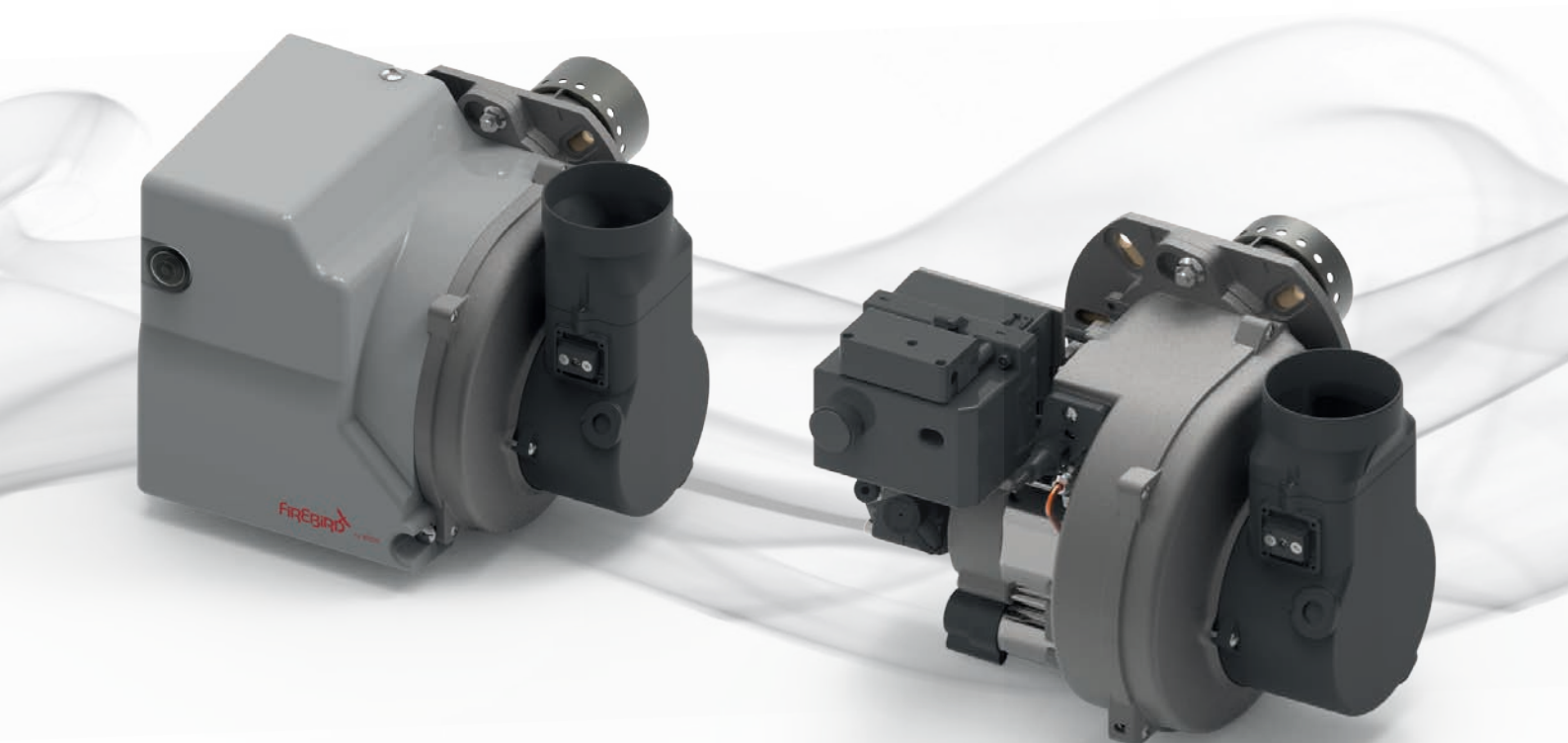


# FB 4 R LN

LOW NO<sub>x</sub>  
LIGHT OIL BURNER



## Instructions to Assembly, Commissioning and Maintenance

Before installing and using the burner, read this manual carefully  
and keep it close to the burner.

Dear Client,

We would like to thank you for having chosen a FIREBIRD product.

The model chosen by you is a high-performance product with an advanced technological conception, high reliability and excellent construction quality.

We advise you to entrust the running and maintenance of this appliance to know qualified professionals, and also to use only original spare parts when needed.

This manual contains important guidelines and suggestions which should be complied with in order to obtain a simple installation and the best possible use of the appliance.

## RANGE

This manual refers to the following products:

BURNER MODEL	FIREBIRD CODE	ELCO CODE
FB 4 R 20 LN	414949	3146467
FB 4 R 26 LN	414950	3146468
FB 4 R 35 LN	414951	3146469

## BURNER DESIGNATION

		<b>FB 4 R 20 LN</b>
<b>FB 4</b>	<b>Burner Series</b>	
<b>R</b>	<b>Light oil</b>	
<b>BOILER TYPE</b>		
<u>20</u>	<u>Boiler nominal power (max)</u>	
<b>EMISSION</b>		
<b>LN</b>	<b>Low NOx emissions (NOx &lt; 120 mg/kWh according to European Commission Regulation No 813/2013 and to pr EN267/2016 Class 4)</b>	

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# 1 SAFETY

## 1.1 Overview

These instructions for the installation, commissioning and maintenance of the burner are for use by technicians from professional heating companies that are qualified to carry out these activities. The instructions contain indications and information on how to move, handle, activate, adjust, maintain and remove the appliance and how to dispose of the components at the end of their useful life.

The instructions must be followed and all applicable legislation complied with in order to ensure safe working conditions.

This manual should be stored near the product and made available to all operators involved in its use.

## 1.2 Intended use

The burner is designed to act as a heat source for heating and DHW generation systems in which water is the heating fluid.

Any other or wider application is outside of the specified intended use.

To avoid risks, the burner should only be used:

- for its specifically intended use
- under the appropriate safety conditions
- following the instructions for installation, commissioning and maintenance
- in compliance with the max. and min. operating values
- in compliance with the required maintenance activities
- immediately repairing any malfunctions that could compromise safety
- maintaining all notes and notices applied to the product so that they remain legible over time

the burner cannot be installed outdoors, unless installed in a boiler specifically designed for that use. If installed outdoors, climatic conditions could cause direct damage to the burner due to the presence of water or frost or cause the components to overheat.

### 1.3 Symbols used

#### 1.3.1 Key to symbols used in the manual



**DANGER**  
Maximum danger. Indicates operations that cause serious injury, death or long-term health risks if performed incorrectly.



**DANGER**  
Indicates a dangerous situation that could cause serious injury, death or long-term health risks, caused by electricity, if handled without due care or incorrectly.



**WARNING**  
Indicates operations that could cause serious injury, death or long-term health risks if performed incorrectly.



**PRECAUTION**  
Indicates potentially dangerous situations and operations that could cause damage to the device or things and minor injury to persons, if handled without due care or performed incorrectly.



**CAUTION**  
Indicates operations that could cause damage to the device or nearby things.



**IMPORTANT INFORMATION**  
This symbol indicates important information that you must bear in mind.

#### 1.3.2 Other symbols



**DANGER FLAMMABLE MATERIAL**  
Indicates a dangerous situation that could cause serious injury, death or long-term health risks, caused by the presence of flammable substances near the equipment, if handled without due care or incorrectly.



**CAUTION**  
Indicates potentially dangerous situations, caused by the presence of surfaces at high temperatures that could cause minor injuries, or burns, if handled incorrectly.



**PERSONAL PROTECTION**  
Several symbols are used to remind operators of the need to use all the personal protective equipment required by applicable legislation during all installation, commissioning and maintenance operations.



**ENVIRONMENTAL PROTECTION**  
Reminds operators of the need to apply a suitable recycling procedure to replaced components.



**ENVIRONMENTAL PROTECTION**  
Reminds operators of the need to deliver the product or its components to a suitable separated waste collection centre at the end of its working life.

**1.4 Requirements for personnel or operators**



**CAUTION**

It may be hazardous to assign activities to personnel that are not sufficiently qualified. It may harm the operators themselves if they perform manoeuvres or operations incorrectly, with a serious impact on personal safety, things and property.



**CAUTION**

Installation, commissioning and maintenance activities must only be carried out by the personnel of dedicated heating companies specifically qualified to perform these tasks.



**CAUTION**

Operators should explain to the proprietor and person responsible for the domestic heating system the burner is installed on, the importance of ensuring good inflow of combustion air and combustion product evacuation. They should also highlight that no modification should be made to the heating system (comprised of air intake, burner, boiler and flue pipe) that could alter the correct operation of the system.

**1.5 Primary hazards**

The following indications refer to “residual risks”, which must be highlighted for the full understanding and responsibility of the proprietor, users and operators.

These risks derive from risk analyses carried out by Research and Development staff as required by European Standard EN 267 and applicable directives (Machine directive, LVD, EMC).



**DANGER**

**Danger of death!**

- Contact with live electrical components may cause serious incidents.
- Only professionally-trained and qualified personal can operate on the electrical system.
- Before any operation, switch off the power supply to the system by operating the main switch. Check there is no power and ensure restart is impossible.
- In the event of damage to the electrical insulation on the product, act immediately to restore the correct level of insulation.



**CAUTION**

**Hot surfaces - Risk of burns!**

- Contact with components at high temperatures may cause more or less serious superficial burns.
- Operators should wear suitable clothing and personal protective equipment.
- They should ensure that all components are at ambient temperature before carrying out any maintenance operations.



**FUEL LEAKS**

- Fuel leaks may cause fire to break out.
- They may be toxic via inhalation and cause skin irritation.
- Act swiftly to remove the cause of the leak. If it is connected to a maintenance operation, use the dedicated personal protective equipment.

## 2 GENERAL

### 2.1 Burner description

**FB 4 R LN** is a latest generation single-stage burner fuelled by light oil. The innovative combustion head ensures low NO<sub>x</sub> and CO emissions within the emission limits set out by European Regulations for energy related products (ErP).

The burner uses functional components that, in addition to ensuring a long working life, also allow for easy installation, adjustment and maintenance. The high-performance electrical components ensure low fuel consumption.

The ventilation system ensures a high level of efficiency, and thanks to a powerful transformer, cold starts don't cause problems. The operation of **FB 4 R LN** burners is reliable even in the event of persistent or intermittent wind, ignition takes place effectively and with smoke-developed index control.

The contained dimensions, low noise and ease of installation make it possible to apply the burner to boilers installed in domestic spaces.

### 2.2 Supply

The burner **FB 4 R LN** includes the following equipments:

- n°1 flange with fixing bolt
- n°1 gasket
- n°2 flexible oil pipes L=1000 mm
- n°2 nipple G 3/8 - 1/4 (for flexible oil pipe)
- n°4 nuts for flange to be fixed to boiler
- n°1 7-pin plug (mounted on the burner)
- n°1 hex key 4 mm
- gauge for checking the settings
- instruction manual



**2.3 Identification**

Check the identification label of the burner ("Fig. 1").



<b>elco</b>		Via Roma, 64 Resana (TV) ITALY	
<b>CE</b>		ErP 	
		414852 BRNxxxELN 3146166 SN0000 000001 SL005600012345 DH31/07/201 8 12.17.58	
(A)	3146467	414949 BRNxxxELN	31-18 (B)
(C)	FB 4 R 20 LN		(D)
	kW	20,6	(E)
	kg/h	1,72	
(F)	1N-230 V ~		50 Hz
(G)	IPxx	210 W (H)	
	FUEL		LIGHT OIL (I)
	Visc. @ 20 °C 1,6-6 mm <sup>2</sup> /s		
	WEIGHT		7,1 kg
	  		
(J)			
	0000000001		Made in Italy

<b>A</b>	Burner code	<b>F</b>	Electrical supply
<b>B</b>	Week and year of manufacture	<b>G</b>	Protection level
<b>C</b>	Burner model	<b>H</b>	Electrical consumption
<b>D</b>	Factory power setting	<b>I</b>	Types of fuel used
<b>E</b>	Burner power output	<b>J</b>	Serial number

Fig. 1



**CAUTION**

It is strictly forbidden to remove the identification label. Tampering, removal or absence of the data plate burner or anything that prevents the secure identification of the burner will create difficulties for any installation and maintenance work.

