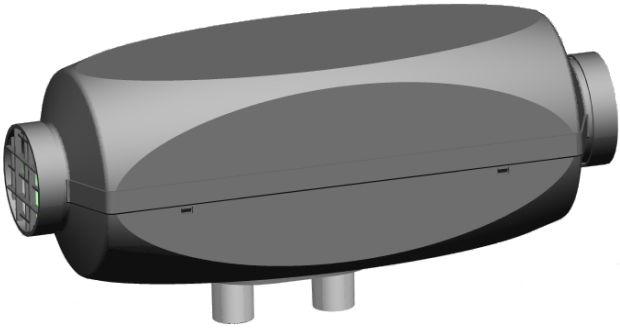
Calaer



Installation manual

2kW Calaer air heater

4kW Calaer air heater

1. Introduction and scope

The Calaer series products provide continuous heating, ensuring a pleasant cabin temperature. It is operated via a step-less thermostatic rotary control and delivers heat between 2 and 4 kW. The heater can be upgraded with more sophisticated controllers and ducting kits.

The purpose of this manual is to give an overview of the heater and notify the user of all aspects of the installation. In the end of the manual you will find instructions on troubleshooting and maintenance. Before installing the heater, please read through the entire manual.

This manual is divided into several chapters to give you a better overview and make it easy to find the necessary information.

2. Safety information

Please read this chapter carefully before proceeding with the installation!

Improper installation or repair of the heater can cause serious accidents including fire and potentially deadly Carbon Monoxide (CO) emissions that may result in serious injury or death. The Calaer heater is designed to minimize the risks as much as possible. Nevertheless, there is a risk of Carbon monoxide poisoning that may cause serious consequences to health if the heating system is installed improperly. Therefore, it is extremely important that you read the installation manual thoroughly before planning installing the heater.

If you have any questions or concerns about the installation or the operation of the heater do not hesitate to contact our customer service.

Warning!

- Improper installation voids all warranties for the product.
- Always turn off the heater when refueling.
- Do not run the heater when there is a risk of accumulation of flammable vapors or dust. For example, close to:
  - Fuel stations
  - Coal depo
  - Wood depo
  - Grain deposits etc.
- Do not install the heater in an unventilated passenger compartments or confined cargo holds.
- Always make sure that the combustion air intake is located in ambient environment or in a compartment that is well ventilated to the atmosphere.
- Make sure that the exhaust gases are led straight to the atmosphere with leak tight pipes, avoid passing through passenger compartments.

Attention:

- Always follow the instructions in the installation manual and heed all warnings.
- It is the installers responsibility to ensure that the installation of the heater, combustion air and exhaust system, fuel system and air ducting is performed according to all country specific regulations.
- To repair the heater systems, you need to have completed a CTH Technologies AB training course and have the appropriate technical documentation, special tools and equipment. Only genuine Calaer parts may be used.

3. Warranty

CTH Technologies AB (herein after referred to as Calaer) warrants Calaer Air Heaters and heater kits against defects in material and workmanship for two (2) Years or 2000 hours of operation, whichever comes first, effective at the time of purchase by the end user.

The warranty is provided to the end user and is to be administrated and serviced by Calaer or Calaer Authorized Dealer according to the warranty policy.

When the heater is self-installed by the end user the diagnosis and repare must be performed by a Calaer or Calaer Authorized Service partner in order to receive compensation under the terms of this warranty.

3.1 Warranty limitations and exclusions

The replacement of components, whether under warranty or not, during the warranty period does not prolong the original warranty period of the component or product.

Calaer excludes and limits from warranty the following:

- Normal wear (fuel filters and fuses are not covered).
- Faults caused by incorrect installation or maintenance, incorrect voltage or connection, lightning, external damage, accidents, moisture or any other conditions beyond our control.
- Faults caused by unauthorized repair or other measures carried out and undertaken by any party who is not authorized by Calaer.
- Transport damages: all claims must be filed with carrier.
- If the heater label and serial number is illegible or missing.
- Modification of product by alteration, use of non-genuine parts.
- Costs or inconvenience the product may have caused as a consequence of a defect on the product.

3.2 Owners responsibility

- Install and perform maintenance activities according to Calaer instructions.
- In case of warranty claims, proof of purchase is required.

4. Statutory regulations

Country specific regulations shall be followed in all installations.

4.1 Directive 2001 / 56 /EU of the European Parliament and the Council

The installation must comply with the requirements from Directive 2001 / 56 /EU of the European Parliament and the Council

Installation of the heater unit

- Body sections and any other components in the vicinity of the heater must be protected from excessive heat and the possibility of fuel or oil contamination.
- Every reasonable precaution should be taken in positioning the heater to minimize the risk of injury and damage to personal property.

Combustion air intake

- The air for the combustion chamber of the heater must not be drawn from the passenger compartment. Combustion air must be taken from the atmosphere or from a well ventilated compartment to guarantee the safety of the passengers.
- The combustion air inlet must be so positioned or guarded that blocking by rubbish or luggage is unlikely.

Heating air intake

- The heating air supply may be fresh or recirculated air and must be drawn from a clean area not likely to be contaminated by exhaust fumes emitted either by the propulsion engine, the combustion heater or any other source.
- The inlet duct must be protected by the mesh which is delivered with the heater unit to prevent damage to the combustion fan.

Heating air outlet (hot air outlet)

- The hot air outlet ducting is hot when the heater is operated. Any ducting used to route the hot air must be so positioned or protected that no injury or damage could be caused if it were to be touched.
- The hot air outlet must be so positioned or guarded that blocking by rubbish or luggage is unlikely.

Fuel supply

- The fuel pump and filter must not be situated in the passenger compartment.
- When the heater is installed with its own fuel supply tank, separate from the main fuel supply tank, the type of fuel and its filler point must be clearly labeled.
- A notice, e.g. by a sticker, indicating that the heater must be shut down before refueling, must be affixed to the fueling point

Exhaust system

- The exhaust outlet must be located so as to prevent emissions from entering the compartment through ventilators, heated air inlets or opening windows.

4.2 The American Boat and Yacht Council Standards

The installation must comply with the ABYC Standard A-7.

Air handling systems

- Air handling systems, including discharge and return air systems, shall be so constructed and installed as to prevent harmful gasses from entering living spaces, and
- shall be airtight, with respect to compartments containing engines or fossil fueled devices where the air handling system shares common partitions with or passes through those compartments, and
- shall neither discharge to, nor return to, any compartments other than the one(s) intended to be serviced by that equipment.

Exhaust systems

- The system shall be accessible for inspection, and
- the fuel terminus shall not be positioned within 20 inches (508 mm) of a refueling fitting or fuel tank vent, and
- shall be positioned to minimize exhaust re-entry into the compartment through any openings into the accommodation spaces.

5. Technical data

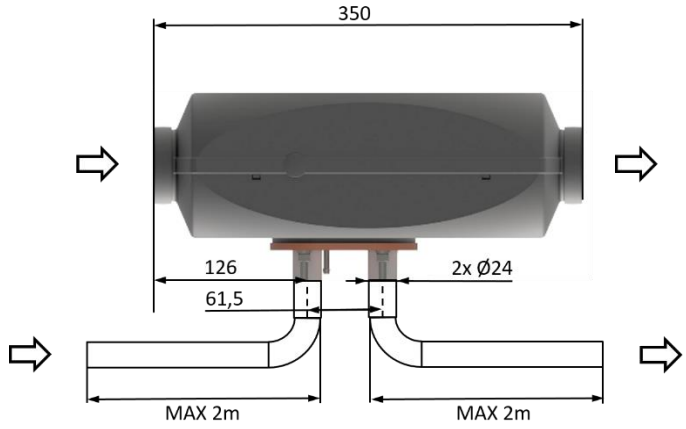
Except where the limit values are specified, the technical data below refers to the usual heater tolerance of +/- 10% at an ambient temperature of +20°C and at the rated voltage.

