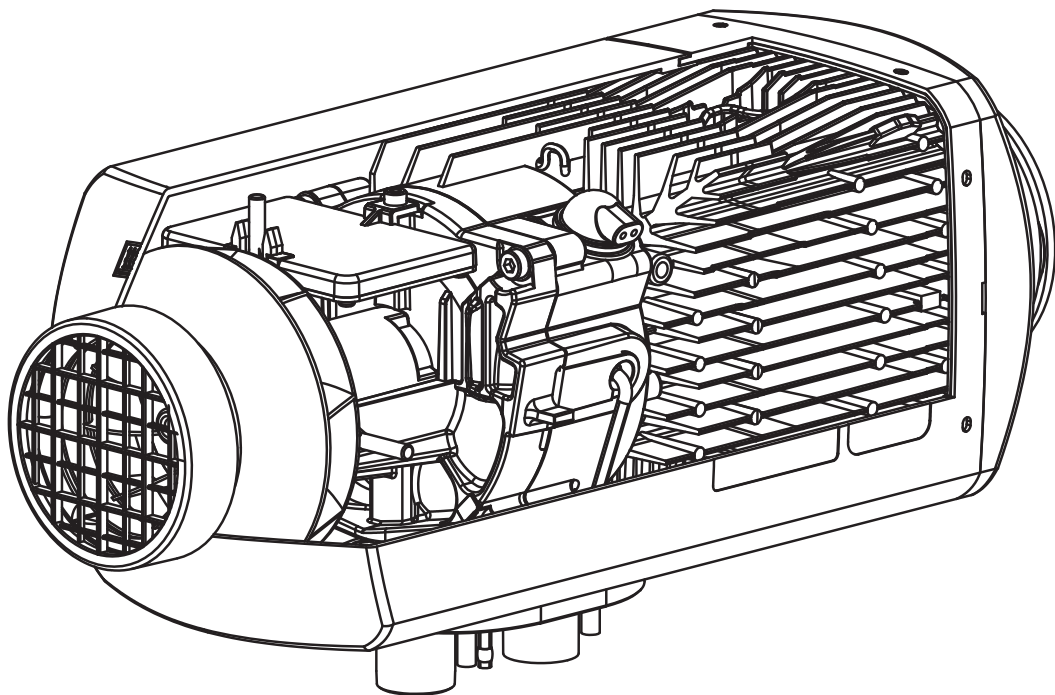




LF Bros[®]
AIR DIESEL HEATER

LF Bros Air Heater

Technical specification, installation manual, maintenance instructions



www.lfbros.co.nz

For spare parts or additional accessories, please visit our website.

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Inovation

- CAN bus communication
- Constant temperature & Intelligent frequency conversion
- Flameout protection
- Anti-electrophoresis function
- Auto-ranging power supply
- Ignition test under low temperature -40°C

Please read carefully and keep at a safe place.

THIS MANUAL DESCRIBES ITS STRUCTURE AND INSTALLATION INSTRUCTIONS. PLEASE READ THIS MANUAL CAREFULLY BEFORE INSTALLING AND USING, AND ENSURE THE CORRECT USE OF IT. PLEASE SAFEKEEP AFTER READING.

Attention:

- THE MANUAL CONTENTS MAYBE HAVE SOME CHANGE, WITH NO SPECIAL NOTIFICATION, BUT THE MANUAL IS IN ACCORDANCE WITH THE PRODUCT.
- WE TRY TO EXPRESS CLEARLY EVERYTHING THAT USERS HAVE TO LEARN. PLEASE CONTACT US DIRECTLY IF YOU HAVE ANY PROBLEM OR GOOD ADVICE.
- AFTER OPENING THE PACK BOX FOR THE FIRST TIME, PLEASE CHECK THE MAIN EQUIPMENT AND SPARE PARTS ACCORDING TO THE PACKING LIST.
- IF THERE IS ANY PROBLEM, PLEASE CONTACT THE DISTRIBUTOR QUICKLY.
- IF MALFUNCTION HAPPENS DURING THE USE, PLEASE CONTACT THE MARKETING DEPARTMENT OR THE SERVICE STATION THAT WE AUTHORIZE.

- WE WILL SERVE YOU WHOLEHEARTEDLY.
- PLEASE KEEP THE WARRANTY CARD CAREFULLY, AND GIVE THE FEEDBACKS ACCORDING TO THE TERMS. THIS WARRANTY CARD IS THE ONLY VALID CREDENTIAL OF AFTER-SALE SERVICE.

CE E9 EAC

0 Packing list

Packaged parts of the Air Heater:

No.	Name	Specification	Unit	Quantity
1	Main equipment	12V/24 V 2kW/3kW/5kW	Set	1
2	Main wire harness		Set	1
3	Fuel pump	12V/24 V (28 ml / 1000 times)	Piece	1
4	Air outlet	∅ 60/90 mm	Piece	1
5	LCD control switch		Piece	1
6	Mechanical control switch		Piece	1
7	Fuel filter		Piece	1
8	Fuel pump rubber clip		Piece	1
9	Air inlet pipe	∅ 25 mm × 600 mm	Piece	1
10	Exhaust pipe	∅ 24 mm × 600 mm	Piece	1
11	Air duct	∅ 60/90 mm × 600 mm	Piece	1
12	Bottom plate gasket		Piece	1
13	Bottom plate		Piece	1
14	Intake pipe clip	∅ 28 mm	Piece	2
15	Fixing clip for exhaust pipe	∅ 27 mm	Piece	2
16	Fuel tank	10 l	Piece	1
17	Nut	M6	Piece	4
18	Self-drilling tapping screw	ST 5.5 × 25 mm	Piece	7
19	Nylon cable ties	200 mm	Piece	4
20	∅ 90 mm air duct clip	∅ 80 mm – ∅ 100 mm	Piece	2
21	Exhaust silencer		Piece	1
22	Fuel hose		Piece	1

1 Overview

The main equipment of air parking heater (hereinafter referred to as the heater) is a small fuel furnace controlled by a single-chip microprocessor. Its furnace body (that's the heat exchanger) is located in the hood-shape case, which serves as an independent air passage.

Cold air is sucked into the air passage by the heat supplying fan and blown out when it becomes hot forming another heating system besides the original vehicle's heating system. This way driver's cab and passengers' compartment can be heated whether the engine is working or not. The schematic diagram is shown in Fig. 1.

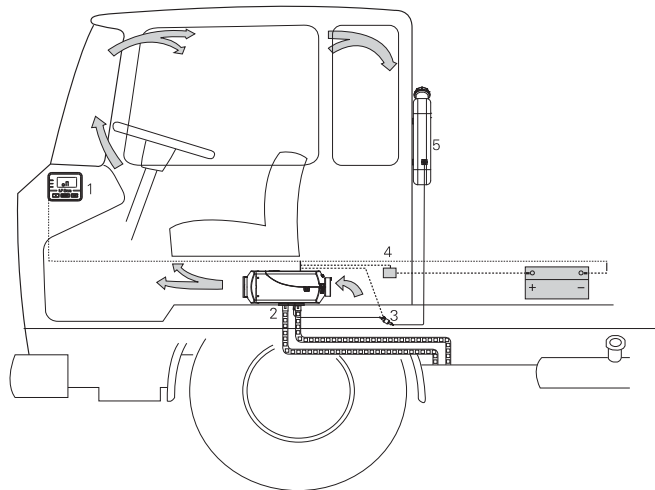


Fig. 1 Heating system

The heater is fully automatically controlled, and it has many

advantages, such as compact structure, easy installation, energy saving, environmental protection, safety and reliability, and simple maintenance.

2 Technical parameters

Please refer to following table for the main technical specifications.

