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User's manual

with installation instructions

for **AUTOTERM Liquid heaters.**

FLOW-5D 12V/24V

FLOW-5B 12V

FLOW-14D 12V/24V

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Dear Customer!

Thank you for choosing the AUTOTERM FLOW heater! We are doing everything to make sure this product meets your requirements. It is essential to us that the quality of our products satisfies every customer.

Introduction

This manual is intended for organizations that specialize in the installation and maintenance of AUTOTERM FLOW liquid heaters (5D 12V/24V; 5B 12V; 14D 12V/24V) (hereinafter referred to as heaters, or 5D, 5B, and 14D for short), as well as users of the product after installation. The document covers instructions and guidelines for the installation of the product on a variety of land vehicles, and small maritime vessels (e.g. yacht, boat, cutter). It also covers function tests of the product after installation, and basic maintenance procedures to ensure the heater operates reliably.



Please read this manual before installing and/or operating the FLOW heaters. This manual contains important information to use this product safely and correctly. Disregarding these instructions can void the warranty of the product, lead to damage of product and/or property, and be a health risk.

1 General instructions and operating principle

AUTOTERM FLOW heaters are designed to be used for:

- pre-heating vehicle engines with liquid cooling systems at an ambient air temperature of up to -45°C ;
- defrosting windshields, heating cabins, cargo compartments, and other confined spaces in vans, trucks, and maritime vessels with a central liquid heating system.

The heater operates independently of the vehicle engine.

The operating principle of the pre-heater consists of heating the fluid in the cooling system, which is pumped through the heat exchanger system.

Fuel is supplied by a separate fuel pump from the fuel tank of the vehicle or vessel, or from an additional fuel tank.

The heater can be powered by a vehicle battery or a separate battery.

The operation of the heater is controlled by the control unit, which controls the temperature of the coolant fluid depending on its set parameters.

If the coolant temperature exceeds the set temperature, the heater switches to the cooling mode: combustion stops, but the pump continues to circulate the coolant throughout the vehicle's heating system. As soon as the coolant temperature drops to the pre-set temperature, the heater switches on again.

The liquid heater continues working for between 20 to 120 minutes (determined in its settings), or until it is shut down. The purging duration is around five minutes.



Installation of the heater and its components **must be carried out by specialized organizations** approved by AUTOTERM. Installation of the heater must be carried out **only by certified specialists** in accordance with the installation instructions.



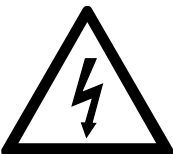
If the heater is handled and/or installed improperly, there is a **possibility of fire hazard and damage to property** because of the use of fuel and electrical components. This is why all safety precautions and installation instructions must be carefully read and followed.

Basic parameters and specifications of the heaters can be found at the end of this manual (*see Annex I*).

2 Safety precautions



- Do not use or install the heater in places where flammable vapors, gases, or large amounts of dust may accumulate.
 - Disable the heater when the vehicle or vessel is being fuelled.
 - Do not cover the heater with clothing, pieces of fabric and so on, and do not place such objects in front of the air intake.
 - Do not install the fuel line inside the cabin of a vehicle.
 - **The installation configuration must exclude the possibility of contact of the exhaust pipe with the air intake, fuel pipe, or other flammable objects.**
 - The vehicle where the heater is installed must be equipped with a fire extinguisher.
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- Do not install the heater electric wiring (harnesses) near the fuel line and the exhaust pipe.
 - Disconnect the heater from its battery during repair work on the heater.
 - Do not connect the heater to the power circuit of the vessel, when the engine is operating and there is no battery.
 - Do not connect or disconnect heater connectors, when the heater is powered.
 - When electric welding is carried out on the vehicle, or repair work is made on the heater, the heater must be disconnected from the battery.
 - Disconnect the heater from the power supply when jumpstarting the vehicle.
 - Do not use fuses rated differently from indicated on the electric circuit diagram.
 - Do not use makeshift devices (wires etc.) instead of fuses.
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- The relevant safety precautions must be observed when working with coolant liquids and electrical and fuel systems when installing and dismantling the heater.
 - **Do not disconnect power from the heater before the purge cycle ends.**
 - When the heater has been switched off, do not switch it on again for 5-10 seconds.
 - **Due to poisonous exhaust gases and the risk of suffocation, DO NOT use the heater in closed and/or unventilated places (e.g. garage, workshop, etc.)**
 - Do not step on the heater or put any objects on it and in it.
 - **Electric wiring, the air intake, and the fuel pipe must be protected from contact with sharp edges of vehicle structures.**
 - If any work was done on a cooling system (repair or replacement of coolant), it is necessary to bleed the system.



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- For safety reasons, contact the service shop to troubleshoot the heater if it fails to launch twice in a row.
 - In case of faults in the operation of the heater, contact only specialized repair organizations authorized by AUTOTERM.

If the consumer fails to follow the requirements above, the warranty of the heater becomes null and void.

Retrofitting

When replacing a different brand of heater for an AUTOTERM FLOW heater, be sure to first check the following things:

→ Diameter of the exhaust pipe.

The FLOW-5D and FLOW-5B have an exhaust pipe with an internal diameter of 24mm, and the FLOW-14D has an exhaust pipe with an internal diameter of 38mm.

Some brands use exhaust pipes with different diameters. If so, it needs to be adjusted to a diameter suitable for the heater in use. Larger diameters can be used if needed. (see “Section 3.4”, for more information on installing the exhaust pipe).



Disregarding these instructions can lead to an insufficient output of exhaust gases due to backpressure, thus damaging the heater.

→ Fuel system.

When retrofitting a heater, all old fuel pipes and fuel pumps must be completely removed, and a suitable fuel system for the AUTOTERM FLOW heater must be installed in its place.

Different brands of fuel pumps may have different fuel outputs, and their fuel pipes may have a different diameter. (see “Section 3.5”, for more information on installing the fuel system).



Disregarding these instructions can cause fuel to overflow in the heater, or lead to an insufficient flow of fuel, thus damaging the heater.

→ Electrical wiring.

All old wiring, electrical connections, control panels, etc. must be removed and installed with new AUTOTERM FLOW components. (see “Section 3.9”, for more information on installing the wiring of the heater).



Electrical related faults are common when using different and unsuitable electrical components.

→ Coolant system.

When retrofitting a heater, all old coolant pipes and water pumps must be completely removed, and a suitable coolant system for the AUTOTERM FLOW heater must be installed in its place.

Different brands of circulation pumps may have different liquid output and coolant pipes may have a different diameter. (see “Section 3.2”, for more information on installing the coolant system).



Disregarding these instructions can cause the heater to overheat, thus damaging it.

3 Main heater unit and assembly installation requirements

The heater can be installed inside, and outside of the vehicle. Install the heater in a dry place that is protected from water, condensation, dirt, excessive vibrations, heat emissions, engine emissions, and fuel or oil contamination.



When installing the heater in a cargo hold of the vehicle, install the heater at a height and location that prevents contact with cargo and in a way that the cargo will not obstruct the air intake for the combustion and exhaust systems.



When installing the heater in the engine compartment, under the front bumper or under the vehicle, make sure that it is protected from road spray, rocks, or other contaminants.

It should never be submerged in water or any other type of liquid.



The heater must be installed below the level of the coolant expansion tank.



When installing the heater on a maritime vessel, it must be protected from water.

Consider the maximum heel of the vessel. Maximum heel must not bring water into the discharge channel for exhaust gases. Bilge and water must also not get on the heater.



The heater cannot be installed in coolant systems where coolant system pressure can exceed a pressure of 2.1 bar.

The heater must be installed following safety requirements and taking into account the type of vehicle or vessel being used. Consider everything related to peripheral equipment, for example, the maximum permissible length of the exhaust gas channel, the intake of air for combustion, the location of the passage in the board (for maritime vessels), the layout and length of electric wires, the distance from the fuel tank, and the layout of the coolant pipes.

All precautions must be observed when installing the heater to reduce the risk of injuries to personnel, or damage to the equipment.

3.1 Installation of the heater

Install the heater, taking into consideration the permissible operating position according to Fig.1. Take into account the possible heel of the vessel, if installing on maritime transport.

When the heater is positioned with the exhaust pipe facing downwards, it is considered the 0° position. FLOW-5D and FLOW-5B have only two mounting positions – 0° and 90° with the air pump pointing upwards. **The FLOW-14D should not be tilted (see Fig.1).**

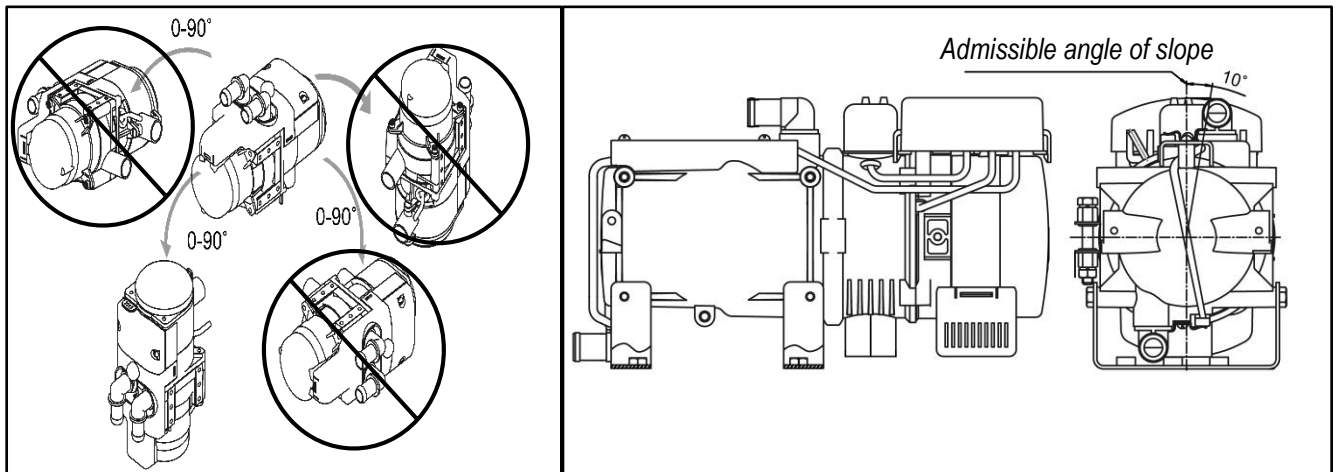


Fig. 1 - Mounting positions of the heaters



WARNING!!! The reliable operation of the heater depends on the correct installation! The heater must be installed according to Fig.1.

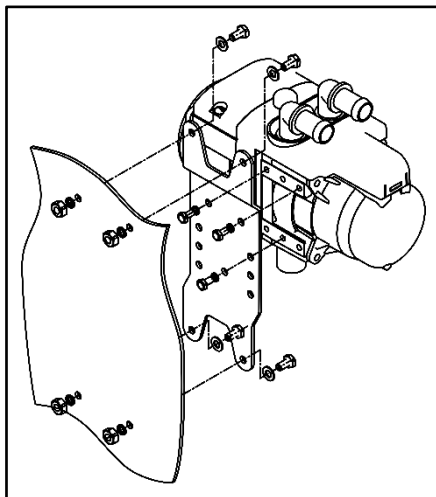


Fig. 2 - Mounting of FLOW 5

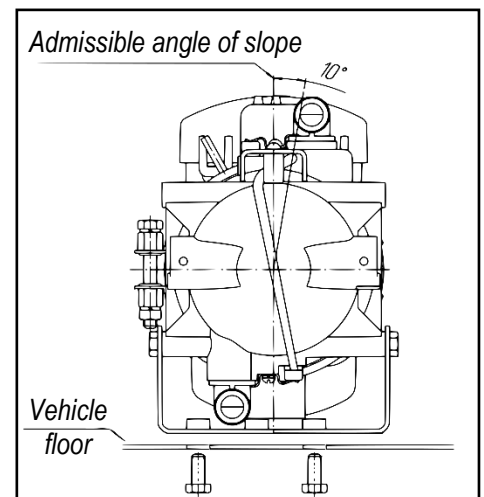


Fig. 3 - Mounting of FLOW 14D

The FLOW 5 must be fixed to the mounting bracket with at least three M5x12 bolts, tightened with a force of 10 Nm. The mounting bracket may be installed vertically or horizontally. The mounting bracket must be fixed to the body of the vehicle with four M6 bolts, tightened with a force of 11.8 Nm (see Fig. 2).

