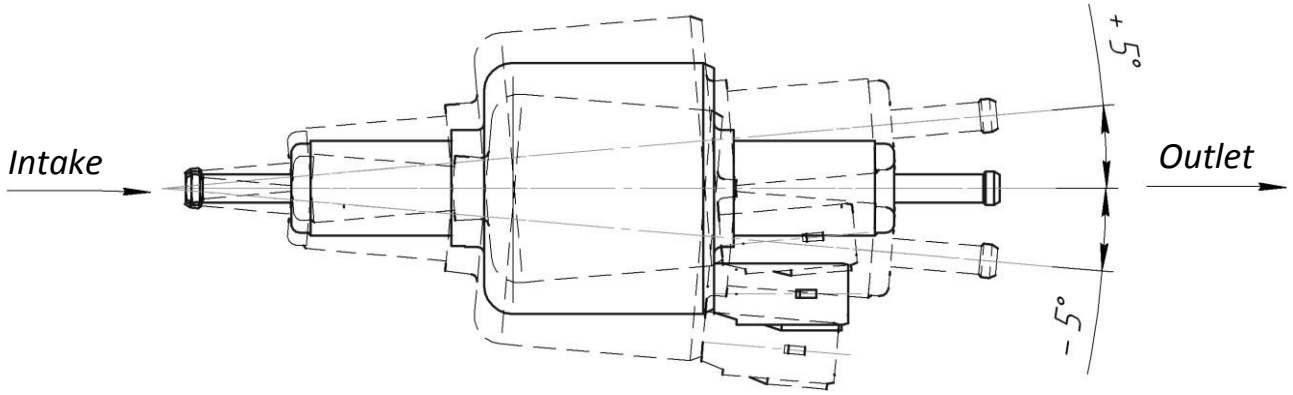


Fig. 8.4a Allowable position for installation of the fuel pump

8.4.2 Fuel supply from the vehicle tank through the fuel intake pipe (optional)

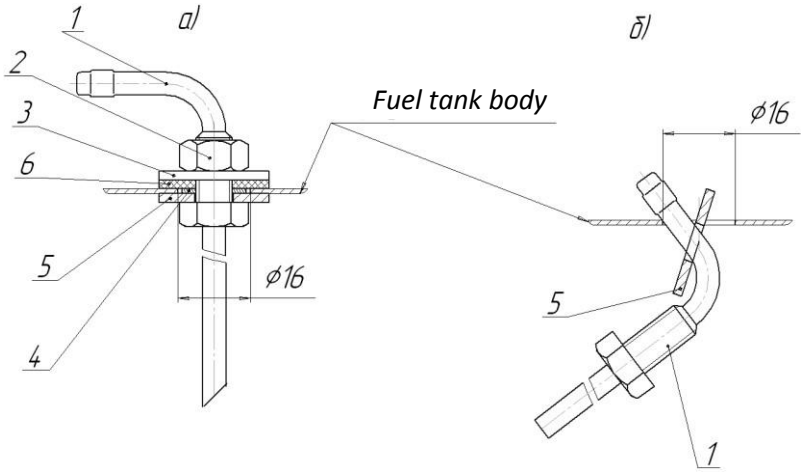
The fuel intake is installed into the fuel tank as shown on Fig. 8.5

a) Install the special washer with the fuel intake in the tank opening as shown on Fig. 8.5.

b) Install the fuel pipe between the fuel intake and the heater as shown on Fig. 8.6.