Product variant	3 kW 12 V	5 kW 12 V	3 kW 24 V	5 kW 24 V
Fuel	Diesel			
Thermal power	1,4 - 3 kW	1,4 - 5 kW	1,4 - 3 kW	1,4 - 5 kW
Rated voltage	12 V		24 V	
Fuel consumption	0.15–0.55 l/h			
Rated power	5W RMS (1.4kW heat) 25W RMS (3kW heat) 35W RMS (5kW heat) 135W peak (innitial preheating / turning off)			
Operating (ambient) temperature	-40 °C to +40 °C			
Weight of the main equipment	4.45 kg			
Dimensions	372 × 141 × 150 mm			

3 Structure

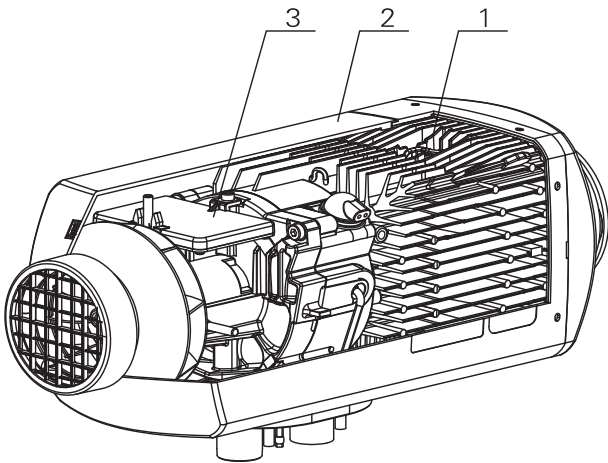


Fig. 2 Heater body

1. heat exchanger
2. hood-shape case
3. controller board

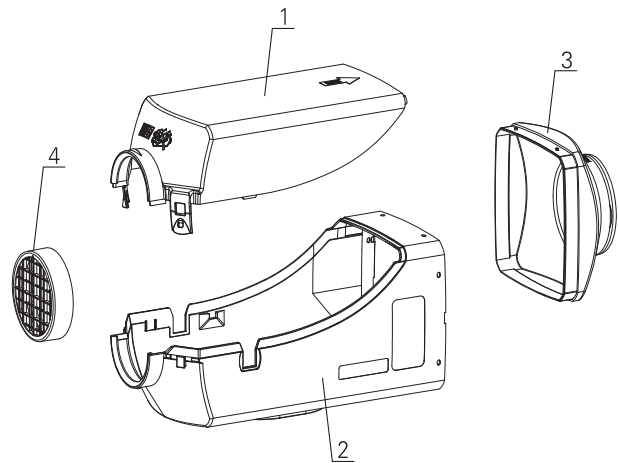


Fig. 3 Case

1. top hood cover
2. bottom hood cover
3. hot air outlet
4. air inlet hood

3.1 Main heater body

The main structure of the heater is described in Fig. 2.

3.2 Case

The case structure is shown in Fig. 3. Blade wheel of the heating fan on the fan motor (the same motor for the combustion-supporting fan) sucks in cold air from the air inlet and delivers the air after being heated by the heat exchanger out through the hot air outlet.

3.3 Controller (circuit board)

The controller is mounted on the rear side of the heating fan. After startup it will automatically complete the control and monitor of the entire working procedures of the heater and the implementation of the fault protection function according to the pre-programmed procedures.

3.3.1 Control of Working Procedures

Adjustment and control on the operating state are performed during the whole working cycle (startup → operation → shutdown) of heater in terms of the rotation speed of fan motor, the frequency of fuel pump, the on-off of glow plug, and the function conversion with the flame sensor in according to given time sequence combined with the preset value and measured value of the temperature of the temperature control point, the temperature of furnace chamber, surface temperature of the heater exchanger and other random parameters.

3.3.2 Fault Lock

The heater will automatically shut down and get into the locking state for protection when any the following conditions happen:

1. The heater can't be ignited or can't work naturally after being ignited.
2. Open or short circuit happens to the glow plug, fan motor, fuel pump and sensors, etc.
3. Overheat of heat exchanger, flame out, unsuccessful ignition, abnormal voltage.

To cancel the fault lock turn the control switch off for more than 3 seconds and then restart it.

3.3.3 Circuit Interfaces

The following circuit interfaces can be found on the controller outer case (see Fig. 4):

- X1 for glow plug/flame sensor socket
- X2 for overheating sensor socket
- X3 for fan motor socket

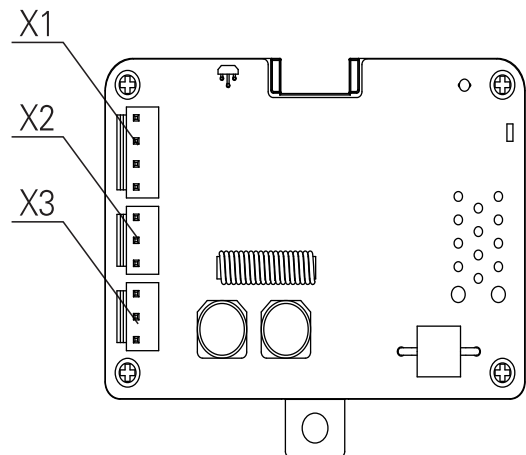


Fig. 4 Circuit interfaces

3.4 Sensors and Safety Protection

3.4.1 Flame Sensor (that's the Glow Plug)

This component has two functions. When it works as the flame sensor, it can monitor the temperature of the furnace cavity due to variable resistance with respect to the temperature. It is used to decide whether the furnace is ignited or not in the ignition stage. In normal working condition it helps to decide whether the flame is burning continuously or not.

3.4.2 Overheating Sensor

The overheating sensor is installed on the outer wall at the middle of the heat exchanger. When the exchanger's temperature is over 210 °C for a long time the controller cuts off the oil pump circuit, stops the fuel supply, and then shuts down the heater to protect the system from overheating.

3.4.3 Temperature Sensor

The temperature sensor is plugged into the corresponding socket on the controller, and it measures the air temperature at the air inlet, and according to this temperature, the controller changes the working status of combustion furnace to adjust the output power.

3.5 Power Supply

The heater shares the power supply with the car's engine but with a separate fuse. When the power supply voltage is outside of specified (lower and upper) limits the heater will automatically report the fault.

3.6 Fuel Supply

The fuel used by the heater can be supplied by a special fuel tank. Fuel delivery and fuel supply adjustment is via a special fuel pump.

4 Installation

Only special parts can be used for installation of the heater.

Fig. 5 is the diagram for installation.