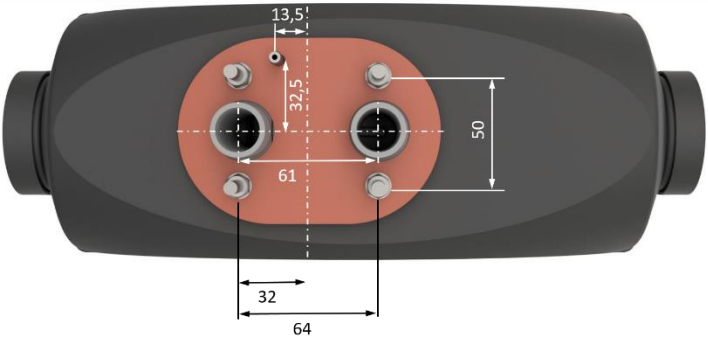
Technical data		
Heater type	**Calaer 2 kW**	**Calaer 4 kW**
Heating output	1 - 2 kW 3 400 – 6 800 BTU	2 - 4 kW 6 800 – 13 600 BTU
Fuel	Diesel	Diesel
Fuel consumption	0.13 – 0.3 l/h 0.034 – 0.079 US gph	0.25 – 0.48 l/h 0.066 – 0.127 US gph
Rated voltage	12 or 24 Volts	12 or 24 Volts
Operating voltage range	12 V: 10-15 Volts 24 V: 19-32 Volts	12 V: 10-15 Volts 24 V: 19-32 Volts
Rated electric power consumption	19-41 Watts	19-48 Watts
CO_2 content in exhaust gas (min to max power)	7.5 – 10.9 %	8.3 - 11.8 %
Weight (heater only)	3.1 kg 6.8 lbs	5.1 kg 11.2 lbs
Dimensions	Length: 350 mm (13.9 inch) Width: 124 mm (4.9 inch) Height: 130 mm (5.1 inch)	Length: 403 mm (15.9 inch) Width: 150 mm (5.9 inch) Height: 160 mm (6.3 inch)
Cold and hot heating air connection	Ø 60 mm (2.36 inch)	Ø 90 mm (3.54 inch)
Maximum length of exhaust pipe	2m (6.5 feet)	2m (6.5 feet)
Maximum length of fuel hose	8.8 m (28 feet)	8.8 m (28 feet)
Maximum length of hot air outlet duct	6.5 m (21 feet) + 3 outlets with vent	10 m (33 feet) + 5 outlets with vent
Maximum length of heating air inlet duct	2m (6.5 feet) + vent	2m (6.5 feet) + vent

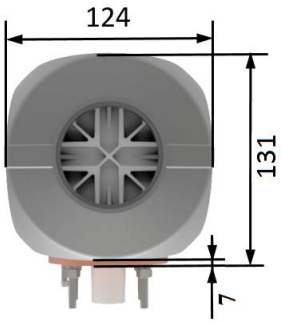
6. Heater dimensions

Calaer 2 kW heater

*All measurements are given in millimeters [mm].

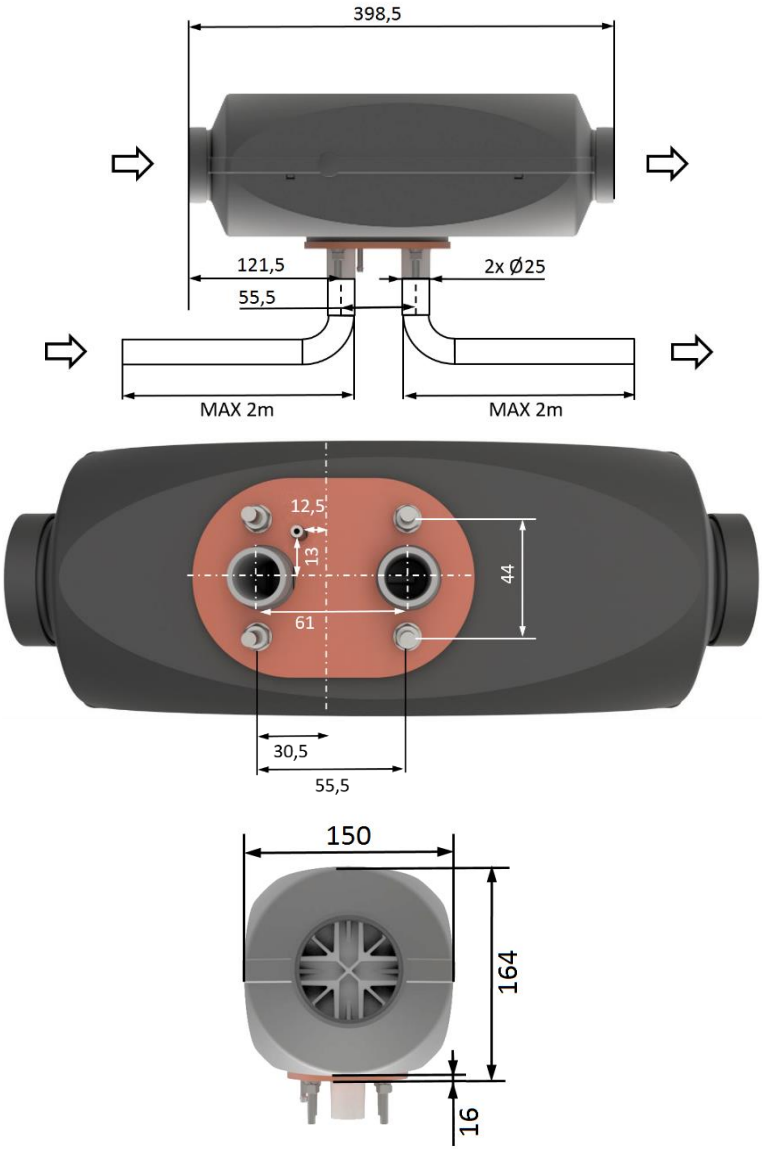




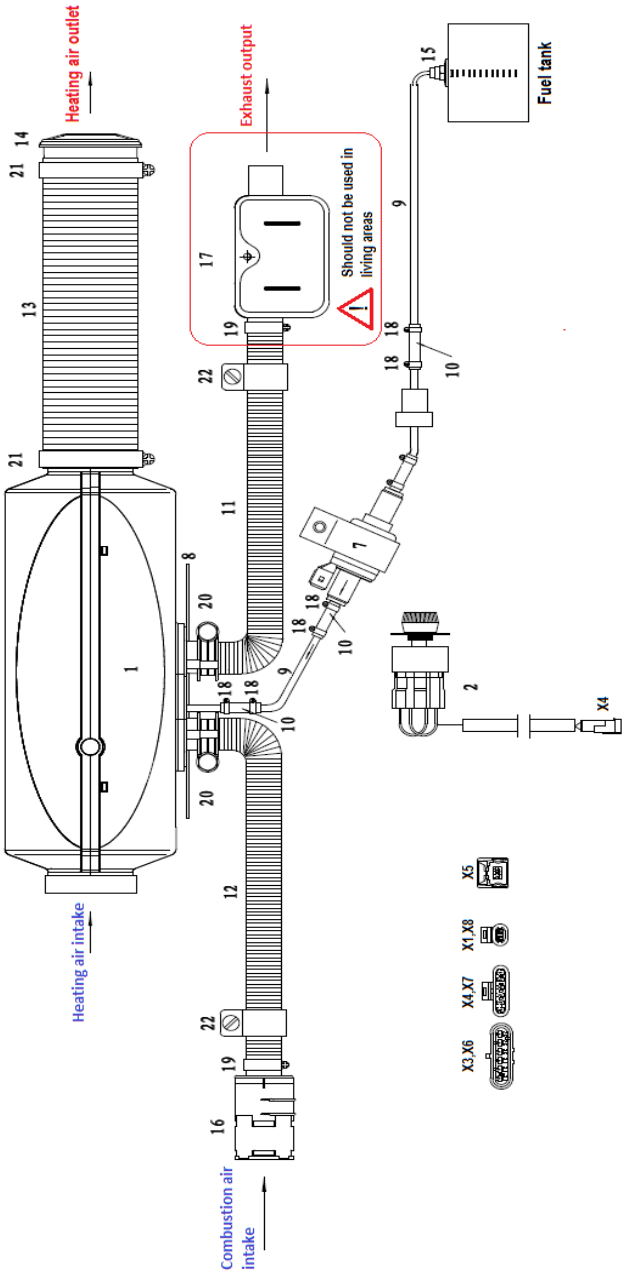


Calaer 4 kW heater

*All measurements are given in millimeter [mm].



