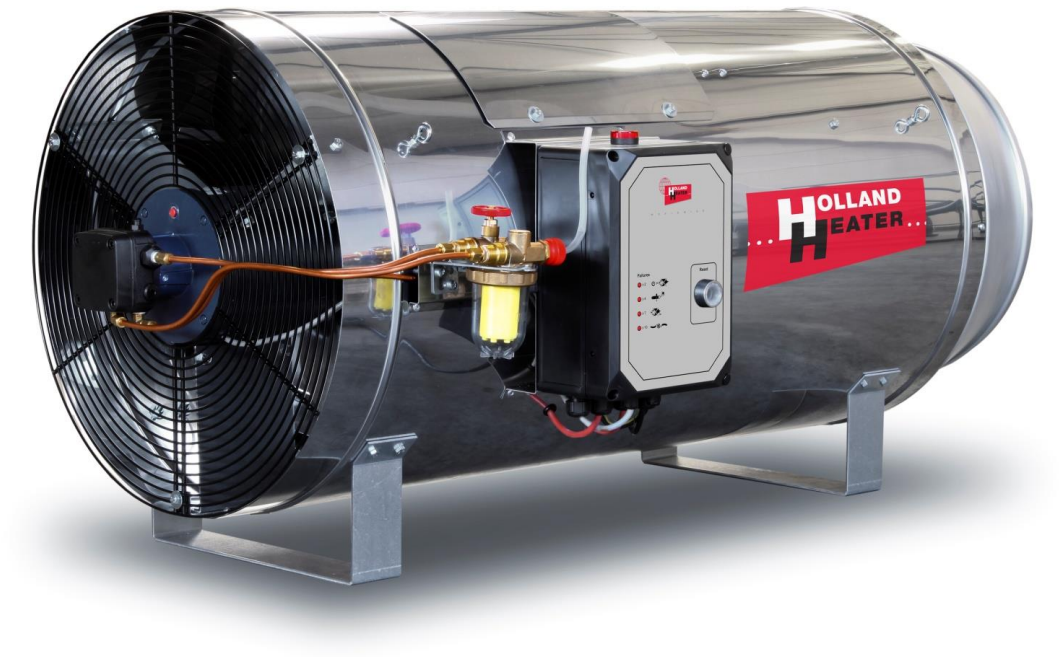
EN

HOLLAND HEATER

W O R L D W I D E



Installation and User manual

HHO 8-10-12L

Oil fired air heater

Dear customer,

Thank you for purchasing our oil fired air heater. This installation and user manual contains all information to get familiar with this product. In order to ensure that your new equipment will always work properly and efficiently and to ensure your personal safety, we recommend to read through this installation and user manual thoroughly and to take particular note of the warning and safety instructions before starting the machine for the first time.

This oil fired air heater (HHO 8-10-12L) is ideal for heating and/or CO_2 enrichment in greenhouses and plastic tunnels. The heaters are also excellent for heating poultry sheds or pig sties. Particularly in their first stages of life, young animals need a lot of heat, whether they are poultry or pigs. Optimum temperatures right from the start have a decisive impact on their development, health and general performance. The heaters can also be used for heating or frost protection in areas used for the storage and/or preservation of potatoes and tuberous crops. However these products should not be destined for human consumption.

The HHO 8-10-12L creates the right conditions for your room. This heater is available for use with kerosene/paraffin oil or diesel. No chimney is needed. The heater is installed exactly where it will be most effective in generating heat. Another positive feature is that the "open combustion" system increases the relative humidity in the room.

The HHO 8–10-12L devices have connections for floating contacts. This allows them to be controlled via thermostats or 24 Volts signal current. There is also the possibility for manual heating and ventilation. The heaters are secured with a burner controller which has a photocell flame security and maximal thermostat. If for some reason the appliance does not ignite or the flame is extinguished, the oil supply is immediately cut off. One solenoid valve unit ensures high levels of safety. No oil can escape unburnt.

This manual is intended for the technical installer and end user of the HHO 8-10-12L. The information you need can be found through the table of contents in the manual.

This is the original installation and user manual. To obtain more information or to order other manuals, contact Holland Heater.

Take good care of this manual and store it near the heater!

The oil used as fuel must be purified, never use polluted fuels or certain Bio fuels, This will harm the heater directly!

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General information

I Disclaimer

Holland Heater
All rights reserved. Nothing in this version may be copied and/or made public by means of printed matter, photocopy, microfilm or any other way, without preceding written permission of Holland Heater. This also includes related drawings and schemes.

Holland Heater has the right to change parts at any moment, without preceding or direct knowledge of the customer. The content of this manual could also be changed without preceding notification. This manual is valid for the standard version of the oil fired air heater. Holland Heater can not be held responsible for possible damage or injury resulting from the deviant specifications of the standard version delivered device.

This manual has been written with all possible care, but Holland Heater can not be held responsible for possible failures in this manual or the consequences thereof.

II Product description

Intended use
The HHO 8-10-12L may only be used for the purpose for which it is intended. The HHO 8-10-12L has been developed for:

- heating and/or CO_2 enrichment in greenhouses and plastic tunnels;
- heating poultry sheds or pig sties;
- heating or frost protection in areas used for the storage and/or preservation of potatoes and tuberous crops. (Not destined for human consumption)

Proper use of the equipment also entails observing the manufacturer's conditions of operation, maintenance and installation.

Unintended use
Use of the equipment for any other purpose as described above shall be regarded as improper use. The manufacturer will not be liable for any damage resulting from improper use; the user shall bear the sole risk thereof. A few remarks in addition to this statement:

- Diesel fuel may not be used in poultry or pig sties, petrol is recommended.
- The Heater may not be connected to a hose or ventilation duct. (see chapter 3.1 page 15)

III Used symbols

	Warning of a general danger
	Warning of dangerous voltage

IV Identification of the air heater

An identification plate can be found on the delivered air heater. It contains information about the producer, model, serial number etc.

The image on the right is an example of what the identification plate could look like.

Holland Heater
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Producer:	Holland Heater
Model:	HHO-10L
Serialnr.:	1112 748
Year of Production:	2012
Voltage:	230 Volt-50Hz
Engine Power:	880 W
Rated load:	100 kW
Fuel consumption:	9,6 l/h
Pump pressure:	Petrol: 9 bar Diesel: 8 bar
Produced for:	NL

V Ordering spare parts

When ordering spare parts, always indicate the following:

- Code no. and description of part or item number with description and manual number for uncoded parts;
- Number of original invoice;
- Electricity supply, e.g. 230/400 V, 3 ph, 50 Hz.

1 Precautions and warnings

General

- Never use polluted fuels or certain Bio fuels, This will harm the heater directly!
- Regular proper cleaning of the heater avoid uncontrolled fire!
- Before using the heater, read the safety instructions and make sure that the heater, fuel lines, oil tank, electrical supply and room thermostat are connected as described.
- Any unlawful alterations to the heater will rule out manufacturer liability for any resultant damage.
- Always follow local- and national regulations.
- Installation and maintenance should only be carried out by persons who have the training, knowledge or practical experience to ensure that the installation and maintenance is done properly.
- When fueled with diesel this heater is not suited for heating and/or CO_2 enrichment in greenhouses or plastic tunnels where plants or crops are being grown.
- The HHO 8-10-12L is a heater for use in mentioned rooms. Use of the equipment for any other purpose shall be regarded as improper use. The manufacturer will not be liable for any damage resulting from improper use; the user shall bear the sole risk thereof.
- No account is taken with general hazard of fire in this manual. Consult the fire insurance company and/ or the local fire brigade for more information.
- With storing manure, gasses are formed which are partly dissolved.
  These poisonous and explosive gases (e.g. Sulphur hydrogen and methane) can be released during stirring and rinsing. With a source of ignition a big explosion may occur.
  To prevent a hazardous situation shut off the heaters completely before stirring or rinsing. Also observe the following points:
  - Close the doors when manure is stored outside;
  - Ventilate the room thoroughly.
- Note the distance of the heater to feeding and drinking equipment and to plants in glasshouses concerning dehydration.
- Always use oil-resistant lines with the correct line clips!
- The "ventilate" mode is particularly useful in the summer. However, make sure that there is enough oil in the tank, since the oil pump could seize if it is not being lubricated by the oil.
- It is advised to use a room thermostat with a differential of ± 2°C. It will activate the heater when the room temperature drops 1°C below the set temperature, and deactivate when the room temperature rises 1°C above the set temperature. Using a thermostat of this kind will reduce the likelihood of failures and improve the performance of the heater.

Safety

- Any work extending beyond the scope of equipment maintenance must be performed by a qualified technician only.
- Never remove the safety grill or inspection hatch while the heater is active or could be activated.
- Do not press the lockout-reset button more than once in case of a failure.
  If the heater keeps locking out, isolate it from the mains electrical supply by removing the mains plug from the socket and contact a qualified technician.
- Before starting up the appliance, examine all electrical wiring for any visible defects and change any damaged wiring.
- Never remove the plug from the socket while the heater is active and always allow the heater to cool down. The heater ventilates for about one and a half minute when the heater has been switched off before the oil valve closes and stops the burning.
- Never use the heater when components are removed or missing.
- Covering electric motors can cause high temperatures to build up, which can destroy the electrical equipment and cause fires.
- Never use polluted fuels or certain Bio fuels, This will harm the heater directly!