1. Heater
2. Main harness
3. Fuse holder
4. Fuse box cover
5. Inserting disk fusing
6. Control switch
7. Connector for control switch X9
8. Fuel pipe
9. Fuel filter
10. Fuel pump
11. Fuel pump connector
12. Pump leading wire
13. Fuel pump clamp
14. Air inlet pipe clamp
15. Air inlet pipe
16. Air inlet pipe fixing clamp
17. M6 nut
18. Gasket
19. Exhaust pipe fixing clamp
20. Exhaust pipe
21. Exhaust pipe fixing clamp
22. Fuel tank

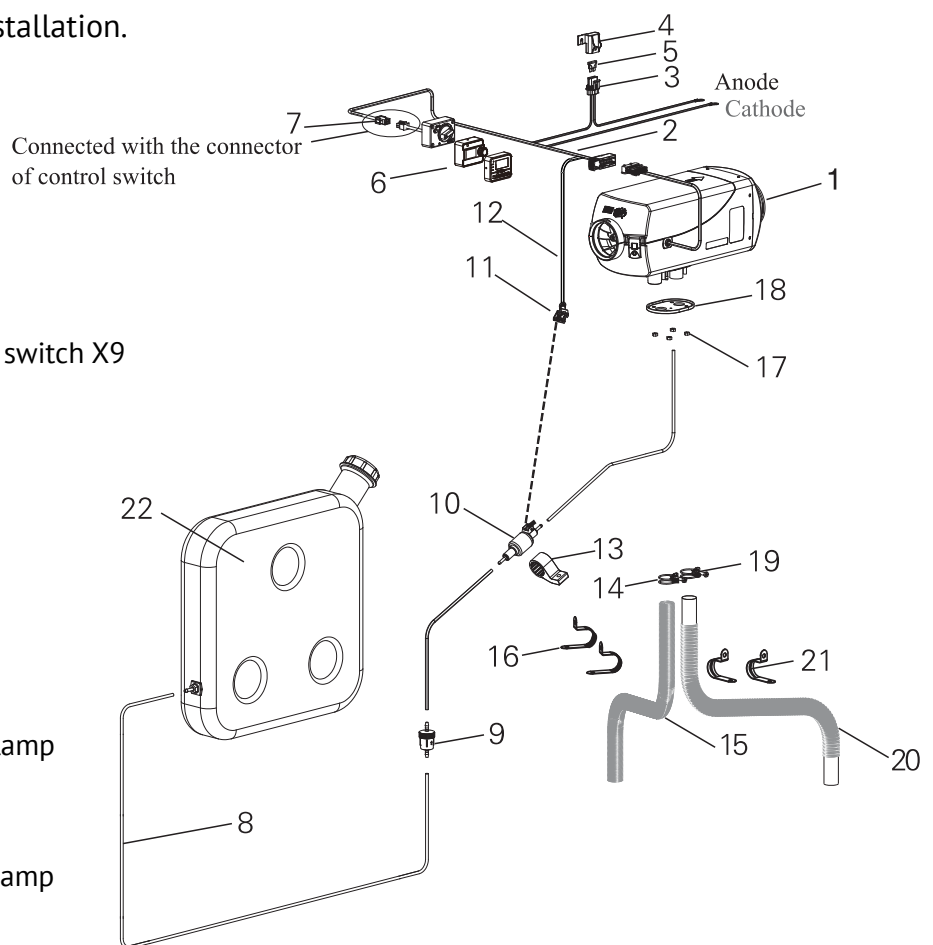


Fig. 5 Installation

The positions and fixing ways of various parts may vary for different types of vehicles, but the general principles must be followed in conformity with the requirements of this chapter. Otherwise, the heater may not work normally, even safety problems may occur.

4.1 Requirements for Installation

Requirements for installation and places of application of the heater:

1. It is not allowed to use the heater in locations with inflammable or explosive substances such as flammable gas or flammable dust.
2. It is not allowed to use the heater in closed space (such as garage or maintenance workshop without air ventilation) to avoid the danger of poisoning due to exhaust from burning.
3. It is not allowed to install and use the heater in the living room.
4. If the heater is installed in special-purpose vehicles (such as vehicles to deliver dangerous goods), special rules must be followed when installing the heater.
5. Make sure to keep fuel tank, compression tank, fire extinguisher, clothes, paper, etc. away from the heater, and also avoid them to opposite to the hot air vent.

4.2 Installation of the main equipment

4.2.1 Where to install

The main equipment can be installed inside or outside of the vehicle. But when it is installed outside the vehicle, a shield (supplied by retailers) which can prevent the damage (splash of stones) from external force should be provided. The heater can't be soaked in the water or in the rain. If the heater is corroded by rain and water, please stop using the heater immediately and let a qualified technician to inspect all components.

4.2.2 Spacing requirements

To ensure heating air flow and easy installation and maintenance of the main equipment, enough space must be provided for installation. Please refer to the scope of double dot line for the space for installation, as shown in Fig. 6. Make sure that there are no interference objects in the gap between the bottom surface of the main equipment and the mounting surface of the vehicle (Fig. 6-F).

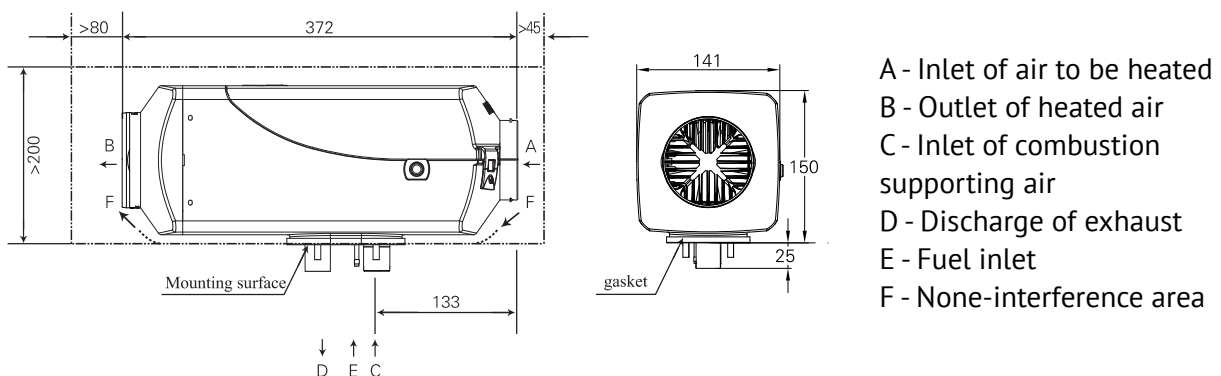


Fig. 6 Spacing

4.2.3 Sealing

Good sealing is necessary between the main equipment and the installation face on the vehicle. A special gasket (as shown in Fig. 6) supplied by the manufacturer must be padded for installation. The installation surface must be even enough. Its parts at the installation bases of the main equipment shall have unevenness less than 1 mm. After drilling installation holes, evenness must be improved according to this requirement, when installation, please rotate the four M6 nuts provided by the manufacturer tightly. The torque for tightening shall be 6Nm+1Nm. The position of installation holes is shown in the Fig. 7.

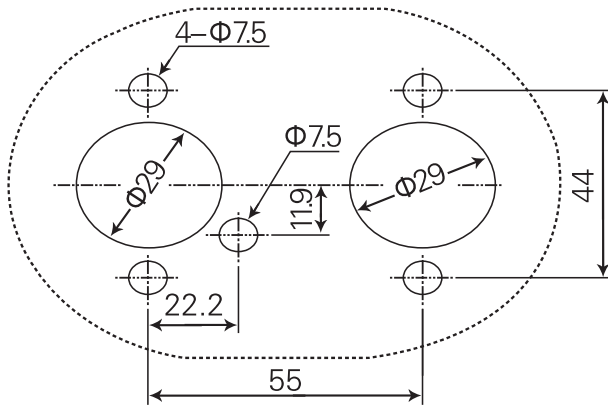


Fig. 7 Sealing

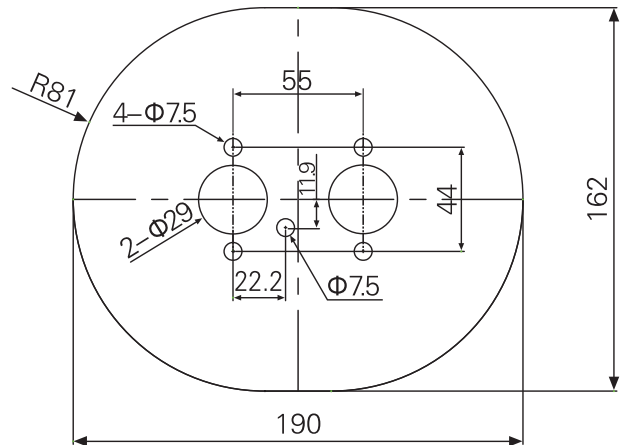


Fig. 8 Mounting plate

4.2.4 Mounting plate

If the thickness of the installation panel is < 1.5 mm a mounting plate is needed. The gap between the mounting plate and the car body must also be sealed (Fig. 8). Please confirm the actual size with the real product.