6. Heater dimensions



7. List of parts

Nr.	Name	Specification	Quantity	Unit
1	Heater unit	12/24 V unit	1	Piece
2	Control knob		1	Piece
3	Fuel pump wire harness		1	Piece
4	Main heater wire harness		1	Piece
5	Thermostat sensor		1	Piece
6	Thermostat sensor harness		1	Piece
7	Fuel pump and filter	12/24V versions	1	Piece
8	Mounting bracket		1	Piece
9	Nylon Fuel line	ϕ5 x 1	5	Meter
10	Rubber fuel line	ϕ4.5 x ϕ11 x 50mm	4	Piece
11	Exhaust pipe	ϕ 25 mm	1	Meter
12	Combustion air pipe	ϕ 25 mm	1	Meter
13	Air duct	ϕ 60/90 mm	1	Meter
14	Air outlet vent	ϕ 60/90 mm	1	Piece
15	Fuel standpipe	5 mm	1	Piece
16	Combustion air silencer		1	Piece
17	Hose clamps	10-12 mm	8	Piece
18	Hose clamps	20-32 mm	2	Piece
19	Exhaust muffler	Not included in base kit	1	Piece
20	Exhaust clamp	30 mm	1	Piece
21	Air duct clamp	50-70 / 80-100 mm	2	Piece
22	Exhaust pipe holder	32 mm	1	Piece

8. Needed tools

The following tools are needed for the installation of the heater:

- 7 mm wrench – Fuel connections and duct clamps
- 10 mm wrench – Heater mounting
- 13 mm wrench – Exhaust clamp

In case you need to install lines through bulkheads the following drill heads may be needed:

- 6 mm - Fuel lines
- 25 mm - Fuel tank diver
- 30 mm - Air intake line
- 35 mm - Exhaust line
- 60/90 mm - Air duct (2 and 4 kW respectively)

9. Positioning of the heater

Note!

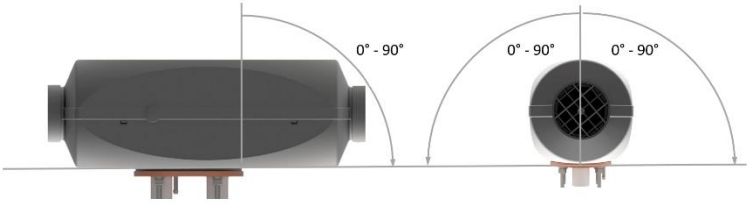
The heater should be placed in a dry and protected position.

When selecting the best location, first consider all aspects of the installation and the constraints that they place on:

- **Mounting location:** Make sure you have a steady surface that can support the heater and not interact with other equipment next to and behind the wall. Verify that your electrical cables are sufficient in length to reach the battery, fuel pump, thermostat position and controllers.
- **Fuel system:** Find a routing for the fuel lines and position for fuel pump so that they are away from any high temperature surfaces (refer to the fuel system chapter for further requirements)
- **Exhaust lines** - Consider the maximum length of the exhaust line and the outlet position. The surface temperature of the exhaust line will be very high and should be placed with at least 5 cm clearance from other equipment and surfaces that cannot withstand temperatures up to 300°C / 570°F.
- **Air ducting** – Consider the possible intake and outlet for your heating air ducts. Think about the possible fastening of the air ducting and outlet vents.

Ideally the heater should be installed so that the exhaust, fuel and combustion air connections are pointing downwards as shown in the picture below.

The heater can be tilted upwards and sideways by maximum of 90° degrees. For very short time (max 1 minute) the heater can deviate from the maximum installation positions by up to +/- 15° degrees.



ATTENTION

Attention:

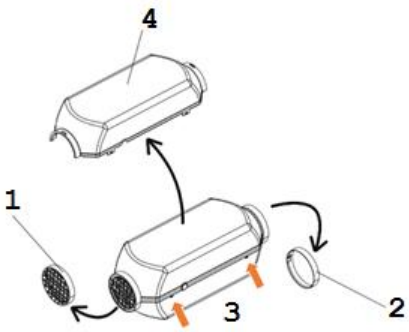
- High temperature on the exhaust line and air ducting
- Do not store flammable materials in the vicinity of the heater unit or the exhaust lines
- Combustion air supply must not be drawn from the engine compartment

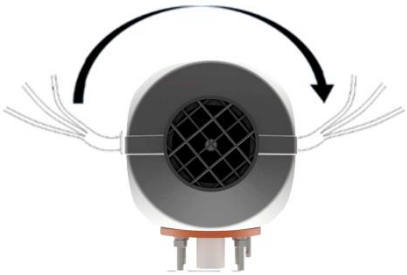
9.1 Cable harness location

If needed the cable harness can be moved over to the other side of the heater.

To do so place the heater so that the exhaust and combustion air connections are facing downwards and follow the steps below:

1. Remove the round fastenings on the heating air intake by turning them 1/8 of a turn
2. Repeat the previous on the heating air output ring
3. Push down on the fastening clips
4. Lift the cover up
5. Re-route the cables to the other side and place the sealing plug (removed from the other side) to the original hole.
6. Close the heater by reversing the four first steps.





9.2 Mounting and fastening

The attachment point of the heater should be on a strong bulkhead, thin bulkheads may require additional supports to ensure safe mounting. For fastening the heater in place use the pre-drilled mounting bracket, which is provided with the heater or the additional mounting brackets available by Calaer.