The FLOW 14D standard bracket is fixed to the body of the vehicle or vessel with four M8 bolts, tightened with a force of 22 Nm. (see Fig. 3) It is recommended to install the heater under the bonnet of the vehicle or in the engine room of the vessel.



When installing the FLOW series heater make sure that the heater is protected from any road spray, dust, water, and moisture. The heater must be fixed properly to bypass any vibrations. It must be installed in a well-ventilated area.



DO NOT install near flammable or heat-sensitive objects such as sails, fenders, clothing, sheets, paper, gas pipelines, fuel tanks, etc.

3.2 The installation of the coolant system

Connect the liquid heater to the cooling system of the vehicle so that it is aligned to the direction of the coolant flow within the cooling system (Fig. 4a/b).

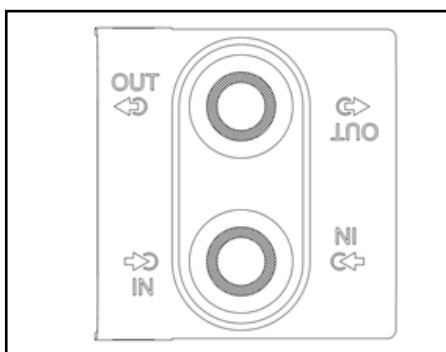


Fig. 4a – Coolant flow direction for FLOW 5

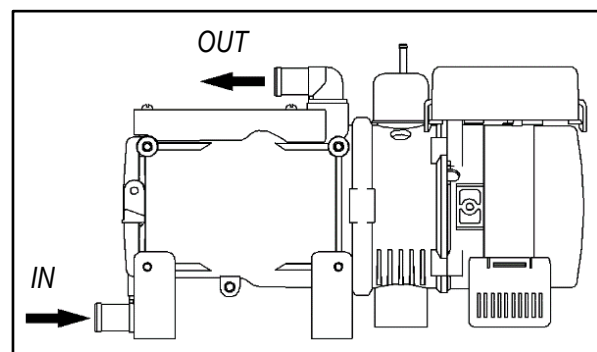


Fig. 4b – Coolant flow direction for FLOW 14D

During installation, use the rubber hoses and shaped pipes included in the installation kit of the heater. The hoses must be laid avoiding sharp bends or crimps and it must be possible to maintain them in a raised position from the heater to ensure unrestricted air bleeding.



When laying the hoses ensure that they are not installed beside the exhaust system and engine parts, which are heated to a high temperature.



Before the first start of the liquid heater and after a change of coolant, ensure that the device is properly bled. The presence of air in the system could result in overheating of the liquid heater.



Make sure that all pipe joints are properly tightened and leak proof.

3.2.1 Installation of the coolant pump

The coolant pump must be installed in the cooling circuit upstream of the liquid heater. The coolant pump should be installed below the level of the expansion tank, radiator, and heater.

The direction in which the coolant flows in the pump must be the same as in the cooling system of the vehicle/vessel.



The installation position of the coolant pump must not cause an airlock inside the pump. See the permissible installation positions in Fig.5.

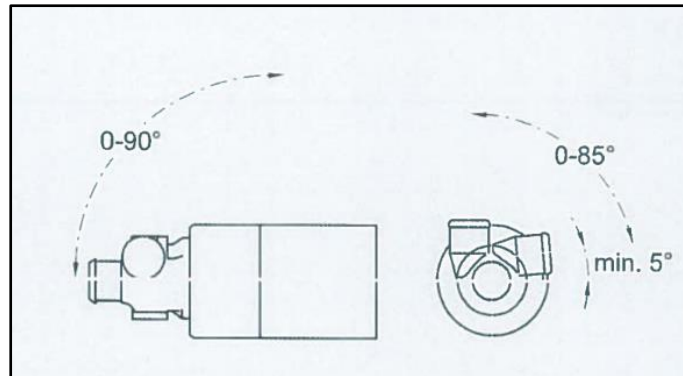


Fig. 5 – Position of the coolant pump

3.2.2 Angle pipes

To assist the installation process, the angle pipes can be turned by 180° for FLOW 5 or by 90° for FLOW 14D (see Fig. 6a/b).

To turn the pipes, loosen the screw in the fixation plates. Turn the pipes to the desired position and retighten the screw in the fixation plate.

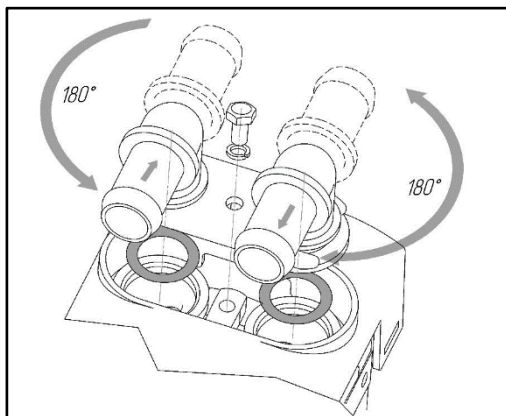


Fig. 6a – Angle pipe fixation for FLOW 5

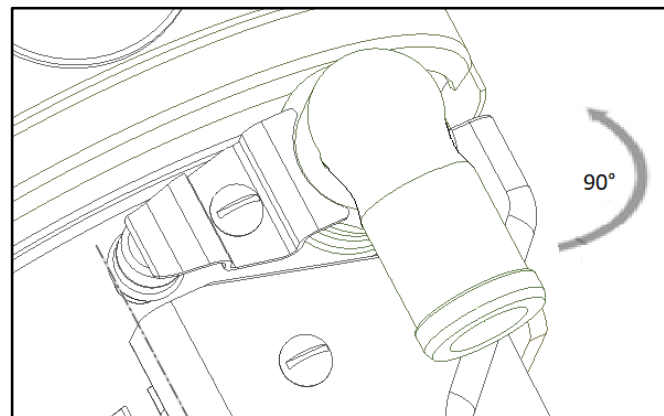


Fig. 6b – Angle pipe fixation for FLOW 14D



Do not rotate the pipes while the screw is being tightened. It will damage the gaskets and cause a leak.



Angle pipes can be changed for straight pipes in the FLOW 5 (*sold separately*).

3.3 Installation of the air intake pipe.

The air for combustion must not be taken from the interior, living space, engine or luggage compartment of the vehicle or vessel. Air should be taken from well-ventilated areas or from outside of the vehicle or vessel.

The maximum length of the air intake pipe is 2 meters. The air pipe must be as short as possible (cut to the minimal length if required)

Make sure FLOW 14D air intake does not touch any rainwater or dirt blockage.



The heater must not be used without an air intake pipe.

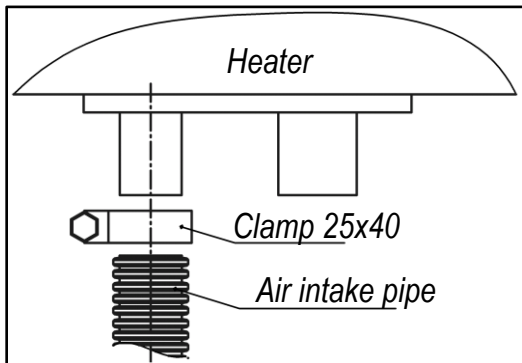


Fig. 7a – Connection of the air pipe to the FLOW 5

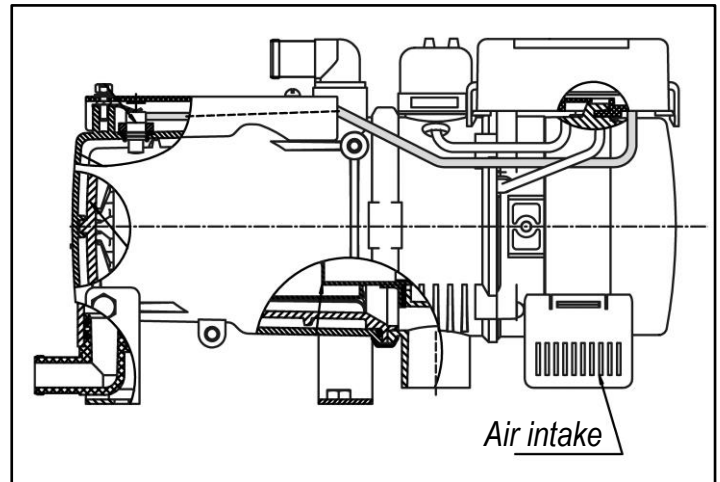


Fig. 7b – Air intake of the FLOW 14D

The air intake pipe is connected directly to the pipe of the heater and fastened with a clamp. (Fig.7a).

When laying the air intake pipe, avoid sharp bends and do not obstruct the opening of the air intake pipe with foreign objects. Make sure the opening is pointing downwards (see Fig. 8).

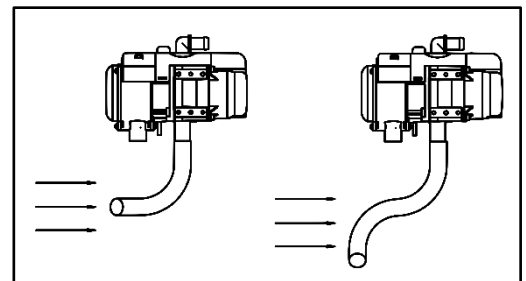


Fig. 8 – Position of air intake/exhaust pipe

If that is not possible, a Ø3mm hole needs to be drilled at the lowest point of the pipe. The correct installation of the exhaust and air intake pipes is when they are on the same side (Fig.9a/b). The distance between them should exclude the re-suction of exhaust gases through the air intake (at least 20 cm).

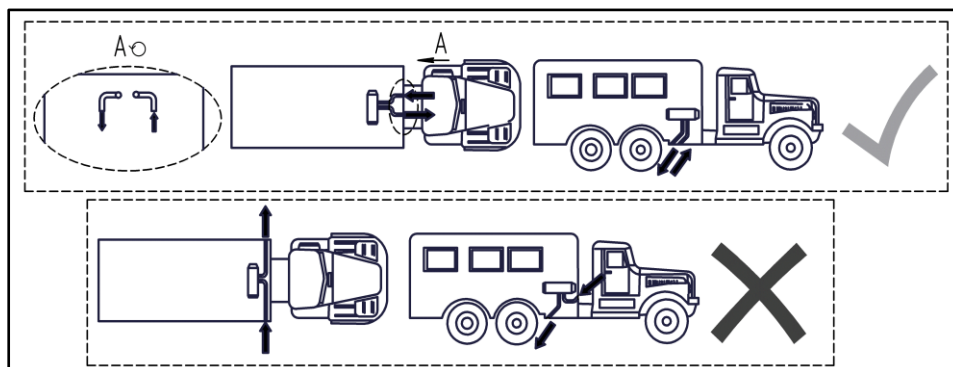


Fig. 9a - Location of intake and exhaust pipes on land vehicles

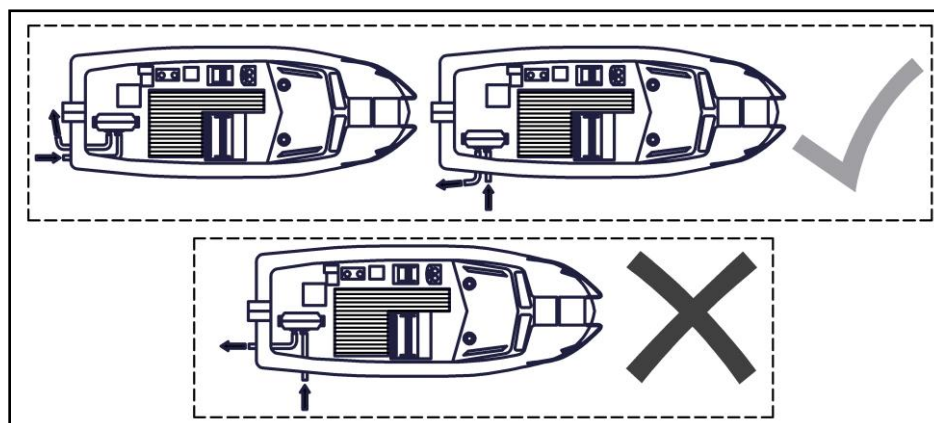


Fig. 9b - Location of intake and exhaust pipes on maritime transport



Disregarding this recommendation can lead to the opposite movement of the flame towards the air pump fan, resulting in the melting of the air pump fan, and to the burning of the heater.