Note: A new gasket must be replaced when the main unit is reinstalled.

4.2.5 Installation direction

The installation direction of the main heater is as shown in Fig. 9. It must be noted that the tilt angle has to be exactly 90 degrees on both sides, otherwise, it will affect the normal operation.

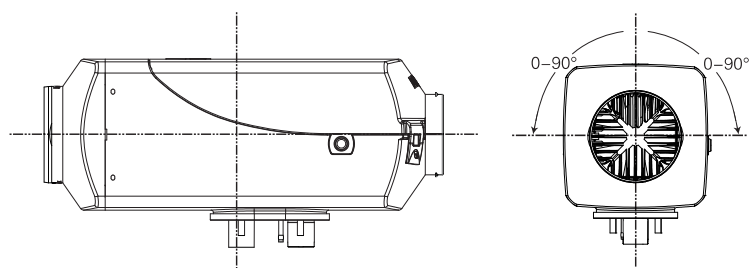


Fig. 9 Upright direction

4.2.6 Check of fan wheel

After the installation, it must be checked to ensure that there is no contact or friction between the fan wheel and the surrounding components to prevent malfunction during work.

4.3 Installation of Air Heating System

4.3.1 Air circulation modes

It's recommended to select the independent outer circulation or inner circulation mode of heater for installation. If the air heating system of the heater has to be connected with the air duct of the vehicle, in order to ensure the air duct unobstructed, the connection way should be decided by the professionals.

4.3.2 Temperature resistance

When an external heating air pipe is attached to the heater its material shall be capable to resist the temperature of 150 °C.

4.3.3 Maximum pressure drop

The maximum pressure drop between the air inlet side and air outlet side of the air heating system shall not be higher than 0.3 kPa.

4.3.4 Safety of vents

The hot air from the heating system shall not erupt onto such parts that are unable to resist heat. In the case of passenger vehicles measures shall be taken to avoid the block of the hot air vent by passengers. A self-provided protective net shall be installed if necessary.

4.3.5 Cold air in

For heater working in internal circulation measures shall be taken to avoid re-entering of the supplied hot air into the air inlet port (as shown in Fig. 10). The inlet air shall be drawn from the cold area of the compartment, such as under the seats or beds. If no air inlet pipe is attached in this mode, an air inlet hood with grids (Fig. 3-4) must be installed at the air inlet port of the main equipment.

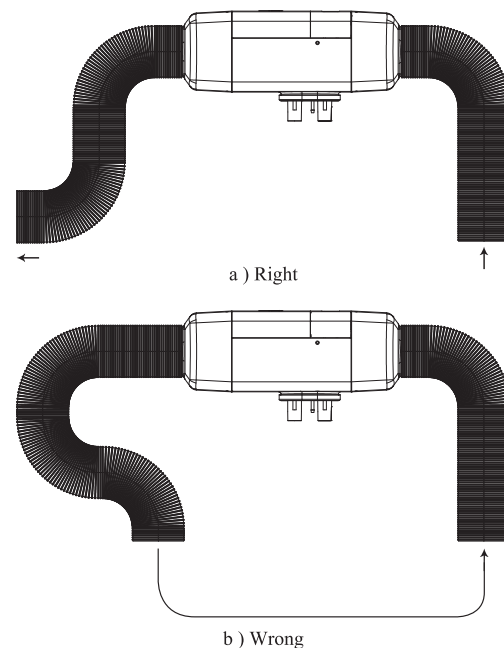


Fig. 10 Cold air as input

4.4 Installation of Fuel Supply System

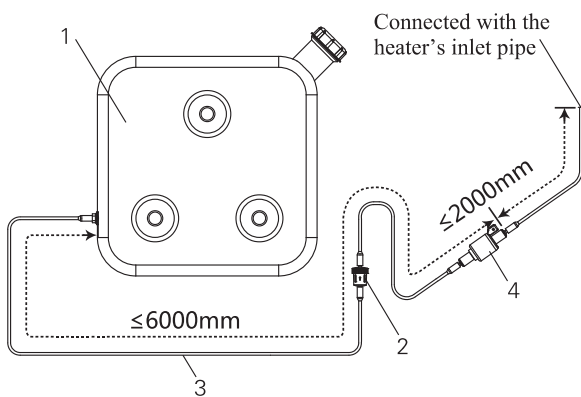


Fig. 11 Fuel supply system:
 1 - Fuel tank
 2 - Filter
 3 - Fuel connecting pipe
 4 - Fuel pump

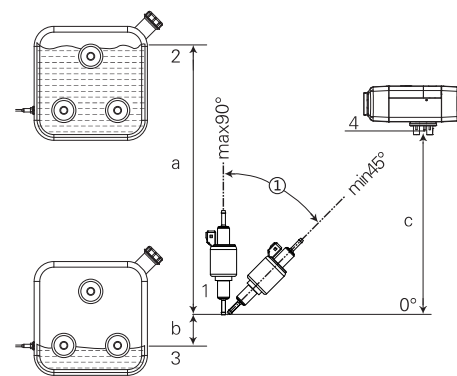


Fig. 12 Elevation differences:
 1 - Fuel pump
 2 - The highest level of fuel
 3 - The lowest level of fuel
 4 - Fuel inlet level for the main equipment
 ① The prior installation angle

The fuel supply system for the heater is as shown in Fig. 11.

4.4.1 Fuel pump

The fuel pump shall be fixed in protective rubber clamp to eliminate the transfer of vibrations. The outlet of the fuel pump shall tilt upwards. The tilt angle can be within range of 45°–95° (see Fig. 12). When conditions permit the fuel pipe between the fuel pump and the heater shall go up gradually.

4.4.2 Elevation differences

The elevation difference between the level of fuel and the fuel pump as well as the elevation difference between the fuel pump and the fuel inlet of the heater can produce pressure (or suction) in the fuel pipeline (See Fig. 12). Therefore, these dimensions shall conform to the requirements as follows: $a \leq 3\text{m}$; $b \leq 0.5\text{m}$; $c \leq 2\text{m}$.

Note: Please check the vent hole on the fuel tank cap during installation.

4.4.3 Installation of Fuel Filter

A fuel filter should be installed before the fuel inlet port of the fuel pump. Make sure that the fuel flow is correctly followed. Its position shall be exactly 90°, in conformity with Fig. 13. The fuel filter should be replaced every 6 months, same as the fuel pipe fittings and clamps.

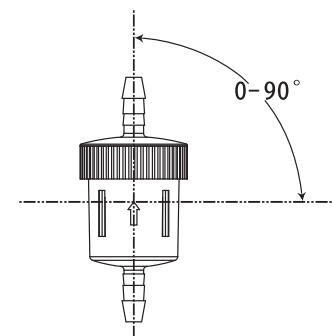


Fig. 13 Fuel Filter

4.5 Installation of Electrical Components

4.5.1 Main wire harness

Connection diagram of the main wire harness and the heater is as shown in Fig. 14. The wires of the main equipment for connection to outside circuits have been made into wire bundles. They can be laid according to the positions of various components and shall be fixed in some proper locations. The distance between two fixing points shall not exceed 300 mm.