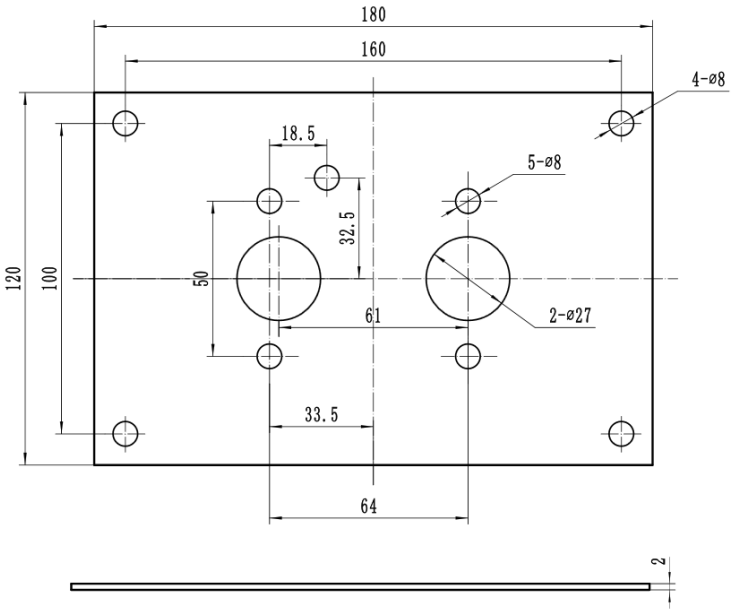


Figure: Bracket for 2 kW heater

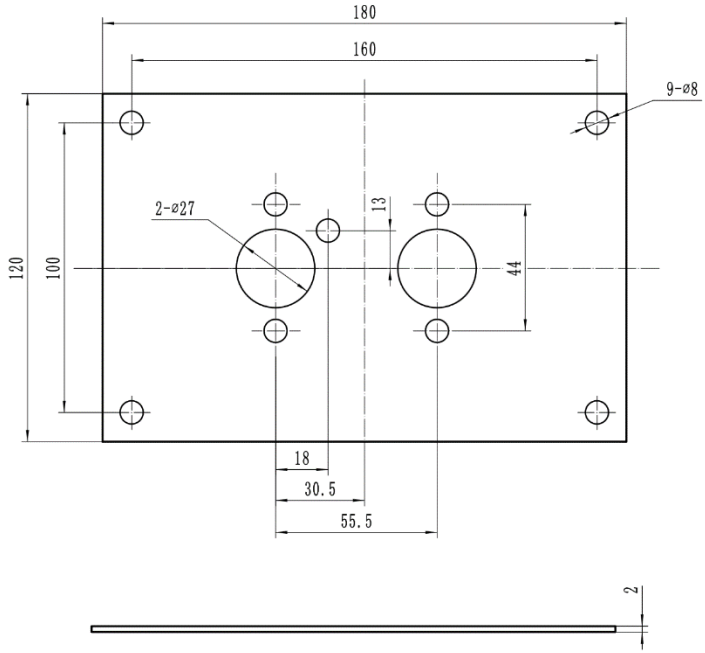
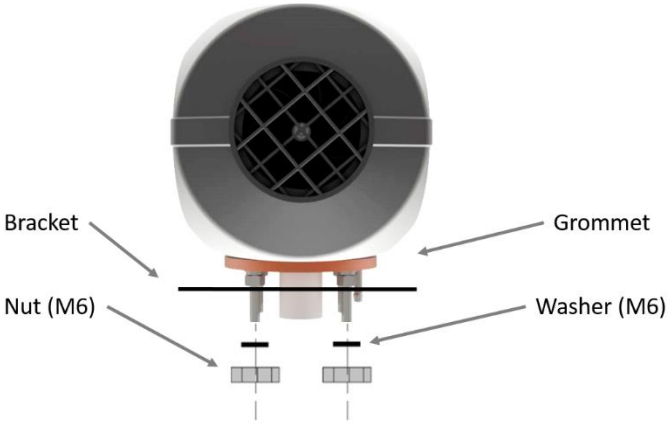


Figure: Bracket for 4 kW heater

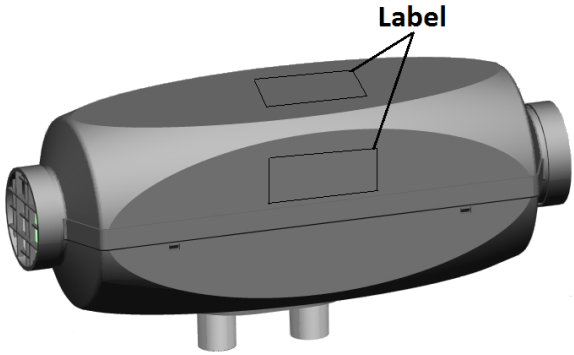
Fasten the bracket securely to the bulkhead. Make sure that the mounting is secure and can withstand vibration and any other “shock” resulting from vehicle/boat movements. It may be necessary to add reinforcements. After the bracket has been fastened to the bulkhead, make sure that the rubber casket is in place under the heater unit and secure the heater to the bracket.

Depending on installation position you may need to fasten the bracket to the heater unit before attaching the combustion air intake, exhaust lines and fuel connections.



9.3 Nameplate

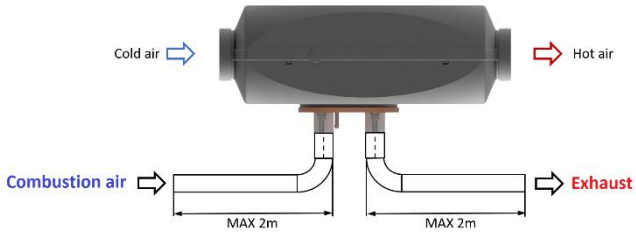
The nameplate with information about the heater should be placed in a clearly visible position where it cannot be damaged. The clearly readable label is necessary for warranty claims. Heater warranty will be void if the heater label and serial number is illegible or missing.



10. Combustion air and exhaust system

10.1 Combustion air intake

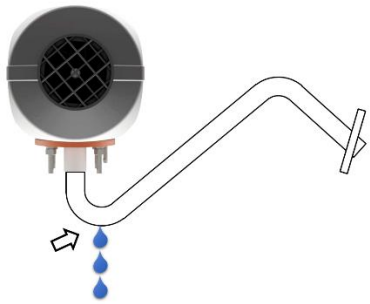
The combustion air intake is located near the main heating air intake of the heater. The maximum length of the combustion air intake tube is 2 meters (6.4 feet). The total radius of the bends should not exceed 270 degrees.



The combustion air can be drawn from outside (recommended) or from a well ventilated internal source.

When drawing the combustion air from an internal source the line should be mounted on a slanting angle away from the heater to avoid condensation traveling to the heater intake. The air intake should not be pointed in the direction of travel

When drawing air form an external source the intake line should be mounted with a goose-neck bend just before the heater. In the bottom of the goose neck make a small drainage hole (5 mm or 3/16 inch) that will allow water to escape the line before reaching the heater.



Before securing the air intake tube to the heater with the provided hose clamp, make sure that the fuel connection is already in place or leave room for it when tightening the clamp.

Secure the line in place with the support brackets.

Warning!

- **Asphyxiation risk:** The combustion air is required to be drawn from the outside or from well ventilated spaces that are not occupied by persons.
- Do not place the combustion air intake close to any exhaust outputs.

10.2 Exhaust system

The heater comes with 2 meter (6.4 feet) long flexible exhaust line what is also the maximum allowed length. The total radius of the bends should not exceed 270 degrees for open pipe and 200 degrees when a muffler is used.

The exhaust outlet should vent straight to open atmosphere.

The exhaust outlet point should be positioned so that it is away from the combustion air intake and any other fresh air suction point.

The exhaust gases can reach temperatures up to 300°C (570°F), therefore extreme caution needs to be taken to ensure that the exhaust lines are well insulated and at safe distance from any heat sensitive materials and possible human contact. Make sure that there is no luggage or other equipment in the vicinity of the heater that could come loose and get into contact with the hot lines.

Avoid passing the exhaust lines through populated rooms.

Install the exhaust pipe in a slanting slope if possible. If necessary, make a drainage hole of approx. ϕ5mm at the lowest part of the exhaust line.

Warning!

Do not make a drainage hole into the exhaust line where it is passing through rooms occupied by persons.

Caution!

Risk of injury: The end of the exhaust pipe is extremely sharp and can easily cut through skin. Use gloves when cutting and mounting the exhaust line.

When fastening the exhaust line to the heater apply exhaust paste on the end of the tube and around the outside of the exhaust fitting on the heater. Push the exhaust line into place and fasten with the heavy-duty clamp supplied with the unit. When tightening the clamps keep in mind to leave room for the fuel connection.

Mount the exhaust line in place with the supplied brackets and make sure that it is secure to withstand vibrations.

Warning!

The burning process inside the heater produces high temperature toxic gases, therefore the exhaust tube must be installed according to the instructions given

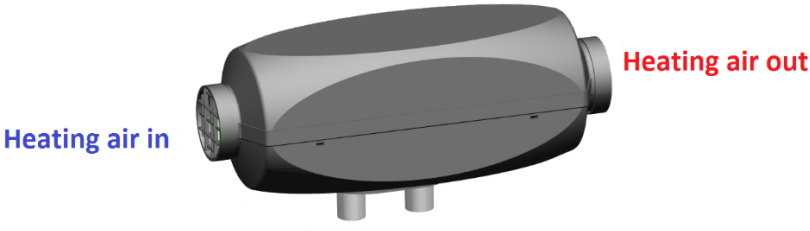
- Do not perform any maintenance or work on the unit or exhaust system when the heater is running.
- Before doing any work on the heater switch the unit off and wait until all the parts have cooled down.
- Do not block or cover the exhaust outlet when the heater is in operation.
- The exhaust system must vent straight to open atmosphere.
- Do not operate the heater in closed spaces where the exhaust is not exiting to open atmosphere.
- Do not point the exhaust outlet in the direction of travel.
- Do not connect the exhaust to other exhaust systems.
- Exhaust lines must be routed in a way that avoids potential human contact.
- Adequate distance must be allowed between the exhaust lines and any heat sensitive or flammable materials.