Electrical

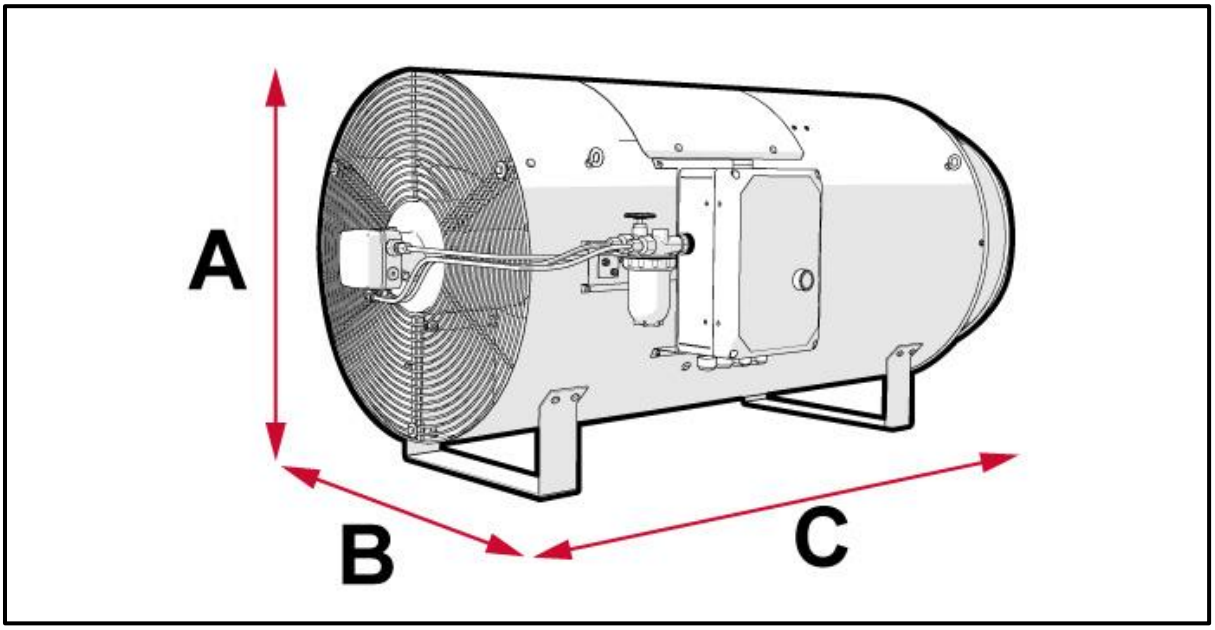
- Have any plug devices that are damaged or destroyed replaced by a qualified electrician.
- The heater must always be connected to the mains electrical supply via an earthed socket.
- Always plug the heater directly into a socket. Do not use an extension cord.
- Always disconnect the appliance from the mains before performing any maintenance.
- Do not connect the burner controller to the three-phase mains.

2 Technical specifications

2.1 General product specifications

Oil-Fired Warm Air Heater

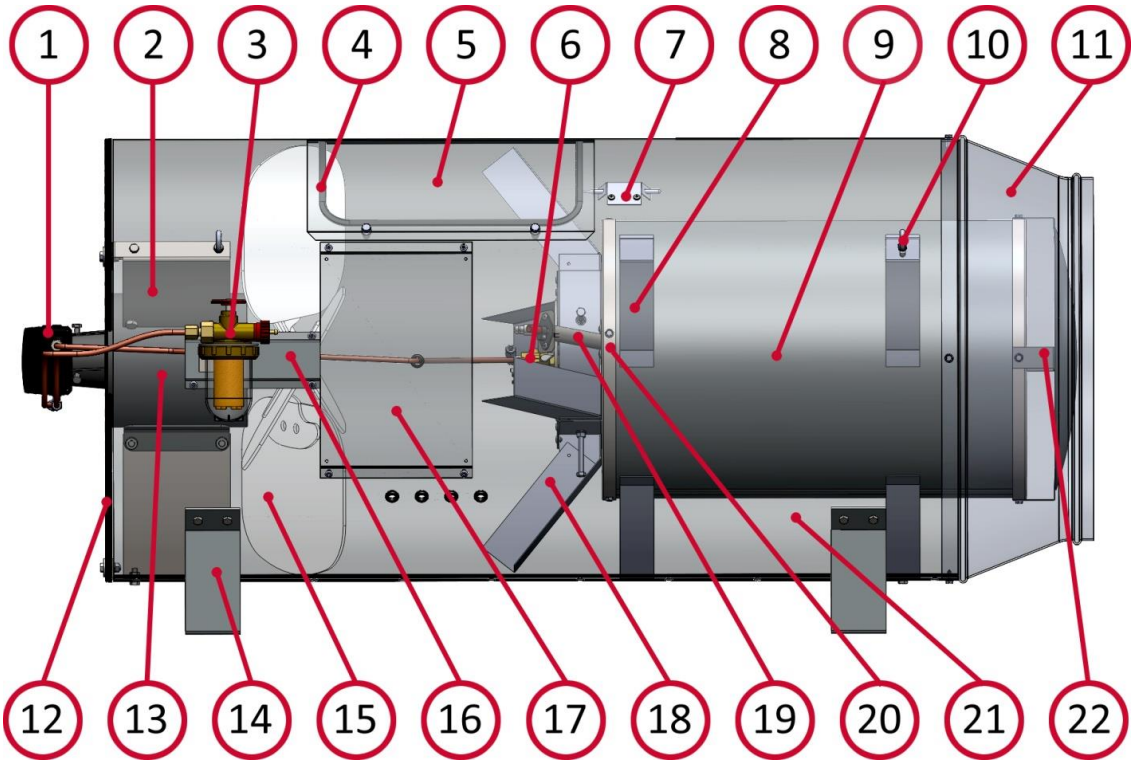
Model HHO -		**8L**	**10L**	**12L**
Output	kcal/h	69000	86000	103000
	kW	80	100	120
	BTU	27300	341200	409450
Fuel consumption	l/h	8	9,6	12
	Kg/h	6,2	7,8	9,4
Air output	m^3/h	7700	7700	7700
	cfm.	4543	4543	4543
Motor speed	rpm	1400	1400	1400
Electric Tension	50-60Hz V	230	230	230
Electric current	230V-50Hz A	5,1	5,1	5,1
Power	230V-50Hz W	1150	1150	1150
Sound pressure	dBA	73	73	76
Weight	Kg	47	47	55
Throw ventilator	m	40	40	40
Height (A)	mm	591	591	591
Width (B)	mm	664	664	664
Length (C)	mm	1268	1268	1368
Diameter mantle	mm	524	524	524
Distance centre brackets	mm	765	765	865



Material
The shell and burner chamber are made of stainless steel 430 BA. The materials used are capable of withstanding the maximum loads.

2.2 Main sections and components

2.2.1 The 8 and 10L versions

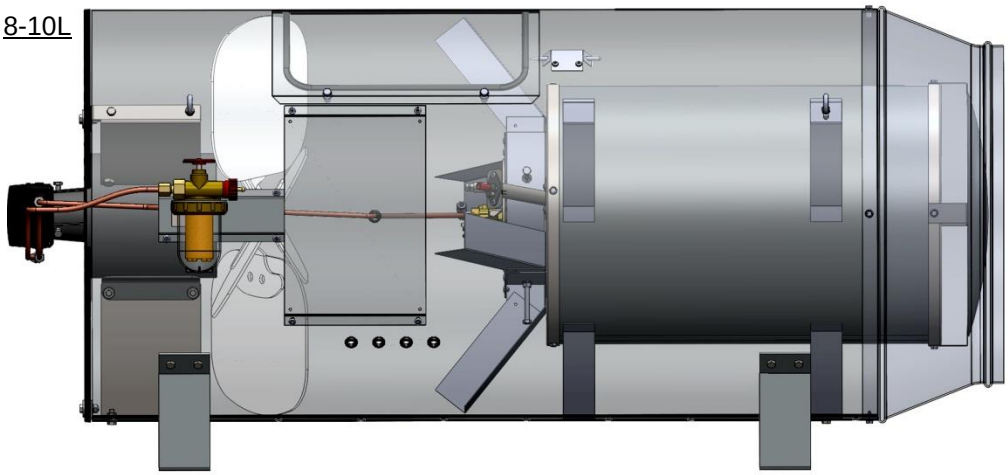


Pos.	Name	Item nr.
1.	Oil pump	(see 2.4)
2.	Engine bracket	
3.	Oventrop Oilfilter	(see 2.4)
4.	Edge profile	
5.	Inspection hatch	
6.	Burnerset	(see 2.5)
7.	Max. thermostat sensor	510173
8.	Burnerchamber support	
9.	Burnerchamer shell	
10.	Hoist ring M6	
11.	Air outlet cone	

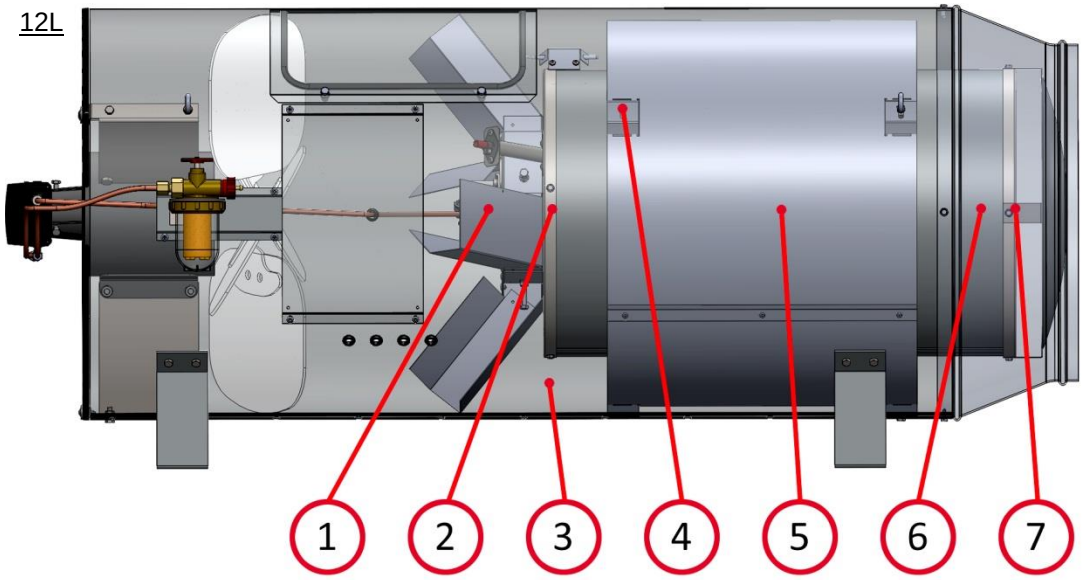
Pos.	Name	Item nr.
12.	Grill	
13.	LeMac Fan Engine	490031
14.	Heater support bracket	
15.	Fan 20” 28º	490035
16.	Mounting plate for oilfilter	
17.	Mounting plate for electrobox	(see 2.3)
18.	Air inlet chamber	
19.	Photocell	(see 2.8)
20.	Burnerchamber backplate	
21.	Main shell	
22.	Heatshield	

2.2.2 Differences between 8-10L version and 12L version of the heater

8-10L



12L



The differences between a 8L heater or a 10L heater is just a different fuel nozzle. However the differences between a 10L and a 12L heater are somewhat more elaborate.