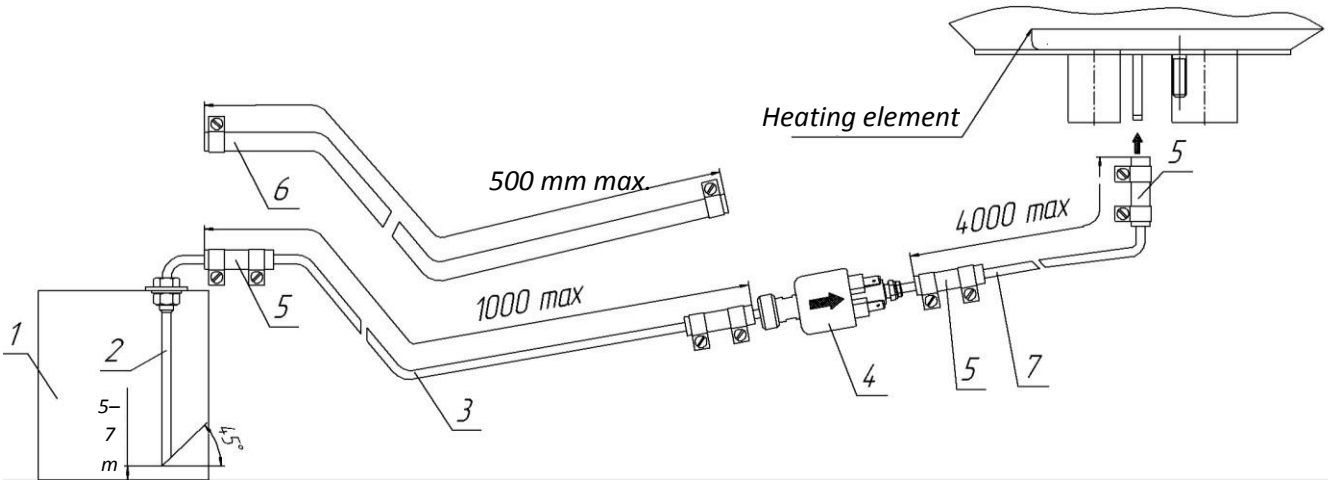
Attention!

Observe safety requirements for working with vessels used for storage of combustible/explosive fuel while cutting the opening in the fuel tank.



1. Fuel intake
2. M8 nut
3. Washer 8 (enlarged)
4. Washer 8 (diminished)
5. Special nut
6. Ring gasket

Fig. 8.5 Fuel intake installation

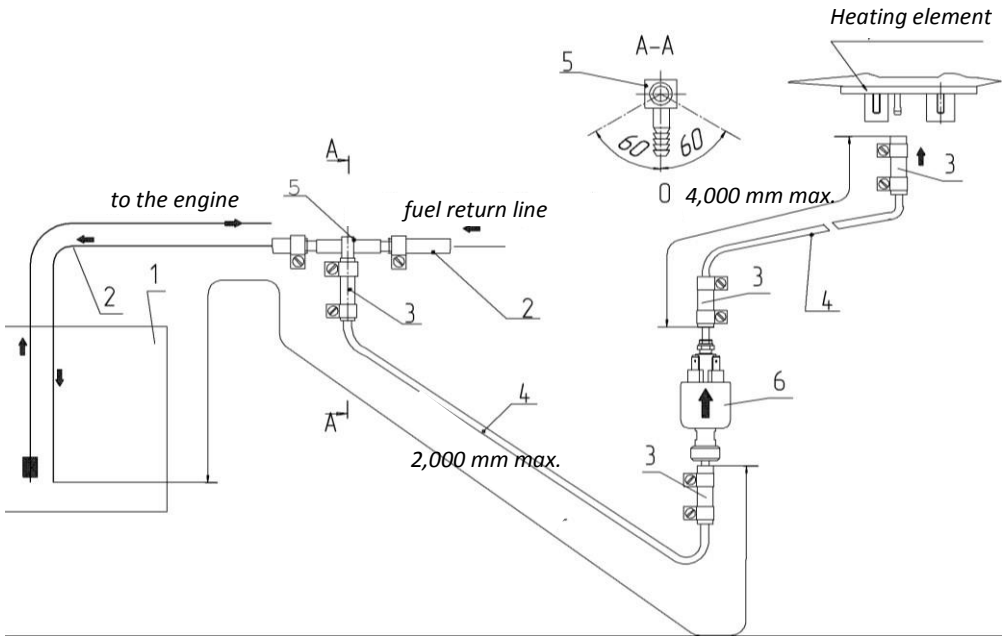


1. Fuel tank
2. Fuel intake
3. Fuel line, Dn = 4 mm
4. Fuel pump
5. Coupling
6. Fuel line, Dn = 5 mm
7. Fuel line, Dn =2 mm

Fig. 8.6 Installation of the heater fuel system using the fuel intake

8.4.3 Fuel supply to the heater through the T-piece

The T-piece to draw fuel to supply to the heater may be installed in the fuel return pipe leading from the engine to the fuel tank. The return pipe must not be pressurized and must lead to the fuel tank bottom. Install the T-piece as shown on Fig. 8.7.