Caution!

Position the exhaust outlet so that neither the combustion air intake or any other inlets would be able to draw in exhaust fumes.

11. Heating air system

The unit comes with 1 meter (3.2 foot) of air duct and one heating air vent. The air ducting can be extended with Calaer approved ducting materials and vents.



The heating air intake line must not exceed 2 meters. The hot air distribution ducts maximum lengths and number of vents are listed in the table below:

Heater type	Maximum inlet ducting	Maximum outlet ducting
2 kW heater	2 m (ϕ 60 mm) + vent	6.5 m (ϕ 60 mm) + 3 outlets with vent
4 kW heater	2 m (ϕ 90 mm) + vent	10 m (ϕ 90 mm) + 5 outlets with vent

Note!

Adjustable vents are recommended to control the air flow. Be aware that at least one ducting channel must be equipped with a non-closeable vent!

11.1 Planning

The air system can be built up in two types of heating circuits Fresh-Air type heating and Recirculation type heating.

In case of the **Fresh-Air type circuit** the heating air is extracted from the outside. For this circuit type, ventilation holes to the outside are required in every heated room to prevent pressurization of the cabin. This may result in reduced air flow and overheating of the unit. The advantage with this type of circuit is that fresh air is continuously introduced to the cabin. The disadvantage is that if the target temperature is reached the heater will turn itself off and until the temperature in the cabin drops it may blow in cold outside air.

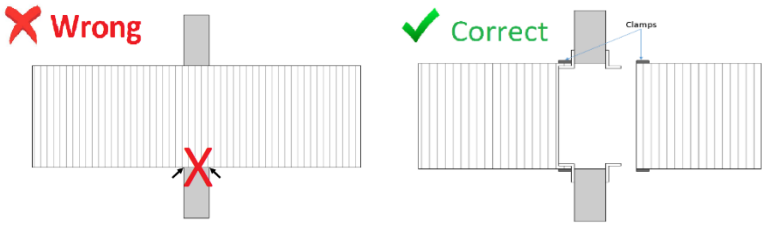
In the second **Recirculation type** of installation the heating air is extracted from the heated cabin. When using this type of heating circuit make sure that the air intake vent is located in an area that will not be blocked by luggage, furniture, opening doors etc. The biggest advantages of this type of installation is that it enables a much faster heating up time, better fuel efficiency and more accurate temperature control of the room.

Note that regardless of the type of heating circuit used there are limitations to the installation:

- The air intake duct shall be positioned so that water or any other foreign objects and substances cannot reach the heater.
- Keep the ducting lines and bends to minimum in order to prevent high flow resistance (risk of overheating the unit).
- The air ducts should be installed so that the lines cannot be crushed or pinched at any location.

Note!

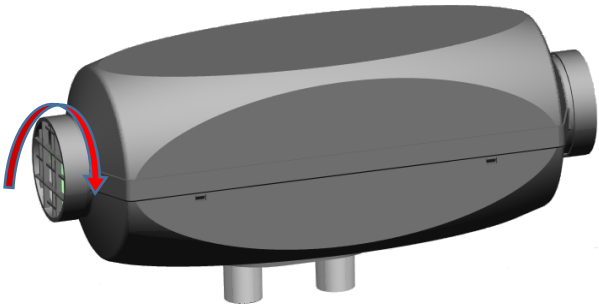
- When the air ducting needs to be routed through bulkheads, use pipe sockets that allow you to fasten the line on both sides of the bulkhead. Ducting holes without the pipe sockets are very likely to ware through in time.



- When routing the lines around a sharp corner make sure that you mount the duct away from sharp edges or use a separate hard bend in order to avoid damage to the ducting lines.
- In case the air ducting passes through a wet environment, the use of spiral wire reinforced ducting is recommended.
- The use of closable air outlets is only allowed in branch lines.
- Care should be taken to ensure that the hot air outlet is positioned so that it will not blow onto any heat sensitive surfaces nor areas where human contact is likely.
- The duct for the air inlet of the heater must not exceed a length of 2 meters.
- The ducting lines should be as short as possible to ensure good air circulation.
- If necessary, cover or insulate the exposed ducting or deflect hot air that poses a potential risk.

11.2 Installation of the air intake duct and vent

When an air intake duct is used, the air intake protection grid what is mounted on the heater unit must be removed. Do this by turning the cap counterclockwise, then pull it carefully away from the heater. Attach the duct to the air inlet using the supplied clamps.



Route the air ducting to desired locations and attach the vent to the end of the line.

Caution!

The heating air intake must be positioned so that any exhaust gases or other harmful gases cannot be drawn into the ducting system.

11.3 Installation of the Hot air ducting and vents

In order to install the hot air ducting, remove the air outlet ring from the heater unit by turning it counter clockwise, then pull it carefully away from the heater. Attach the air outlet duct to the heater using one of the supplied clamps. The original air outlet ring can be discarded.

The heating air outlet vents should be positioned low in the heated rooms. Note that the heating air can reach upwards to 110°C (230°F). Make sure that the outlets are mounted in a location where contact with humans and heat sensitive materials is unlikely.

Keep the ducting lines as straight as possible and make sure that the hot air outlet is positioned away from the heating air intake.

Warning!

The heating air temperature can reach upwards to 110°C (230°F). Make sure that there are no heat sensitive materials in the vicinity in the air ducts and adequate clearance is given.

11.4 Possible installation examples:

The heating air ducting can be divided into several branches. Only Calaer certified ducting parts are allowed to be used. The maximum length and number of vents are stated in the beginning of this chapter.

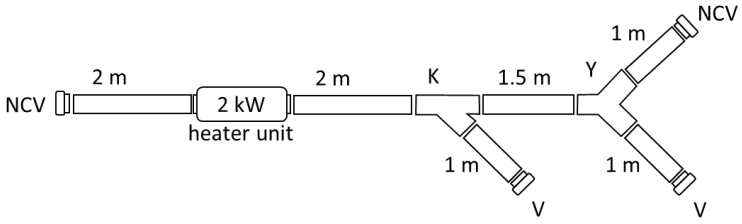


*Figure: 2 kW heater installation example * NCV- Non-Closure vent*

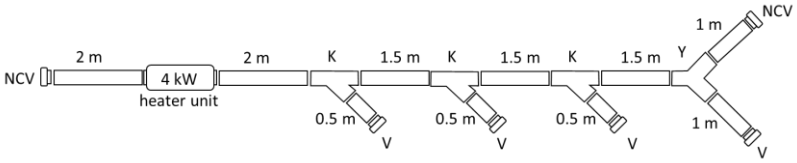


*Figure: 4 kW heater installation example * NCV- Non-Closure vent*

Warning!

Risk of overheating: At least one outlet vent must be non-closable.

12. Fuel system

Specific requirements may apply in different countries for fuel tanks and fuel lines, consult your local authorities.

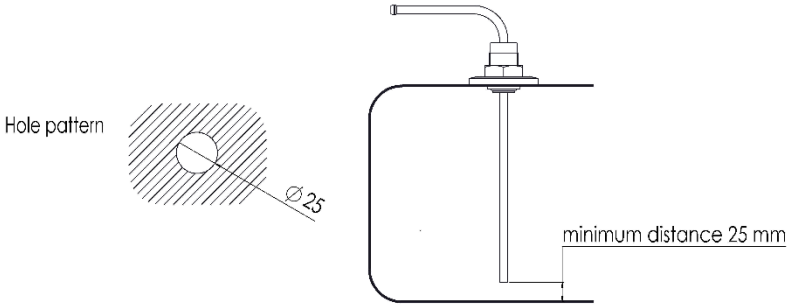
12.1 Fuel tank

For the fuel pick up point, both the engine main fuel tank or a separate fuel tank can be used. Do not connect the heater to the engine main fuel line with a ”T” connection. The heater must have its own fuel pick up point that is not influenced by any other device. Both plastic and metal fuel tanks can be used, but make sure that the tanks comply with all legal regulations and standards in your country.