## 2.4 Structure

### 2.4.1 Structure of the burner

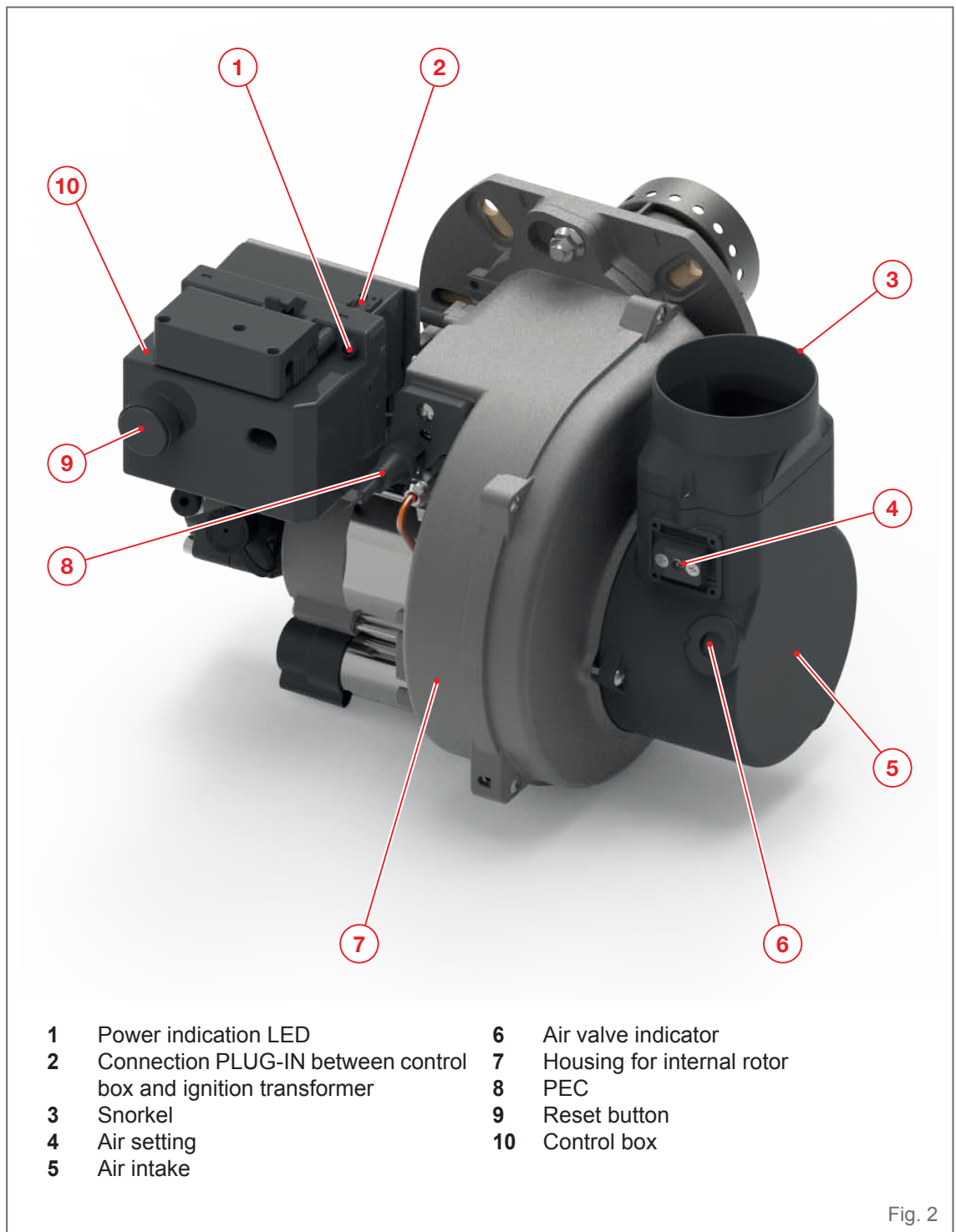
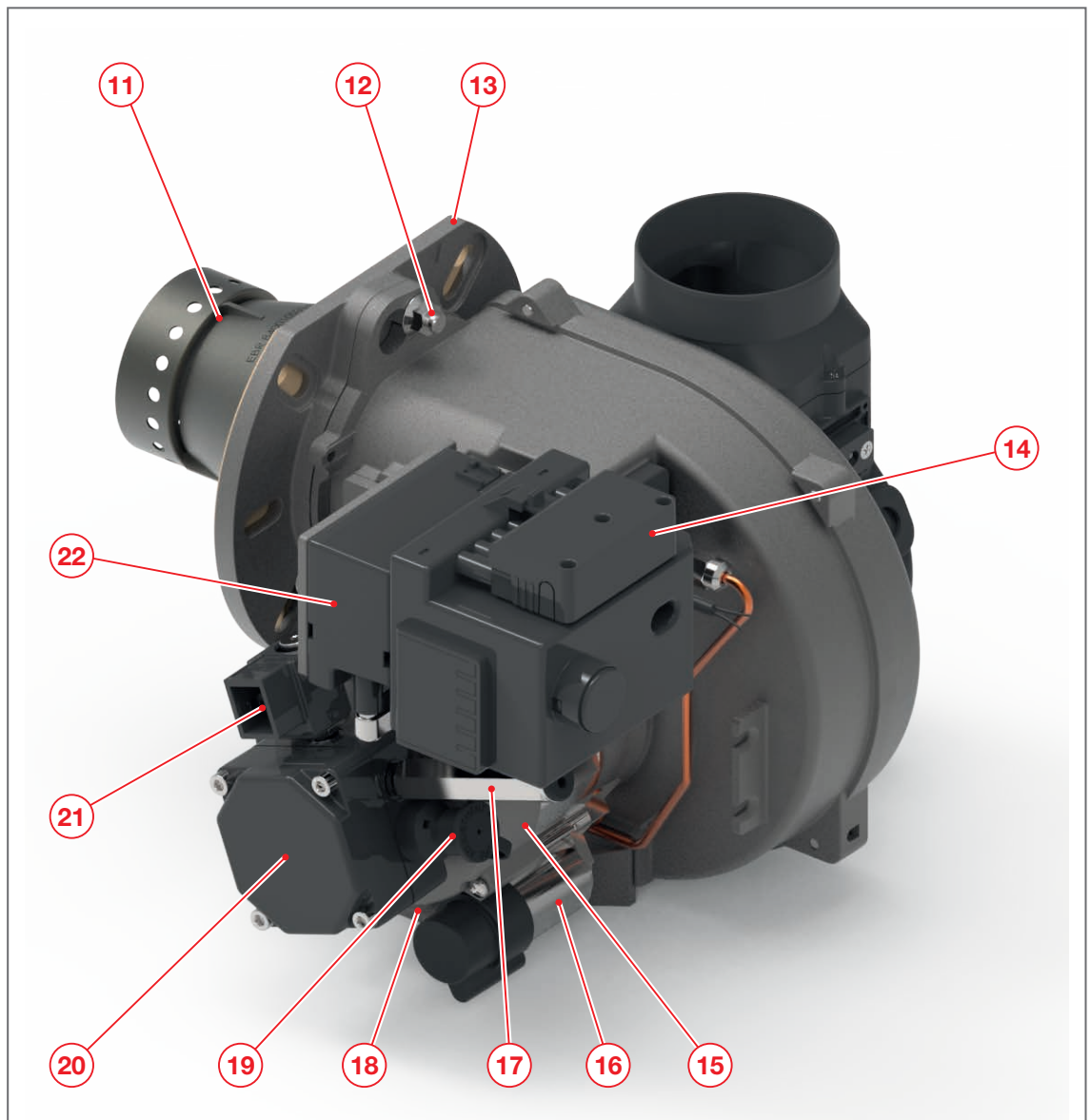


Fig. 2



- |    |                                 |    |                        |
|----|---------------------------------|----|------------------------|
| 11 | Combustion head                 | 17 | Extended pressure port |
| 12 | Burner fixing bolt              | 18 | Burner base            |
| 13 | Burner flange (supplied)        | 19 | Oil pressure regulator |
| 14 | 7 pin plug                      | 20 | Fuel-oil pump          |
| 15 | Electric motor for pump and fan | 21 | Solenoid valve         |
| 16 | Capacitor                       | 22 | Ignition transformer   |

Fig. 3

## 2.4.2 Structure of the combustion head

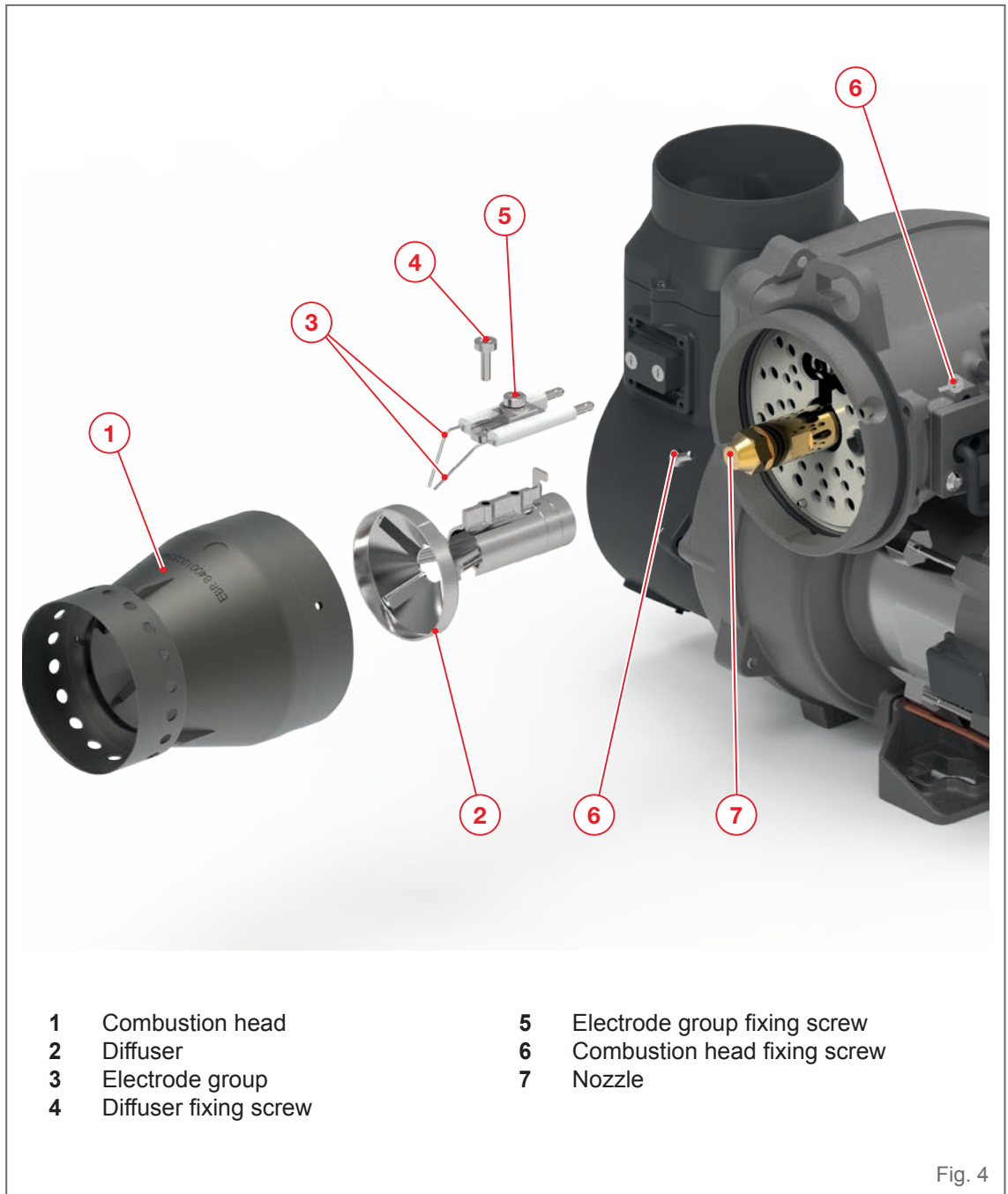


Fig. 4

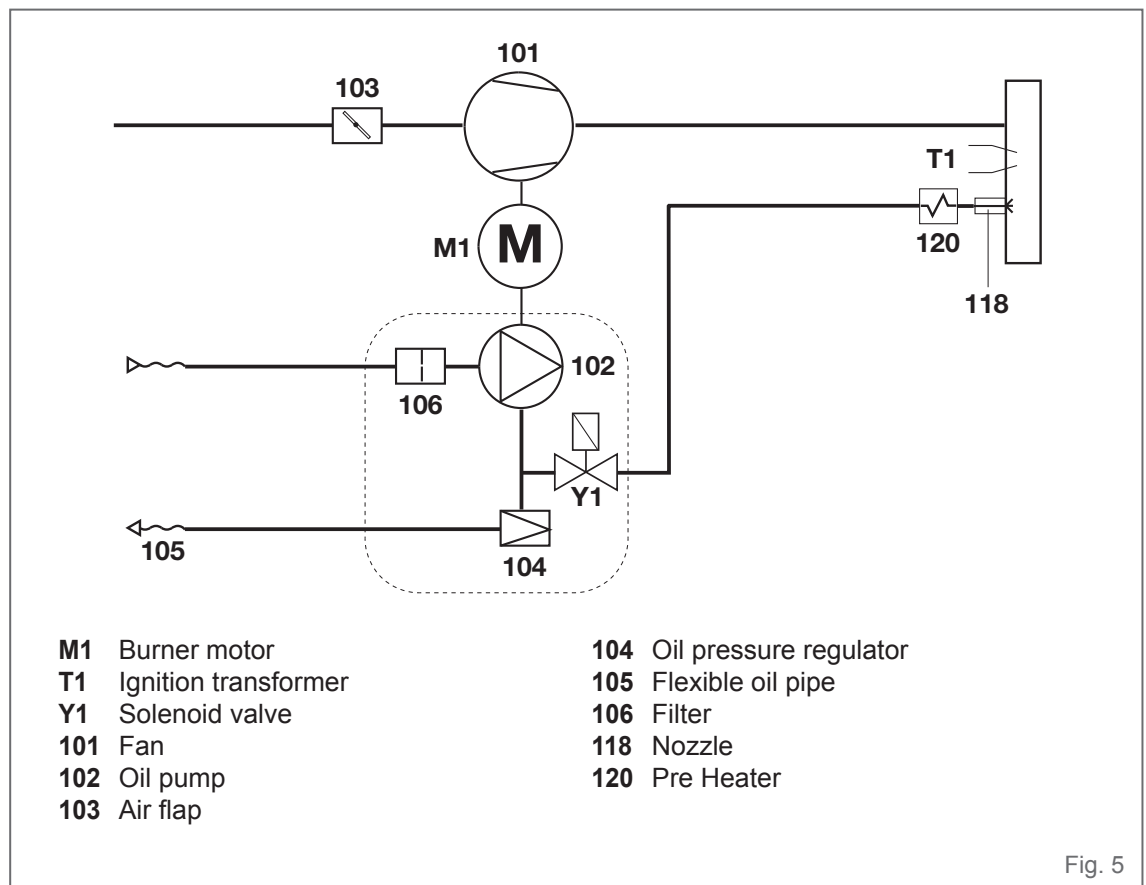
## 2.5 Control box

The EBR-M4 control box, controls and monitors the forced draught burner. The microprocessor-controlled program sequence ensures maximum stability of time periods, regardless of fluctuations in the power supply or ambient temperature.