1. Vehicle fuel tank
2. Fuel return line to the tank from the vehicle engine
3. Coupling
4. Fuel line, Dn = 2 mm
5. T-piece
6. Fuel pump

Fig. 8.7 Installation of heater fuel system using the T-piece

Do not bend the couplings used for connection of fuel pipes. Cut sections of the fuel pipe with a sharp knife as shown on Fig. 8.8. The cutting sections must have no reduction of the flow passage, no bents or dents.

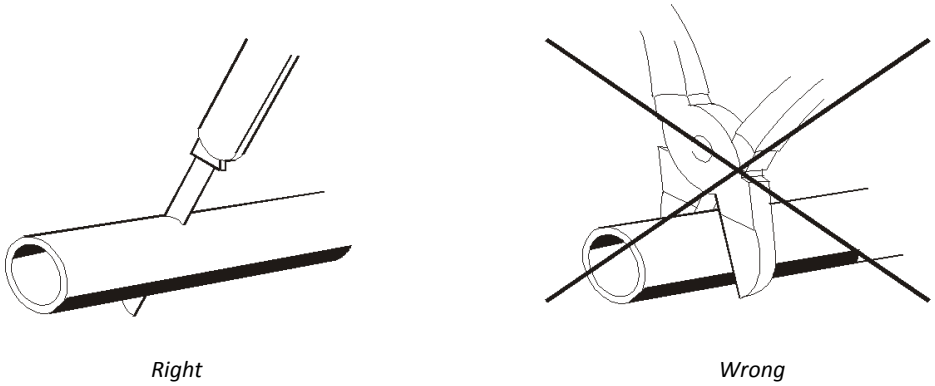


Fig. 8.8 Cutting the fuel line before installation

Attention!

1. **The fuel line and the fuel pump must be protected from heat and hence should not be installed near the exhaust pipe or onto the engine.**
2. **The fuel line from the fuel pump to the heating element is recommended to be installed at a rising angle.**

8.5 Installation of heater electric wiring

Install heater wire harnesses in accordance with the heater electric circuit diagram shown on Fig. 4.1. Install the harnesses in a way that prevents their heating, deformation, and moving during vehicle operation. Fix the harnesses to vehicle parts with plastic clamps.

If needed, cut an unnecessary part of the harness out of its middle. Insulate the connection with two heat shrink sleeves (in scope).

Attention! Good practice is to cut the harness at a 500–700 mm distance from either end of the corrugated sleeve of the harness and cut out the unnecessary section. Remove wires, pile off insulation from the ends of all wires to be connected, pull the heat shrink sleeve onto the wires and twist wires of matching colors together. Install the heat shrink sleeve in a way so that the place where the wires are twisted together is in the middle of the sleeve. Heat the sleeve up and wait until it shrinks on the wires. Insert the wires into the corrugated sleeve and cover the connection spot with insulating tape.

Attention! Remove fuses prior to installation.

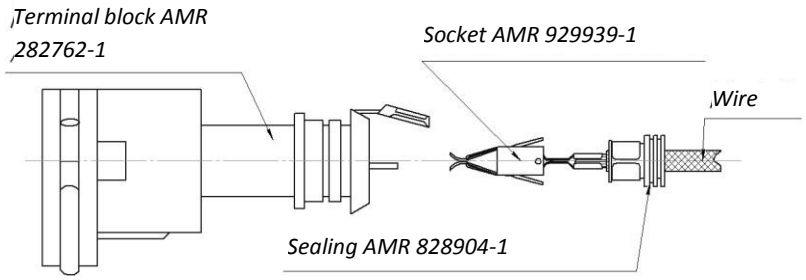


Fig. 8.9 Position of the terminal block and the socket before installation

8.6 Control panel installation and connection

Install the control panel inside the vehicle cabin on the dashboard or in any other place suitable for the driver.

Connect the panel to the heater as shown on the electric circuit diagram (Fig. 4.1).

9 Check of the heater after installation

9.1 During installation, ensure:

- tightness of the fuel lines and clamps
- secure fastening of heater electric contacts, harnesses, and devices.