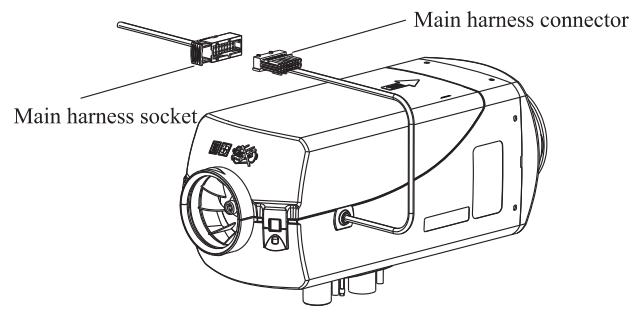


Fig. 14

Any wire bundle exposed out of the vehicle body or out of the wiring groove must be protected by the corrugated pipe.

4.5.2 Battery connection

Connect the RED wire on the fuse box to the PLUS terminal of the vehicle's battery, while the BLACK wire to the MINUS terminal.

4.5.3 Fuel pump connection

Connect the fuel pump leads with the fuel pump.

4.5.4 Control panel

Install the control panel in a position for convenient operation. The arrangement shall make an easy observation on the indicator on the case to identify the working conditions (operation/stop) of the heater easily. The terminals of the leads of the control panel should be plugged in the socket according to the order as shown in Fig. 15 and then connected with the self-locking mechanism to the connector X9 on the main wire harness.

4.5.5 Avoid short-circuit

Each wire end shall be wrapped with electrician's insulating tape to avoid short-circuit.

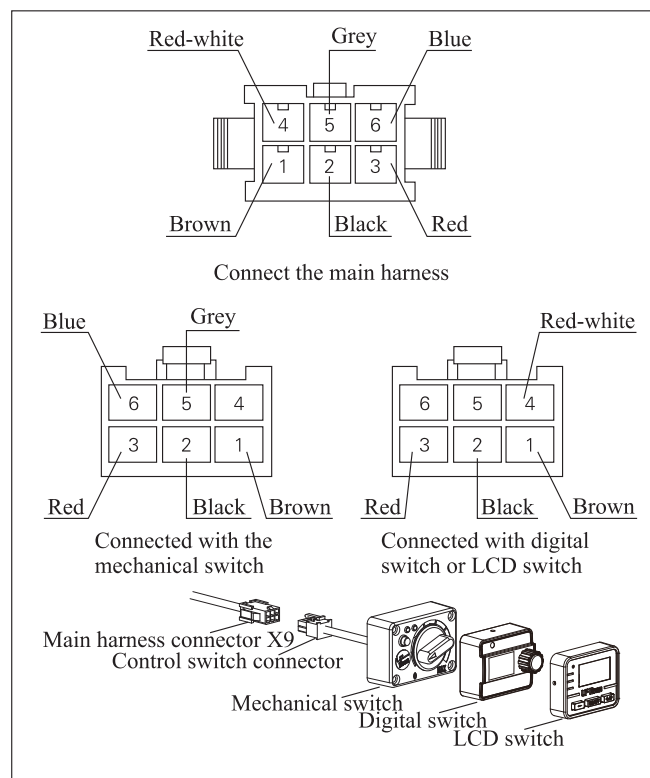


Fig. 15

4.6 Installation of pipes

Installation of Air inlet pipe and Exhaust pipe.

4.6.1 Separate air circuits

The combustion supporting air must be sucked in from the external fresh air outside the vehicle. The fumes from combustion must be discharged into the exterior air through the exhaust pipe. Measures must be taken to avoid fumes re-entering the vehicle.

The pipes go through the outer wall or holes at the bottom of the vehicle. Measures must be taken to prevent entering of splash water into pipes. The pipes must be protected and be able to resist shock permanently.

4.6.2 Installing the pipes

Only the air inlet pipe and exhaust pipe provided with the heater can be used. The air inlet pipe is an aluminum bellows; the exhaust pipe is a stainless steel bellows. They cannot be installed incorrectly or swapped during installation. To connect them with the heater please use the supplied clamps to fix them tightly on the combustion supporting air inlet and exhaust pipe vent respectively. The protective hood on the vents of the air inlet pipe and exhaust pipe must be kept intact and shall not be damaged or removed.

4.6.3 Direction of pipes

Both the air inlet pipe and exhaust pipe shall come outwards and downwards from the heater (Fig. 16 left), or a \varnothing 5mm hole shall be prepared at the bottom of the pipe for discharge of condensate water.

If the pipe has to be bent, the bending radius of the pipe must be at least 50 mm.

Also, the sum of all curve angles for each pipe shall not exceed 270°.

The openings of the pipes shall not be opposite to the direction of the running vehicle.

4.6.4 Protect from dirt

Arrangement of the pipes shall protect the pipe openings from blocking by slurry, snow or other dirt (Fig. 17).

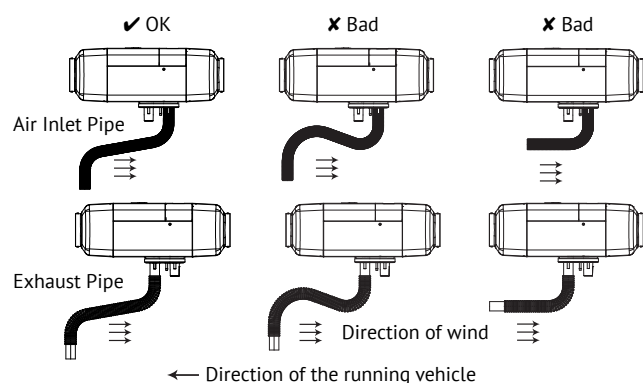


Fig. 16

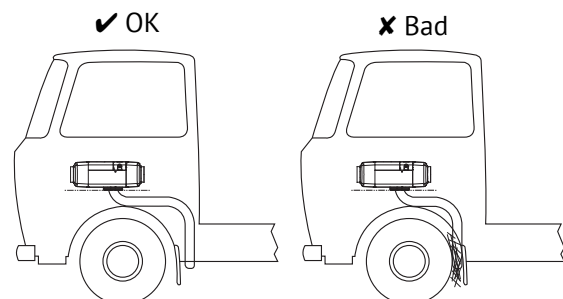


Fig. 17

4.6.5 High temperature

When the heater is running the exhaust pipe is at high temperature. During installation make sure to install the pipe in the far distance from the plastic parts or other objects with the poor thermal resistance of the vehicle body.

The exhaust pipe shall be properly fixed. The exhaust vent shall be downwards, perpendicular to road surface with an angle of $90^{\circ} \pm 10^{\circ}$ (Fig. 18). To ensure such an angle, the fixing clamp for the exhaust pipe shall be within 150 mm from the pipe end.

WARNING: Violation against the above requirements may cause the fire. We won't afford any responsibility for any consequences caused by not installing according to our requirement.

4.6.6 Protective cover

If the section of the exhaust pipe inside the vehicle may be touched by the passenger a protective cover has to be installed to prevent human contact and burning the skin.

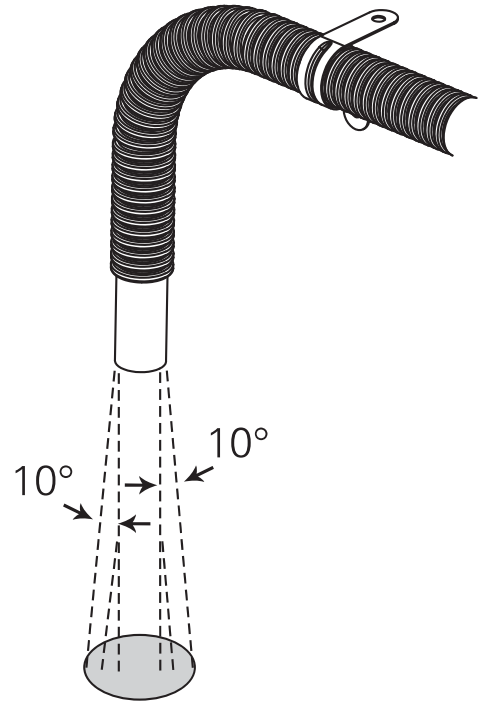


Fig. 18 HIGH TEMPERATURE

The inflammables should be away from here because there might be flames out.