The air intake must not be installed in the movement direction of the vehicle/vessel.



In cases when the intake of clean air cannot be ensured, such as off-road and special purpose vehicles, please mount the dedicated AUTOTERM air filter (assy.2684)

3.3.1 Installation of the air intake pipe on maritime vessels

→ Air intake from well-ventilated areas

Ambient pressure and sufficient ventilation using outside air must be present in the air intake zone. Increased or reduced pressure in the air intake zones is not permitted. It is recommended that the air duct is attached along the entire length of the vessel's hull of using plastic clamps when possible. Put a cap on the end of the air duct to protect it from drawing in foreign objects.

→ Air intake from outside of the vessel.

An air intake pipe (Fig.10) should be used to take in the air from outside. Make an opening of $\text{Ø}26^{+1}$ mm in the board of the vessel to install it. Install a rubber gasket between the flange of the air intake pipe and the hull of the vessel. Attach the air duct using three bolts as shown in Fig.10. Attach the air duct to the air intake pipe using the clamp.

It is recommended to attach the air duct along its entire length to the hull of the vessel using plastic tie straps when possible. Make a 3mm opening in the bottom point of the air duct to drain condensation or any water that has penetrated the air intake pipe.



Do not place the intake opening of the air intake pipe in front of the incoming air flow of the moving vessel.

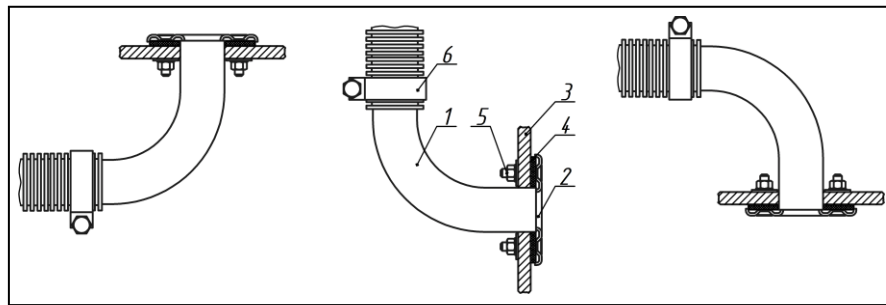


Fig. 10 - Installation of the air intake pipe

- | | |
|------------------------------------|------------------------|
| 1 – Air intake pipe; | 4 – Gasket; |
| 2 – Flange of the air intake pipe; | 5 – Fastener assembly; |
| 3 – Hull of the vessel; | 6 – Clamp. |

3.4 Installation of the exhaust pipe.

When installing the exhaust pipe, take into consideration the high temperature (up to 500°C) of the exhaust pipe when the heater is in operation. Cut the exhaust pipe (flexible crinkled metal hose, maximum length – 2 meters) to the necessary length. It is advised to use a two-layer exhaust pipe when installing the heater. Attach the exhaust pipe (Fig.11) using clamps and install it so that it is slightly inclined to the bottom, in the direction of the exhaust. Install heat insulation on the exhaust pipe to protect individual sections of the vessel (wiring or other heat-sensitive objects).

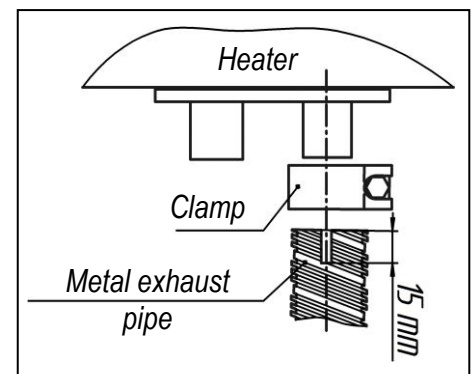


Fig. 11 - Attachment of the metal pipe to the heater



Install the exhaust pipe to avoid the possibility of repeated intake of exhaust gases by the air intake pipe, and make sure that no exhaust gases enter the interior or are drawn in by the fan through the cab heater radiator.



At the end of the exhaust pipe, a shield is installed, which is necessary for stable operation at low heating modes (Fig.13).

In the absence of the shield, air will be blown back into the exhaust pipe. This leads to increased heater sooting and impairs heat capacity. Exhaust gases must be expelled outside of the vehicle.

An airtight exhaust silencer is provided with the heater. This means it can be mounted in small vessels and confined spaces. When mounting the exhaust silencer on the outside of the vehicle, a Ø5mm hole needs to be drilled at the bottom of the silencer (see Fig. 14a).

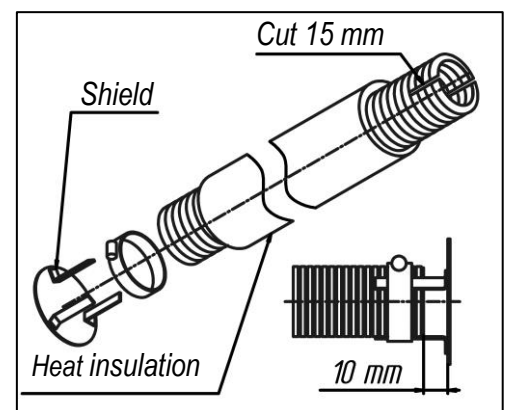


Fig. 13 – Exhaust pipe shield

If the desired mounting situation requires the exhaust silencer to be mounted vertically, the condensation drain hole must be drilled, as shown in Fig. 14b, to avoid the build-up of condensation in the exhaust silencer. If that is not possible, it is recommended to install it sideways (see Fig.14a).

The outlet of the exhaust pipe must be installed **pointing downwards (Fig. 8)**, and in such a position that would prevent the clogging or invasion of snow and dirt, and also provide a free drain for any water that gets into it.

When installing on a maritime vessel, the silencer must be mounted using the bolt and nut provided, so it will be in a fixed position.

Make longitudinal cuts (about 15mm) (see Fig. 11, Fig. 13, Fig.15) on the ends of the metal hose to ensure better sealing when connecting the heater pipe to the pipe for discharge of exhaust gases through the board of the vessel, but without going beyond the pipe to be covered.

A rubber bushing (sold separately) must be used if exhaust pipe goes through plastic parts. For example, the bumper of a vehicle (see Fig. 15).

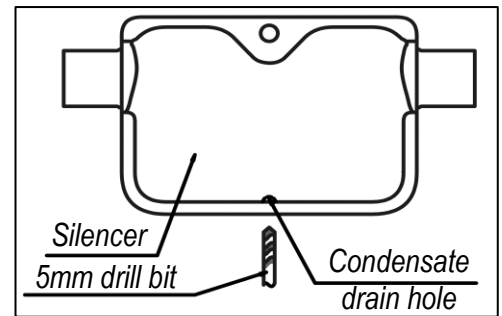


Fig. 14a – Condensate drain hole for horizontal mounting

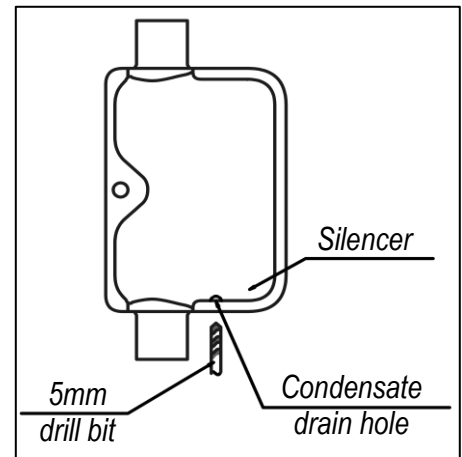


Fig. 14b – Condensate drain hole for vertical mounting

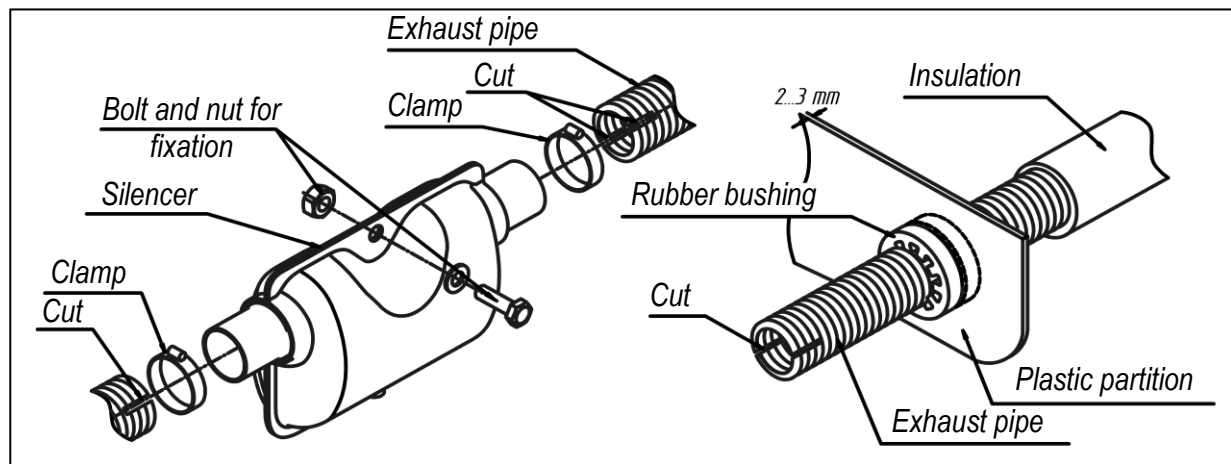


Fig. 15 - Attachment of the exhaust pipe to the heater and usage of rubber bushing



The exhaust pipe needs additional insulation at every connection of the metal hose. For example, use a heat-resistant tape or sealant to prevent any leaks of exhaust gases at connection points.



Additional heat insulation must be installed at all places where the exhaust pipe goes through the floor or the sidewall of the vehicle (Fig.16) to avoid an unnecessary fire hazard.



If the exhaust pipes of the heater run through the living space or confined space of the vehicle/vessel, solid stainless-steel pipes must be used. Flexible exhaust pipes are only suitable for external use and use in engine rooms.

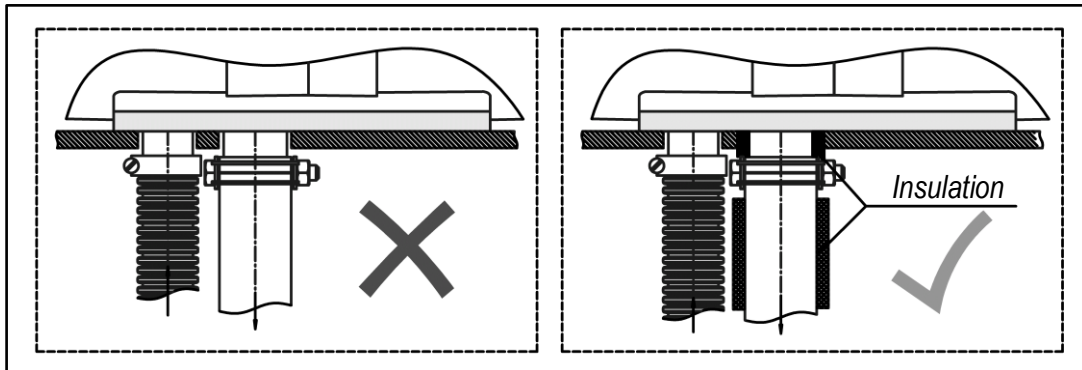


Fig. 16 – Installation of additional heat insulation

The end of the metal hose should not contact the rubber seal of the heater. It is highly recommended to install the exhaust gas discharge system in such a way that does not allow the exhaust gases to flow inside areas used by people; such as the driver's cabin or the living quarters of a maritime vessel (e.g. away from open windows, doors), to avoid the possibility of inhaling dangerous exhaust gases.



Do not place the output opening of the exhaust pipe in front of the incoming airflow of the moving vehicle or vessel (see Fig. 8).

3.4.1 Installing the exhaust adapter on maritime transport

Exhaust gases are discharged away from the vessel. Install the discharge of the exhaust gases in a location inaccessible to water (at least 60 cm above the waterline) and to avoid the possibility of re-intake of exhaust gases by the air intake pipe.