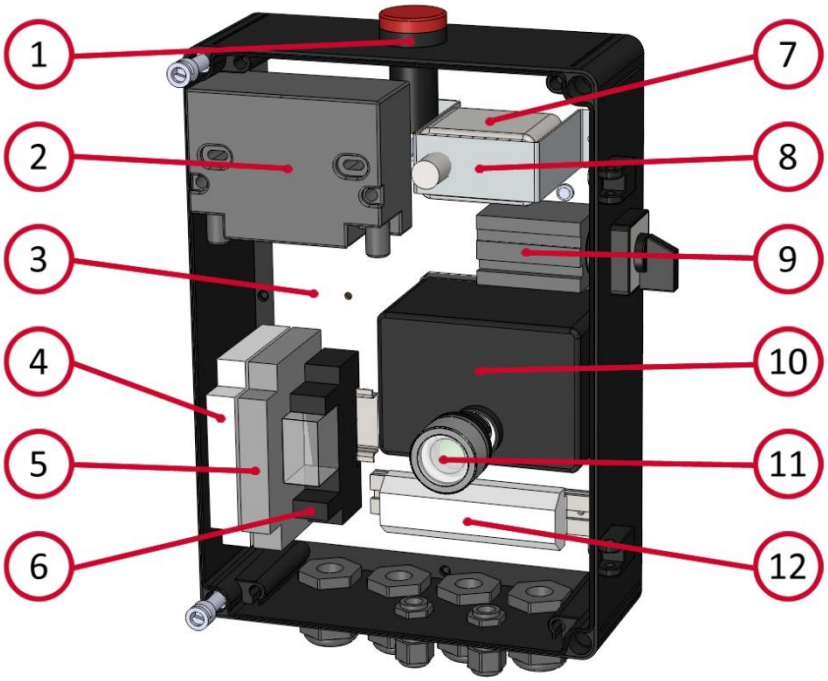
The main difference is that the 12L heater has a bigger burnerchamber (**6**) not only is it longer the diameter is also larger. As a result the dimensions of some related parts change as well. First and foremost is the main shell, the 12L burnerchamber is 10cm longer and so is the main shell (**3**). The diameter of the burnerchamber is 37mm larger and as a result the burnerchamber backplate (**2**) and the heatshield (**7**) are aswell.

Because the diameter of the burnerchamber is larger and the (inner) diameter of the main shell is the same as the 10L, the burnerchamber supports (**4**) decreased in size.

The most significant change to facilitate a 12L input is the addition of a extra protection shell (**5**) to prevent the main shell (**3**) from getting to hot. Also the air scoops of the air inlet chamber (**1**) got larger to provide the flame with more oxygen.

Apart from these differences the 3 heaters are similar, the names of the other components of the 12L can be found in paragraph 2.2.1

2.3 Electrical components

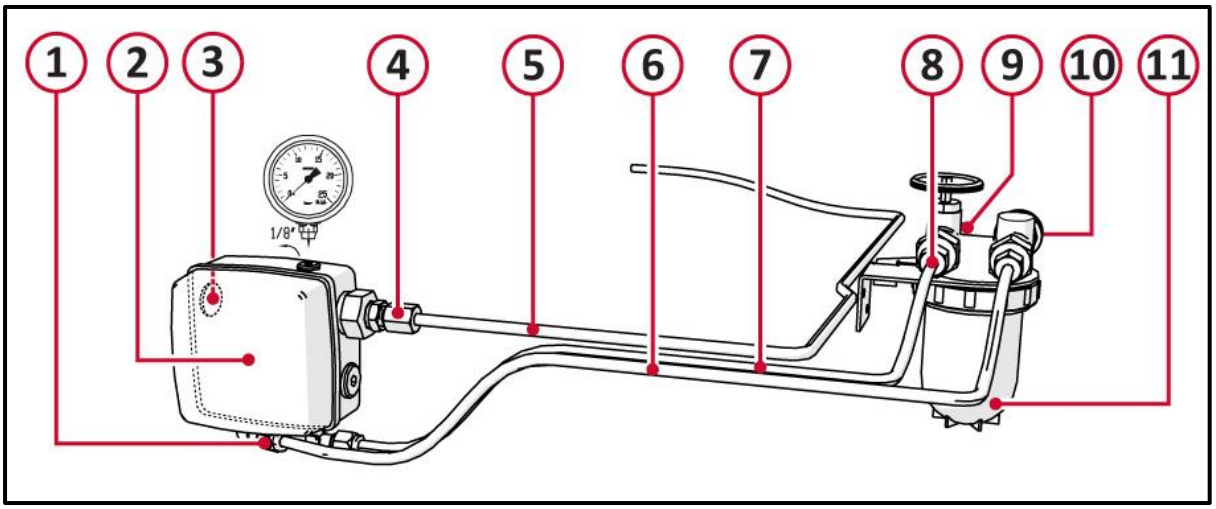


Pos.	Name	Item nr.	Pos.	Name	Item nr.
1.	Fault indication lamp	510146	7.	Max.thermostat	510173
2.	Ignition transformer	100046	8.	Max.thermostat bracket	
3.	Mountingboard components		9.	Main operating switch	510140
4.	Circuit breaker	510069	10.	Burner controller	490032
5.	Timer	490056	11.	Reset button	510135
6.	Relay	510125	12.	Terminal Strip	

2.4 Pump pressure

The heater's pump pressure is set at the manufacturer but it is advisable to check the pump pressure during maintenance. Always check the pump pressure during a failure and also when the flame appearance is barely visible. To do so, use a pressure gauge with a measuring range of 0 to 16 bar or 0 to 25 bar.

Install the pressure gauge including the screw to adjust the pump pressure as shown in the image below:



Pos.	Name	Item nr.
1.	¼ x 6 mm coupling 90º screw-in 2x	560061
2.	Oil pump	100009
3.	Adjustment screw pump pressure	
4.	¼ x 6 mm coupling straight screw-in	560062
5.	Oil line pump > nozzle	
6.	Oil line pump > oil filter	
7.	Oil line oil filter > pump	
8.	⅜ x 6 mm coupling straight screw-on 2x	490070
9.	Input from fuel tank	
10.	Output for air bleeding/ return	
11.	Oil filter Oventrop	490044

The correct pump pressures for the various models of heater are shown in the table below

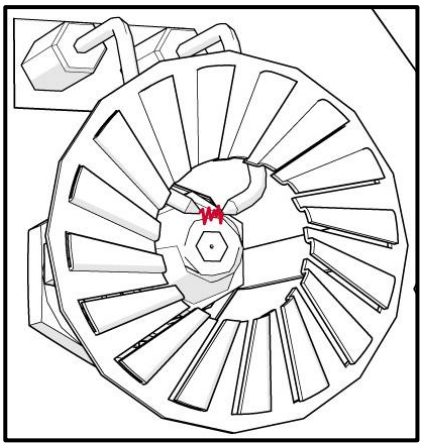
Type	HHO 8L	HHO 10L	HHO 12L
Kerosene	9 bar	9 bar	9 bar
Diesel	8 bar	8 bar	8 bar

Pressures of up to 1 bar above or below the correct pressure are acceptable. The pump pressure can therefore often best be set on the basis of observed combustion performance.

NOTE:
If the heater has an unpleasant smell and the flame appearance is too small, the oil supply is low and the pressure should be increased. If the flame appearance is reddish and flames are coming out of the heater, the oil supply is too high and the pressure should be reduced. However, these problems are not necessarily down to incorrect pump pressure alone. A defect nozzle could also be the cause of the problems. See chapter 7 "Failures" for more information about troubleshooting.

2.5 Burner set

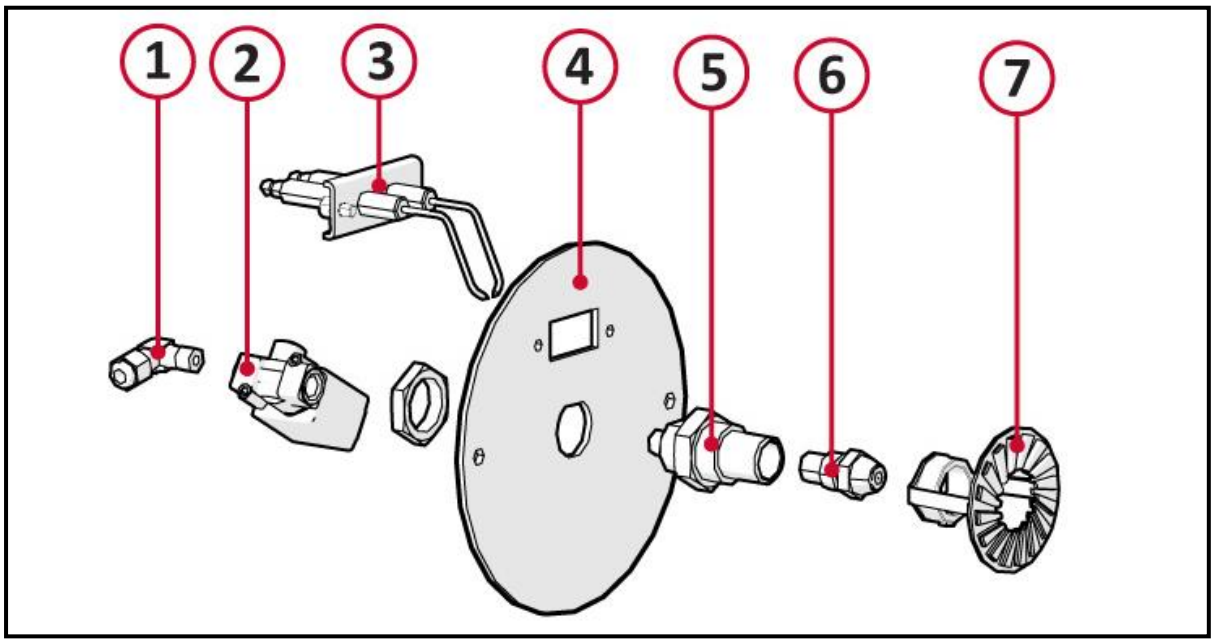
The burner set is a vital part of the heater. Its function is to light the oil coming out of the nozzle, and it must be capable of doing so under adverse conditions. It is therefore very important that it is properly adjusted. If the burner set is badly adjusted, the ignition spark may form in the wrong place or may not form at all. This will cause the heater to lock out.



When the heater is activated, it is possible to see that the burner set system starts operating. Between the two ignition electrodes a well-defined spark should be visible.