5 Precautions

5.1 Air in the fuel

After installation of the heater, the air trapped in the fuel supply system shall be removed thoroughly to make the fuel line filled up with fuel. Please use the fuel pumping mode until the fuel lines are fully filled with the fuel.

5.2 Check before using

The heater shall be commissioned before use. Carefully check the leaks and safety conditions of all connections during the test run. If the discharge of dense smoke is observed or irregular combustion noise or fuel smell is sensed, the heater must be turned off. Please take out the fuse, to make the heater unable to operate. The heater can only be put into use after being repaired by qualified professionals.

5.3 Inspect before each season

Before each heating season starts, a careful inspection shall be performed by qualified professionals for maintenance, details as follows:

1. Check the contamination and foreign matter in the air inlet and outlet.
2. Clean the external of the heater.
3. Check if there is any corrosion or loose connection for electric contacts.
4. Check to find any blockage and damage to the air inlet pipe and exhaust pipe.
5. Check to find any leakage on the fuel line.

5.4 Keep it alive

If the heater is not used for a long time you should better run it once every four weeks and let it run for 10 minutes at least to prevent malfunction of mechanical parts.

5.5 Keep the pipes clean

The air inlet port and air outlet vent of the heater must be kept clean and unblocked to provide the smooth route for air flow and prevent overheating.

5.6 Refueling

When replacing low-temperature fuel the heater should be operated for at least 15 minutes to fill the new fuel into the fuel line and fuel pump.

The heater must be turned off before refueling.

5.7 Life time

The heat exchanger should not be used for more than 5 years. After expiration it must be replaced with genuine parts and replaced by the heater manufacturer or its authorized agent. At this time the overheating sensor shall also be replaced at the same time.

If it's arranged in the area of passengers, the exhaust pipe of the heater for a discharge of fumes shall be replaced with genuine parts when the usage time is reaching 5 years.

5.8 Welding the vehicle

If electric welding is performed to the vehicle please detach the positive wire of the power supply of the heater from the battery and connect it to earth to protect the controller from any damage.

5.9 Transportation and storage

During the transportation and storage of the heater the ambient temperature should not exceed the range of $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ range to prevent any damage to electronic components.

5.10 Installation and repair

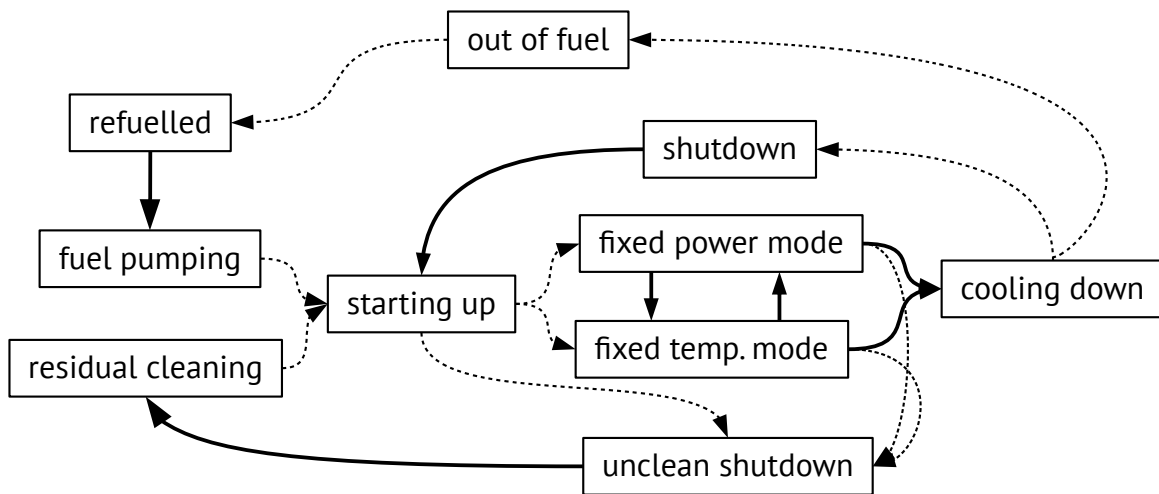
Only authorized customer service stations are allowed to install and repair the heaters and non-original parts are prohibited from being used to avoid danger.

5.11 Responsibility for damage

The manufacturer shall not be responsible for any damage to the heater if the heater is opened without authorization or such damage is caused due to installation or operation with violation against the regulations.

6 Usage

6.1 Modes of operation



6.1.1 Fuel pumping (first start or after refueling)

After the initial installation the heater should be started with the Fuel pumping mode to remove the air lock from the fuel pipes.

It's used for filling the fuel pipe with diesel for the first-time use or after the heater stopped because of insufficient diesel left in the fuel tank. Normally it would take two cycles to fill up the whole fuel line.

6.1.2 Normal startup

After requesting to start the heater at the control panel the glow plug will start to work in about 2 seconds. The fuel pump will start pumping fuel in about 1 and half minutes. After successful ignition the heater starts running naturally in about 5 minutes.

The settings can't be adjusted until the startup process is finished. Then it's possible to switch between the fixed power or fixed temperature modes or shut the heater down.

6.1.3 Fixed power mode

Just running at a given fixed power without regard to the temperature. The power can be selected from a range supported by the heater.

Note: The maximum power is dependent on the model of heater.

6.1.4 Fixed temperature mode (thermostat)

The heater will adjust its power to maintain the given temperature.

Note: The maximum achievable temperature is dependent on the model of heater, volume of the heated cabin, exterior temperature and thermal resistance of the walls.

6.1.5 Shutdown

After the shutdown is requested at the control panel the pump will stop immediately, but the fan will still run in order to cool down the heat exchanger case below 50 °C.

6.1.6 Unclean shutdown

When electric power was interrupted during operation while the fuel pump was running there are residual of the fuel that need to be removed.

6.1.7 Cleaning residuals after unclean shutdown (ventilation mode)

After the heater shut down in an unclean way it's necessary to blow away residual fuel left in the heater. After the residuals are cleaned the heater can continue in one of the normal working modes.

6.2 Control panel usage

This section describes how to control the heater using three different types of control panels: mechanical, LCD with buttons and LCD with knob.

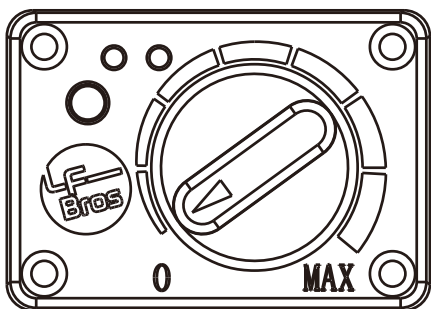


Fig. 19: Mechanical

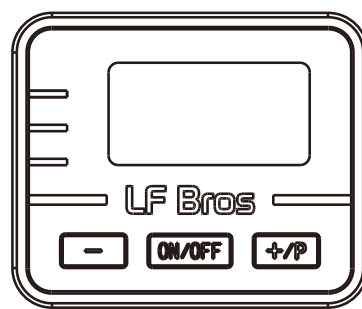


Fig. 20: LCD with buttons

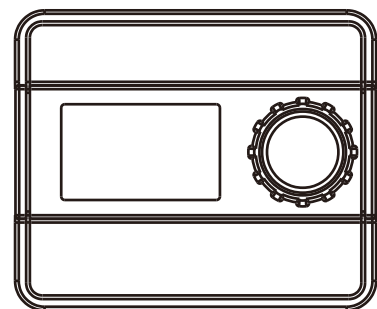


Fig. 21: LCD with knob

6.3 Mechanical control panel

It contains two controls and two indicators (Fig. 22):

1. control knob (temperature, power)
2. start button (mode switch)
3. start indicator (left, green/red)
4. work indicator (right)

When the control knob is at the **0** position, the heater is turned off, otherwise the heater starts working. There are two normal operating modes (given temperature or power) and one special mode.