To install the exhaust pipe adapter (hull fitting), drill a hole in the hull of the vessel at least 5 mm larger in diameter than the actual outer diameter of the hull fitting. Install the exhaust pipe into it as shown in Fig.17 with the pipe looking upwards (to avoid water infiltration). Install a rubber gasket between the flange of the exhaust pipe and the hull of the vessel to seal the connection.

To prevent exhaust gas leaks or the exhaust pipes falling off, it is advised to use exhaust cement or a different kind of sealant on every connection of the exhaust pipe. Sailboats should not install the exhaust adapter on the side of the hull, only at the stern.

- | | |
|---------------------------------|-----------------|
| 1 – Exhaust pipe adapter; | 5 – Fasteners; |
| 2 – Flange of the exhaust pipe; | 6 – Clamp; |
| 3 – Gasket; | 7 – Metal hose. |
| 4 – Hull of the vessel; | |

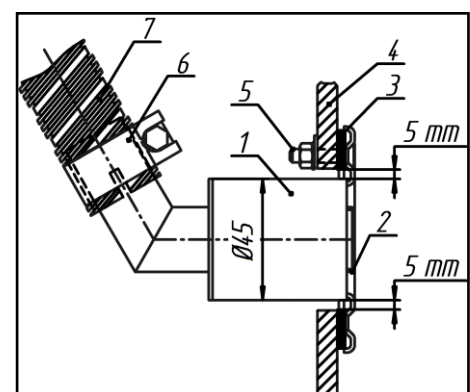


Fig. 17 - Installation of the exhaust pipe

3.5 Installation of the fuel system.



Do not operate the heater using biofuel.

Use only diesel fuel standard EN590 and petrol fuel standard EN228, depending on the ambient temperature.

Use the instructions detailed in Fig.18 and Fig.21 to install the fuel system. The fuel pump and the fuel supply line must be protected from heating.

It is recommended to install a small inline fuel filter before the fuel pump. Make sure the filter is filled with fuel, and that you are using fuel lines of the same diameter as the heater.



Do not take fuel from the fuel filter or its casings, as doing so causes fuel leaks.



Do not take fuel from the fuel line between the fuel filter and fuel pump of the vehicle's engine, the return line of the engine, or after the high-pressure pump of the vehicle.

The heater is not designed to work with such high pressure.



The fuel line system should be as short as possible. The recommended maximum length of the fuel line is 5m. The distance between the fuel tank and the fuel pump should not exceed 1m, and the distance between the fuel pump and the heater should not exceed 4m (see Fig.18 and Fig.21).

3.5.1 Fuel suction using a fuel suction hose.



Before installing a fuel suction hose in the fuel tank of the vehicle or vessel, make sure that the fuel level is high enough to ensure operation of the heater and low enough to easily remove the fuel tank if needed.

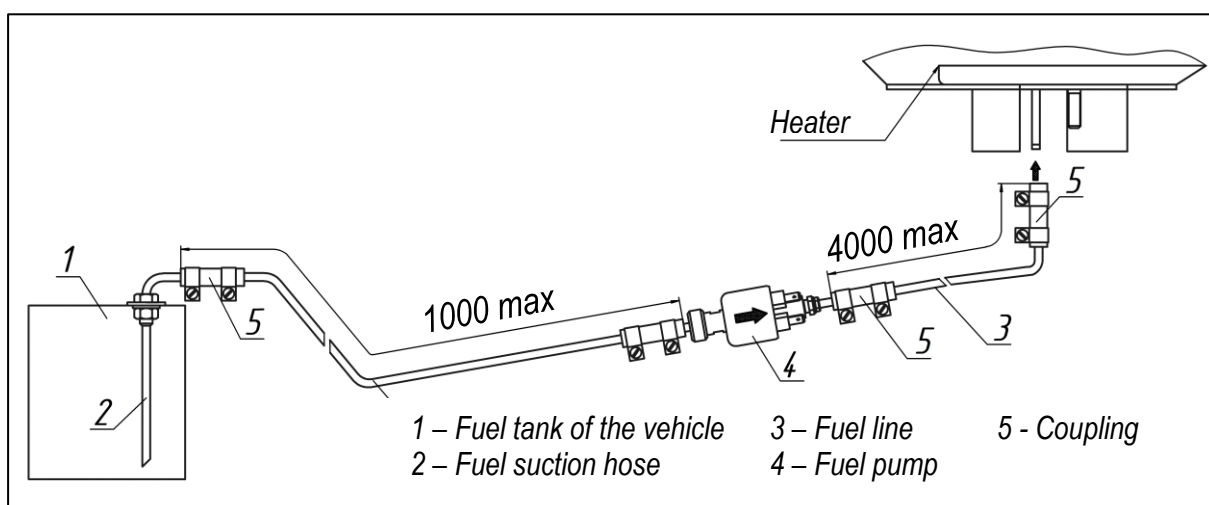


Fig. 18 - Example of fuel supply to the heater with fuel suction hose

Fuel is taken directly from the fuel tank of the vehicle or vessel, or from an additional tank. Drill a Ø16mm hole in the fuel tank to install a fuel suction hose. When drilling the hole in the fuel tank, follow safety precautions that should be observed when working with any transport, filled operating with fuel or explosive substances. If needed, cut the immersible tube of the fuel suction hose to make it shorter before installation. The bottom end of the tube must be located about 10-15 mm above the bottom of the tank, or at the height at which fuel for engine can be provided to the fuel tank at any time. The cut at the end of the fuel suction hose must be made at a 45° angle to the axis of the tube. Remove all burrs from the cut after the work is done.

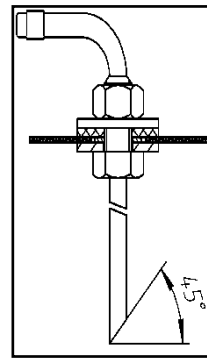


Fig. 19a – Installation of the fuel suction hose

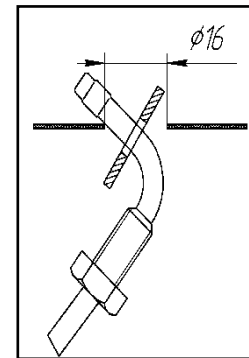


Fig. 19b – Installation of the washer

Install the fuel suction hose in the fuel tank as per Fig.19a. Install the special washer of the fuel suction hose in the tank hole as per Fig.19b. Apply a fuel-proof sealant on the threaded surface of the fuel suction tank to properly seal the connection between the fuel suction hose and the fuel tank.



Never install the suction hose on the side of the fuel tank. It must be installed on the top side of the fuel tank.

3.5.2 Fuel suction from an additional fuel tank

Consider the convenience of fuelling, while installing the fuel tank (Fig.20). Install the fuel tank in such a way that the amount of fuel and its potential leaks from the inlet, fuel suction nozzle or connections can be visually controlled.



When filling the fuel tank, be careful not to spill any of the fuel on the exhaust system, wiring or other objects, which can be damaged due to their contact with fuel.



The fuel tank must be installed with its wide side perpendicular to the direction of the movement of the vehicle/vessel (see Fig. 20).

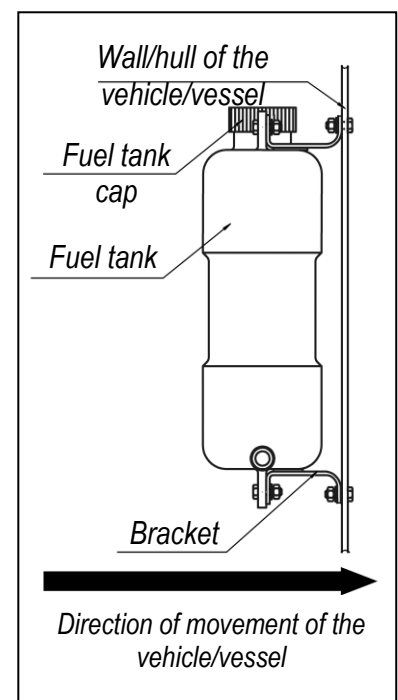


Fig. 20 Installation of the fuel tank

3.5.3 Fuel suction from the fuel tank of the vehicle.

Fuel is taken from the fuel line of a vehicle using a T-piece (see Fig.21). This method can only be used if there is no pressure in the fuel line. If the vehicle is equipped with a low-pressure fuel pump in the fuel tank, then those fuel lines cannot be used, fuel suction hose must be installed instead. **Keep in mind the installation position of the T-piece.**

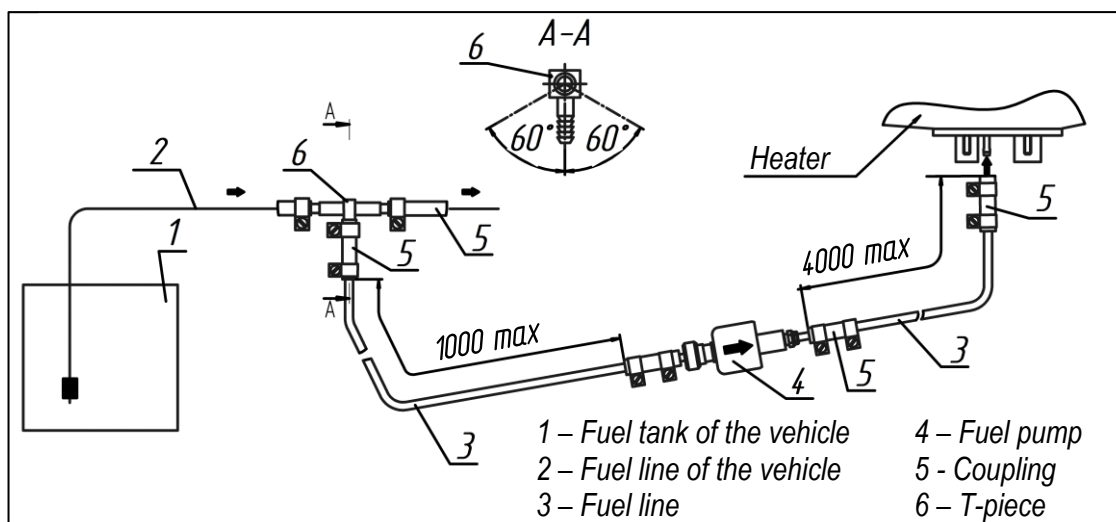


Fig. 21 – Fuel suction using a T-piece

3.5.4 Installation of the fuel pump and the fuel supply line.

The fuel pump is connected to the heater through its own harness and supplies fuel depending on the required heat capacity to the combustion chamber of the heater. The fuel pump is operated by electrical impulses sent by the control unit. When operating, the fuel pump makes a characteristic, metallic clicking noise.

It is recommended to install the fuel pump close to the fuel tank (the distance should not exceed 1 meter (see Fig.18 and Fig.21)) and below the low level of fuel in the fuel tank, but not lower than 70cm of the minimal fuel level (see Fig.23, point a)). But the distance between the fuel pump and the heater cannot be greater than 1,5 meters (see Fig.23, point b)). The fuel pump should be positioned with a slight angle pointing upwards (see Fig.22).

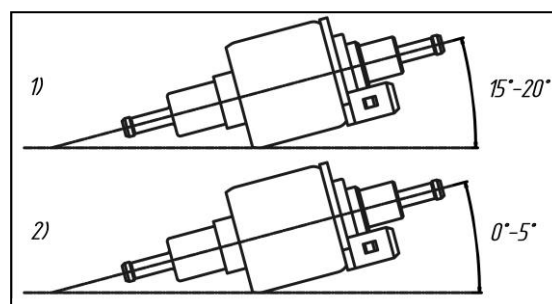


Fig. 22 – Installation angle of TH-9; TH-10; TH-11 fuel pump (1) and Thomas Magnete (2) fuel pump.

If for some reason the fuel pump seal is compromised, it is advised to install the fuel pump lower than the heater to avoid leaks and flooding the heater with fuel due to gravity.



Remember to properly bleed the “silent” TH11 fuel pump. If it’s not properly bled it will be as loud as a standard fuel pump.

To bleed it start the heater and position the fuel pump with its outlet upwards until there are no air bubbles in the fuel line and only then secure the fuel pump to its recommended position.