9.2 Install 25 A fuses.

9.3 Fill the fuel line with the booster pump (not in scope).

9.4 Switch the heater on and check its operation:

- at minimum duty,
- at maximum duty.

Launch procedure begins with quick purging of the combustion chamber. Next, the ignition process starts, and the heater reaches the required operation mode.

9.5 Switch the heater off. If the heater is switched off, gas supply stops, and the combustion chamber and the heat exchanger are purged with air.

9.6 Start the heater with the vehicle engine on and check functioning of the heater.

Attention!

1 During the first launch after installation, good practice is to fill the fuel line up to the heater intake nozzle with air using the booster pump. In case no booster pump is available, launch the heater several times to ensure the fuel line is full.

2 Remember that in case the heater fails to start in the heating mode, the control unit automatically repeats the launch attempt.

10 Recommendations

10.1 To ensure reliability of heater operation, start it up once every month for 5–10 minutes (including during the warm season if the heater is not in use). This is necessary to remove viscous film deposits from moving parts of the fuel pump. Failure to do so may lead to a heater malfunction.

10.2 Operation of the heater depends on fuel used. Use fuel compatible with GOST 305-82 and with ambient temperature (see table 10.1). Fuel mixtures are also allowed, if compliant with Fig. 10.

Table 10.1

Ambient temperature, °C	Fuel (mixture) type
Above 0	Diesel fuel L-0.2-40 or L-0.2-62 under GOST 305-82
0 to minus 5	Diesel fuel Z-0.2 minus 35 under GOST 305-82
Minus 5 to minus 20	Diesel fuel Z-0.2 minus 35 under GOST 305-82 or diesel fuel Z-0.2 minus 45 under GOST 305-82
Below minus 20	Diesel fuel A-0.4 under GOST 305-82

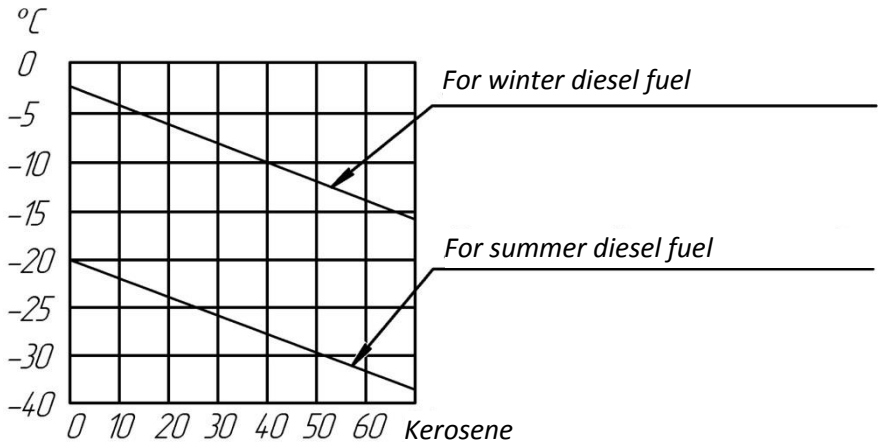


Fig. 10 Kerosene content in diesel fuel mixture depending on ambient air temperature

10.3 In case winter fuel is not used in appropriate weather, the fuel intake filter of the fuel tank (if available) and the filter of the fuel pump may become clogged with paraffin, which leads to failure to launch the heater or its shutdown during operation.

To repair such a malfunction:

1) Dismount the fuel pump from the vehicle. Hold surface A with a 17 mm wrench to prevent it from turning; remove the nozzle and the filter (see Fig. 10). Do not use other surfaces to secure the fuel pump when removing or reinstalling the nozzle.
2) Rinse the filter, purge it with compressed air.
3) Reinstall the filter into the fuel pump; if no sealing gasket is available for the nozzle, seal it with sealing compound.
4) Install the fuel pump and check operation of the heater.