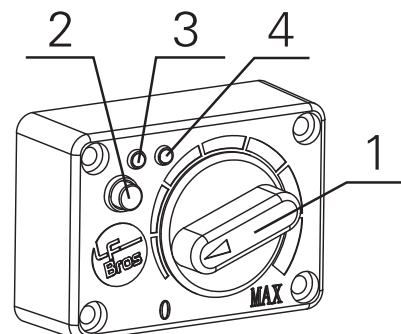


Fig. 22

6.3.1 Fixed power mode

Just setting a fixed power. Press the *start button* so that is in the released state. The *start indicator* light gets red. Turn the *control knob* to adjust the heater's power. It can be continuously adjusted between 1.4–MAX kW, where MAX is the maximum power of the model (3 or 5 kW).

6.3.2 Fixed temperature mode

Given a desired temperature the heater will adjust its power to maintain the temperature. Press the button to the depressed state. The *start indicator* light gets green. Turn the *control knob* to set the desired temperature. It can be continuously adjusted between 10–30° C.

6.3.3 Shutdown

In order to shut down the heater turn the *control knob* to the **0** position. After 3 seconds the *work indicator* turns off. The pump will stop immediately, however, the fan will still run in order to cool down the heat exchanger case below 50 °C.

6.3.4 Start after unclean shutdown

1. Turn on the heater (*control knob* to position other than **0**) and wait for the *work indicator* to start flashing.
2. Press the *start button* once per second at least 6 times in a row.

After the *work indicator* stops flashing the system is in the emergency start mode. The fuel pump will continue to supply fuel at a high frequency until the ignition is successful or stop running when the pump has pumped fuel for about 500 times but still fails to ignite. Then you can repeat the above procedure to start the Fuel pumping mode.

6.4 LCD control panel with buttons

The LCD control panel contains **-**, **ON/OFF** and **+P** buttons, display and buzzer. (Fig. 20).

6.4.1 After Installation (fuel pumping mode)

After the initial installation please start the heater with the Fuel pumping mode (6.1.1) to remove the air lock from the fuel pipes.

Long press **+P** button for 5 seconds. The display shows **PolI**, the buzzer will beep once and the heater will enter the fuel pumping mode (Fig. 23).

Note: It's used for filling the fuel pipe with diesel for the first-time use, or after the heater stopped because of insufficient diesel left in the fuel tank. Normally it would take two cycles to fill up the whole fuel line.

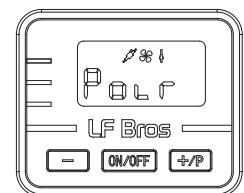


Fig. 23

6.4.2 Startup



Fig. 24

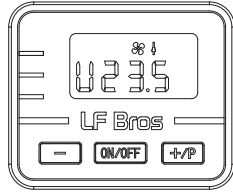


Fig. 25

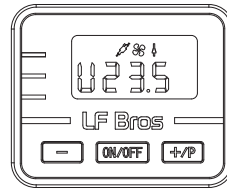


Fig. 26

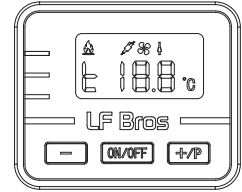


Fig. 27

Long press the **ON/OFF** button for 3 seconds, the buzzer will beep, and the main display shows **ON** (Fig. 24).

The glow plug will start to work in about 2 seconds. The display shows the current voltage in V, eg. **U23.5**, in the range 8–16 V for 12V model and 18-32 V for the 24V model (Fig. 25).

The fuel pump will start pumping fuel in about 1 minute and 30 seconds (Fig 26).

After successful ignition the heater starts running naturally in about 5 minutes. The settings can't be adjusted until the startup process is finished. The display shows the ambient temperature (Fig. 27).

6.4.3 Fixed power mode

Press the **+P** button and then the **ON/OFF** button to enter the power mode. Press the **-** or **+P** button to adjust the power up and down.

After adjusting wait 3 seconds for the buzzer to beep and the setting is completed. The display shows the set power, eg. **P3.5KW** means 3.5 kW (Fig. 28).

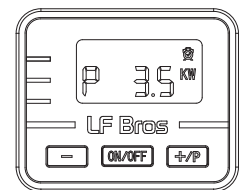


Fig. 28

6.4.4 Fixed temperature mode

Click the **+P** button, and then click the **ON/OFF** button to enter into temperature mode. Press the **-** or **+P** button to adjust the temperature up and down.

After adjusting wait 3 seconds for the buzzer to beep, and the setting is completed. The display shows the set temperature (t: 10°C - 35°C) (Fig.29).

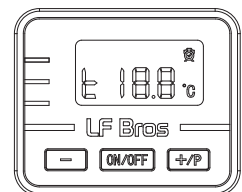


Fig. 29

6.4.5 Shutdown

Long press the **ON/OFF** button for 3 seconds to shut down the heater. The heater will stop in a heat dissipation state for 2-3 minutes and the display will show **OFF** (Fig. 30).

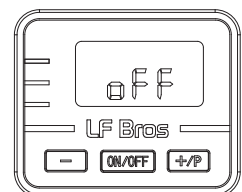



Fig. 30

6.4.6 Start after unclean shutdown (ventilation mode)

After the heater shut down in an unclean way it's necessary to blow away residual fuel left in the heater. After the residuals are cleaned one of the normal working modes should be selected.

Long press the  button above 3 seconds. The buzzer will beep once and the heater will enter into ventilation mode. The display shows the fan speed (900–3500 RPM) (Fig. 31).

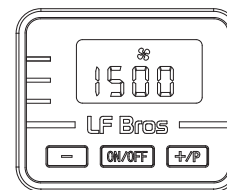



Fig. 31

6.5 LCD control panel with knob

This type of control panel contains a combined knob that allows both turning and pressing, an LCD display and a buzzer (Fig. 21).

6.5.1 After Installation (fuel pumping mode)

After the initial installation please start the heater with the Fuel pumping mode (6.1.1) to remove the air lock from the fuel pipes.

Long press *knob* for 5 seconds. The display shows , the buzzer will beep once and the heater will enter into the fuel pumping mode. (Fig. 32)

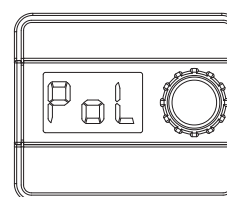


Fig. 32

6.5.2 Startup

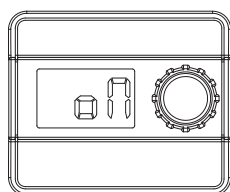


Fig. 33

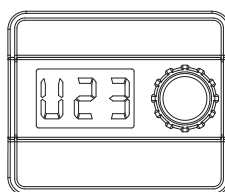


Fig. 34

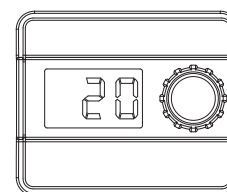




Fig. 35

Long press the *knob* for 3 seconds, the buzzer will beep, and the main display shows  (Fig. 33).