Caution!
The fuel tank must have a vent to avoid over and under pressure in the tank.

12.2 Fuel standpipe

The fuel stand pipe is included in the heater base kit. The unit can be attached to the fuel tank by pressure sealing with provided parts. The bottom end of the standpipe should be at least 25 mm from the bottom of the fuel tank to ensure that particles and other contamination in the bottom of the tank are not introduced into the heater fuel system.



For the installation of the fuel standpipe cut a hole of 25mm (1 inch) for connector fitting. Make sure that no metal threads get into the fuel tank while drilling. Cut the fuel pipe into length and remove any shreds of metal from the end. Tilt the pipe to the side to be able to get it into the fuel tank and fasten with the connector. Fasten the fuel line to the standpipe with a provided rubber line and clamps.

Caution!

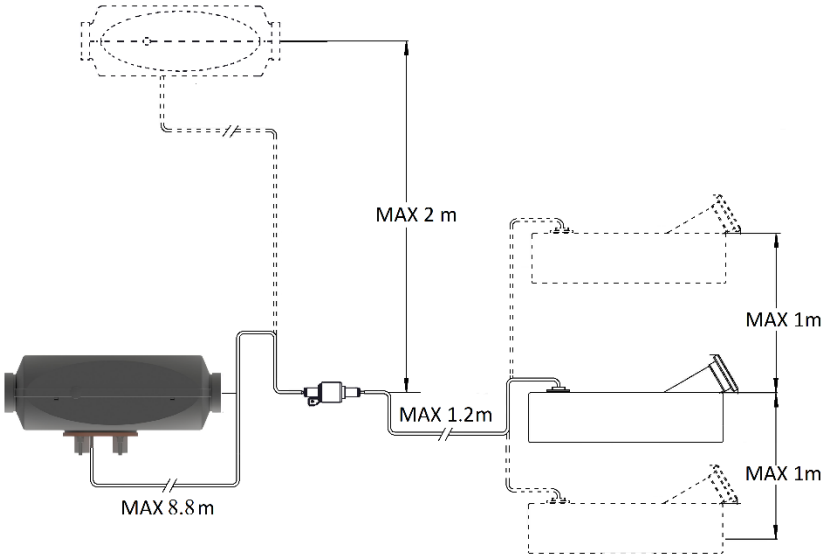
Caution when handling fuel!

- Turn off the heater before refueling and doing any kind of work on the heater.
- Do not inhale fuel vapors.
- Avoid contact with the skin.
- Do not smoke
- No open flames when handling fuel.
- Mixtures of used oil are NOT allowed!

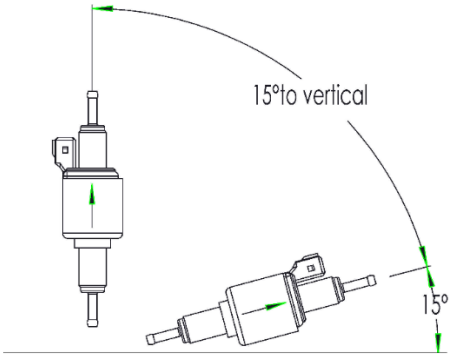
12.3 Fuel pump and fuel filter

The possible positions of the fuel pump are determined by the location of the heater and the fuel tank.

The pump must be installed with a fuel line maximum length of 1.2meters (78 inch) from the fuel tank and no more than 8.8 meters from the heater unit. The fuel pump must also be positioned in such a way that it is not more than 1 meter (39 inch) above the minimum fuel level and 1 meter (39 inch) below the maximum fuel level in the tank.

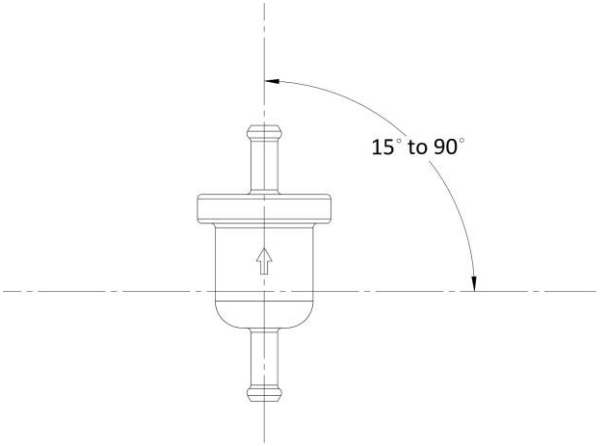


The pump is recommended to be placed at a 45degree angle but angles of 15-90 degrees are allowed. The pump can be turned 360 degrees around its central axes.



The fuel pump should be mounted to a bulkhead with the provided bracket.

The fuel filter is preinstalled to the fuel pump. When fastening the fuel pump in place make sure that the attached fuel filter will be at an angle between 15 and 90 degrees.

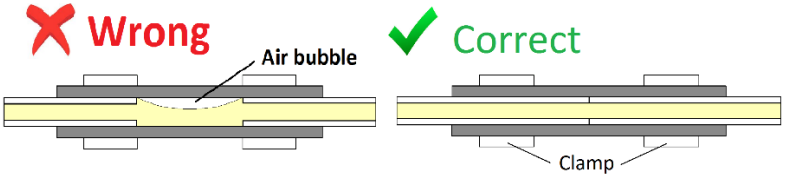


Cut the fuel lines to length with a sharp knife, clean the interfaces from burrs and make sure they are not crushed.

Caution!

- The fuel line between the fuel pick-up point, fuel pump and the heater should be on a continuous rise.
- Avoid routing the fuel line through cabins and other populated rooms.

Connect the fuel lines to the standpipe, fuel pump and heater with the rubber tubes and hose clamps provided with the unit. When mounting the fuel lines, always connect them with a putt joint in order to prevent air pockets in the fuel system.



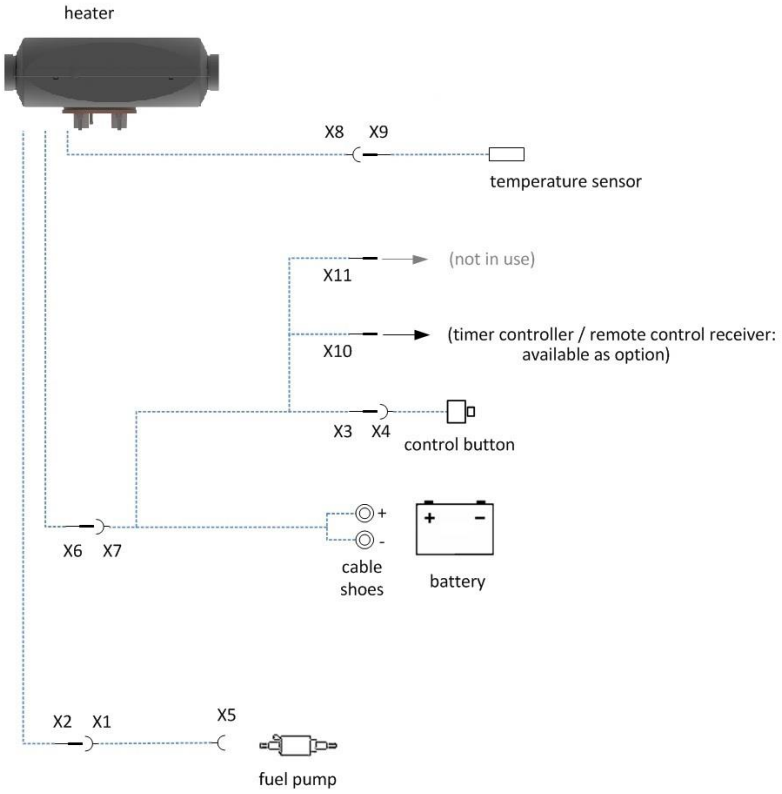
Warning!