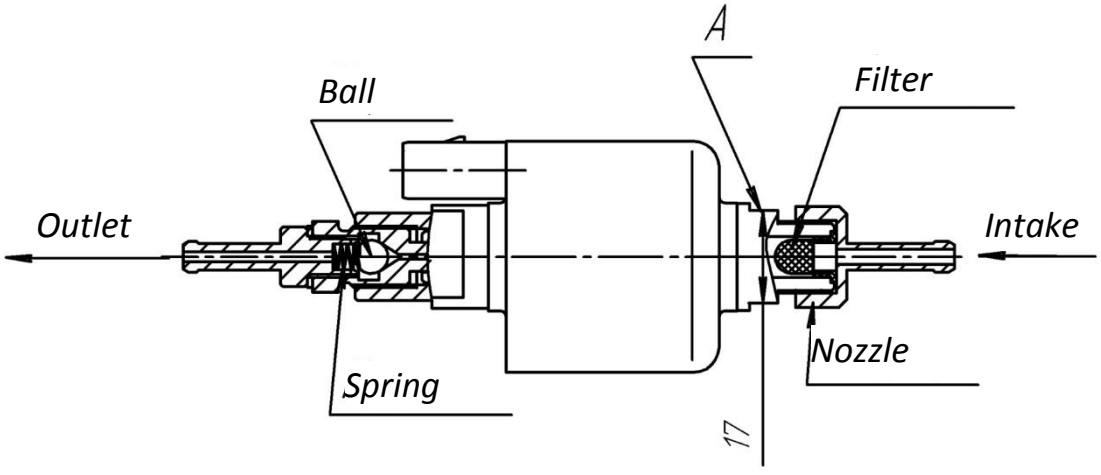


Fig. 10 Fuel pump

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

10.5 Good practice is to switch the heater on with the grounding breaker closed.

10.6 Good practice is to disconnect the heater from the power source (battery) during long standstill or storage of the vehicle in order to prevent discharge (an out-of-service heater consumes 30–40 mA).

11 Possible malfunctions at heater launch and their troubleshooting

11.1 Faults correctable by the user. If the heater does not start upon turning on, check the following:

1) amount of fuel in the tank and the fuel line after the fuel pump
2) the 25 A fuse
3) security of connection of terminal blocks and fuse contacts (oxidation is possible).

11.2 Any other fault may be identified by the way the panel LED blinks. The number of blinks and malfunction codes are specified in Table 6.1.

11.3 Contact a service station in case any fault occurs during operation, apart from those specified in section 11.1.

12 Transportation and storage

12.1 Heaters are safe for transportation and may be transported by any means, including by air or railroad, provided packed goods are protected from weather according to Condition 5 of GOST 15150-69, and from mechanical impact according to Category S of GOST 23216-78.

12.2 Conditions of storage of heaters in manufacturer's packing must comply with Condition 2 of GOST 15150-69.

12.3 Heater shelf life in manufacturer's packing is 24 months.

13 Warranty

13.1 The warranty period expires upon reaching one of the following conditions:

- 18 months have passed after product date of sale
- the product has been used for more than 1,000 hrs (warranty life)
- the vehicle the product is installed on has run more than 50,000 km.

13.2 Specified lifetime of the heater is 3,000 hrs.

13.3 In absence of a stamp with a specified sale date, the warranty period is calculated since the date of manufacture.

13.4 The manufacturer does not accept claims on incomplete scope of supply and mechanical damages after sale.

13.5 The manufacturer guarantees normal operation of its product, provided the user observes all rules of its operation, transportation, and storage specified in this manual. Should a failure appear during the warranty period, it will be corrected for free. The product must be installed by an organization authorized by the manufacturer and specified in the "Installation information" section of the warranty certificate.

The warranty does not cover defects appearing as a result of:

- force majeure circumstances, including lightning strike, fire, drowning or flood, unacceptable voltage surges, and road accidents
- failure to observe rules of installation, operation, and storage
- installation, repair, or maintenance of the heater performed by personnel or organizations not authorized by the manufacturer to perform installation and warranty repair
- heater fault due to contamination of the combustion chamber
- vehicle electric equipment faults
- repair performed by the user or use of inauthentic spare parts.

See www.autoterm.ru for the list of organizations performing warranty repair of Advers OOO and Teplostar OOO products.

Please contact Servisnaya kompaniya OOO in Samara (phone +7(846)207-05-20**) or the "Forum" section of www.autoterm.ru (in Russian) regarding any issues of technical service.**