Under the influence of the air current, the spark should form in front of the nozzle. If a strong spark is visible and it is in the right place, the burner set should function properly.

Carefully adjust the ignition electrodes. If the porcelain sleeve of the electrode breaks or cracks, the whole electrode needs to be replaced.



Pos.	Name	Item nr.
1.	⅛ x 6mm coupling 90° screw-in	560056
2.	Magnetic valve	100019
3.	Ignition electrodes	490054
4.	Mounting plate	
5.	Nozzle block	100028
6.	Nozzle	(See 2.6)
7.	Burner disk	490057

2.6 Oil atomising nozzle

Note the position of the parts before replacing them.

The oil atomizing nozzle and the pump pressure together determine the output of the heater. After a few years, a worn nozzle may deliver too much or too little oil. This could lead to combustion problems.

If too little oil is being delivered, and the pump pressure is correct, check to see whether there are any blockages in the fuel system, dirt in the oil filter or in the nozzle filter. If no blockages are found, the nozzle should be replaced.

If too much fuel is being delivered, and the pump pressure is correct, check to see whether there are any leaks in the heater. If no leaks are found, replace the nozzle.

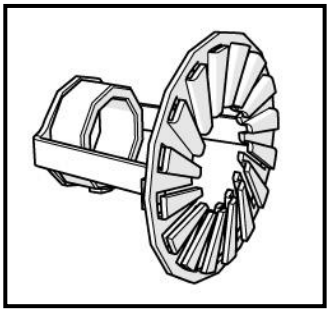
- Replace the oil atomizing nozzle with a genuine nozzle of the same make and type. The heater is designed and adjusted to suit that particular make and type of nozzle.
- After a new nozzle has been fitted, check the adjustment of the ignition electrodes and the burner disk.

The correct nozzles for the various models of heater are shown in the table below.

Heater model	Make of nozzle	Discharge (US-gal/h)	Flow ltr/h	Nozzle model	Item no.
	DANFOSS				
HHO 8L		2,00	8	60° S	
HHO 10L		2,25	9,6	60° S	490041
HHO 12L		2,75	1	60° S	490082

The burner disk

The burner disk is attached to the nozzle block. The burner disk ensures that the fuel and air are thoroughly mixed and trained to form a spiral jet. If the heater is used in a particularly dusty area, the burner disk can become very dirty. This in turn can lead to combustion problems. The burner disk should therefore be cleaned with a wire brush so that its blades are free of dirt. After cleaning, check that the whole burner set assembly is properly adjusted before replacing it.

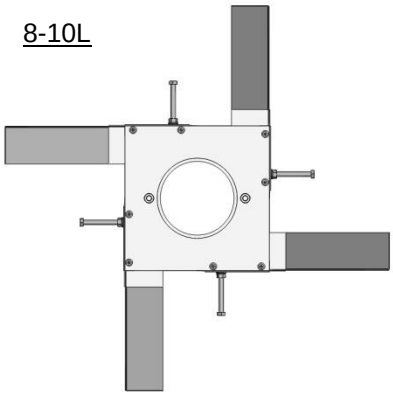


2.7 Air inlet chamber

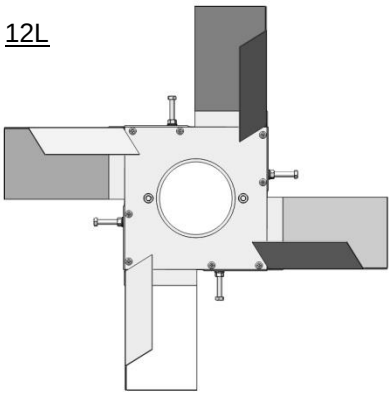
The air inlet chamber is the square housing mounted to the burner chamber. The burner set is attached onto the air inlet chamber.

The air inlet chamber has four air inlets that provide air (oxygen) that is needed for the combustion process. The inlets are adjusted at the manufacturer and need no further attention, although the openings should be cleaned with compressed air once they become dusty (see paragraph 5.1). Do not adjust the openings, altering the air supply will likely lead to ignition- or burning problems.

8-10L



12L



2.8 Photocell

The photocell is mounted in a holder attached to the back of the combustion chamber. The photocell's function is to check whether there is a flame in the combustion chamber when the heater is activated and while it is operating. If no flame is detected during activation or when the heater is in operation, the heater will lock out. However, if the photocell is dirty or faulty, it may not detect a flame even when there is one, causing the heater to lock out.

3 Installation

3.1 General

Mind the following precautions before installing the heater:

Mounting

- The heater must be properly secured using the suspension eyes or (if it is being fixed down) using the tunnel brackets on its bottom. Secure the heater using chain or steel cable of at least 4 mm in diameter.
- The heater must be as close to the horizontal as possible, and certainly not inclined at an angle of more than fifteen degrees.
- The heater must not be connected to a duct system and it is forbidden to use the heater at a location where inflammable objects are placed.

Oil connection

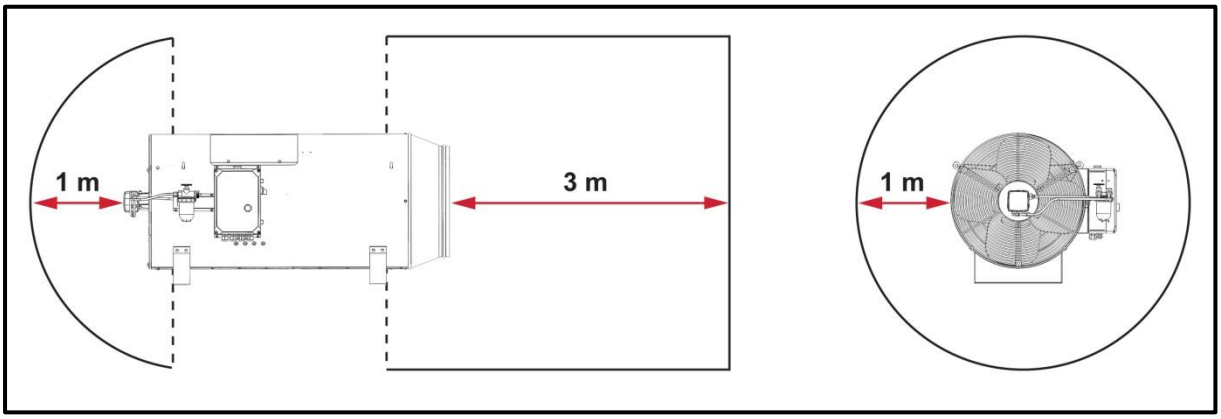
- **The oil used as fuel must be purified!**
- Never use polluted fuels or certain Bio fuels, This will harm the heater directly!
- Check the fuel supply lines regularly for leaks and loose fittings.
- The oil tank must meet the relevant environmental standards and must be contained within a spillage sump. The capacity of the sump must be at least the same as the capacity of the tank. The sump must be protected from the rain.
- The bush in the spillage sump through which the primary fuel line passes must be watertight and oil-tight by line clips.
- The main fuel pipe must be thick-walled and made of stainless material.
- The diameter of the main fuel pipe must be at least 3/4" (20 mm).
- The oil tank and each of the oil boxes must be fitted with a manual oil valve.
- The fuel line must be secured to the heater and to the oil tank with suitable line clips.
- Oil lines should not be left on the ground, lead them along a steel construction or wall without sharp bends.

Electrical

- Make sure to use a well earthed socket.
- Always unplug the heater before performing maintenance.
- Never take the plug out of the socket while the heater is still working, always let it cool down.
- Have the heater repaired by a certified dealer during failures.
- Press the reset button three times maximum during a failure. Is there still a failure, unplug the heater and consult a qualified technician.

Safety

- Never use polluted fuels or certain Bio fuels, This will harm the heater directly!
- Never remove the grill or service hatch when the heater is or might start running.
- Never use the heater when parts are removed.
- To avoid oxygen depletion, the room in which the appliances are installed must have enough ventilation:
  - Either by a mechanical extractor device or ventilation system that extracts at least 10 m^3 of air per hour for every 1 kW of installed output.
  - Or it must have adequate natural ventilation; if the room has two openings, a ventilation factor of 1.0 (i.e. one change of room air per hour) can be achieved naturally. The openings must have a free opening area of at least 60 x B cm^2, where B is the installed output in kW. The overall output of the installed appliances must not exceed 1 kW per 20 m^3 of room volume if natural ventilation is used.
- Always replace defect or faulty parts with original ones or with the same specifications.
- Make sure there is enough space around the heater:
  - The area around the heater should be at least 1 m free from obstacles.
  - The area in front of the heater should be at least 3 m free from flammable objects.



3.2 Connecting the oil supply

Note the distance of the heater to feeding and drinking equipment and to plants in glasshouses concerning dehydration.

Legend of the images in the next four paragraphs:

A. Non-return valve
B. Filter
C. (Manual) Shut-off valve
D. Reduction regulator
E. Vacuum valve
F. Oil box

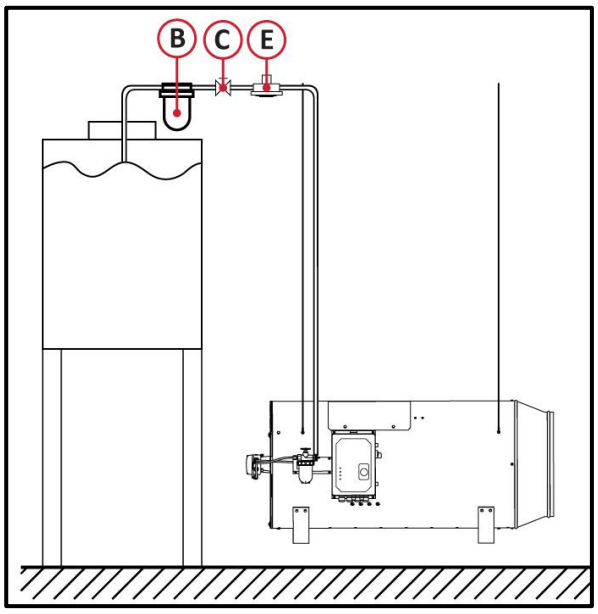
Different circumstances require different ways of installation; paragraph 3.2.1 describes an installation where the tank is higher than the heater, paragraph 3.2.2 describes an installation when the tank is lower than the heater, paragraph 3.2.3 describes an installation with an extra oil pump and paragraph 3.2.4 describes an installation when using oil boxes.