The design of the control box protects it from the effects of flame outs. Whenever the supply voltage drops below its rated minimum level ( $170 \pm 8$  V), the control box shuts down - even in the absence of a fault signal.

The control box switches itself back on again once the voltage has exceeded the  $190 \pm 8$  V.

## 2.6 Operating logic (Two-pipe system)



### 2.6.1 Operating function

- If heat is requested by the heating controls, the control box starts the program sequence.
- The motor starts, the ignition transformer is switched on and the preventilation period of 15 s commences.
- The pre heater heats the oil in the oil line.
- During the preventilation period, the furnace is monitored for flame signals.
- At the end of the preventilation period, the fuel-oil solenoid valve opens and the burner starts.
- The ignition transformer remains switched off while the burner is in operation.

**2.6.2 Controlled shutdown**

- Boiler temperature control interrupts heat request.
- The fuel-oil solenoid valve closes and the flame is extinguished.
- The post-ventilation starts: time factory-set at 15 s. After the burner motor switches off.
- Burner enters standby.

**2.6.3 Safety function**

A safety shutdown occurs:

- if a flame signal is present during preventilation (flame monitoring)
- if no flame is produced within 5 seconds (safety time) of start-up (fuel authorisation)
- if no flame is produced after an unsuccessful restart attempt in the event of 5 flame failures during operation.

A safety shutdown is indicated by the malfunction lamp lighting up and it is then only possible to reset the burner by pressing the reset button after the cause of the malfunction has been rectified. For further information, see the automatic combustion control unit description.

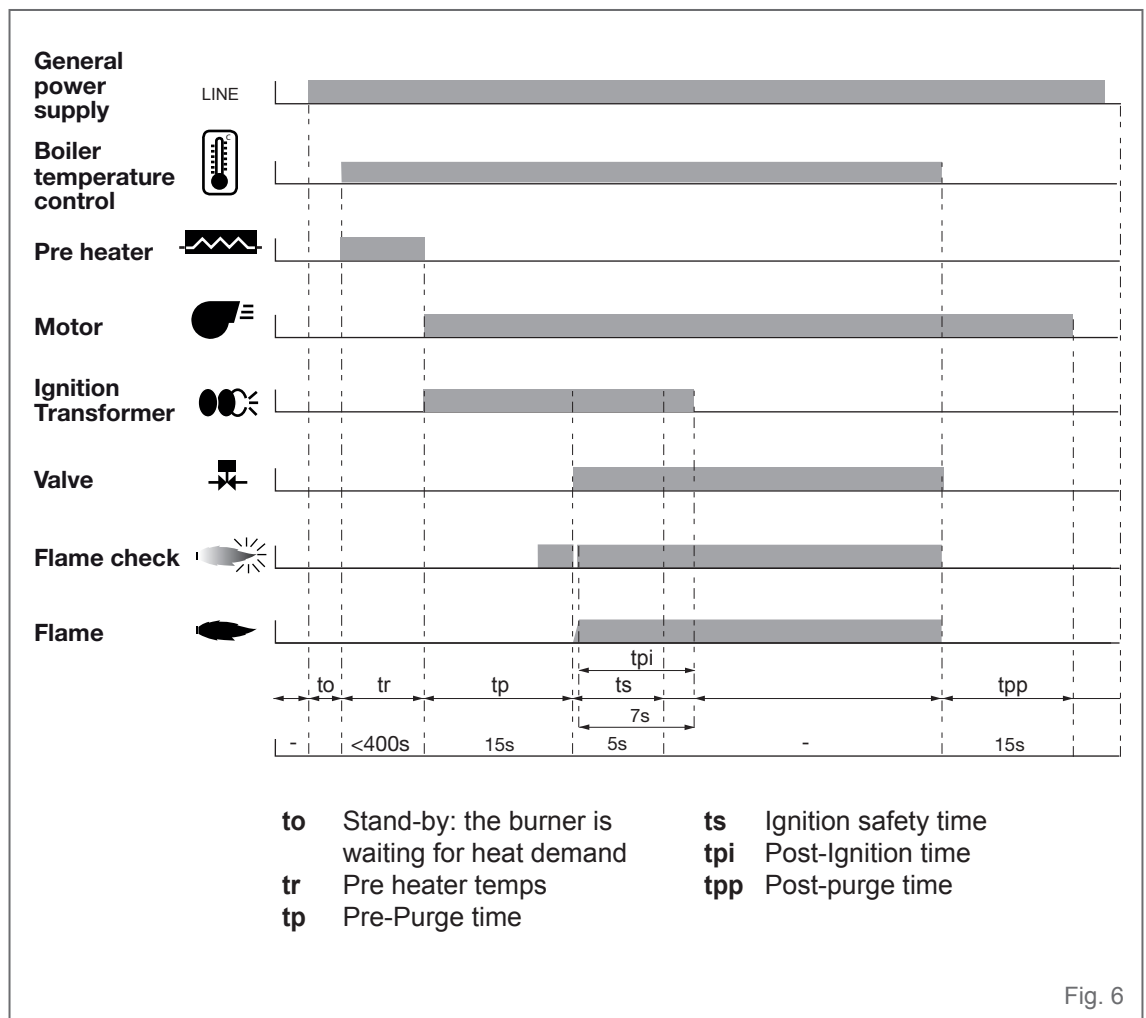


Fig. 6

**3 TECHNICAL DATA**

**3.1 Dimensions and weights**

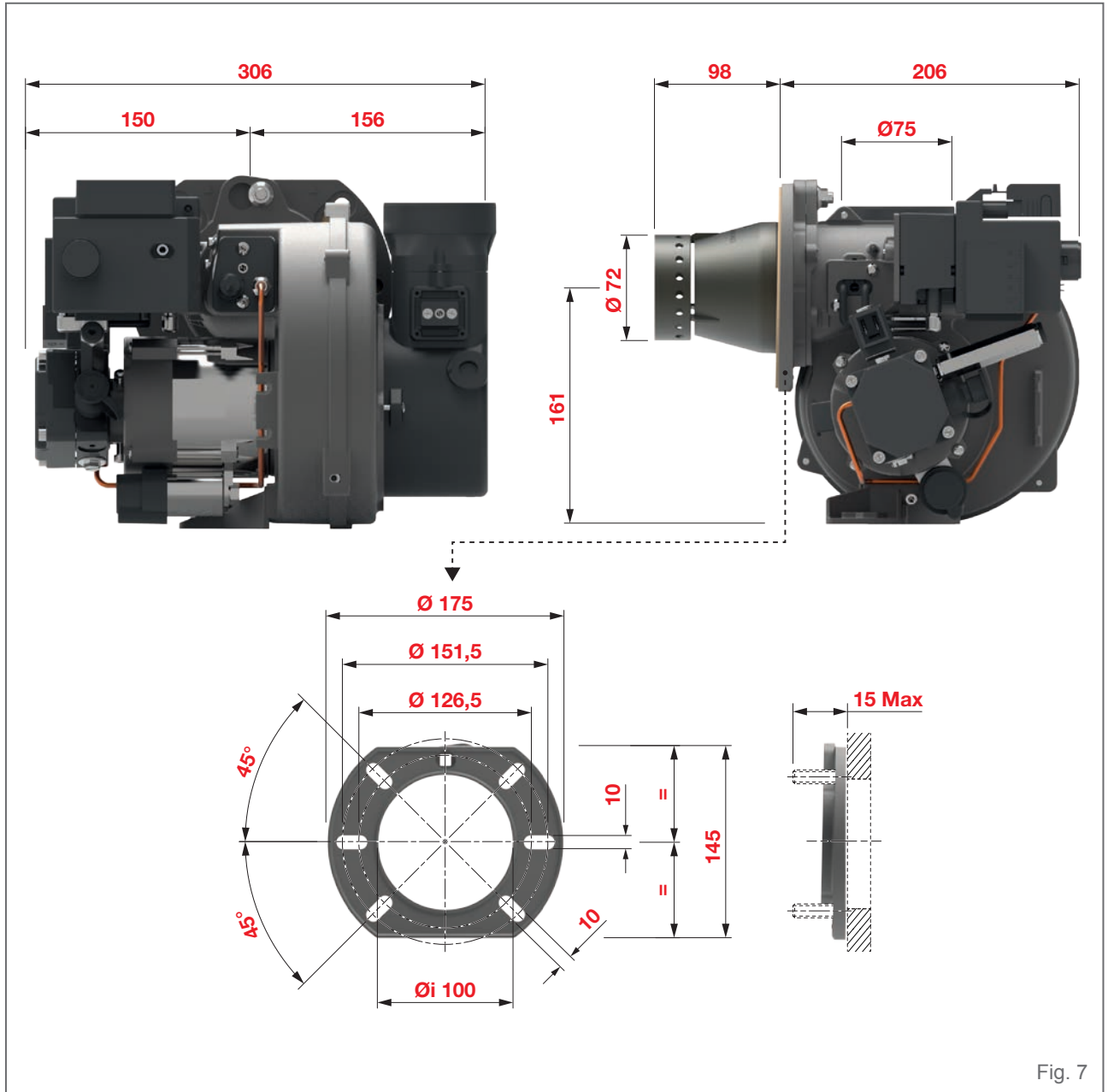


Fig. 7

Model	Weight (kg)	
	net	with packaging
FB 4 R 20 LN	7,1	9,5
FB 4 R 26 LN	7,1	9,5
FB 4 R 35 LN	7,1	9,5

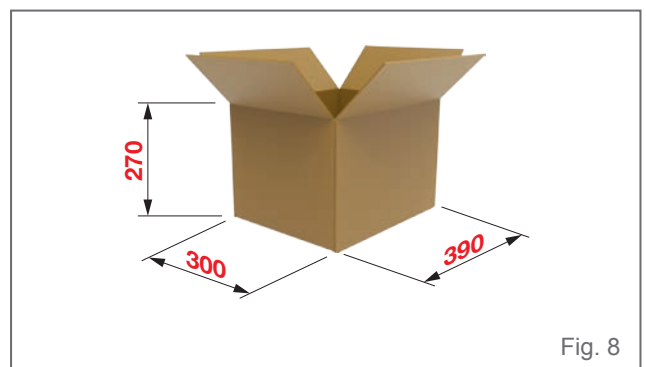


Fig. 8

All measurements are given in millimetres.

### 3.2 Technical data

	FB 4 R 20 LN	FB 4 R 26 LN	FB 4 R 35 LN
Burner output factory setting <sup>(1)</sup>	20,6 kW	26,8 kW	36 kW
	17.716 kcal/h	23.048 kcal/h	30.960 kcal/h
Oil throughput factory setting <sup>(1)</sup>	1,72 kg/h	2,23 kg/h	3,0 kg/h
Fuel oil <sup>(2)</sup>	Light oil, visc 1,6-6 mm <sup>2</sup> /s at (Hi=11,97 kWh/kg)		
NOx emissions	< 120 mg/kWh (according to European Commission Regulation No 813/2013 and to pr EN267/2016 Class 4)		
Control box	EBR - M4 R 15-15		
Flame sensor	Photoelectric controller (PEC)		
Ignition transformer	Fida 2P 26 kV pp-35 mA rms		
Fuel-oil pump	Danfoss BFP special		
Pump coil	BFP T85		
Electric motor	EBR 90 W, 2800 rpm		
	90 watt		
Capacitor	Inco 4 μF , TEKNO 45T (T = top series)		
Electrical supply	1 / 230 / 50 Ph / V / Hz		
Power consumption (operation) (+/- 10W)	210 W	210 W	200 W
Protection level	IP20 (burner without cover) IP40 (burner with cover)		
Sound pressure level	65 dB(A)		
Ambient temperature for storage	-20°C ... +70°C		
Temperature for use	-10°C ... +60°C		

<sup>(1)</sup> Reference conditions: Ambient temperature 20 °C – Barometric pressure 1013 mbar – Altitude 0 m. a.s.l.