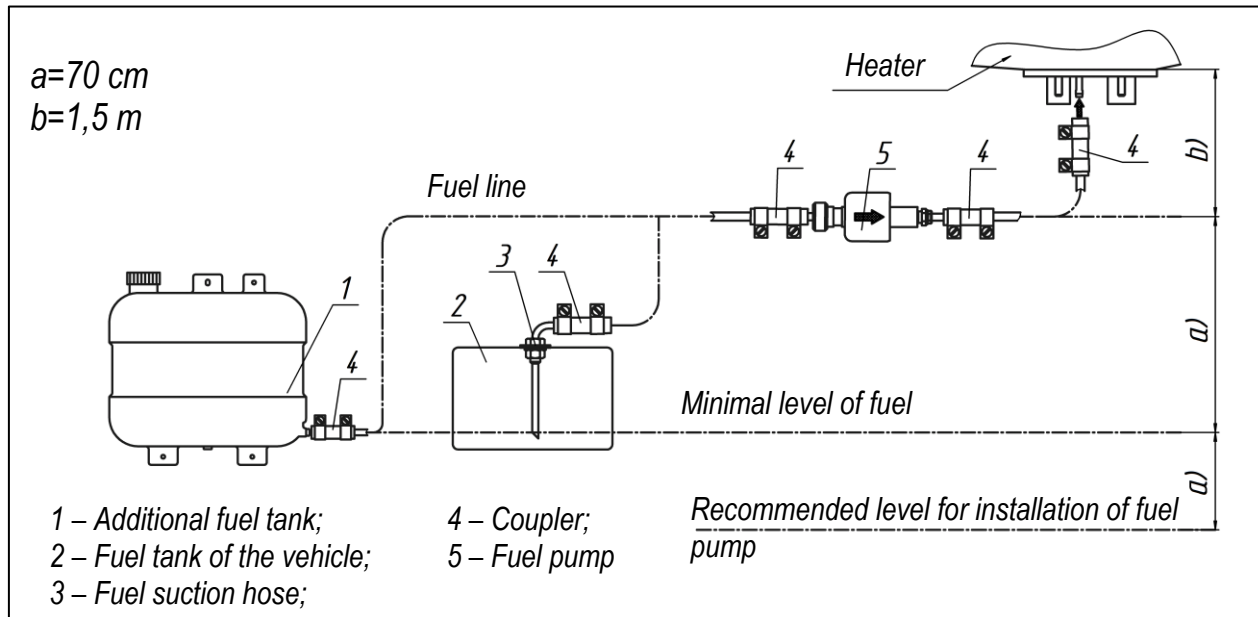


Fig. 23 – Height position of the fuel pump in the fuel system

Attach the fuel pump to the flexible rubber clamp (supplied with the heater), to reduce the transfer of noise to the frame of vehicle or hull of the vessel (see Fig. 24).

Proceed as instructed on Fig.18 and Fig.21 to install the fuel supply lines. Use clamps to attach the fuel supply lines. Do not tighten the clamps too much in trying to avoid leaks as clamps break easily if tightened with too much force.

It is preferable to lay the fuel supply line on a straight line and with a small inclination upwards in the direction of the heater. The fuel supply line should be fastened at equal distances to prevent sagging, mitigate the effects of vibration and to avoid fractures. Do not allow the fuel pump and the fuel supply line to come in contact with hot objects. Cut the fuel supply line using only a sharp knife as per Fig.25. At the locations of cuts, there should be no narrowing of the flow cross-section of the fuel line, dents or kinks.

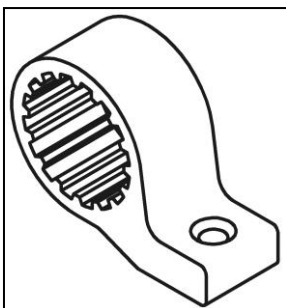


Fig. 24 - Flexible rubber clamp

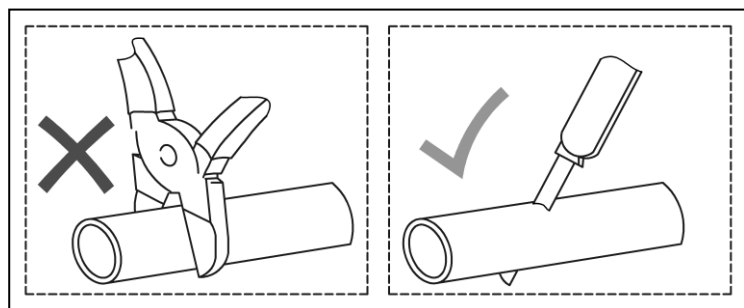


Fig. 25 - Cutting of the line before installation.

3.5.5 Installation of the electrical harness of the fuel pump.



If the length of the wiring harness of the fuel pump needs to be shortened, it is permissible to remove the unnecessary portion from the middle of the harness. The connection point must be insulated.



Never connect the fuel pump to a continuous DC power supply. It will burn the coil of the fuel pump.

Installation of the electrical harness connector of the fuel pump is shown in Fig.26.

Make sure that the wiring of the fuel pump is installed in the right way before inserting the pins of the wiring in the plastic casing.

Make sure the pins are inserted all the way to the end and that they lock securely in the plastic casing. When correctly inserted, a small click can be felt. The polarity of the pins does not matter.

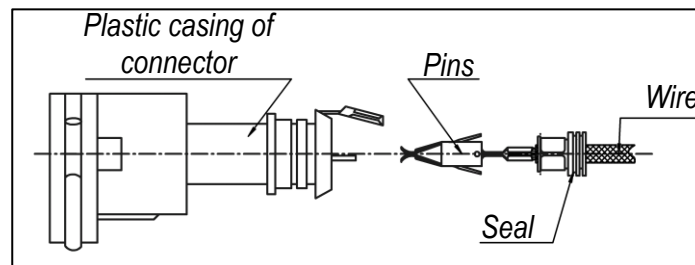


Fig. 26 - Installation of the connector of the electrical harness of the fuel pump

3.6 Installation of heater wiring.

Install the electric harnesses of the heater according to the diagram of heater electrical connections. (see Annex.4).

When installing electrical harnesses avoid all possibility of them being heated. Install all the wire harnesses and electrical elements in dry and protected places. No deformation or wire movement is permissible when the vehicle or vessel is operating.



IMPORTANT!

Fuses must be removed before installing electrical harnesses.

The battery of the vehicle or an auxiliary battery powers the heater. Control the charge of the battery on a regular basis. It is recommended to disconnect the heater from the battery to avoid discharge during long dockage or storage of the vessel or vehicle. **Do not disconnect the heater from power before the purge cycle ends.**

The heater must be connected to an uninterrupted power supply at all times. Cutting the power to the heater will result in loss of settings (clock, operation mode and settings).

If the heater is connected to an existing electrical installation, the wiring should be of sufficient diameter to prevent a voltage drop (main cause of error 15). It is always recommended to connect the heater directly to the battery of the vehicle/vessel or auxiliary battery. It is strongly recommended to use new and provided wiring for installation of the heater.

3.6.1 Installation of the relay

i Relay is sold separately

The relay is necessary to connect the FLOW pre-heater to the interior fan of the vehicle. When the coolant set temperature (*see operation manual of the control panel*) is reached, the relay activates the interior fan of the vehicle.

i In some cases, the switch of the interior fan of the vehicle must be turned on for this feature to work.
For vehicles with a climatronic heating system an additional relay may be needed.

Connect the relay according the connection diagrams (Fig 27 and Fig. 28)

i It is important to solder the connections of the wires and to properly insulate the connection.

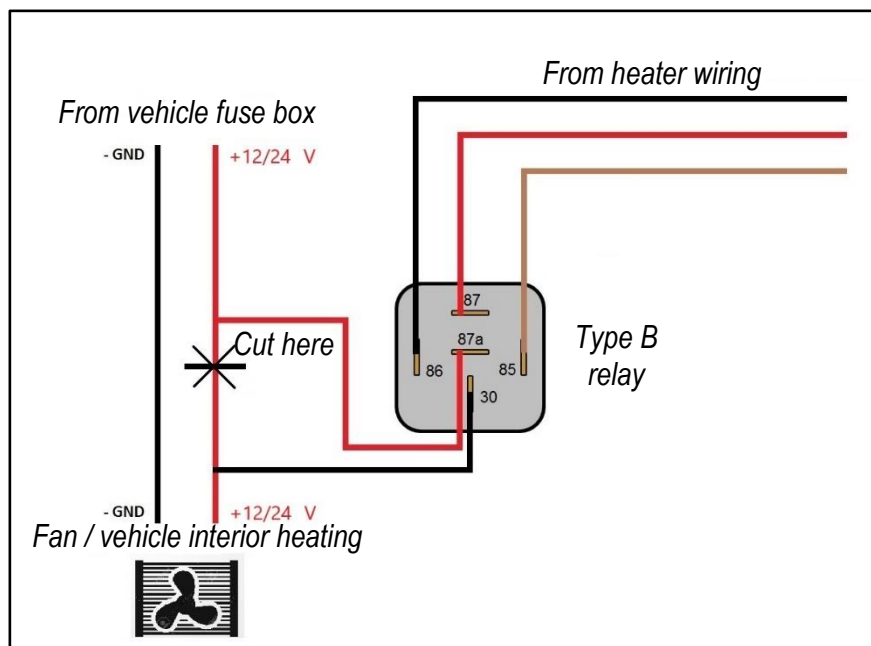


Fig. 27 – Connection diagram for FLOW 5

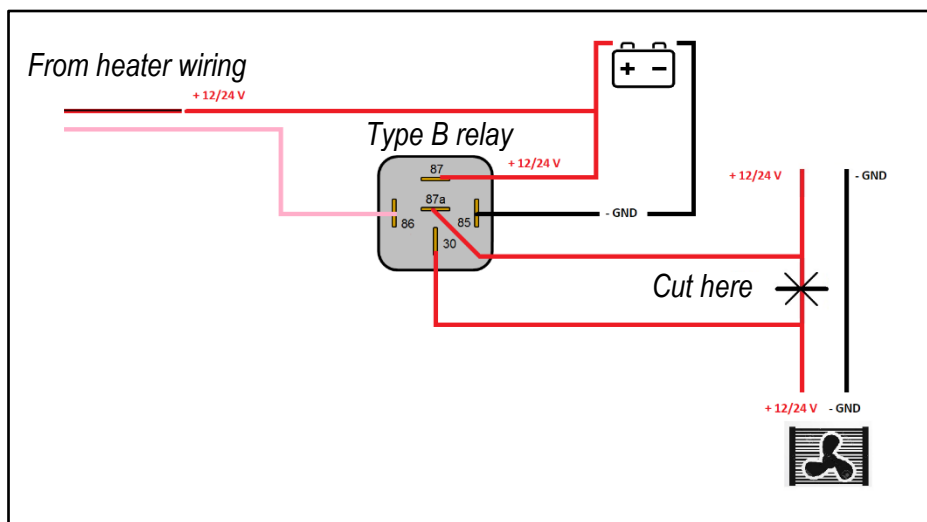


Fig. 28 – Connection diagram for FLOW 14D

3.7 Installation of the control panel.

The control panel is intended for the operative control of the heater. Install the panel in a convenient (appropriate) place protected from water. The panel is attached using double-sided adhesive tape or a standard bracket (Fig.29). The wire may be brought out of the panel casing through the back cover or the partition of the inner surface of the panel casing. Before installation, degrease the surface where the panel is to be installed. Remove protective film from adhesive tape and install the panel on the prepared surface.

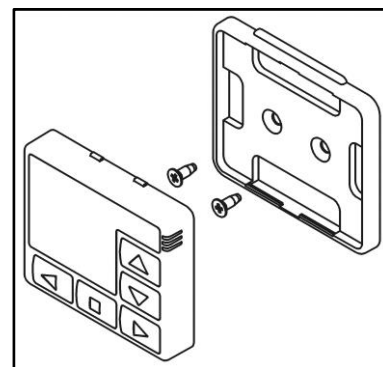


Fig. 29 – Installation of the control panel PU-27 using a mounting bracket.



Never extend the cable of the control panel itself as it is transmitting a digital signal. In the event of a bad connection, this will result in malfunctions.

Use designated control panel wiring extensions.

4 Testing the heater after installation and first launch

The heater can only be put in operation when the system has been fully installed!

After installation, check:

- tightness of the air intake, exhaust, and fuel pipes clamps
- tightness of the coolant system clamps
- battery voltage
- the secure attachment of harness' electric contacts and heater assemblies.

Fill the main fuel line with fuel, preferably using a fuel-priming device. These can be ordered from official dealers. When the fuel system is filled, check that the fuel supply line is sealed.