3.2.1 The tank is higher than the heater

Install a vacuum valve (E). It prevents spilling a complete tank of fuel in case of a leak.

The vacuum valve has to be placed before the oil line drops beneath the highest level in the tank.

Always use a filter (B) when the oil or the tank may be dirty.



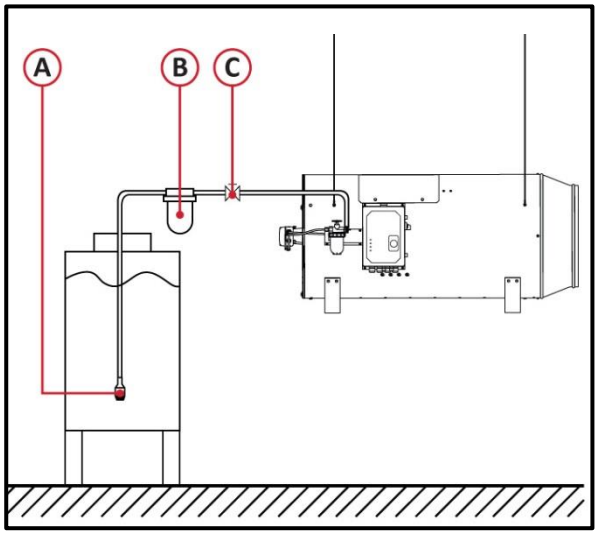
3.2.2 The tank is lower than the heater

The pump draws the fuel directly from the main tank.

Make sure the oil doesn't flow back, use a non-return valve (A) at the supply line in the tank. Mind the height difference, see the table in chapter 3.3.

The return oil line has to end at least half way in the tank.

Always use a filter (B) when the oil or the tank may be dirty. Use oil lines of max. 3/8" (9,5 mm). Bigger diameters could cause air bubbles.

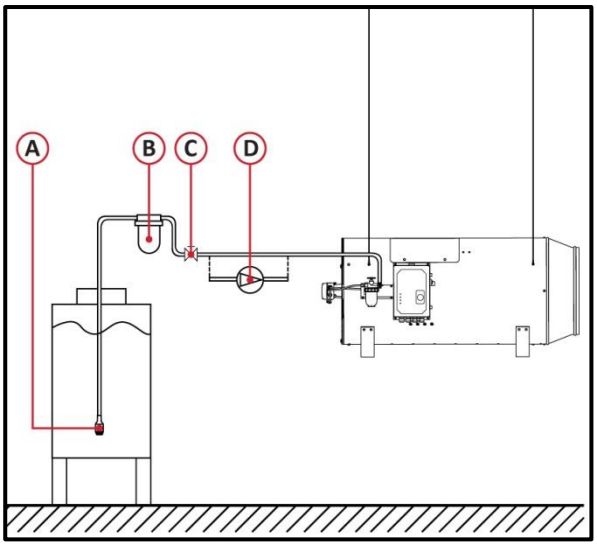


3.2.3 Use of an extra oil pump

Mind the pump pressure; use a reduction regulator (D). The pressure on the filter may not exceed 0,5 bar.

If necessary, use aluminum or brass filter jars or oil conduits that can sustain higher pressure and clamp them well on the nipples!

⚠ Always use a filter (B) when the oil or the tank may be dirty.



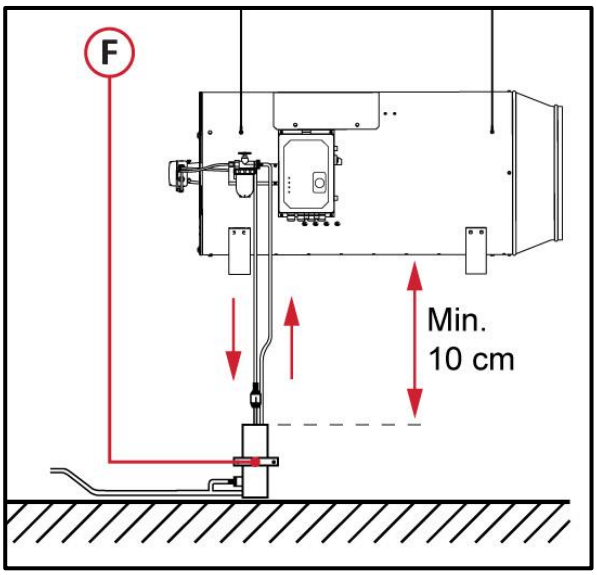
3.2.4 Use of oil boxes

The oil box (F) serves as a small reservoir, the oil circulates between the oil box and the heater.

Make sure the boxes are at least 10 cm lower in relation to the underside of the tank.

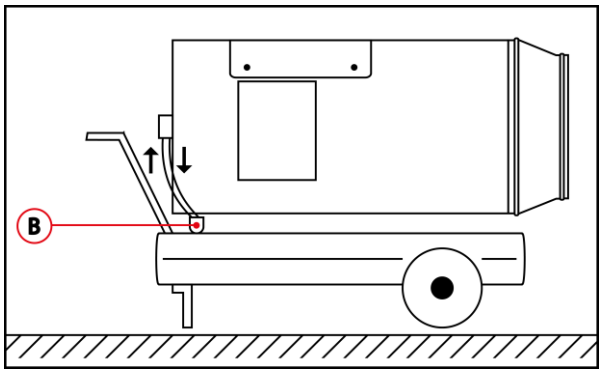
Connect a manual valve on each box and bleed the boxes regularly!

The advantage of using an oil box is that there is no need for return lines to the main tank.



3.2.5 Mobile Heater with tank

The mobile HHO oil with tank takes his oil directly out of the tank, on the tank is an oil filter mounted. (B) is oil filter.

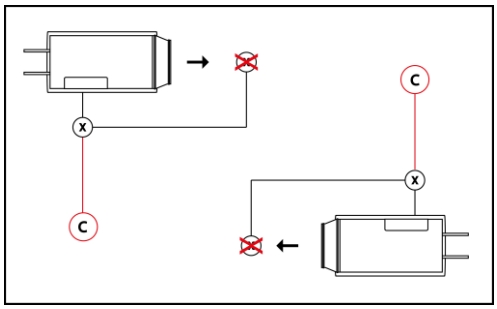


Warning! Before you connect the heater to the mains and start using the heater you have to fill up the tank! Use only diesel of a good quality!

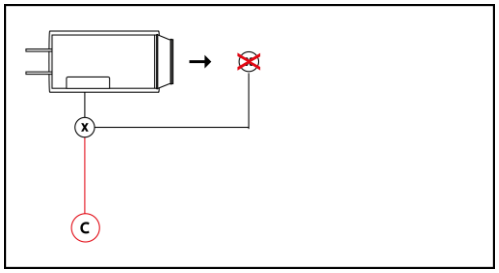
To run the heater without oil in the tank can damage the oil pump! Never let the heater run without fuel for ventilation only! On top off the oil pump is an crew to remove air in the system (don't forget to close it!)

Thermostat
If you use the mobile heater with an thermostat don't place the thermostat directly in front of the heater in the warm airflow but near the heater on a couple of meters distance.

Position of the thermostat
House with two heaters



Position of the thermostat
House with one heater



Climate computer
If the HHO heater is controlled by an climate computer be aware that the running time is not lesser than at least 5 minutes to short running times course problems the dust sticks on the burner what effect the good operation!

3.3 Oil lines

Always use oil-resistant lines with the correct line clips.

The following features of the oil supply system must be compatible with one another:

- The total length of oil line used (i.e. fuel line run);
- The diameter of the oil line;
- The height difference between the oil tank and the heater;
- The type of fuel to be used.

The table below shows the permissible combinations. Make sure that the oil supply system complies with this table. The figures in the table have been worked out on the assumption that the heater is higher than the oil tank.

Fuel: kerosene (paraffin oil) 2,15 mm²/s (cST)
diesel (domestic fuel oil) 6,00 mm²/s (cST)

H = difference in height between bottom of oil tank (or oil box) and oil pump on heater (in meters).

Ø = internal diameter of oil line (in millimeters).

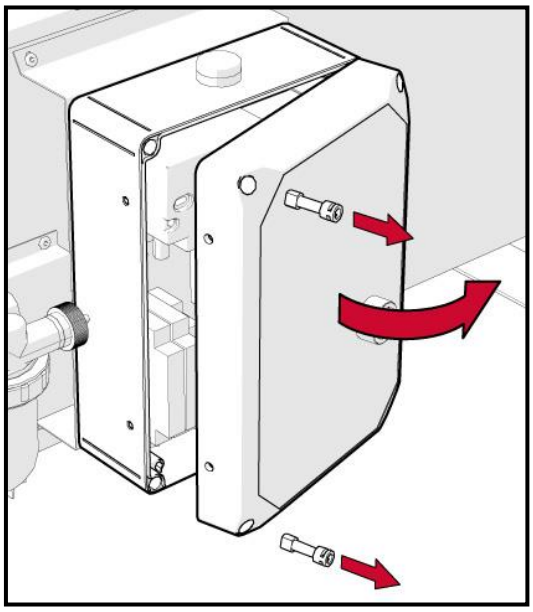
L = maximum allowable oil line run (in meters).

	KEROSENE / PARAFFIN OIL			Diesel		
H	**Ø 8 L**	**Ø 10L**	**Ø 12L**	**Ø 8L**	**Ø 10L**	**Ø 12L**
0	100	100	100	12	36	89
0,5	98	100	100	10	32	78
1,0	86	100	100	9	28	68
1,5	73	100	100	7	23	57
2,0	61	100	100	6	19	47
2,5	48	100	100	5	15	36
3,0	36	87	100	3	10	25
3,5	23	56	100	2	6	15
4,0	11	26	54	1	2	4

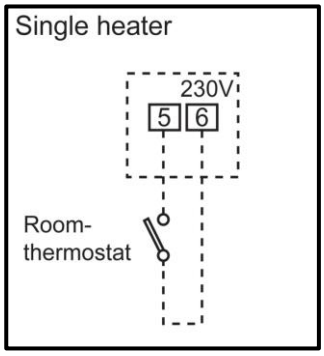
3.4 Electrical connections

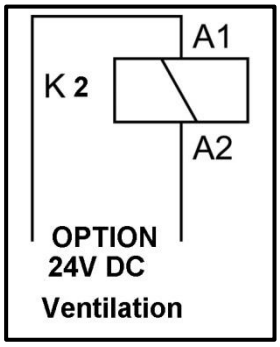
Do not connect the burner controller to the three-phase mains.