WARNING

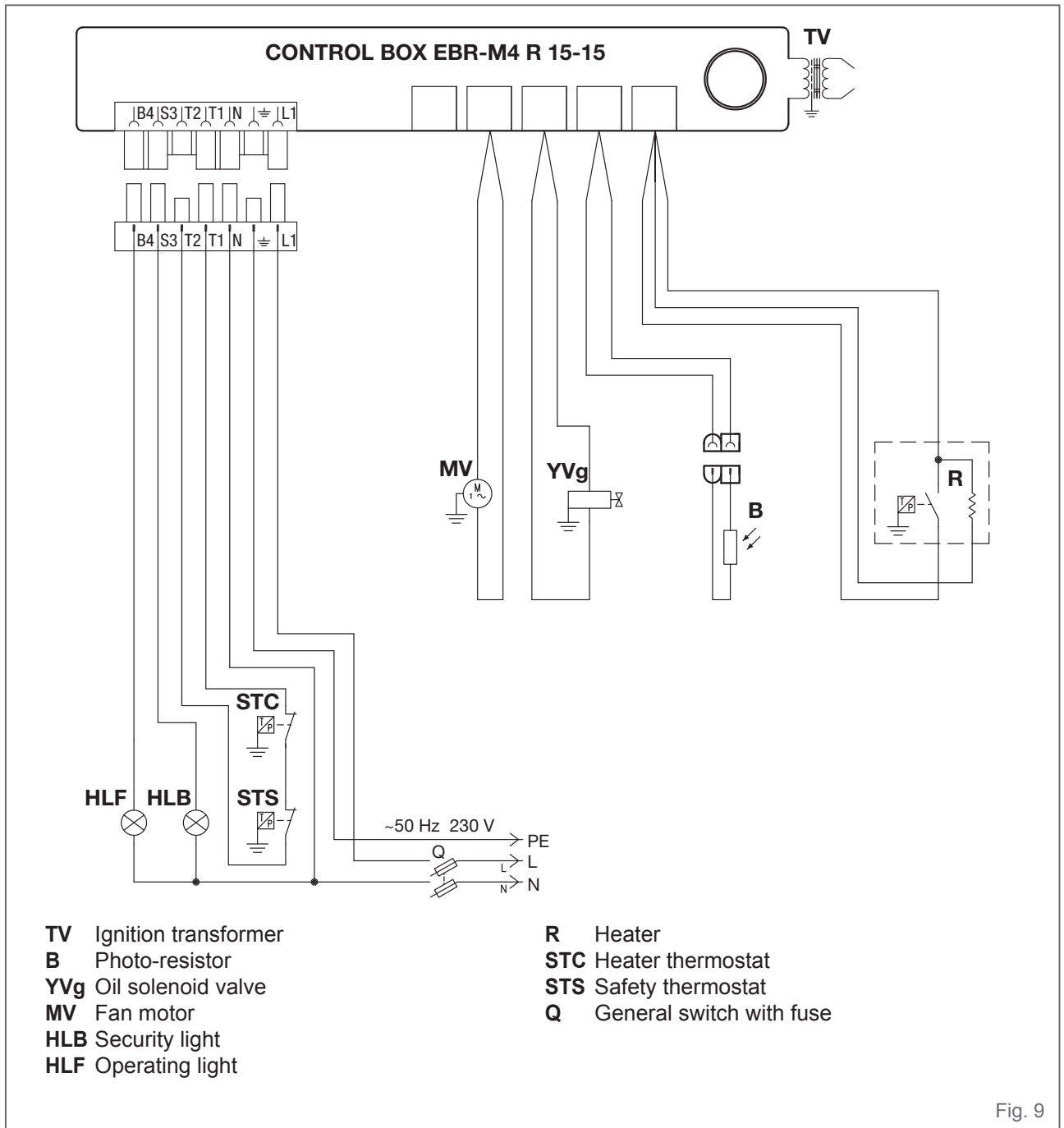
#### WARNING

<sup>(2)</sup> The burner is suitable for light oil with bio content up to 10%. It is a minimum requirement that the fuel blend (up to 10% Bio) is obtained with light oil in accordance with the relevant standards and regional regulations.

In case of Bio oil content higher than 10% please contact the manufacturer.



**3.3 Electrical diagram**



## 4 INSTALLATION

### 4.1 Safety during assembly

**DANGER****Danger of death!**

- Contact with live electrical components may cause serious incidents.
- Only professionally-trained and qualified personal can operate on the electrical system.
- Before any operation, switch off the power supply to the system by operating the main switch. Check there is no power and ensure restart is impossible.
- In the event of damage to the electrical insulation on the product, act immediately to restore the correct level of insulation.



WARNING

**WARNING****Danger of death due to contact with fuel oil!**

- Risk of lung damage caused by inhalation or ingestion of fuel oil; take the following precautions:
- observe the instructions on the safety data sheets for the fuel oil and any additives (available from the associated suppliers)
  - in the event of the formation of an oil mist, use a protective mask with filter for organic vapours and particulate filter
  - do not eat, drink or smoke when working on the heating system.



WARNING

**WARNING****Danger of injury due to contact with fuel oil!**

- Repeated and prolonged skin exposure to fuel oil can damage and irritate the skin; take the following precautions:
- as far as possible, avoid contact with the skin
  - use personal protective equipment, such as a protective gloves and suitable clothing
  - do not put rags soaked with oil in your pockets
  - change clothes stained with oil as soon as possible.



CAUTION

**CAUTION**

It may be hazardous to assign activities to personnel that are not sufficiently qualified. It may harm the operators themselves if they perform manoeuvres or operations incorrectly, with a serious impact on personal safety, things and property.



CAUTION

**CAUTION**

Installation, commissioning and maintenance activities must only be carried out by the personnel of dedicated heating companies specifically qualified to perform these tasks.



CAUTION

**CAUTION**

Operators should explain to the proprietor and person responsible for the domestic heating system the burner is installed on, the importance of ensuring good inflow of combustion air and combustion product evacuation. They should also highlight that no modification should be made to the heating system (comprised of air intake, burner, boiler and flue pipe) that could alter the correct operation of the system.

## 4.2 Installation area

Before installation, make sure that the installation area satisfies the following requirements:

- operating temperature between +5°C and +45°C
- dry, frost resistant, well-ventilated
- no accumulation of heavy powders
- no high levels of humidity
- no atmospheric pollutants created by halogenated hydrocarbons (contained in solvents, adhesives, aerosols, etc.)
- no atmospheric pollutants created by sulphurous gases
- no vibration.



### **WARNING**

#### **Danger of death caused by fire!**

Highly flammable materials or liquids can catch fire

- do not use or store explosive or highly flammable substances (such as petrol, paint, paper, wood, etc.) in the installation area of the appliance
- do not dry clothing within the boiler installation area
- do not use the equipment in an explosive atmosphere.



### **CAUTION**

Flammable materials or liquids should not be stored or used near the burner.



### **IMPORTANT INFORMATION**

Failure to observe these instructions will invalidate the warranty with respect to any damages caused by any of these causes.

### 4.2.1 Flue gas system

Before installation, check the design suitability of the combustion flue system with respect to the type of boiler to be installed and with respect to the applicable standards and regulations.



### **CAUTION**

Operators should explain to the proprietor and person responsible for the domestic heating system the burner is installed on, the importance of ensuring good inflow of combustion air and combustion product evacuation. They should also highlight that no modification should be made to the heating system (comprised of air intake, burner, boiler and flue pipe) that could alter the correct operation of the system.

## 4.3 Assembly tools

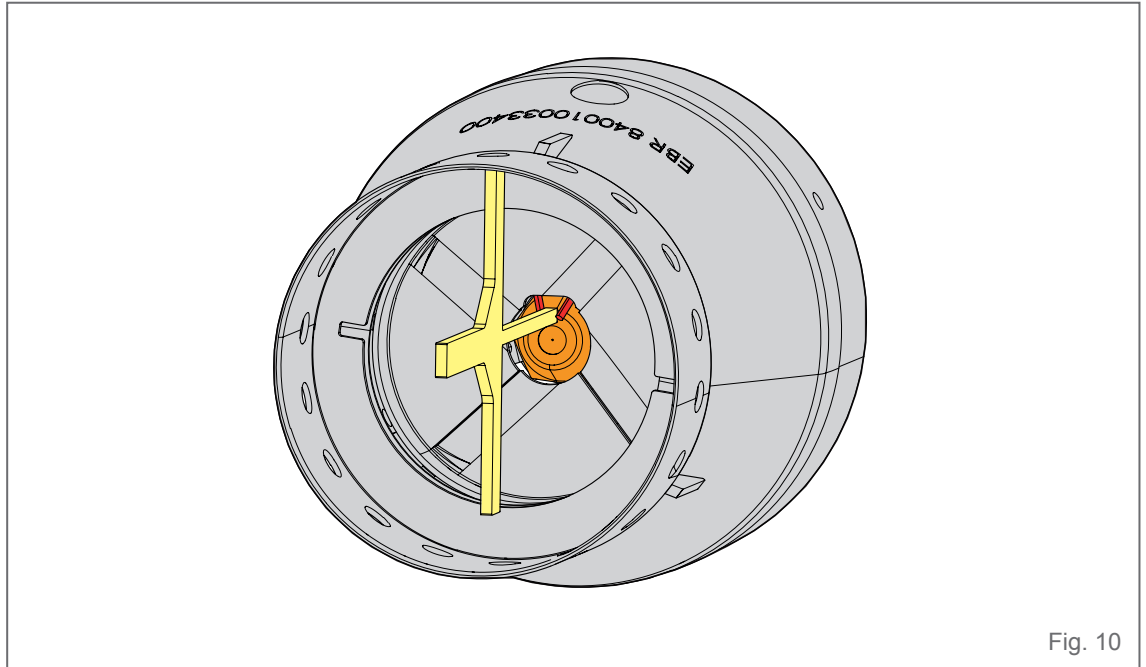
The most common and frequent operations on the burner are carried out simply using only the hex key supplied. This key can be used to:

- remove the burner cover (if it present)
- remove the diffuser
- adjust the electrodes group
- adjust the fuel pressure
- adjust the air setting
- operate on the pump.

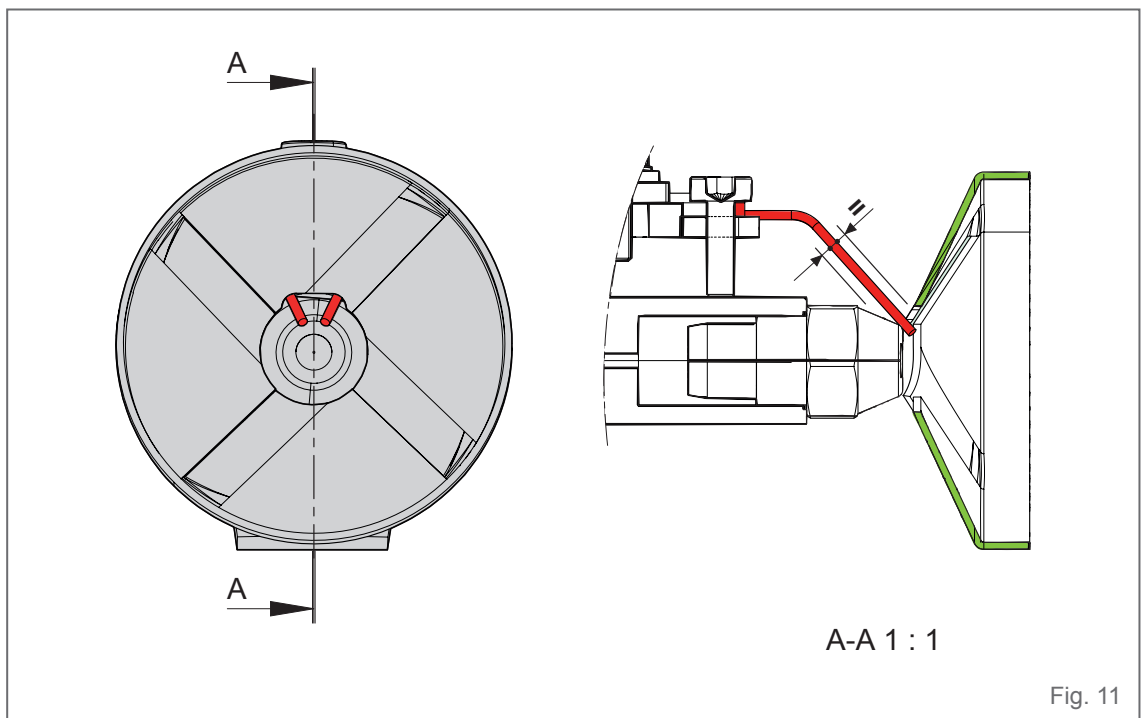
#### 4.4 Preliminary checks before mounting the burner

Before mounting the burner onto the boiler:

- check the distance between tips of electrodes (2 mm)



- Check the position of the electrodes assuring that they are centered as shown in "Fig. 11".



**4.5 Burner assembly**



**CAUTION**

Install the burner on the boiler according to the installation position shown in “Fig. 12”. Installation 2,3 and 4 are forbidden for safety reason.



Fig. 12

The burner is secured to the boiler using the connection flange supplied with the burner. Follow the instructions below:

- couple the gasket (2) supplied with the connection flange (1).