The glow plug will start to work in about 2 seconds. The display shows the current voltage in V, eg. , in the range 8–16 V for 12V model and 18-32 V for the 24V model. (Fig. 34).

The fuel pump will start pumping fuel in about 1 minute and 30 seconds. After successful ignition the heater starts running naturally in about 5 minutes. The settings can't be adjusted until the startup process is finished. The display shows the ambient temperature (Fig. 35).

6.5.3 Fixed power mode

Rotate the *knob* (left or right) to switch to the settings. Turn clockwise to increase the power or counter-clockwise to decrease it.

After adjusting wait 3 seconds for the buzzer to beep and the setting is completed. The display shows the set power, eg. **P1.5** means 1.5 kW. Press the knob in this state to enter into the temperature mode adjustment. (Fig. 36).

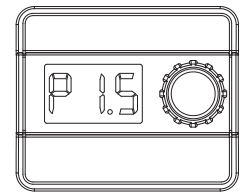


Fig. 36

6.5.4 Fixed temperature mode

Rotate the *knob* to switch to the settings. Turn clockwise to increase the temperature or counter-clockwise to decrease it.

After adjusting wait 3 seconds for the buzzer to beep, and the setting is completed. The display shows the set temperature (t: 10°C - 35°C). Press the knob in this state to enter into the power mode adjustment (Fig. 37).

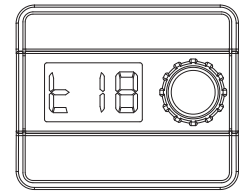


Fig. 37

6.5.5 Shutdown

Long press the *knob* for 3 seconds to shut down the heater.

The heater will stop in a heat dissipation state for 2-3 minutes and the display will show **OFF** (Fig. 38).

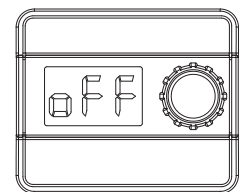


Fig. 38

7 Troubleshooting

7.1 Solutions to common problems

During the usage the heater might be unable to start naturally or die out after startup, which would lead to malfunction locking state. In such case restart the heater: turn it off, keep it shut down for at least 3 seconds and then start it again.

Circuit malfunction might be caused by different reasons, such as: corrosion (of connectors, wires, fuse, battery poles), poor contact of connectors, wrong connection of wires, etc. Users need to pay attention to inspection and maintenance to prevent such troubles from happening.

7.2 Common problems indicated at the display

7.2.1 Control panel wires disconnected

When turning on the heater the display is empty or shows **Conn** or **Con** (See Fig. 39/40), indicating that the wiring harness of the control panel is not connected properly. Which wire harness is disconnected?

- display show nothing -> the red-white wire harness
- buzzer beeps continuously and display shows **Conn** or **Con** -> any one of the other three wire harnesses

After 5 seconds, the controller will turn off the heater, regarding it as a normal shutdown. In both cases make sure that all electrical connections are connected and then start as usual.

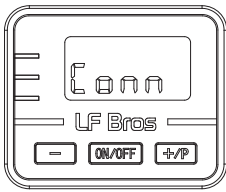


Fig. 39

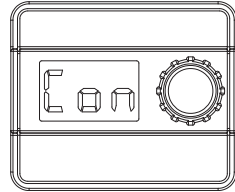


Fig. 40



Fig. 41

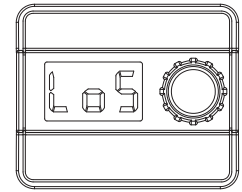


Fig. 42

7.2.2 Electric power failure

The electric power may get suddenly disconnected and the heater will stop immediately. Depending if it's during the startup phase before the pump started pumping the fuel or during normal operation it's treated differently. In both cases make sure the power cord is attached well and the electric power is available and then start the device again.

In the first case when pump did not started pumping the fuel it's regarded as a normal shutdown and the device can restart as usually.

In case of power failure after the pump has been pumping the fuel, it's regarded as an illegal shutdown. After restart the buzzer will make a one long beep and the display will show **LOST** or **LOS** (Fig. 41/42). In a sweeping process fuel residuals will be cleared which may take a couple of minutes, then the heater starts up as usually.

7.2.3 Abnormal shutdown

When you turn the heater on and the main display show **LOST** or **LOS** (Fig. 41/42) it indicates last shutdown was not clean. Please wait around 5 minutes for the automatic processing to complete, and it will automatically switch to the normal power-on state.

7.2.4 Error codes

The device may detect the reason of fault and display its error code, eg. **E07** (Fig. 43/44).

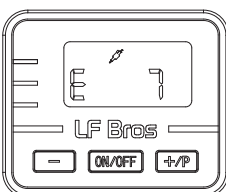


Fig. 43

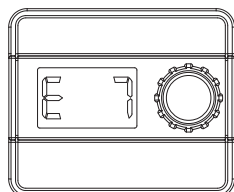


Fig. 44

7.2.5 Table of error codes

The following table describes the meaning of the error codes and possible causes:

Error Code	Fault Description	Possible causes / solutions
E00	Control unit error / incorrect parameter	1) replace the control panel
E01	Failed to start (has been tried twice) / failed to form a flame	1) fuel exhaustion 2) bubbles in the oil line and the oil supply is discontinuous 3) fuel pump is abnormal 4) bad quality of fuel
E02	Flame off (already repeated 3 times)	1) bubbles in the oil line and the oil supply is discontinuous 2) fuel pump is abnormal 3) bad quality of fuel
E03	Undervoltage or overvoltage	1) confirm if the voltage of the power supply matches the voltage of the heater 2) poor power cord installation 3) access to additional non-compliant power cord 4) power converter can't provide enough current 5) power converter output voltage is instable
E04	Premature ignition identification	1) residual fuel in the heater
E05	Thermal efficiency failure (burning problems or pump failure)	1) fuel pump is abnormal 2) filter is blocked 3) fuel inlet is blocked 4) too much carbon deposition 5) Pt1000 sensor fault
E06	Temperature sensor is open or shorted	1) temperature sensor circuit board is damaged
E07	Metering pump is open or shorted	1) the wire of fuel pump is open or shorted 2) fuel pump fault
E08	Motor of the fan is open / shorted / overloaded / blocked	1) motor blade is stuck 2) motor fault
E09	The glow plug is shorted	1) short-circuit of ignition needle 2) the wire of ignition needle is connected reversely
E10	Overheat	1) a large flow of fuel pump is connected by mistake 2) air duct of air inlet or air outlet is blocked
E11	Overheat sensor is shorted or	1) Pt1000 shell temperature sensor failure

	overtemperature sensor is shorted	
E12	Ignition needle is open	1) poor contact of the wire of ignition needle 2) ignition needle failure
E13	-	-
E14	The overheat sensor is not positioned correctly	1) Pt1000 sensor is installed correctly
E15	Open circuit of setpoint generator	

8 Maintenance record

Record for repairs and maintenance

Date	Maintained items and the maintenance cause

1. THE WARRANTY TIME IS ONE YEAR FOR NON-ARTIFICIAL MALFUNCTION.
2. THIS PRODUCT IS QUALIFIED AFTER INSPECTION AND MEETS THE MARKET STANDARDS.
3. BEFORE THE USAGE, PLEASE INQUIRE QUALIFIED TECHNICIANS TO AVOID THE WRONG OPERATION.
4. PLEASE CONTACT LF BROS MAINTENANCE STATION. DO NOT DISASSEMBLY ARTIFICIALLY.

It is necessary to inspect and maintain the heater by qualified installer before using every winter.



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Certifications

CE E9 EAC