- Fuel lines must be placed and fastened to avoid any damage from vibrations.
- Fuel lines must be protected against any mechanical damage.
- Make sure that the fuel lines are protected from any excessive heat source.
- Do not fasten or route the fuel line with the exhaust system. If crossing is not avoidable make sure that adequate heat protection is applied.

13. Electrical system

The electrical system of the heater consists of the heater unit, main wire harness, individual cables for fuel pump and temperature sensor.

The cables can be routed as one or in separate directions depending on the installation of the heater and the location of the battery, fuel supply and the selection of the controller location.



The wire harness of the heater unit is connected to the left side of the heater by default. It can be repositioned to the right side of the heater if needed. Instructions for this operation are included in the Heater installation position chapter.

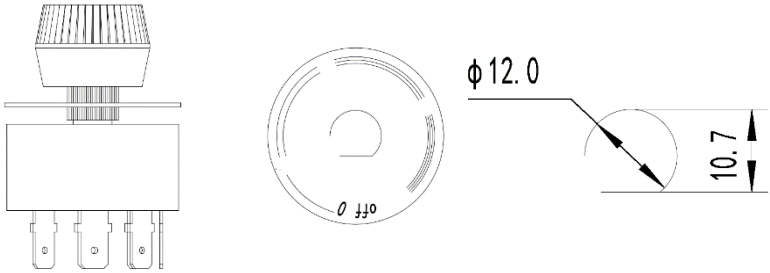
13.1 Installing the temperature sensor

When selecting the location for the temperature sensor (thermostat) avoid areas where it can be affected by sunlight, drafts, cooking devices and other heat emitting or cooling equipment. We suggest to mount the sensor in the mid height of the heated room to ensure the best temperature control.

13.2 Control knob installation

The control knob should be mounted in a dry and protected location. The best location would be with other control instrumentation.

For the installation of the control knob to a surface, pull the turning switch off then screw off the nut and remove the dial plate. Make a hole in the mounting location with a diameter of 12 mm. Place the unit through the hole and tighten with the nut. Place back the dial and turning knob.



13.3 Power connection

The power connection for the heater is provided as round leads with a fuse in the “plus” wire. The unit can be connected straight to the battery (permanently live) or through a battery isolator. If a timer or a remote controller is used, make sure that the heater is connected so that it can start when the isolator is switched off.

Note!

The connection terminals and connectors must be free from corrosion and tightened firmly.

Note!

The power supply cable can be extended with the following requirements on the wires:

- For 12 V system the maximum voltage loss over the extension cable cannot exceed 0.5 V. For a 5-meter total length of plus and minus cables, the cross sectional area of the wire needs to be at least 4 mm2
- For 24 V system the maximum voltage loss over the extension cable cannot exceed 1 V. For a 5 to 8-meter total length of plus and minus cables, the cross sectional area of the wire needs to be at least 6 mm2

In case the cables are connected to a fuse box, the cables leading to the fuse box shall be included in the calculation for the maximum voltage loss.

Caution!

- For permanently live connection several legislation requirements may apply depending on the country (additional isolator, circuit breaker etc.).
- Check for any legislation that may forbid the use of a heater when the vehicle/boat etc. is unattended.
- Make sure that only fuses with specified ratings are used.
- Take care when the routing the cables, make sure that the insulation of the electrical cables has not been damaged. Avoid placing the cables near moving objects and machinery.
- Make sure that any unused cables are well insulated.

13.4 Wiring diagram

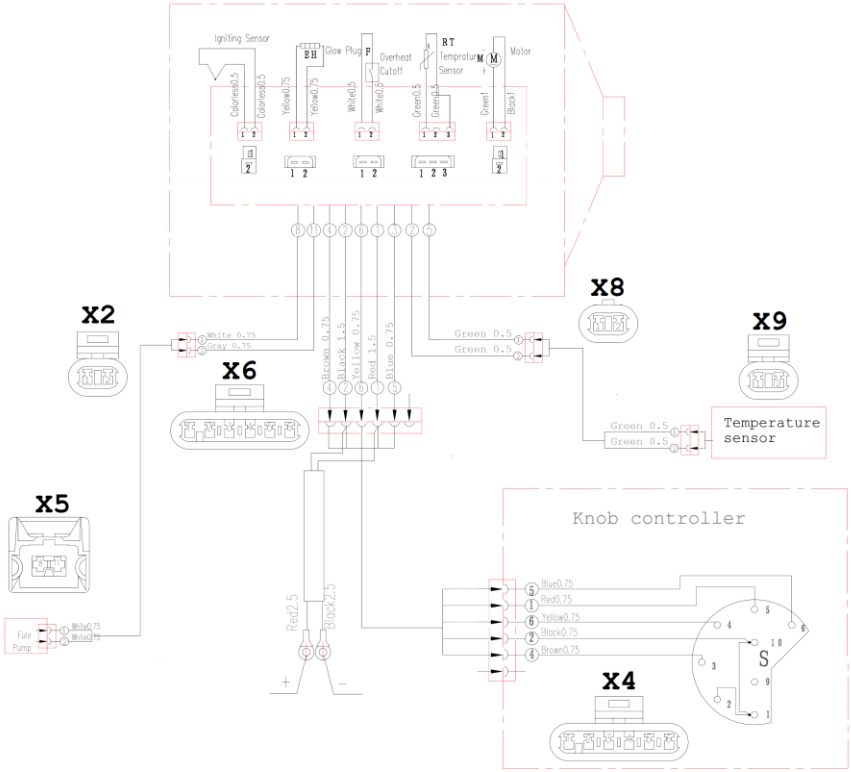


Figure: Wiring diagram for Calaer 2 and 4 kW air heaters

14. Operating instructions

The heater is operated by a control unit. This control unit can be the controller knob, timer or a remote controller.

14.1 Initial start-up procedure

Install and connect the heater according to this instruction manual.

In order to fill the fuel lines, start the heater by turning the control knob to maximum. The heater will go through the normal startup procedure and start filling the lines with fuel. Depending on the length of the fuel line it might take several startup procedures to fill the lines with fuel.

The heater will go through the startup procedure twice before signaling an error code (F1 or F2), briefly disconnect the power leads to the battery. This will reset the failure mode and the heater can be started again. Repeat this procedure until the fuel lines are filled and the heater starts to operate. Let the heater run for at least 10 minutes.

Caution!

- During the trial run a check on all the air, exhaust, heating and fuel lines for any leakages and firm fitting.
- During the initial run the exhaust pipe might smoke a little as the oil residues from production of the unit evaporate away.
- If you notice light smoke during the first run, then let the system run for at least 10 minutes and monitor the smoke. It should disappear after the heater has reached normal operating temperatures.

Warning!

- Improper installation may cause fire, property damage and health risks.
- Make sure that the heater surroundings are clean from open fuel and other combustible materials.
- Make sure that in case of an emergency you have an escape route available.

14.2 Heater control knob

The control button is used to set a desired set point in temperature where the temperature sensor is located and also to turn the heater on and off when no other control unit is connected.

It features an off-position, a temperature gradient for setting the heater thermostat and a status light for heater operation feedback.

- To start the heater and increase the thermostat set point, turn the control button in the clockwise direction.
- To decrease the thermostat set point, turn the control button in the counterclockwise direction.
- The heater is turned off by turning the control button all the way in the counterclockwise direction to the off-position until a “click” can be heard.

14.3 Normal start and stop procedures

The heater is started by turning the control button from “off” to the desired setting. The heater responds by starting the fuel pump after 3 seconds and turning on the control button status light.

The fuel pump will stop after 7 seconds and the heater will then go to pre-heating mode for 50 seconds where the glow plug is used to heat the combustion chamber. After pre-heating the fuel pump is switched on again and combustion will begin.

The glow plug is switched off when stable combustion is detected. For the first two minutes, the heater will run at maximum output power. After that, it will start to regulate the power to reach the desired thermostat setting.