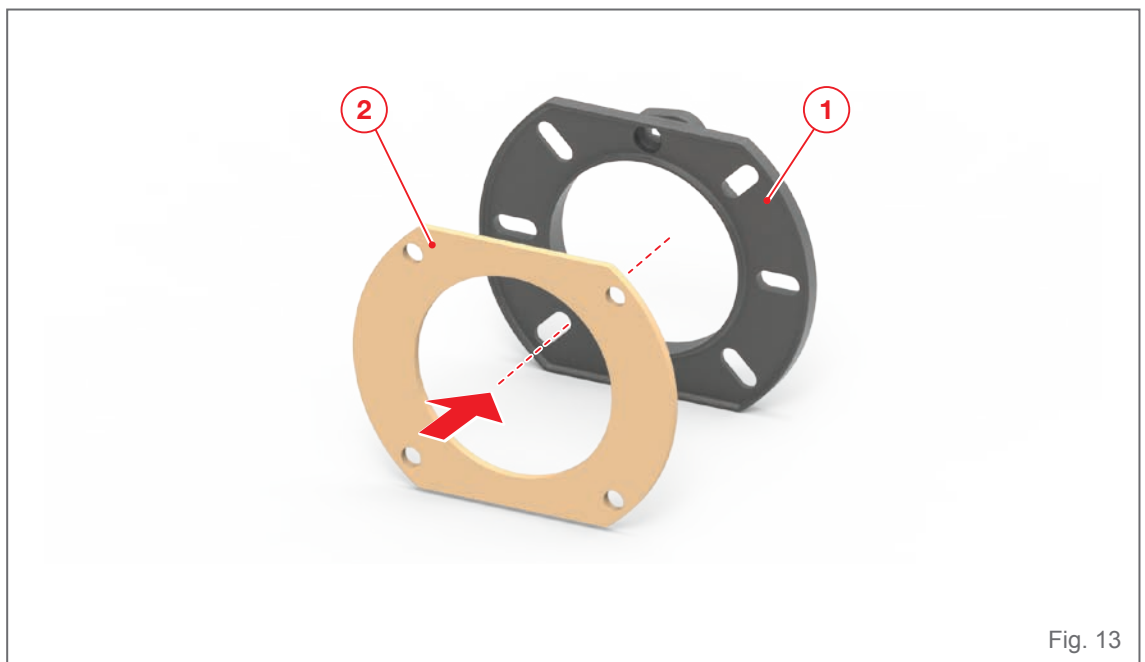


Fig. 13

- position the flange (2), with the screw (1) facing upwards, onto the boiler and secure it with the nuts (5) supplied
- **tighten the nuts (5) of the flange evenly and diagonally with a tightening torque of 3,5 Nm max.**
- insert the burner combustion head (6) with care inside the flange

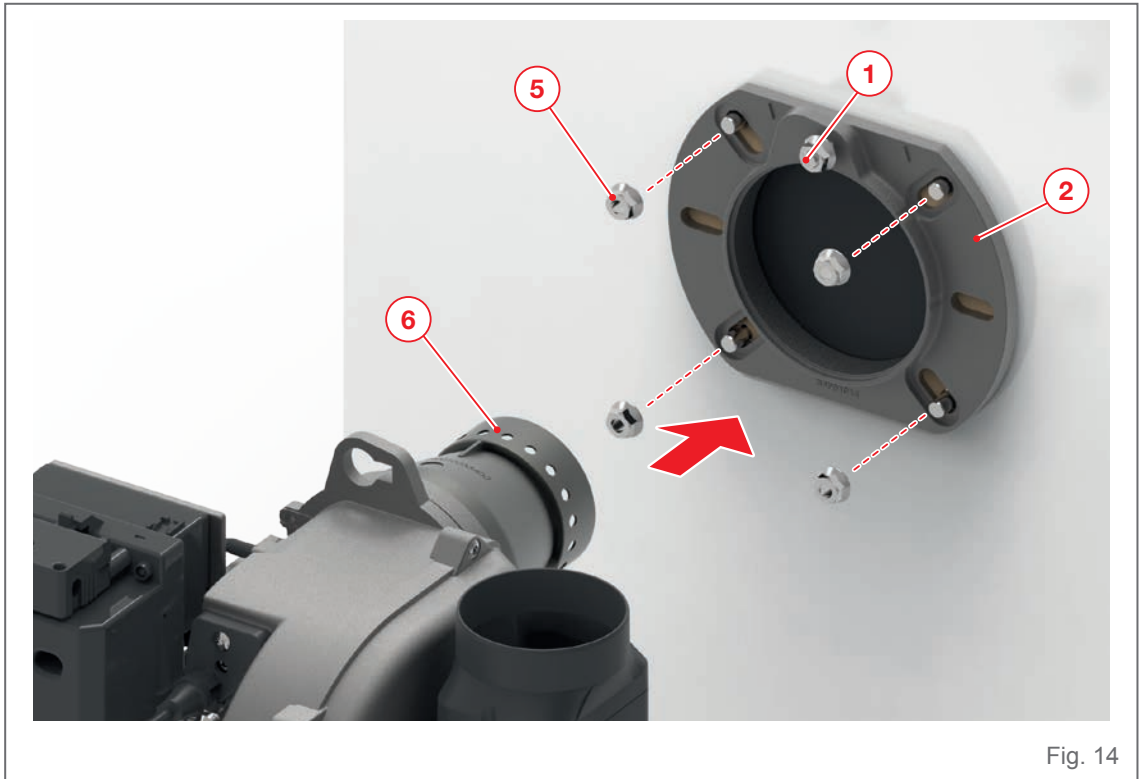


Fig. 14

- rotate the burner first to the right and then to the left to insert the fastening screw (1) into the housing (7) on the burner
- fully tighten the nut (3) and at the same time press the burner in the lower part towards the boiler to ensure maximum seal between the burner itself and the boiler

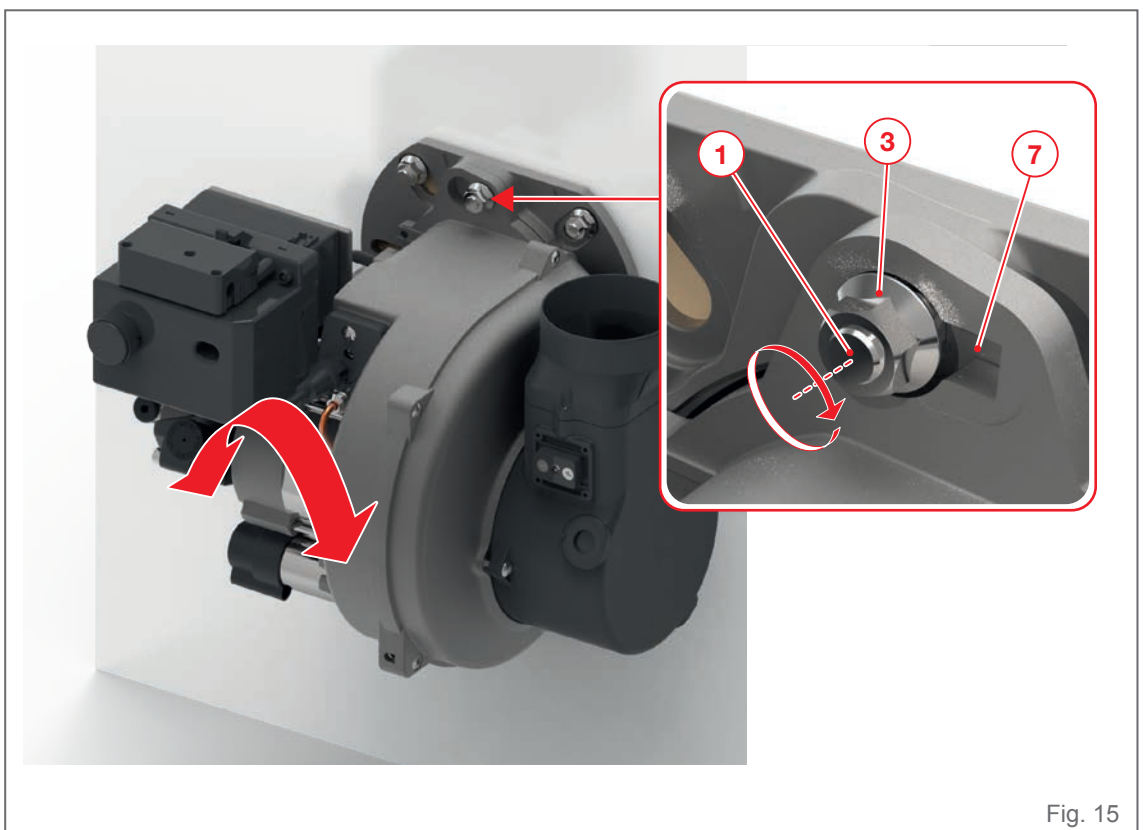


Fig. 15

- insert the air intake pipe (8) and secure it using a pipe clamp (9), not supplied

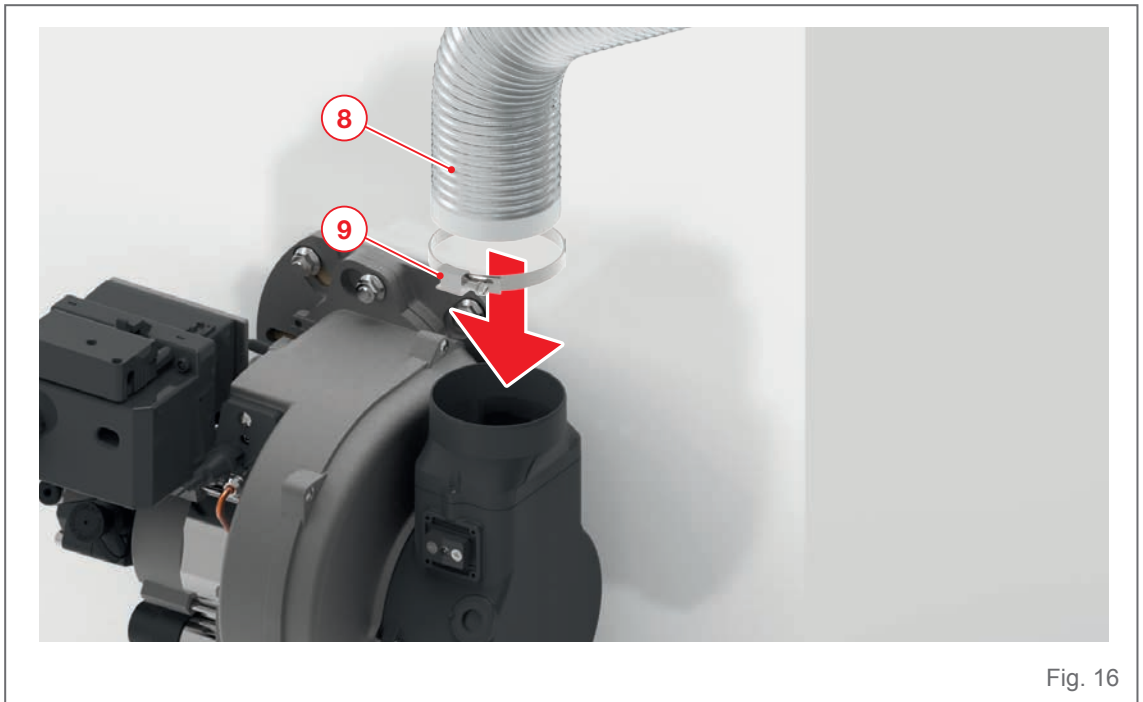


Fig. 16

## 4.6 Oil systems



CAUTION

### FUEL LEAKS

- Fuel leaks may cause fire to break out.
- They may be toxic via inhalation and cause skin irritation.
- Act swiftly to remove the cause of the leak. If it is connected to a maintenance operation, use the dedicated personal protective equipment.



WARNING

### WARNING

#### Danger of injury from gas in the atmosphere!

To prevent the formation of gas caused by worst combustion/deflagration:

- when filling the tank, switch off the burner and leave it switched off for approximately 3 hours to ensure degassing of the fuel and the deposit of suspended particles
- have any damage to the oil pipes repaired immediately by a specialised technician
- never operate the burner with the oil tank empty.



### IMPORTANT INFORMATION

Corresponding legislation pertaining to water resources and the installation of fuel pipes must be observed.