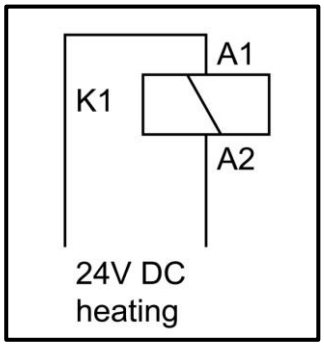
Unscrew the lid from the electrical casing and open it.



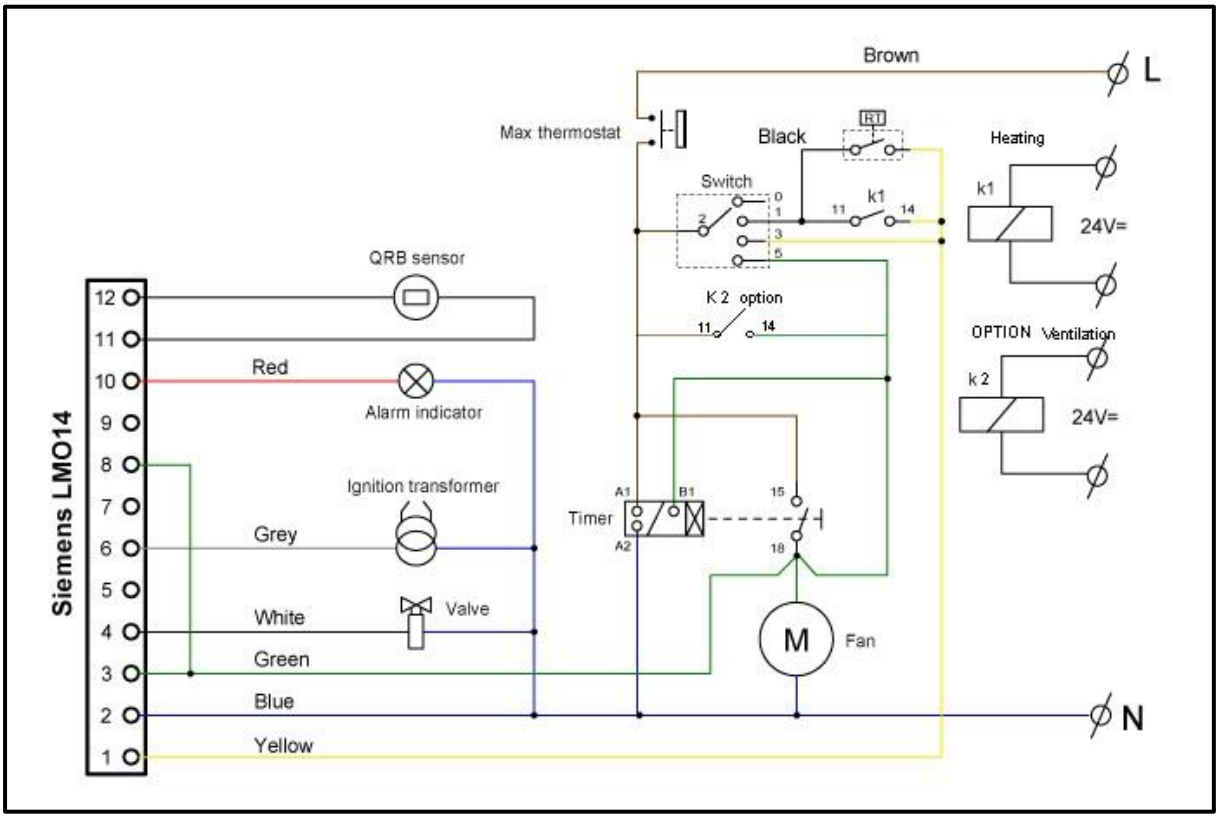
The connection of the thermostat, external signals and other components are described below (wiring max. 2,5 mm^2):







Electrical scheme HHO 8 – 10 - 12L



Legend:

L	Phase 230 Volts
N	Zero
RT	Room thermostat
k1	Heating relay
k2	Ventilation relay (Option)
M	Fan

Switch

0	Off
1	Automatic heating
3	Continuous heating
5	Continuous ventilating

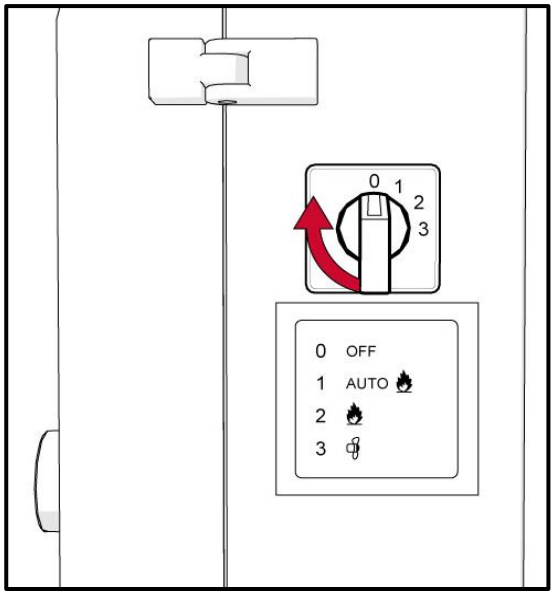
4 Operation

4.1 First use (single pipeline system)

Before using the heater, read the safety instructions and make sure that the heater, fuel lines, oil tank, electrical supply and room thermostat are connected as described.

1. Turn the ‘on/off’ switch to position 3 (continuous ventilating).

The fan motor starts working and controls the oil pump.

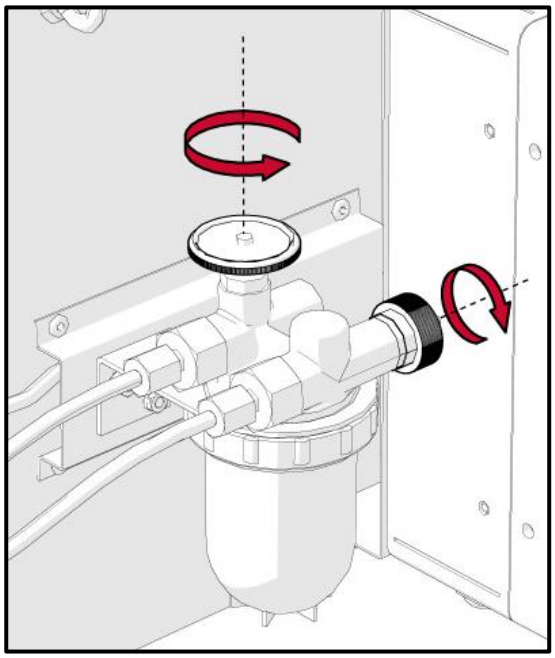


2. Open the oil filter valve and the air bleed valve.

The oil now flows into the system and the oil filter will be filled. Close the air bleed valve once the oil filter is full. The internal oil system of the heater is filled with oil and is bled.

The heater is now ready for use (see paragraph 4.3).

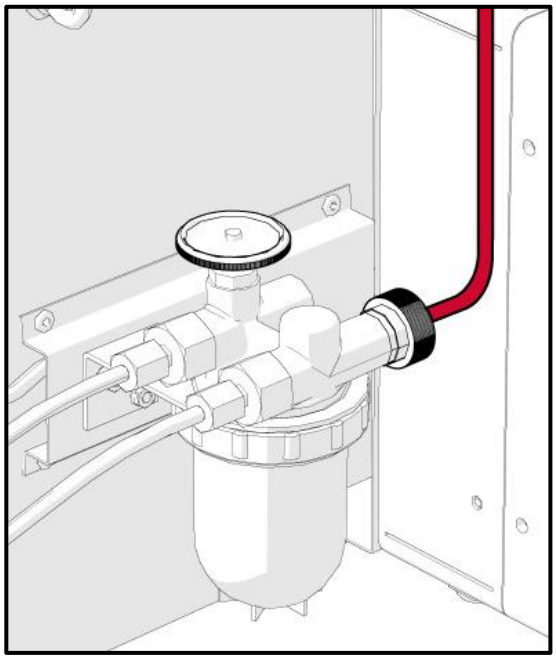
Oil could leak from the return valve during bleeding.



4.2 First use (return pipeline system)

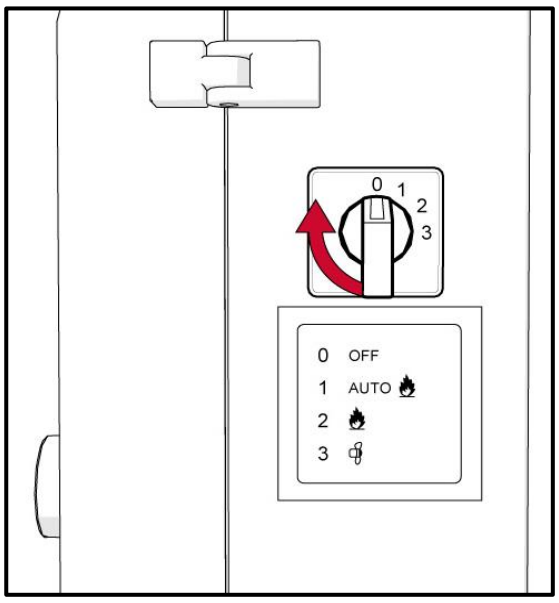
Before using the heater, read the safety instructions and make sure that the heater, fuel lines, oil tank, electrical supply and room thermostat are connected as described.

1. Check if the return line has been connected to the oil filter return.



2. Turn the ‘on/off’ switch to position 3 (continuous ventilating).

The fan motor starts working and controls the oil pump.



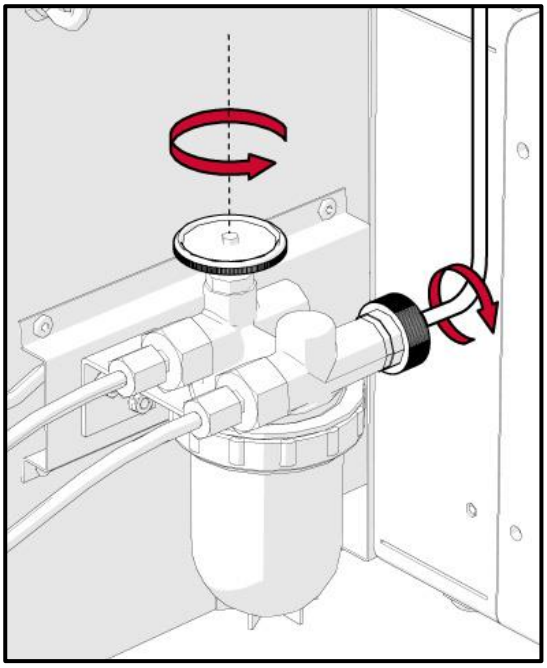
3. Open the oil filter valve and the air bleed valve.