Start the heater and check its operation in minimum and maximum modes. Check tightness and sealing of all exhaust connections, as well as air intake and coolant pipes. Make sure there is no air in the coolant system. Run the heater for about 2 hours.



During first time operation, the exhaust pipe might emit some smoke for a short period of time.

The launch process of the heater starts with less than a minute-long power-on-self-test. During that time the heater self-checks its components for errors. During this phase all components are powered up once, which results in a single audible pump click, a short fan burst, and internal checks of glow plug and sensors. After that it starts a phase of heating the glow plug to remove any fuel vapours remaining from the previous work cycle. This lasts for up to 120 seconds and is a silent process.

After the purge ends, the process of ignition starts and the continuation of the set mode. This means that the fan will slowly start to rotate and fuel pump start to click.



Before starting to heat the coolant, the pump will start to check if the heating liquid is frozen. The heater will then power up to 100% to heat up the combustion chamber and to provide proper burning temperatures. Depending on the ambient temperature and model of the heater, this process can take up to 15 minutes.



Hot liquid only flows after the heat exchanger is heated up. This process takes up to 3-5 minutes depending on the ambient temperature and the heater model.

IT DOES NOT HAPPEN INSTANTLY.

Stop the heater. When the heater is stopped, the fuel supply stops, and the combustion chamber and the heat exchanger are vented to reduce temperature.

After the first launch, please test the heater with the vehicle/vessel running engine to check for possible fuel and/or power supply problems.



During the first few hours of operation, the heater can emit an unpleasant smell. To get rid of the smell, run the heater for several hours on maximum power. Ensure good ventilation.



The insulation of exhaust pipe has to burn-in. This process can also cause an unpleasant smell.

4.1 Automatic Control Features

- 1) If for some reason the heater did not start, the start-up process will be automatically repeated. After two failed attempts the heater will be switched off;
 - 2) If burning is interrupted during heater operation, the heater automatically re-starts. Restarts after consecutive flameouts are performed up to three times;
 - 3) In case of overheating of the heater coil (for example due to a blocked intake or output of the heating unit), the heater automatically switches off;
 - 4) If the maximum temperature of the heated coolant is exceeded (for example, due to air trapped in the coolant system), the heater automatically switches off;
 - 5) If voltage drops below 20V (10V) or increases to more than 30V (16V), the heater automatically switches off.
-



The numbers in brackets are for the heaters with a nominal voltage of 12V;

- 6) If the heater switches off due to an emergency situation, a malfunction code appears on the control panel.
- 7) In case one of the temperature sensors is faulty, the heater will not start, and a malfunction code will appear on the control panel.

4.2 Vehicle alarm wire start

Heater can also be started with vehicle alarm wires in two ways:

- If the brown and white wires are connected to an impulse relay (with an impulse between 1-3 seconds), the heater will work on previously set work mode for two hours.
- When the brown and white wire is connected continuously (for example, using a rocker switch) the heater will work on previously set work mode for 2 hours max.

5 Recommendations

If the heater does not start after switching on, make sure there is fuel in the tank, check the charge of the battery, check if all connectors are properly connected and if the 25A fuses are viable.

If you are unable to find the primary cause of a fault, contact your nearest dealer or service centre, or check the website www.autoterm.com.

WARNING!



When starting the heater for the first time after installation, it is preferable to fill the main fuel line up to the input nozzle of the heater using a priming device. If there is no priming device, start the heater several times until the main fuel line is filled.



It is important to remember that if the heater has not started after activation, the control unit will restart the heater in automatic mode. If the heater does not start after two attempts, a fault code will be displayed on the control panel. (Look for fault codes table in “Section 6 – Malfunctions” in this manual)

For correct operation, the heater needs regular (annual) maintenance. Stop the heater and let all system parts cool down before any maintenance or repair work:

- check for corrosion on electrical plugs and contacts (with the battery disconnected);
- check the fuel and coolant hose seals;
- check the exhaust gas system for corrosion and sealing;
- check if the air intake pipes and air ducts are clean;
- check all air ducts for damage;
- run a computer diagnostic of the heater.



Periodic, preventative maintenance is important and must be carried out to ensure reliable operation of the heater. See the table of periodic maintenance in “Annex 5”.

To ensure the reliable operation of the heater, switch it on at least once a month for 20 minutes, including during the warm seasons of the year when the heater is out of operation. This action is necessary to remove any viscous film sediments on the moving parts of the fuel pump. Failure to do so may lead to premature failure of the heater.

For diesel heaters. If separate a fuel tank is used, fuel in the system has to be changed at least once a season. Before the start of the heating season, check the fuel tank. If the tank stored fuel for a long time (for example from the past heating season), it is necessary to drain it! Rinse the tank with gasoline or kerosene and fill it with fresh diesel fuel. This procedure is designed to remove sediment formed in the fuel during prolonged storage. Failure to follow this procedure can lead to clogging or failure of the fuel pump and increased sooting in the combustion chamber.

In case of extended parking or vessel/vehicle storage, disconnect the heater from the power source (battery) to prevent it from discharging (current out of season heater consumption is (30 ÷ 40) mA).

6 Malfunctions

Code	Malfunction description	Cause of malfunction	Recommended troubleshooting methods
01	Overheating (upper temperature limit exceeded)	Temperature near one of the sensors exceeds 120°C	1. Check the entire liquid circuit for air blocks. 2. Check the pump. 3. Check the overheating sensor and the temperature sensor. 4. Check the antifreeze for suitability at current ambient temperatures
03	Temperature sensor 1 fault	Short or open circuit in the electric wiring	Replace the sensor assembly
04	Temperature sensor 2 fault		
05	Flame detector fault	Short circuit to frame or open circuit in the detector wiring	Check the flame detector
06	Control unit temperature sensor fault	The temperature sensor is faulty (located in the control unit, cannot be replaced)	Replace the control unit
09	Glow plug fault	Short or open circuit, control unit fault	Check the glow plug. Check the control unit
10	Air blower fault. Speed lower than rated	Foreign particles obstructing spinner movement, or the spinner hits the air blower cover	Check the electric wiring. Check the air blower for dirt
12	Shutdown due to overvoltage	Power supply voltage is above 16 V	Check voltage at XS2 connector on the heater. Check fuses, the battery, the vehicle voltage regulator, and power supply wiring
13	All attempts to start failed	Failure to ignite (after two attempts)	Check the fuel line, the fuel pump, and the air blower. Check the exhaust pipe. Check the combustion chamber, clean the opening in the plug nozzle of the combustion chamber if necessary
14	Pump fault	Short or open circuit of current-conducting parts	Check for short or open circuit of the pump wiring; check the pump. Clean the pumping elements of the pump
15	Shutdown due to undervoltage	Power supply voltage is below 10 V	Check voltage at XS2 connector on the heater. Check fuses, the battery, the vehicle voltage regulator, and power supply wiring
16	Ventilation time exceeded	The flame detector is not cooled down by purging sufficiently	Check the air intake and the gas exhaust pipe. Check the flame detector; replace if necessary
17	Fuel pump fault (short circuit)	Short circuit in the fuel pump wiring	Check the fuel pump
20	No communication between the control unit and the control panel	Short or open circuit in the electric wiring between the liquid heater and the control panel	Check the 5 A fuse. Check circuits and terminals

Code	Malfunction description	Cause of malfunction	Recommended troubleshooting methods
21	Flame blow off in the "WARMUP" mode	Poor conditions for combustion. Lack of fuel/air, the heat exchanger is fouled, the exhaust pipe is clogged	Check the air intake, the gas exhaust pipeline, and fuel supply, resolve the fault(s), and replace the fuel pump and the flame detector if necessary
22	Fuel pump fault (open circuit)	Open circuit in the fuel pump wiring	Check the fuel pump
24	Rapid temperature change indicated by one of the sensors	Possible overheating near one of the temperature sensors due to poor coolant circulation	1. Check the entire liquid circuit for air blocks. 2. Check the pump. 3. Check the overheating sensor and the temperature sensor.
25	The coolant is being heated up too quickly	The liquid heater goes into the cooling down mode three times in one cycle in less than 6 min	4. Check the antifreeze for suitability at current ambient temperatures
27	Air blower fault	The motor does not rotate (movement is possibly obstructed)	Check the fuel system. Check the security of the fuel line clamps, the seal of the fuel line and the fuel pump nozzle, as well as the fuel pump capacity
28	Air blower fault	The motor rotates uncontrollably (possible fault in the 5 V power supply to the control unit)	
29	All ignition attempts failed with the liquid heater in operation	Ignition has been tried more than four times	Check the fuel system. Check the security of the fuel line clamps, the seal of the fuel line and the fuel pump nozzle, and the fuel pump capacity
30	Flame blow off in the combustion chamber due to a voltage drop	The air blower stops when the vehicle voltage drops	Check the battery and wiring. (Voltage drop may be caused by long operation of the electric starter.)
37	Liquid heater is locked	Malfunction 13 appears three times in a row	Find and eliminate the cause of the malfunction. Unlock the liquid heater
50	No communication between the control panel and the router	Short or open circuit in the wiring	Check the 5 A fuse. Check circuits and terminals
78	Flame blow off	Flame blow off during operation. Information warning (not a critical fault)	Occurs to inform the user. Check the security of the fuel line clamps, the seal of the fuel line and the fuel pump nozzle.

*** If error 13 appears three times in a row during liquid heater start, it will be locked. This lock is to prevent excess fuel supply to the combustion chamber. In case of lock, the fault code 37 will be displayed on the control panel.**

7 Warranty Terms

The heater warranty terms expire when one of the following is reached:

24 months from the date of purchase;

heater operation reached for all air heaters - 2000 working hours;

heater operation reached for all liquid heaters - 1000 working hours.

The warranty does not apply to defects resulting from:

improper installation, which is not in accordance with valid, supplied installation instructions or approved original equipment manufacturer (OEM) applications.

force majeure: lightning strike, fire, flood, voltage fluctuations, accident;

transport damages;

usage, storage and transportation conditions have not been met;

if the repair, adjustment or installation of the heater has been conducted by organizations not authorized by AUTOTERM

the independent repair or use of spare parts not approved by original manufacturer;

use of wrong voltage;

failure of the heater due to combustion chamber impurity.

While warranty is provided to the “original end-user”, it is to be administered and serviced through an authorized AUTOTERM dealer in accordance with the heaters warranty terms. All AUTOTERM certified services are listed on the www.autoterm.com/warranty website.

Normal wear of serviceable parts: (filters, gaskets, glow plug screens and fuses are not covered by warranty).

For full warranty terms visit www.autoterm.com/warranty.