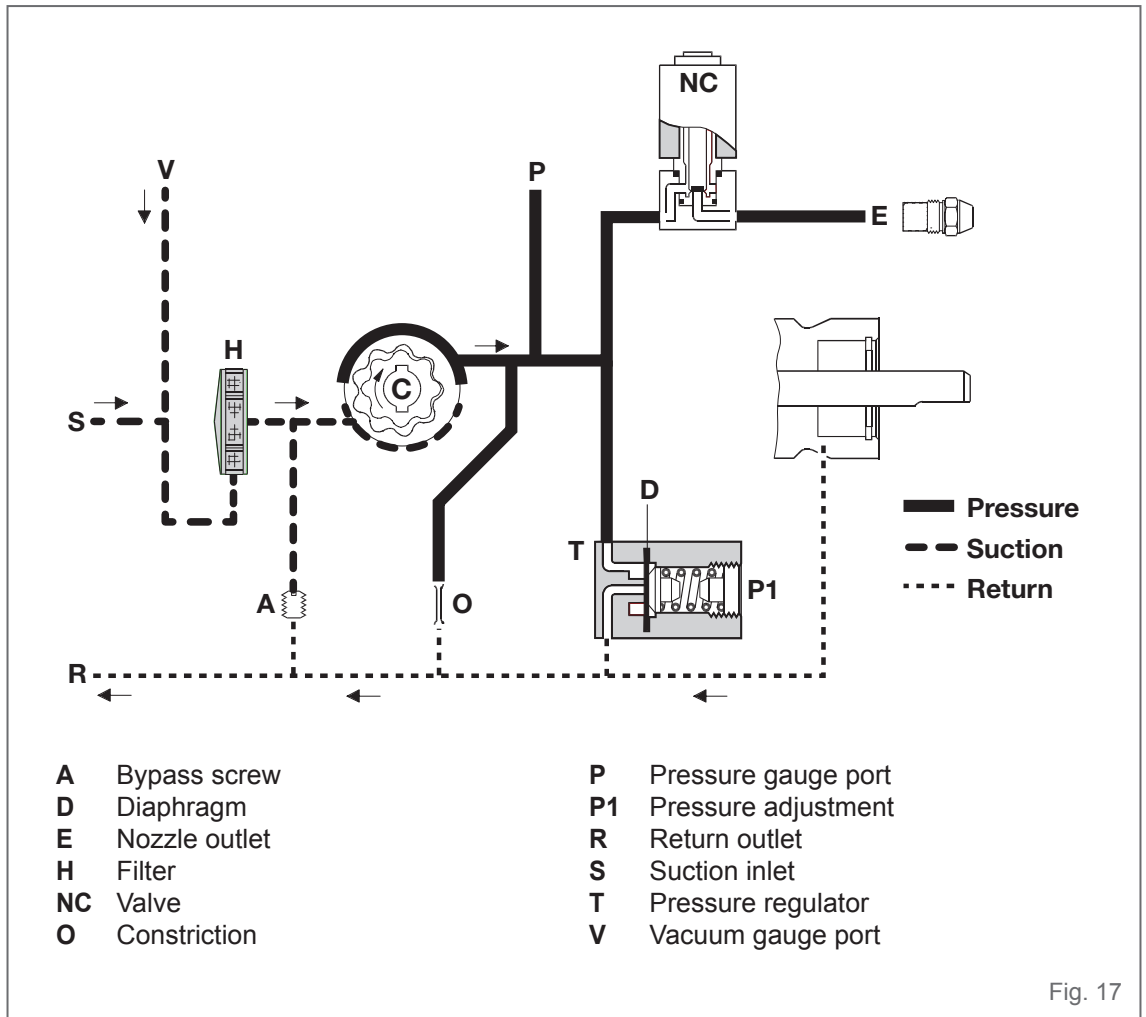
### IMPORTANT INFORMATION

Leaks in the fuel supply system can cause combustion problems and malfunctions in the burner.

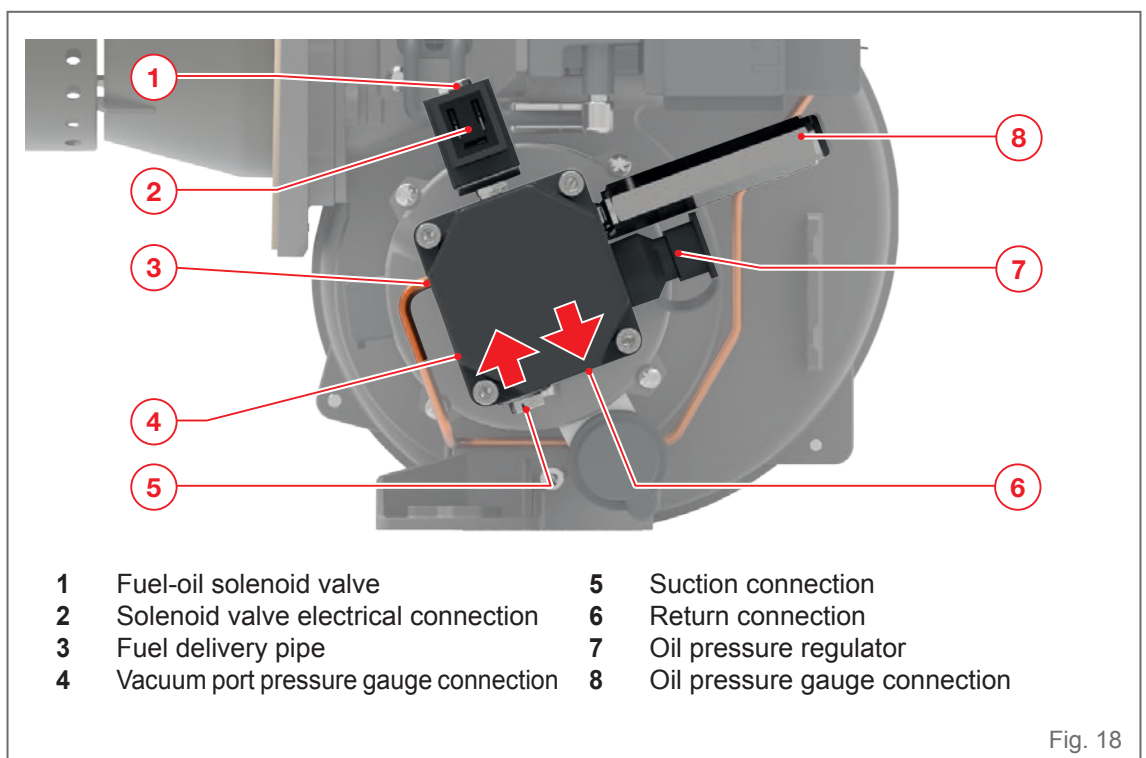
The fuel tank, including the installation of the pipes, must be carried out in such a way as to ensure that the temperature of the oil going into the burner is at least + 5°C.

When the burner is replaced, also replace the fuel filter.

4.6.1 Hydraulic diagram



4.6.2 Oil pump





• **Two-pipe system (standard)**

The pump is supplied for operation with two pipes.

To apply the fuel delivery pipe, proceed as follows:

- remove the plastic cap (9) and screw in the delivery pipe (10) supplied with the burner.

To apply the fuel return pipe, proceed as follows:

- remove the cap (11) from the connection and screw in the additional return pipe (12), supplied with the burner.

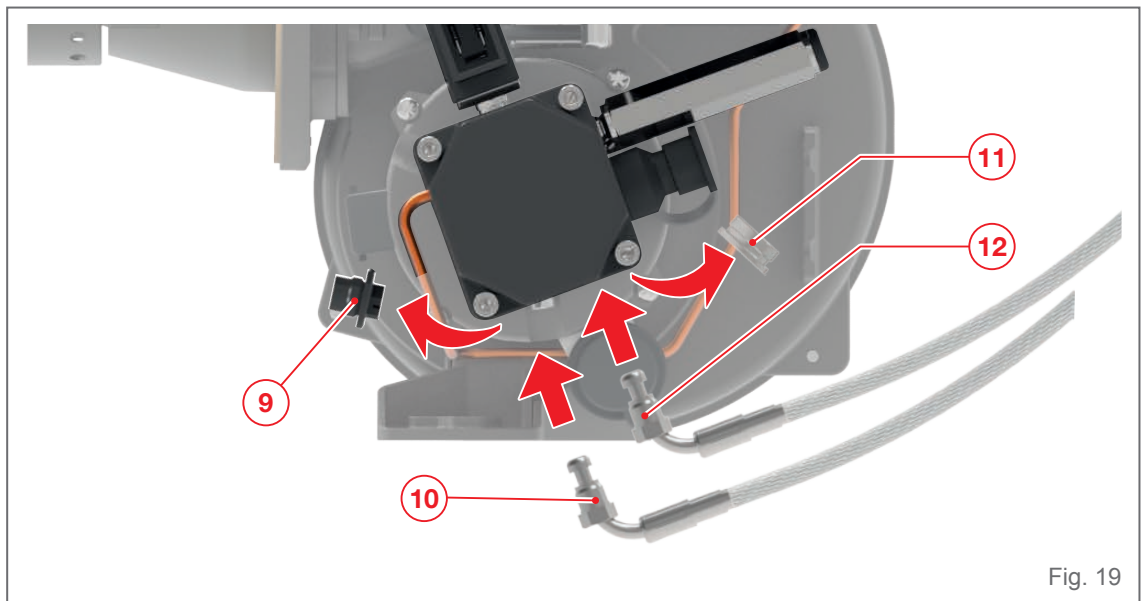


Fig. 19



**IMPORTANT INFORMATION**

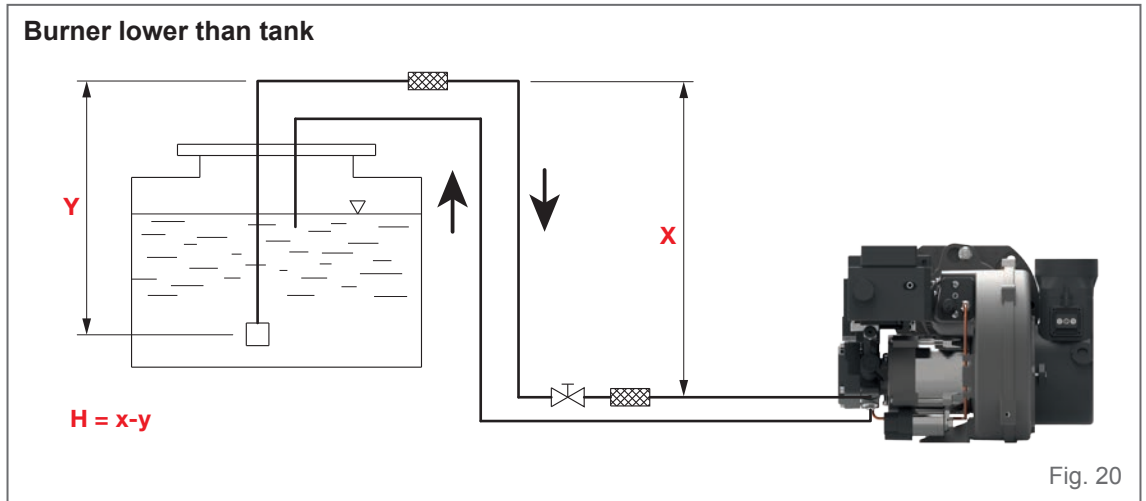
There is an intake filter and an oil pressure regulator integrated in the pump. Pressure gauges for negative pressure (vacuum) measurement must be connected before the equipment is commissioned.



**CAUTION**

Before starting the burner, check that the return pipe is open. An eventual obstruction could damage the pump sealing device.

4.6.3 Oil feed and suction line with two-pipe system



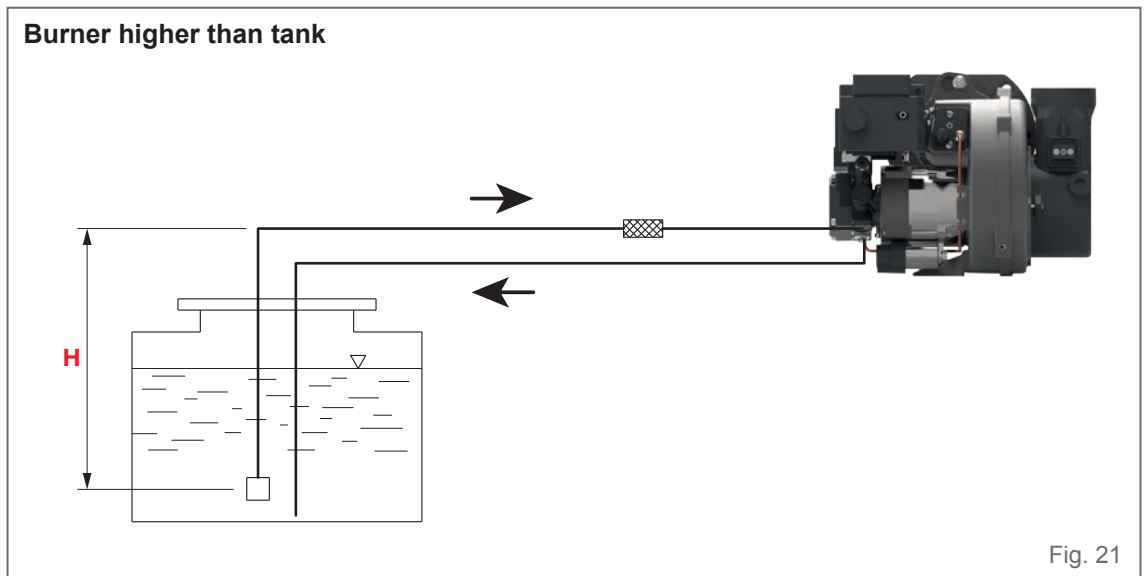
H (m)	Pipe length (m)		
	Ø6 mm	Ø8 mm	Ø10 mm
0,5	19	60	100
1	21	66	100
1,5	23	72	100
2	25	79	100

H (m)	Pipe length (m)		
	Ø6 mm	Ø8 mm	Ø10 mm
2,5	27	85	100
3	29	91	100
3,5	31	98	100
-	-	-	-



**CAUTION**

- X < 20 m
- Y must be kept as lower as possible in order to avoid cavitation. Anyway Y < 4 m.



H (m)	Pipe length (m)		
	Ø6 mm	Ø8 mm	Ø10 mm
0,5	15	47	100
1	13	41	99
1,5	11	34	84
2	9	28	68

H (m)	Pipe length (m)		
	Ø6 mm	Ø8 mm	Ø10 mm
2,5	7	22	53
3	5	15	37
3,5	-	9	22
-	-	-	-

**4.7 Electrical connection**



**DANGER**

**Danger of death caused by live components!**

Contact with live parts can lead to serious injury, take the following precautions:

- ensure that the power is switched off for all electrical parts
- electrical wiring installation must be carried out by qualified personnel and in compliance with the regulations currently in force in the country of destination. Refer to the wiring diagrams.



**CAUTION**

- The electrical installation should include a minimum of a type A MCB.
- Check to ensure that the power supply voltage is as specified in the electric diagram and in data plate.
- Burner fuse: 3 Amps.