The oil now flows into the system and the oil filter will be filled.

Next, the oil flows back to the internal oil system through the return line. The internal oil system of the heater is filled with oil and is bled.

The heater is now ready for use (see paragraph 4.3).

⚠ Make sure to bleed the external oil system after all the heaters are connected.



4.3 Regular use

The heater ventilates for about one and a half minute after the heater has been switched off. During this one and a half minute the fan cools the burning chamber.

The "ventilate" mode is particularly useful in the summer. However, make sure that there is enough oil in the tank, since the oil pump could seize if it is not being lubricated by the oil.

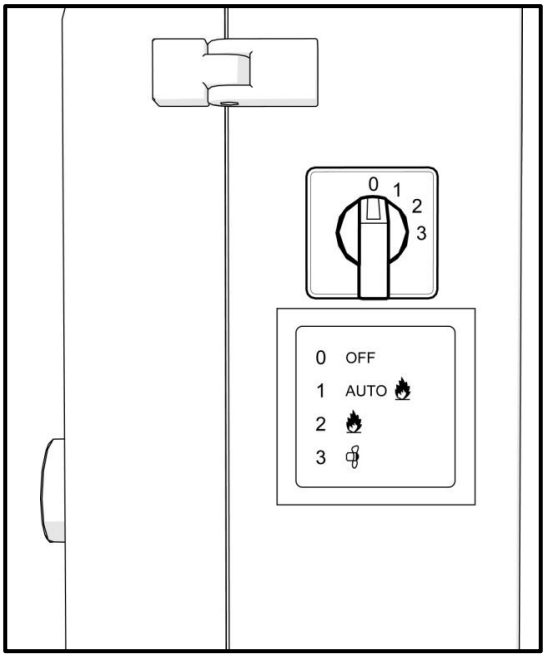
The selector switch has four positions:

Position 0 (off):
- The heater is switched off.

Position 1 (automatic heating):
- Turn the switch to this position to control the heater external by means of a 24 Volts signal or with a room thermostat (see paragraph 3.4 and 4.4).

Position 2 (continuous heating):
- Option to manually turn on the heater. The fan starts working and the heater will ignite.

Position 3 (continuous ventilating):
- Option to ventilate only.



4.4 Room thermostat

It is advised to use a room thermostat with a differential of ± 2°C.
It will activate the heater when the room temperature drops 1°C below the set temperature, and deactivate when the room temperature rises 1°C above the set temperature. Using a thermostat of this kind will reduce the likelihood of failures and improve the performance of the heater.

For the heater to be regulated automatically, the burner controller has to be in mode “automatic”. Set the room thermostat to the required temperature. When the room temperature falls below the set level, the heater will start and will keep heating until the temperature reaches the set level.

Depending on the type of room thermostat in use and where it is positioned, the room temperature is able to vary within a band either side of the temperature to which the thermostat is set. The difference between the temperature at which the room thermostat cuts in and the temperature at which it cuts out is referred to as the thermostat's differential. The smaller the thermostat's differential, the more often the heater will come on and go off.

5 Maintenance

5.1 General

This chapter is intended for qualified technicians and not for users. Repairs should only be carried out by persons who have the training, knowledge or practical experience to ensure that the repair is done properly.

Always disconnect the appliance from the mains before performing any maintenance.

Important: prevent dust accumulation, clean the heater regularly

- Check that the appliance or machine has been returned to its proper state after carrying out repair work. Technical equipment must not be re-started until all safety devices are in place.
- Spare parts must at least correspond to the technical requirements specified by the manufacturer of the equipment. Therefore only use original spare parts.
- Regularly check the heater(s) and all oil lines for loose connections and leaks.
- Always wear protective gloves.
- When using oil boxes, the bleed valve on the oil boxes must be opened regularly to allow any air which may have collected in the fuel lines to escape.
- When using the heater seasonally, check that it is in good working condition before using it.
- Perform maintenance to the heater at least once a year.

Recommended maintenance intervals. (by 8 till 10 hours operation/day)

Every 42 days: clean the photocell, the ignition electrodes and the burner disk.
Every 84 days: clean the fuel filter
Every 300 hours: replace the fuel filter by a new one.
Every eight months: clean the fuel tank.

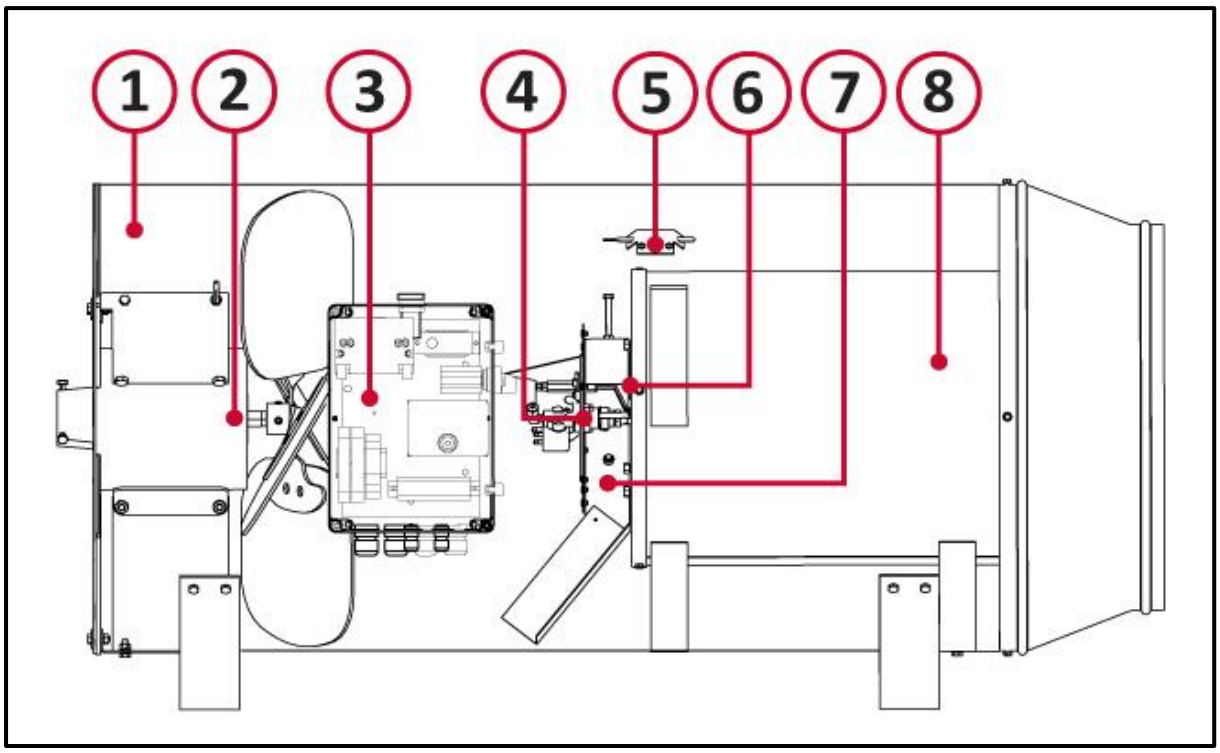
Cleaning filter:
- unscrew the clear cup and remove particles
• take out the filter element and clean it
• fill the fual cup to approx. ¼ to facilitate operation of the ehater.
• refit all components making sure that gaskets are fitted and located

Cleaning photocell:
• take out the photocell
• clean the lens with a soft cloth
• refit the photocell in its holder put in in the wright position

5.2 Cleaning

Do not use water to clean the appliance!
Inadequate cleaning can result in serious damage.

Components that need to be thoroughly cleaned:



1. Main shell
2. Motor and fan
3. Controlbox and electrical wiring
4. Burner set
5. Maximal thermostat sensor holder
6. Photocell and holder
7. Air inlet chamber
8. Burner chamber

After a fattening period of +/- 42 days or when the heater is sooner polluted by dust , the air heater must be thoroughly cleaned of dust. In the event that the HHO is used for other purposes than in broiler houses, the appliance must be cleaned of dust sooner.

- Always disconnect the appliance from the mains: Before carrying out maintenance work, always isolate the heater from the mains electrical supply by removing the mains plug from the socket.
- Periodically wipe the outside of the heater with a soft cloth. A small amount of a non-aggressive cleaning liquid may be used, but the heater must be thoroughly dried afterwards.
- Remove dust and dirt from the inside of the heater with compressed air. To do this you will need to remove the safety grill from the back of the heater or the service cover on the side.
- After carrying out maintenance work, make sure that all components you have removed from the heater are correctly replaced.
- If you think that the heater or its combustion system is not working properly, consult a qualified technician. Qualified technicians have special equipment with which they can check the heater thoroughly.

- If the heater is being used in a very dusty environment e.g. a broiler house, the burner set, the photocell and the photocell housing should be cleaned after every crop. To do this, remove the burnet set from the burner chamber by loosening the two wing bolts (see diagram chapter 2). The burner set can then be withdrawn and cleaned (with compressed air). Make sure to clean the four air inlets on the air chamber. The photocell can be cleaned with a dry cloth. Compressed air should then be blown through the photocell housing. When replacing the photocell in its holder, remember that it has to be oriented so that the pipe on the photocell clicks into the matching recess on the holder.

- Clean the oil filter on the pump when dirty. Do not forget the rubber O-ring when reassembling the filter (tighten the filter jar well).

6 Environment and discharge

6.1 Environment

When ending the products lifeline, it needs to be separated from other waste. The user is obligated to take the product to a location to hand in electronic devices. If this is not possible and the product needs to be replaced by a newer version, send the product back to the manufacturer.

At the manufacturer the heaters are tuned to keep the emission of harmful substances to a minimum. Nevertheless, the combustion system will not function optimally if for instance:

- There is a shortage of oxygen;
- The wrong fuel is used;
- There is a leak in the oil supply system;
- Water gets into the oil tank (this can also damage the oil pump);
- Dirt gets into the oil supply system.