Annex 1: Basic parameters & specifications of heaters

1. Basic parameters of the heater FLOW-5D, 5B

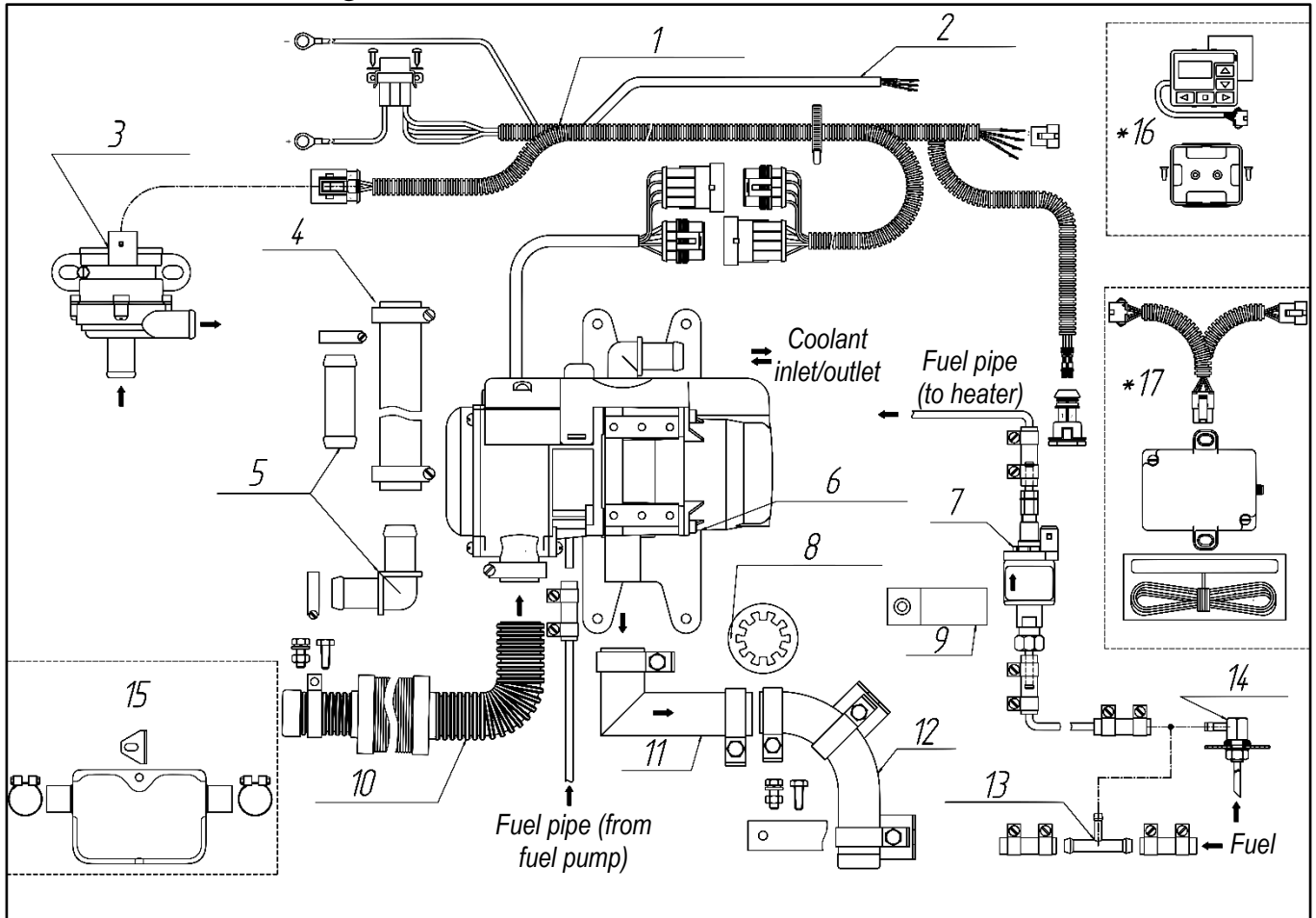
Characteristics	Models		
	FLOW 5B	FLOW 5D	
Voltage	12V	12V	24V
Heating medium	Coolant, antifreeze coolant		
Optimal liquid/coolant volume	10 - 12 L		
Coolant liquid flow rate	At 0 bar pressure: 1200 l/h At 0.18 bar pressure: 800 l/h		
Heating power	5 kW		
Power consumption	42 W		
Power consumption, at start	122 W		120 W
Max. work altitude (MASL)	1000 m		
Fuel	Petrol fuel in accordance with EN228	Diesel fuel in accordance with EN590	
Fuel consumption	0,7 l/h max	0,62 l/h max	
Control mode	Manual, standard remote control, modem		
Weight of the heater	2,4 kg		
Heater dimensions	220x90x136 mm		

2. Basic parameters of the heater FLOW-14D

Characteristics	Models	
	FLOW 14D-12	FLOW 14D-24
Voltage	12V	24V
Heating medium	Coolant, antifreeze coolant	
Optimal liquid/coolant volume	25 - 30 L	
Coolant liquid flow rate	At 0 bar pressure: 2000 l/h At 0.18 bar pressure: 1300 l/h	
Heating power	14,5 kW	
Power consumption	46-124 W	46-113 W
Max. work altitude (MASL)	1000 m	
Fuel	Diesel fuel in accordance with EN590	
Fuel consumption	0,5-1,2 l/h max	
Control mode	Manual, standard remote control, modem	
Weight of the heater	5,7 kg	
Heater dimensions	340x160x206 mm	

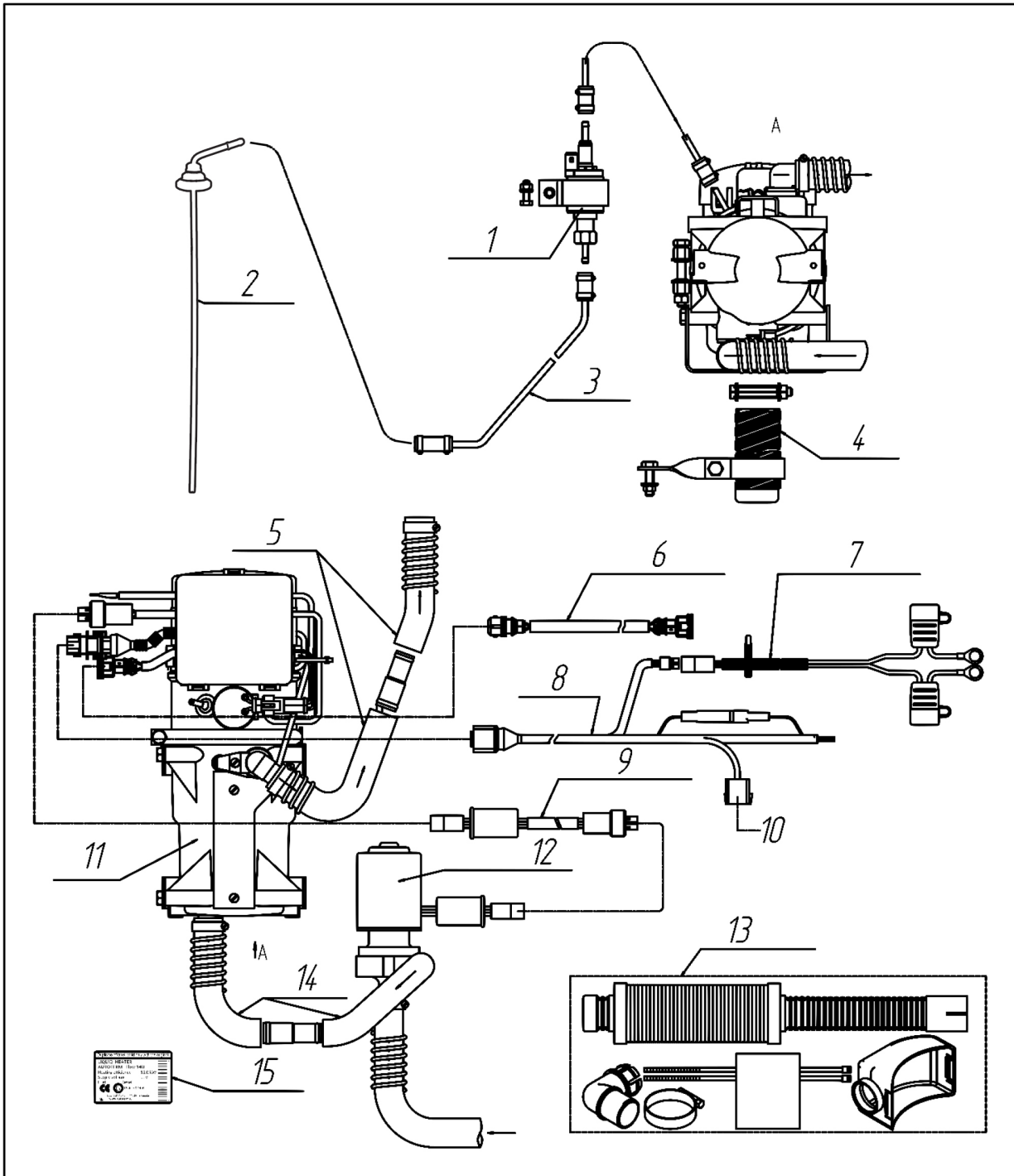
Annex 2: Connection diagrams of heaters

1. Connection diagram of the heater FLOW-5D, 5B



- | | |
|-----------------------------|--|
| 1 - Wiring harness | 10 - Air intake with silencer |
| 2 - Connection of the PWM | 11 - Corner pipe |
| 3 - Coolant pump | 12 - Exhaust pipe |
| 4 - Rubber hose | 13 - T-connector |
| 5 - Reducing pipe | 14 - Fuel intake |
| 6 - Heater | 15 - Exhaust pipe silencer (with installation kit) |
| 7 - Fuel pump | |
| 8 - Grommet to exhaust pipe | |
| 9 - Fuel pump stirrup | |
- *Optional parts**
- | |
|----------------------------------|
| *16 - Control panel with console |
| *17 - Modem |

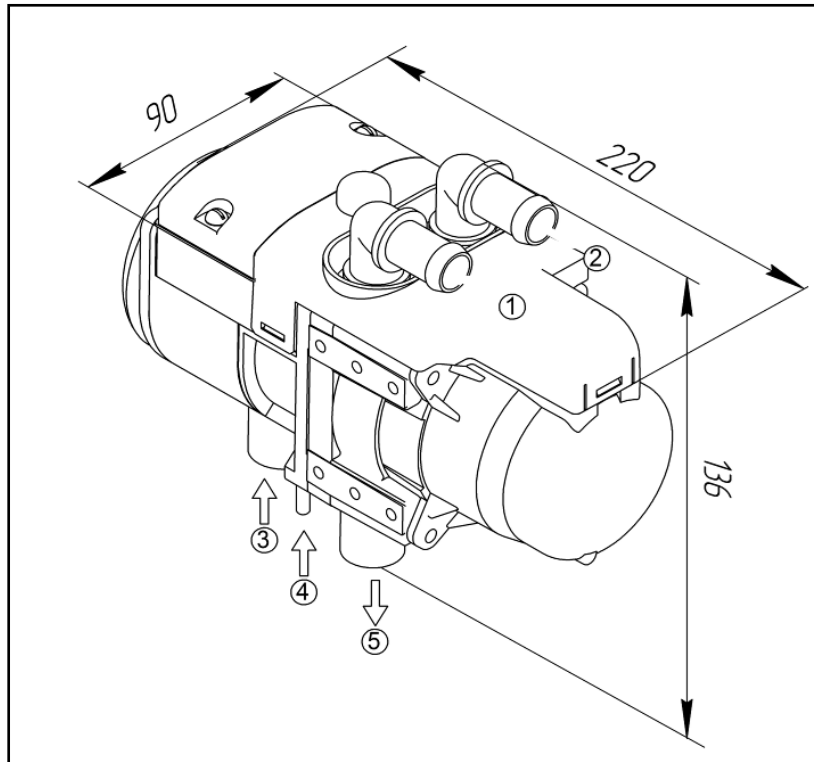
2. Connection diagram of the heater FLOW-14D



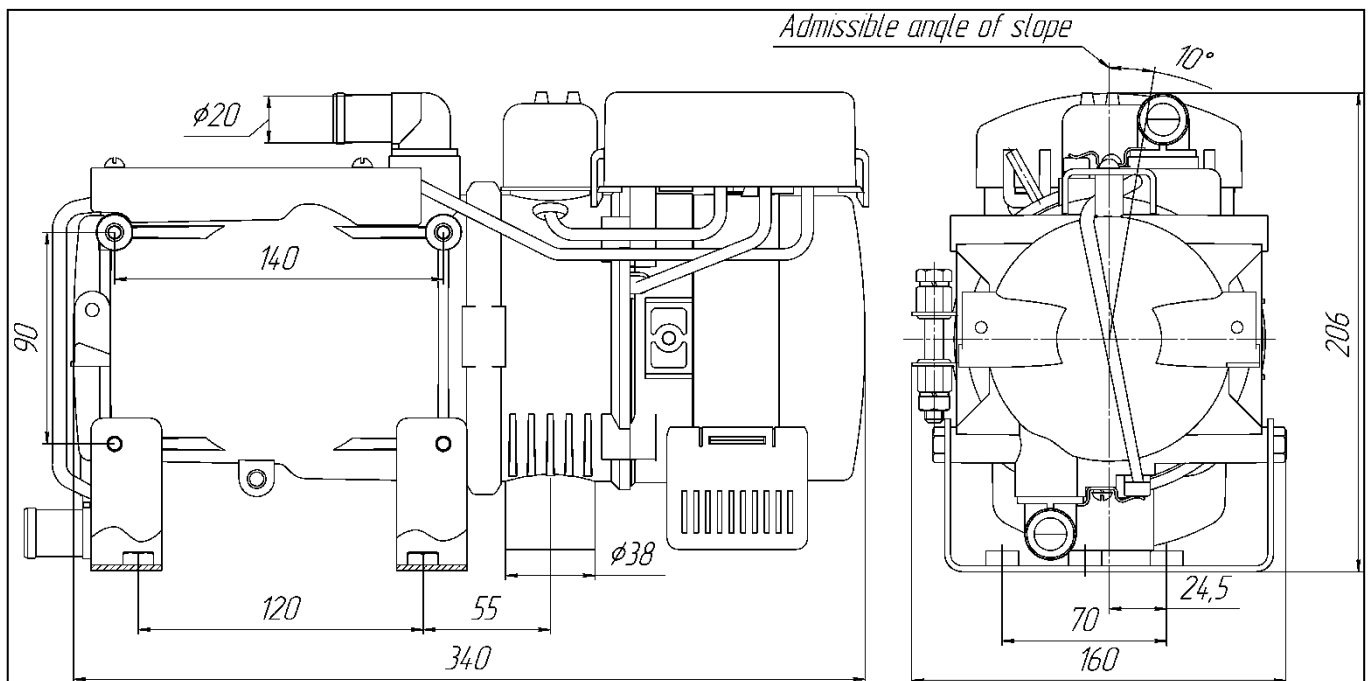
- | | |
|--------------------------|-------------------------------|
| 1 - Fuel pump | 9 - Coolant pump harness |
| 2 - Fuel stand pipe | 10 - Control panel connection |
| 3 - Fuel line | 11 - Heater |
| 4 - Exhaust pipe | 12 - Coolant pump |
| 5 - Coolant pipe line | 13 - Air intake mounting kit |
| 6 - Fuel pump harness | 14 - Coolant pipe line |
| 7 - Power supply harness | 15 - Duplicate of label |
| 8 - Harness | |