**WARNING**

- Use flexible cables in compliance with the EN 60 335-1 standard. Assure a correct earth connection.
- The wiring section must be minimum 1 mm<sup>2</sup> (in any case verify with the standard and local rules).
- This control flame is equipped with the post ventilation function. Other versions of the burner are not to be fitted.
- Check operation of boiler thermostatic control.
- Check operation of Photocell by withdrawing from burner and then covering to simulate flame out condition.

**4.7.1 Electrical connection to the boiler**

Burner **FB 4 R LN** leaves the factory configured for connection to a 7 pin electrical cable. A 7 pins plug is also supplied and factory mounted.

Proceed as follows to connect the burner to the boiler:

- connect the cable coming from the boiler to the 7 pins plug (1) (supplied).

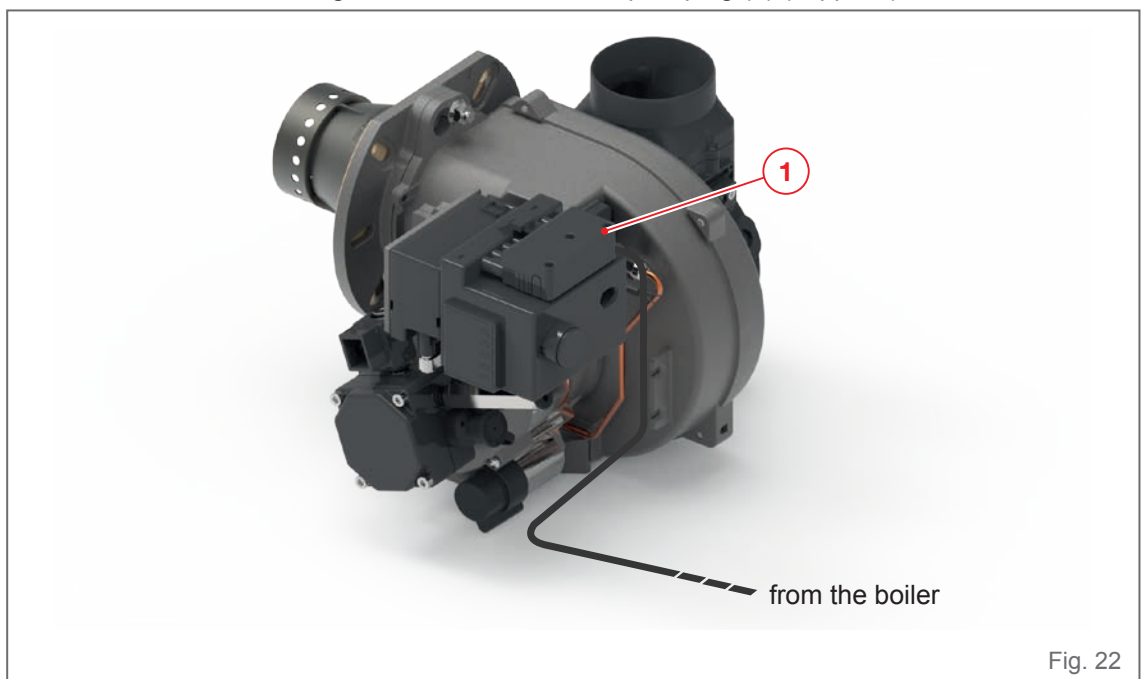


Fig. 22

## 4.8 Removing the burner

**DANGER****Danger of death caused by live components!**

Before carrying out any operations on the burner, operate the main power switch for the system to cut off the power supply.

If it becomes necessary to remove the burner, proceed as follows:

- close the fuel taps upstream of the burner
- detach the 7 pins plug (1) from the burner

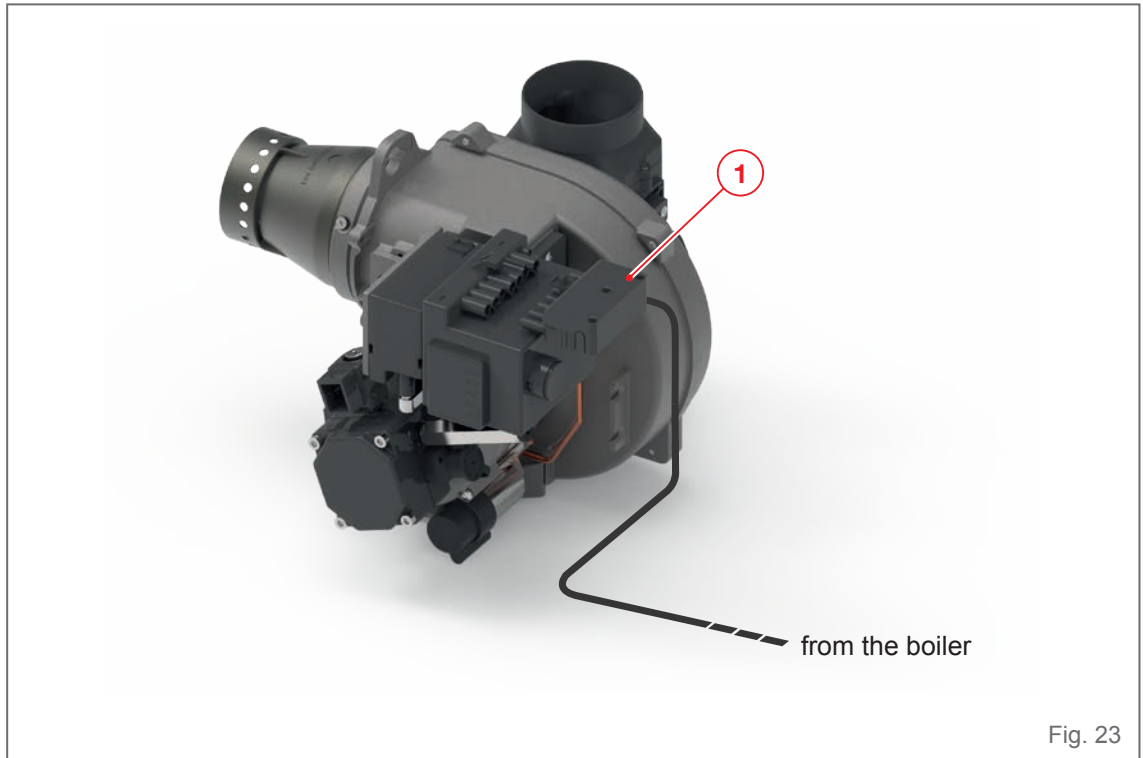


Fig. 23

- remove the fuel delivery pipe (2) and the return pipe (3)

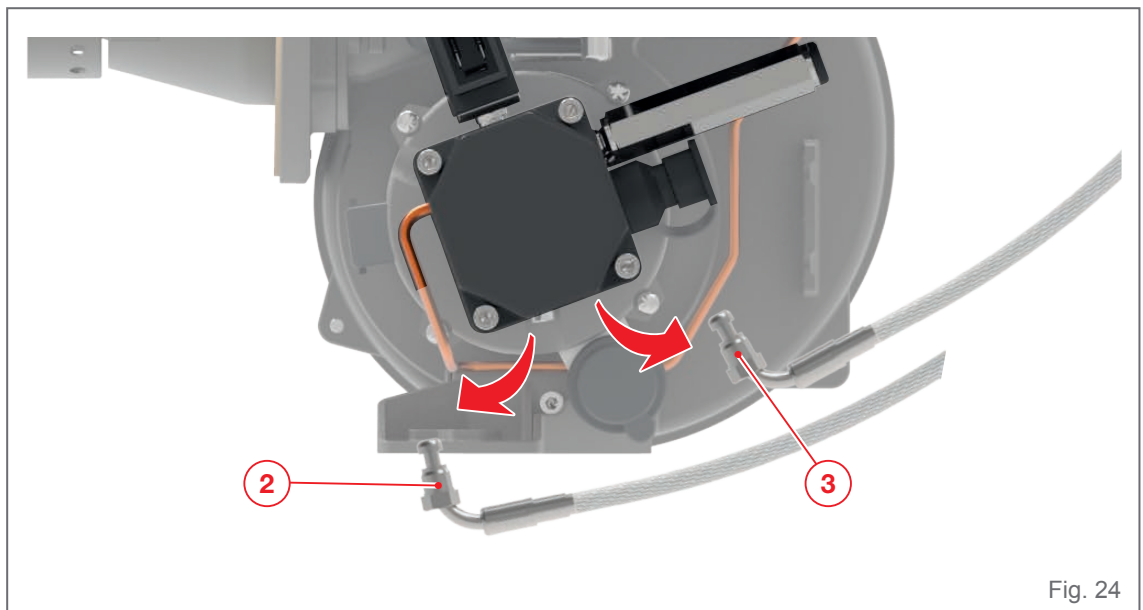


Fig. 24

- drain any fuel still inside the burner and in the fuel delivery pipe and collect it in a basin
- loosen the pipe clamp (7) and remove the air intake pipe (8), if present

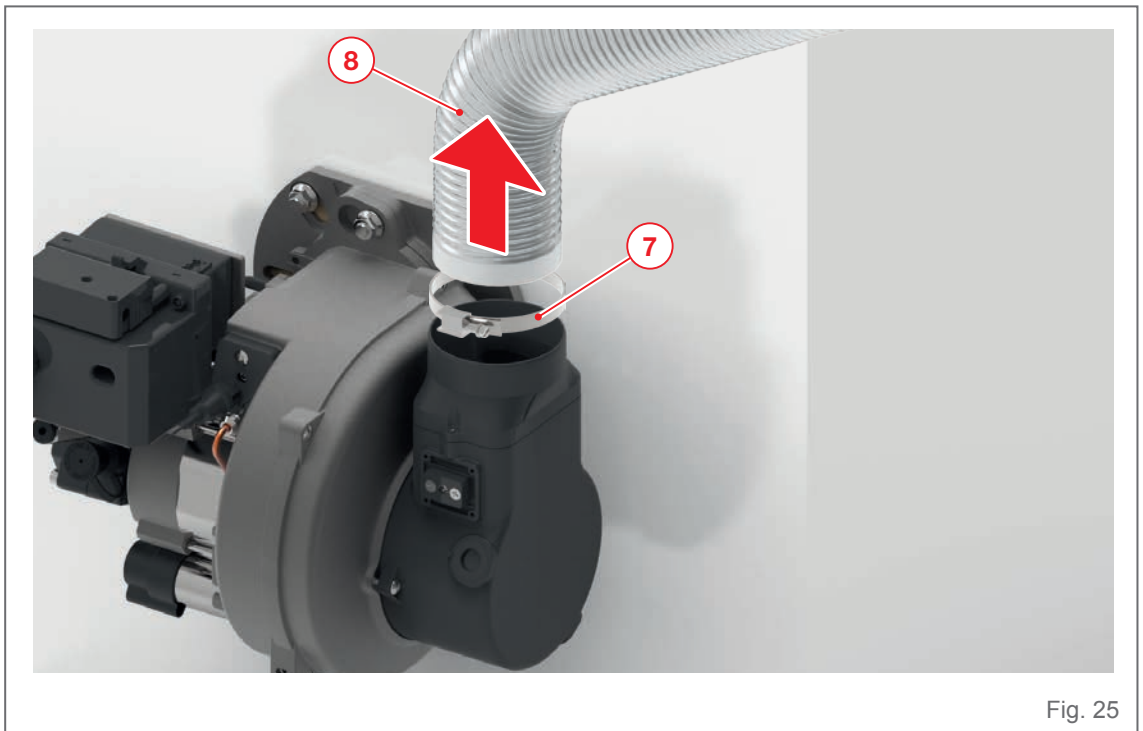


Fig. 25

- loosen the nut (9) securing the burner to the boiler and, rotating the burner (10) slightly to the right, slide it off the boiler.

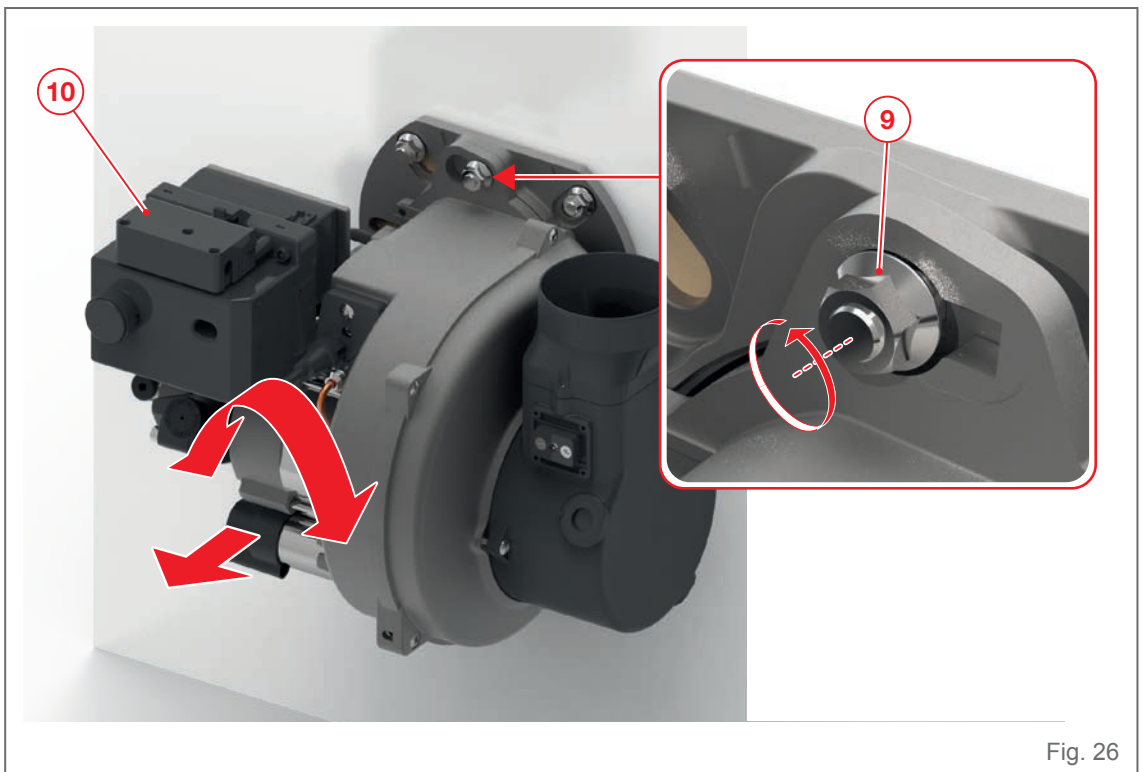


Fig. 26



**CAUTION**

Dispose of any fuel that comes out of the burner in accordance with applicable legislation in the destination country. Separated waste management avoids potential damage to the environment and peoples' health. It also allows many recyclable materials to be recovered, with significant economic and energy savings.