Poor combustion can be harmful not only to the environment, but also to the crops or to the room or space in which the heater is being used. Therefore, have the heater checked regularly to see that the combustion system is in good working order. Also follow the safety and installation instructions closely.

The oil storage arrangements must meet the relevant environmental standards. In other words, the tank must be contained within a spillage sump, the capacity of which must be at least the same as the capacity of the tank. The sump must also be protected from the rain.

Regularly check the heater and the fuel lines for leaks. If you have reason to disconnect a heater, make sure to catch the oil that runs out of the fuel lines and filter and dispose it in an environmentally responsible manner.

6.2 Discharge

After the installation or repairs of the installation, the packaging and non-usable waste should be delivered to the appropriate places.

7 Failures

7.1 Burner controller response to failures

The table below illustrates the response of the burner controller to various types of malfunctions. After the appliance has frozen, the red signal lamp will light up. When the power is restored following a power failure, the appliance will still be frozen. The cause of the malfunction must be investigated and, after resolving the malfunction, the appliance can be restarted by pressing the reset button.

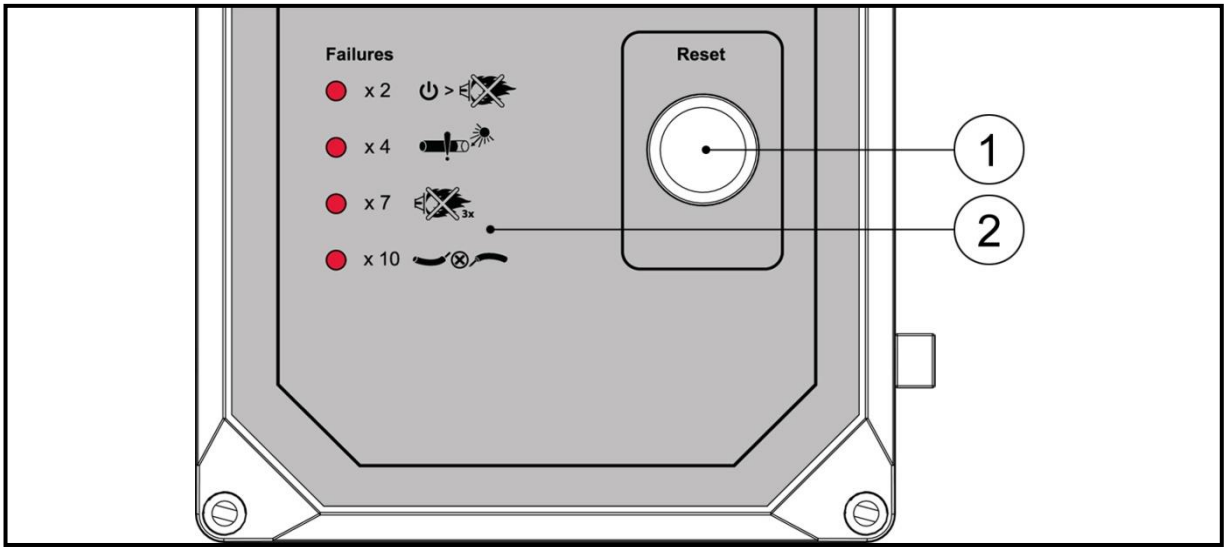
If lockout occurs, the outputs for the fuel valves, the burner motor and the ignition set will immediately be deactivated (< 1 second).

Cause		**Response**
Mains failure	→	Restart
Voltage has fallen below the undervoltage threshold	→	Restart
Extraneous light during «**t1**»	→	Lockout at the end of «**t1**»
Extraneous light during «**tw**»	→	Prevention of startup, lockout after 40 seconds at the latest
No flame at the end of «**TSA**»	→	Lockout at the end of «**TSA**»
Loss of flame during operation	→	Max. 3 repetitions, followed by lockout

Legend:

t1	Prepurge time
tw	Wait time
TSA	Safety time for ignition

7.2 Burner relay status indicator



Pos.	**Name:**
1	Multicolour signalling lamp (LED) and reset button
2	Error code pictograms

During normal operation, the various operating statuses are indicated in the form of colour codes, as shown in the colour coding table below. During start-up, the status is indicated in the table on the next page.

Colour coding table for the multicolour signalling lamp (LED)		
Status:	**Colour code:**	**Colour:**
Delay time <<tw>>, other waiting statuses	o.....	Off
Ignition phase, controlled ignition	● o ● o ● o ● o ● o	Flashing yellow
In operation, flame present	□.....	Green
In operation, poor flame signal	□ o □ o □ o □ o □ o	Flashing green
Undervoltage	● ▲ ● ▲ ● ▲ ● ▲ ●	Yellow - red
Failure alarm	▲.....	Red
Error code export (see <<error code table>>)	▲ o ▲ o ▲ o ▲ o	Flashing red
Interface diagnosis	▲ ▲ ▲ ▲ ▲ ▲▲	Red flickering light

Legend:

.....	Continuously lit
▲	Red
o	Off
●	Yellow
□	Green

7.3 Burner relay malfunction indicator

After the appliance has frozen, the red error signalling lamp on the top of the box will remain lit continuously. In this situation, the visual diagnosis of the cause of the malfunction according to the error code table can be activated by holding down the reset button for 3 seconds. If the reset button is pressed once more for at least 3 seconds, the interface diagnosis is activated. Should the interface diagnosis be activated accidentally, in which case the faint red light of the signal lamp will flicker, this can be deactivated by pressing the reset button once more for at least 3 seconds. The changeover is indicated by a yellow pulsing light.

Error code table		
Red blink code of signal lamp (LED)	**«AL» at term. 10**	**Possible cause**
2 blinks ● ●	*On*	*No establishment of flame at the end of «**TSA**»* *- Faulty or soiled fuel valves* *- Faulty or soiled flame detector* *- Poor adjustment of burner, no fuel* *- Faulty ignition equipment*
4 blinks ● ● ● ●	*On*	*Extraneous light on burner startup*
7 blinks ● ● ● ● ● ● ●	*On*	*Too many losses of flame during operation (limitation of the number of repetitions)* *- Faulty or soiled fuel valves* *- Faulty or soiled flame detector* *- Poor adjustment of burner*
10 blinks ● ● ● ● ● ● ● ● ● ●	*Off*	*Wiring fault or internal fault, output contacts, other faults*

Legend:

AL	Alarm Device
TSA	Safety time for ignition

7.4 Malfunctions and potential solutions

Malfunction :	**The air heater does not start, even when started manually.**
Possible cause:	• The plug is not in the wall socket. • No mains voltage. • Faulty burner relay. • Master switch is switched off. • Maximum safety has been engaged.
Solutions: 	• Check the mains lead for breaks and/or insert the plug into the wall socket. • Check that there is a current using a voltmeter. If not, check the voltage circuit. • Replace the burner relay. • Reset the master switch. • Reset the maximum safety system.

Malfunction :	**The air heater does not respond to the heat demand of the thermostat and 24 VDC drive. Manual ventilation and heating do work however.**
Possible cause:	• No 24VDC drive. • Loose wiring. • Break in the system wiring. • 24VDC relay is loose or faulty. • Faulty thermostat. • Faulty burner relay.
Solutions: 	• Check the 24VDC drive. • Repair loose wiring. • Check the system and repair the break in the wiring. • Replace the 24VDC relay. • Replace the thermostat. • Replace the burner relay.

Malfunction :	**The air heater does nothing. It is however connected to the mains voltage and oil system.**
Possible cause:	• Maximum safety has been engaged. • It is possible that the capacitor is faulty. • It is possible that one or more electrical components are faulty.
Solutions: 	• When restarting the appliance, check that the fan continues to ventilate for 90 seconds afterwards. • Check that the fan is working. • If necessary, replace the fan or capacitor.

	• Remove any dirt from the grill in front of the fan. • Check that all electrical components are working correctly.

Malfunction :	**The air heater starts correctly, but does not ignite. Oil is however being released. The red error lamp lights up (Error code 2).**
Possible cause:	• The ignition set is faulty. • The ignition cable makes connection, is loose or is not connected properly. • The burner relay is faulty and does not allow the ignition. • Ignition transformer is faulty.
Solutions: 	• Replace the ignition set. • Lift the connection up or repair loose contacts. • Repair or replace the loose earth wire. • Replace the burner relay. • Replace ignition transformer.

Malfunction :	**After starting up, the fan starts, but stops within a minute. The red error lamp lights up (Error code 4).**
Possible cause:	• Extraneous light in burn chamber, photocell kicks in before ignition.
Solutions: 	• Check the air heater for dirt or blockages. • Check if direct or indirect light sources, illuminate the inside of the burner chamber. • Replace the photocell. • When the fault has been resolved, reset the appliance by pressing the reset button.

Malfunction:	**The air heater burns for a while and then cuts out. The red error lamp lights up (Error code 7 or 10).**
Possible cause:	• Burner relay is not functioning correctly. • The fan is not producing enough rotations. • The mains voltage is too low. • Oil pressure is set too low. • The oil filter is dirty and needs to be replaced. • One of the couplings or oil lines are broken or leaking. • Air in the oil system.
Solutions: 	• Replace the burner relay. • Check if the fan is properly secured to the engines axle. • Check whether the supply voltage is correct by measuring. Resolve the problem. Reset the appliance by pressing the reset button. • Check the oil pressure with a pressure gauge. • Replace the oil filter. • Check for signs of leaked oil within the main body of the heater and replace broken couplings or damaged oil lines. • Bleed the internal oil system. • Bleed the external oil system or oil boxes.

Appendices

Appendix I EC Declaration of Conformity

CE

We declare that the design and model of the machine described above being placed on the market by ourselves complies with the relevant health and safety requirements of the EC Directive.
The heater described in this manual meets the requirements of the following EEC directives:

• Machine Directive 89/392/EEC
• Low-voltage Directive 73/23/EEC

Appendix II Accessories

A range of accessories for use when setting up a heater installation or modifying an existing installation is available. The products include:

Oil line

- For connecting heaters to oil boxes or directly to an oil tank. Available in various diameters. Oil-resistant.

Oil box

- For use when connecting several heaters to a common oil tank. Complete with fittings, non-return valve and bleed valve.

Line clips

- For attaching oil lines to oil pump and oil boxes. Available in various sizes.

Room thermostat

- Ready-mounted on a panel with 7 meters of connecting cable.

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