Annex 3: Size and dimensions of heaters

1. Size and dimensions of the heater FLOW-5D, 5B



2. Size and dimensions of the heater FLOW-14D



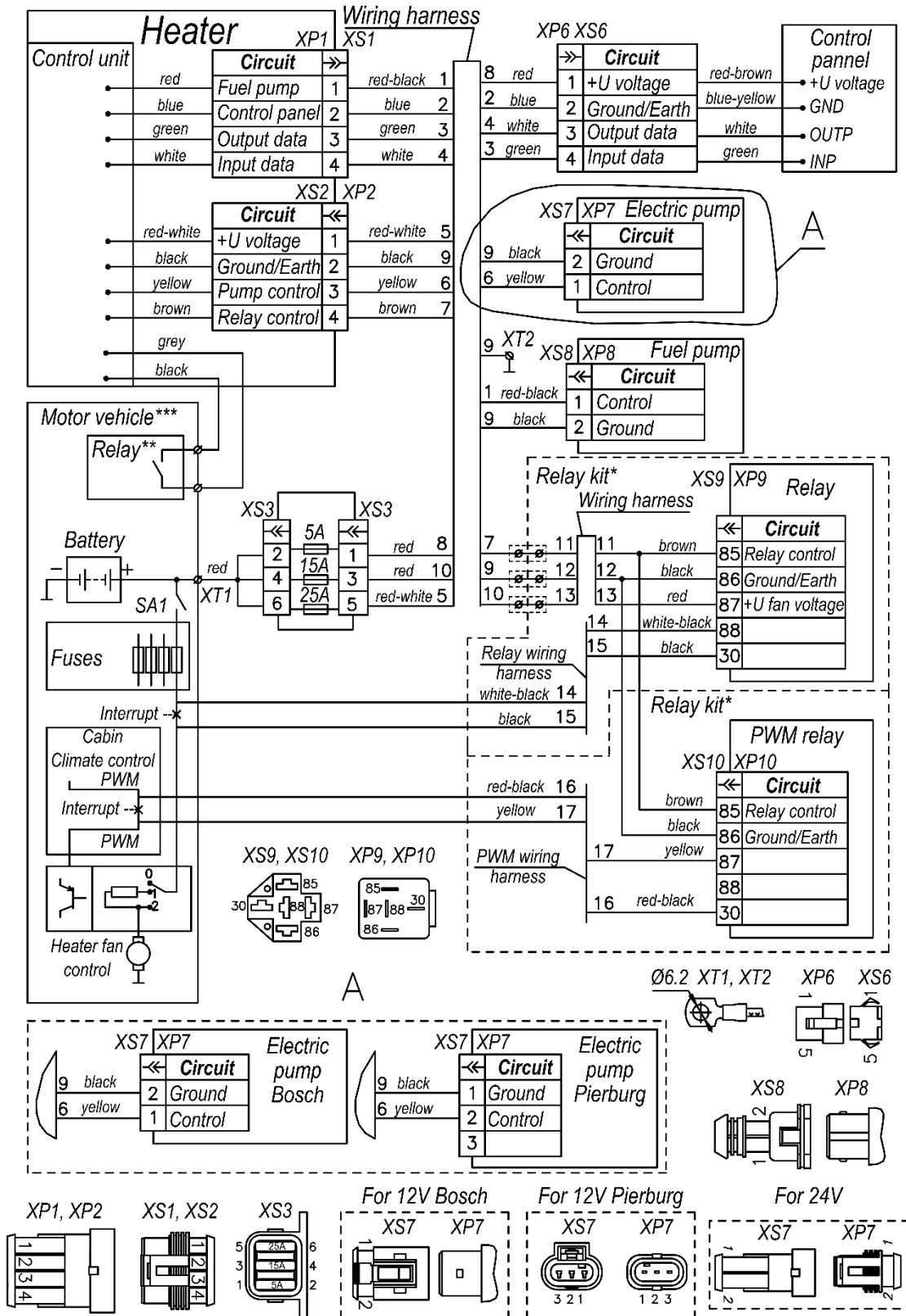
Annex 4: Electrical wiring diagrams of heaters

1. Electrical wiring diagram for the heater FLOW-5D, 5B

* Additional order. It is possible to install set of relays consisting of wiring harness, relays and PWM relay

** Relay – controlled remote signalling

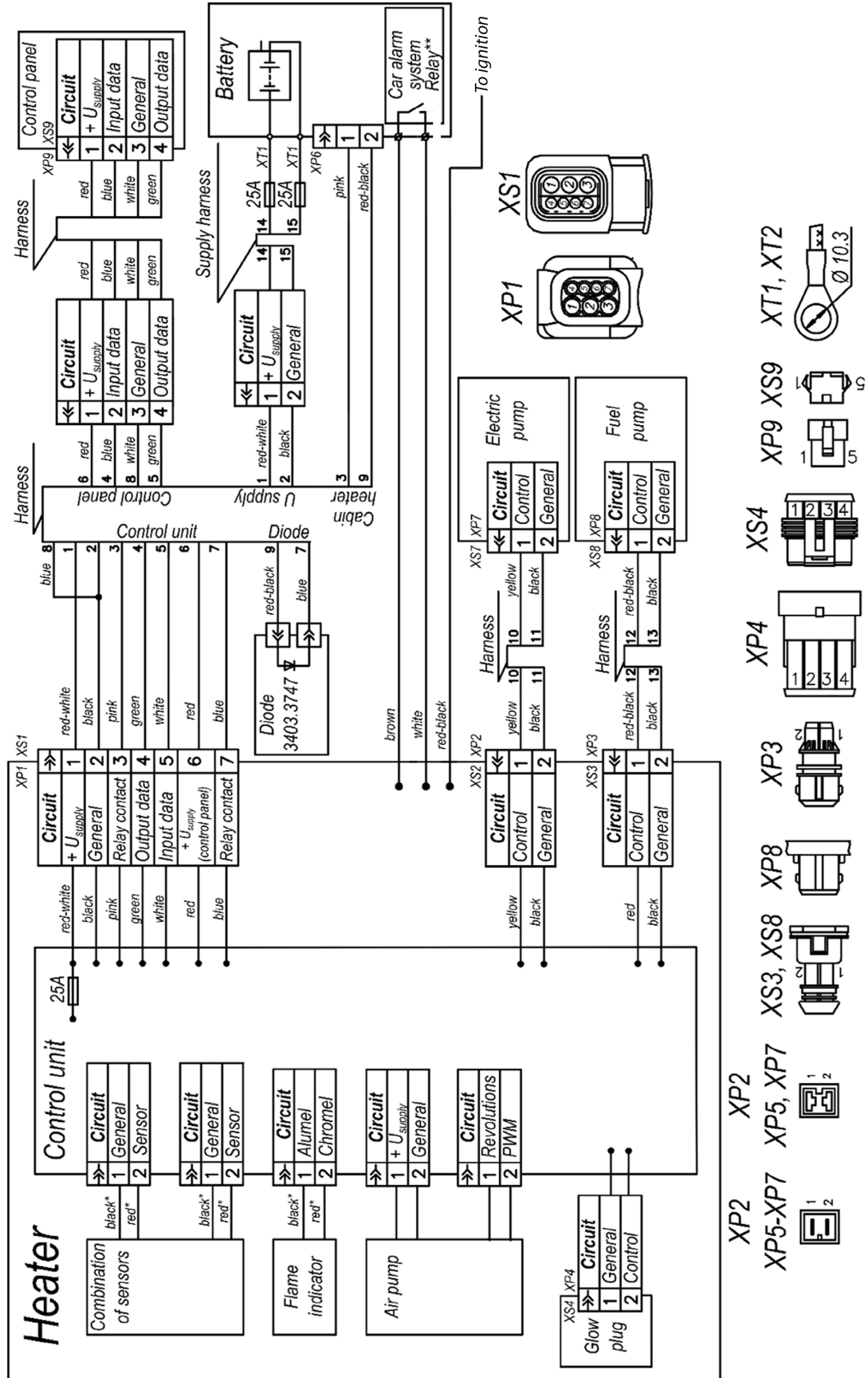
*** Example of the connection of a pre-heater to a vehicle



2. Electrical wiring diagram for the heater FLOW-14D

* Color labels on the wires of sensors, flame indicator and air pump

** Example of the connection of a pre-heater to a vehicle



Annex 5: Periodic maintenance table

Service object, description of activities and maintenance technique	Required inspection	Required materials, tools	Type of maintenance	
			PERIODIC	SEASONAL
Electrical equipment Check the security of the attachment of the heater electrical contacts. In case of dirt or oil deposit on the contacts, remove with suede moistened in petrol. In case of carbon deposit on the operating interface of contacts, smooth it out with fine glass paper № 150 and wipe with petrol.	Visual inspection	petrol, white spirit	Every 500h	+
Air intake Dismantle the air intake, rinse with petrol and clean out the net by blowing with compressed air	Visual inspection	Petrol (acetone)	Every 500h	+
Glow plug (for FLOW 14D) - Dismantle the air intake, remove 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. If this is the case, replace the glow plug.	Visual inspection	S=17 wrench, clean rags, benzene (acetone), screwdriver	Every 500h	+
Combustion chamber Clean up the Ø 1.5 mm hole for air supply to the ignition plug	Visual inspection	S=17 wrench, screwdriver	Every 500h	+
Fuel pump Prevention of formation of viscous film deposits on driving parts of the fuel pump.	Start heater	-	Monthly	+
Fluid system Clean up the heat exchanger	Visual inspection	screwdriver, brush, tank for cooling liquid	Every 500h	-
Fuel system Check the fuel pipe for leakage; tighten up clamp connections, if necessary.	Visual inspection	screwdriver	Every 500h	+

Annex 6: Maintenance check list

DATE:		VEHICLE YEAR:	
HEATER MODEL:		VEHICLE MAKE:	
SERIAL NO.:		VEHICLE MODEL:	
TECHNICAN NAME SURNAME		VIN:	
CATEGORY	DIAGNOSTIC TASK	✓	✗
Preliminary Check	Installation Position		
	Fuel pump mounting position (where applicable)		
	Proper length of fuel line before and after fuel pump		
	Heater is well protected from road spray and dirt		
	Fuel Level		
	Battery Condition and Voltage		
Visual Inspection	Wiring connections clean, tight and corrosion free		
	Intake and Exhaust position		
	Fuel line routing and Clamps tight		
	Debris in combustion or heated air intake		
	Fuses		
	Coolant flow direction		
Maintenance	Run heater 20 minutes minimum once a flame is established		
	Clean air intake of debris		
	Clean and tighten battery terminal connections		
	Check and clean glow plug		
	Check and clean exhaust pipe		