To turn off the heater, switch the control button to the “off” position and the heater will then initialize the shutdown procedure.

The shutdown procedure requires 5 minutes, during which the glow plug and fan will be active to ensure controlled cool down and removal of fuel residues from the heater. Once the shutdown procedure has completed the control button status light turns off.

15. Troubleshooting

15.1 Maintenance

Diesel fuel will degrade when stored for a long time. Operating the heater with old fuel can affect the operation of the fuel pump. Run the heater once per month for 15 minutes to refresh the fuel in the lines and keep the fuel pump from malfunctioning.

Use proper type of diesel that is meant for the time of the year when the heater is used. Summer grade diesel might cause failure of the fuel pump or heater when it is used at low temperatures.

In the event that ignition is not detected within 90 seconds, the heater will switch off and retry ignition after 20 seconds. In the event that two sequential failures are detected, the heater will flash the light on the control button to indicate an error.

In the event that the flame extinguishes during operation, the heater will attempt to reignite itself two times before flashing the light on the control button, indicating the type of error.

In the event that the voltage drops below 10/19 Volts or goes above 15/32 Volts (12 Volt/24 Volt system respectively), the system will switch off for protection of the heater and battery.

15.2 Checklist for fast troubleshooting:

Heater will not start

- Disconnect the heater briefly from the battery.
- Switch the power to the heater on and off.
- Does the control knob light go on?
    - Are the fuses ok?
    - Is the heater connected properly?
- Does the fan start to spin when turning the heater on?
    - Check that the electrical connections are ok

- Does the fuel pump start to tick?
    - Check that the cable is connected and fastened.
    - Check that there is fuel in the tank and in the fuel lines.
- Heater does not start but the fan is running and the fuel pump is working.
    - Check that there is nothing blocking the combustion air intake and exhaust.
    - Check that the fuel lines are intact and not broken or blocked at any point.
    - Check for a blocked fuel filter.
    - Check that there is not a significant amount of water intruded into the burner.

Heater stops in the middle of operation

- Check that there is fuel in the tank.
    - If the fuel tank was empty and there is air in the fuel line, follow the “initial start-up” procedure described in the Operational Instructions chapter.
- Make sure that there is no fuel leakage anywhere in the system.
- Check that there is nothing blocking the combustion air intake and the exhaust.
- Check that there is nothing blocking the heating air ducts and vents.

15.3 Failure codes

Failure of the heater operation will be made visible to the user by an error code, consisting of a series of short and long flashes of the light on the control knob. The coding of the error codes are as follows:

Long flash (▬): Approx. 0.5 seconds.

Short flash (▪): Approx. 0.2 seconds.

F01	Ignition failure	1 long 5 short ▬ ▪▪▪▪▪
F02	Flame loss	2 long 5 short ▬▬ ▪▪▪▪▪
F03	Under/overvoltage	3 long 5 short ▬▬▬ ▪▪▪▪▪
F04	System overheat	4 long 5 short ▬▬▬▬ ▪▪▪▪▪
F05	Ignition sensor open load	5 long 5 short ▬▬▬▬▬ ▪▪▪▪▪
F06	The temperature sensor open load or shortcut	6 long 5 short ▬▬▬▬▬▬ ▪▪▪▪▪
F07	Fuel pump open load or shortcut	7 long 5 short ▬▬▬▬▬▬▬ ▪▪▪▪▪
F08	Fan motor open load or shortcut	8 long 5 short ▬▬▬▬▬▬▬▬ ▪▪▪▪▪
F09	Glow plug open load or shortcut	9 long 5 short ▬▬▬▬▬▬▬▬▬ ▪▪▪▪▪
F10	Overheating sensor open load or shortcut	10 long 5 short ▬▬▬▬▬▬▬▬▬▬ ▪▪▪▪▪
F11	Ignition open load or shortcut	11 long 5 short ▬▬▬▬▬▬▬▬▬▬▬ ▪▪▪▪▪
F12	Flame not extinguished during delayed shutoff	12 long 5 short ▬▬▬▬▬▬▬▬▬▬▬▬ ▪▪▪▪▪

15.4 Advanced troubleshooting

The table below lists the potential causes and remedies for fault codes.

Code	Trouble	Cause	Remedy
F01	**Ignition failure**	Battery low	Check battery voltage Charge or replace battery
		Empty fuel tank	Fill tank
		Old or wrong fuel	Replace fuel
		Blocked or broken fuel line	Replace fuel line
		Blocked or broken fuel filter	Replace fuel filter
		Broken or damaged fuel pump	Replace fuel pump
		Broken glow plug	Replace glow plug
F02	**Flame loss**	Empty fuel tank	Fill tank
		Old or wrong fuel	Replace fuel
		Blocked fuel filter	Replace fuel filter
		Blocked fuel line	Replace fuel line
		Exhaust pipe blocked	Clear exhaust pipe
		Combustion air intake blocked	Clear combustion air intake pipe
		Broken or damaged fuel pump	Replace fuel pump
F03	**Under/ overvoltage**	Battery low	Charge or replace battery
		Faulty or wrong battery	Replace battery

F04	**System overheat**	Heating air intake blocked	Clear heating air intake
		Heating air output blocked	Clear heating air output lines
		Heating air system too long or with too many bends	Reduce the length or bends of the heating ducts
F05	**Ignition sensor open load**	Broken cable or connector	Replace cable
		Broken ignition sensor	Replace ignition sensor
		Broken control unit	Replace control unit
F06	**Temperature sensor open load or shortcut**	Broken cable or connector	Replace cable
		Broken temperature sensor	Replace temperature sensor
		Broken control unit	Replace control unit
F07	**Fuel pump open load or shortcut**	Broken cable or connector	Replace cable
		Broken fuel pump	Replace fuel pump
		Broken control unit	Replace control unit
F08	**Fan motor open load or shortcut**	Broken cable or connector	Replace fan assembly
		Broken fan motor	Replace fan assembly
		Broken control unit	Replace control unit
F09	**Glow plug open load or shortcut**	Broken cable or connector	Replace the glow plug assembly
		Broken glow plug	Replace the glow plug assembly
		Broken control unit	Replace control unit

F10	**Overheating sensor open load or shortcut**	Broken cable or connector	Replace overheating sensor
		Broken overheating sensor	Replace overheating sensor
		Broken control unit	Replace control unit
F11	**Ignition open load or shortcut**	Broken cable or connector	Replace glow plug
		Broken glow plug	Replace glow plug
		Broken control unit	Replace control unit
F12	**Flame not extinguished during delayed shutoff**	Broken overheating sensor	Replace overheating sensor
		Broken control unit	Replace control unit

15.5 General faults and potential causes with remedies

Trouble	Cause	Remedy
Heater does not respond – no light when switched on	Battery empty	Charge or replace battery
	Fuse broken	Replace fuse
	Battery cable or contact bad	Replace cable or contact to battery
	Control button cable or contact bad	Replace cable or contact to control button
	Control button broken	Replace control button
	Control unit broken	Replace control unit
Continuous dense smoke while running	Exhaust pipe blocked	Clear exhaust pipe
	Combustion air intake blocked	Clear combustion air intake pipe
	Old or wrong fuel	Replace fuel
Smell of exhaust fumes in cabin	Leaking exhaust tube connections	Seal exhaust tube connections
	Wrong placement of muffler (placed in cabin)	Mount exhaust muffler in a ventilated compartment separated from the cabin
	Exhaust fumes entering fresh air intakes to cabin	Mount exhaust opening away from fresh air intakes
	Broken burner gasket	Replace burner gasket
Fan noise	Fan blades touch cover	Replace fan assembly
	Broken fan blades	Replace fan assembly
	Damaged fan motor	Replace fan assembly

Information in this manual is subject to change without notice, the latest updated manual cab be found on our website at www.calaer.com

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www.calaer.com

Product number: 100079 to100082

Book: 334-000560-001

Setting Standards for Safer Boating
This product complies with ABYC standards