## 5 COMMISSIONING

### 5.1 Safety during commissioning



#### CAUTION

It may be hazardous to assign activities to personnel that are not sufficiently qualified. It may harm the operators themselves if they perform manoeuvres or operations incorrectly, with a serious impact on personal safety, things and property.



#### CAUTION

Installation, commissioning and maintenance activities must only be carried out by the personnel of dedicated heating companies specifically qualified to perform these tasks.



#### CAUTION

##### Hot surfaces - Risk of burns!

- Contact with components at high temperatures may cause more or less serious superficial burns.
- Operators should wear suitable clothing and personal protective equipment.
- They should ensure that all components are at ambient temperature before carrying out any maintenance operations.



#### FUEL LEAKS

- Fuel leaks may cause fire to break out.
- They may be toxic via inhalation and cause skin irritation in some individuals.
- Act swiftly to remove the cause of the leak. If it is connected to a maintenance operation, use suitable personal protective equipment.

### 5.2 Checks before commissioning

The following must be checked before initial commissioning:

- That the burner is assembled in accordance with the instructions given here
- That the burner is pre-set in accordance with the values in the adjustment table
- Setting the combustion components
- The boiler must be ready for operation, and the operating regulations for the heater must be observed
- All electrical connections must be correct
- The boiler and heating system must be filled with water and the circulating pumps must be in operation
- The thermostats and any other safety or limiting devices that might be fitted must be connected and operational
- The flue system must be unobstructed and the secondary air system, if available, must be operational
- An adequate supply of fresh air must be guaranteed
- The heat request must be available
- Fuel tanks must be full
- The fuel supply lines must be assembled correctly, checked for leaks and bled
- In the event the burner does not start on initial start-up following a long period of storage, the pump should be checked to ensure it is not blocked. See chapter on "5.6.4 Check pump rotation" on page 34
- A standard-compliant measuring point and analyser test point must be available, the flue system to the measuring point must be free of leaks to prevent anomalies in the measurement results.

**5.3 Factory pre-setting**

Burner	Nozzle			Pump*	
	Type	gph	spray		type
FB 4 R 20 LN		0,50	80° S	Danfoss	10,0
FB 4 R 26 LN		0,60	80° H	Danfoss	10,5
FB 4 R 35 LN		0,75	60° S	Danfoss	11,5

**Reference conditions**

- Conventional Flue system: diameter 80 mm / length 1.5 m
- Ambient temperature: 20°C +/-5
- CO2 = 12.5% ± 0,2.

(\*) The pump pressure is referred to a stability period of 5 min.

**Note.**

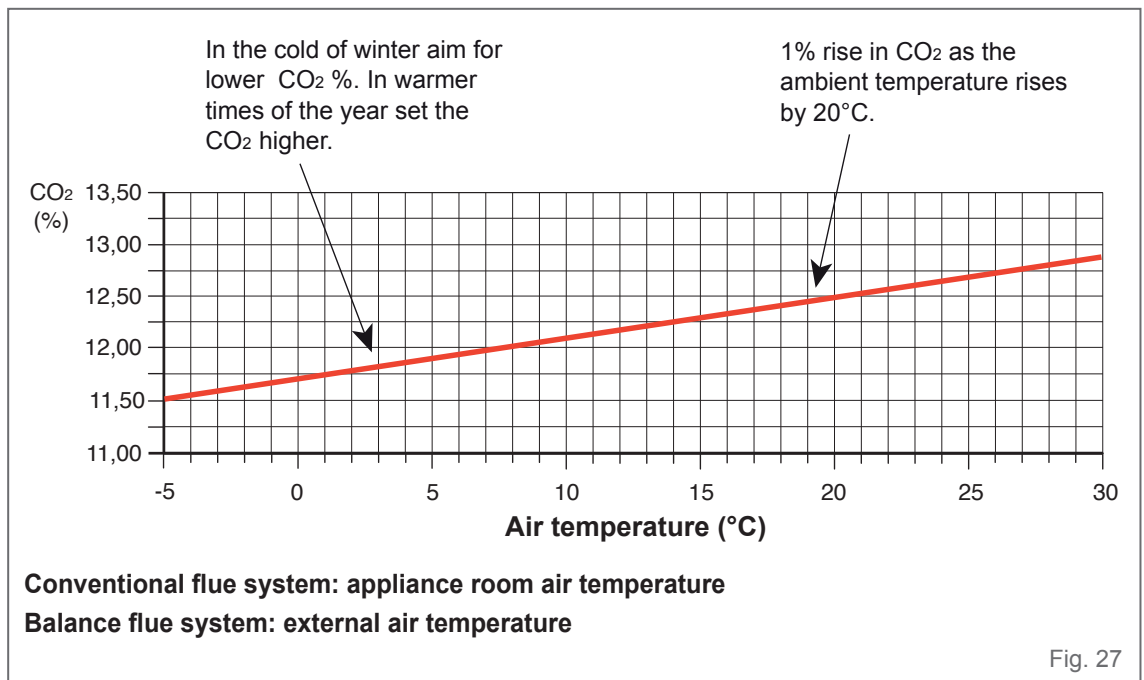
**All the burners are factory tested and adjusted. The air flap and combustion head are set to have the CO2 % within the above limit.**

**5.4 Combustion adjustment**

The burners leave the factory set according to the paragraph “5.3 Factory pre-setting”.

The installation of the burner on the boiler, the commissioning and servicing must be carried out following the boiler technical manual, including the check of the CO2 and CO level in the flue gases, their temperatures and the average temperature of the water in the boiler.

In case of outside temperature conditions influencing the combustion it is recommended to adjust the CO2 according to the diagram below.



5.4.1 Air flap position

Turn the hex key (1) supplied:

- clockwise to increase the air flap opening (O<sub>2</sub> rises, CO<sub>2</sub> decreases).
- counterclockwise to reduce the air flap opening (O<sub>2</sub> decreases, CO<sub>2</sub> rises).

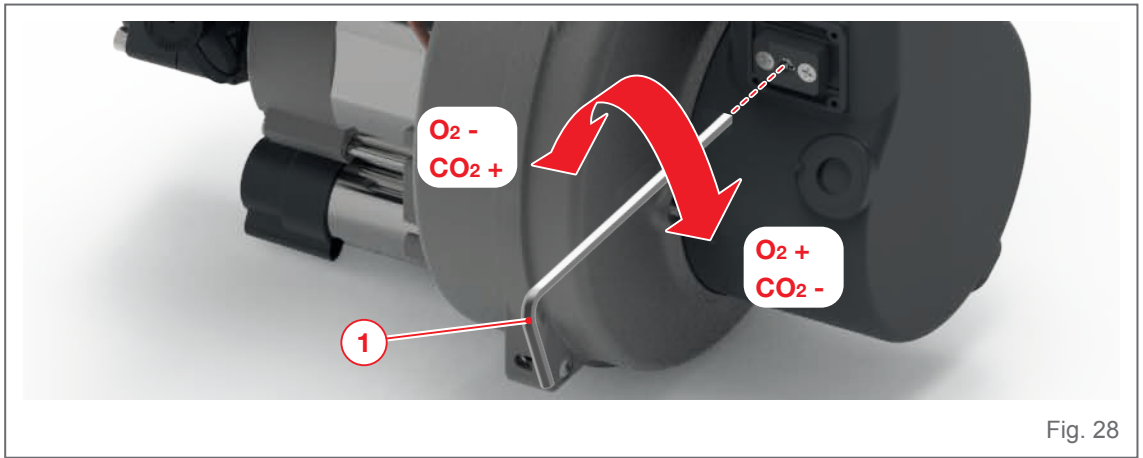


Fig. 28

5.5 Adjusting burner output

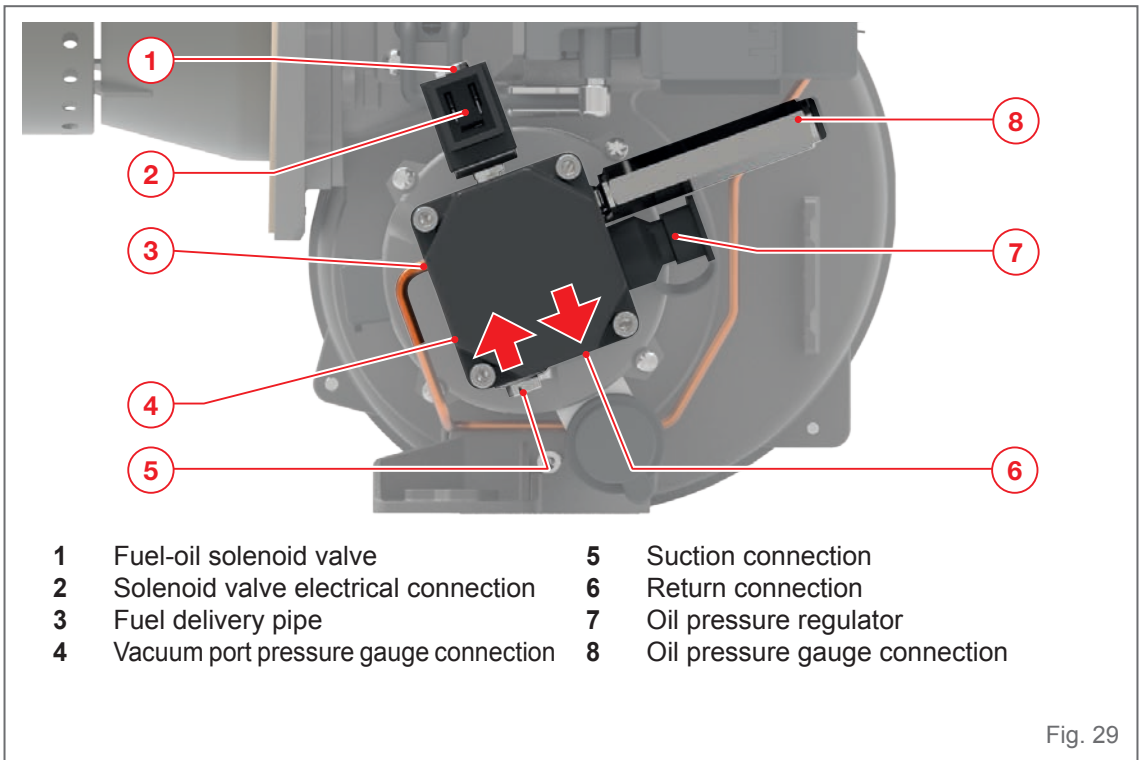


Fig. 29



**WARNING**

Continuously check CO, CO<sub>2</sub> and soot emissions when adjusting the output of the burner. CO must not exceed 50 ppm.



**5.5.1 Burner start**

Before starting the burner, draw oil in until the filter is completely filled. Then start the burner by creating a heat demand on the boiler (refer to boiler installation manual). Open the bleed screw on the oil filter to allow the oil line to bleed fully during the preventilation phase. The negative pressure (vacuum) must not fall below 0.4 bar. Close the bleed screw when the filter is completely filled with oil and oil is flowing out without bubbles. Boiler has to maintain in operation at least 15 min. or reach a steady condition of operation, then check the combustion values.

**5.5.2 Burner adjustment**

Use the pressure regulator to adjust the oil pressure in accordance with the table (tab.1). Monitor the combustion values continuously as you do so (CO, CO<sub>2</sub>, smoke test). Adjust the airflow gradually if necessary. Operating on air flap setting.

**5.6 Oil pressure setting**

**5.6.1 Oil pressure setting**

The oil pressure, and therefore burner output, is adjusted using oil pressure regulator (7), see "Fig. 29", on the pump.

Sequence to adjust the oil pressure:

- connect a pressure gauge at point (8).

Turn the regulator screw (7) to:

- right: to increase pressure.
- left: to reduce pressure.
- verify the correct pressure with the pressure gauge.

At the end of adjustment.

- to disconnect the pressure gauge.
- to tight the plug (8).

**5.6.2 Checking negative pressure**

The vacuum gauge for checking negative pressure must be connected to point (4). Maximum permissible negative pressure is 0.4 bar check the oil supply in case those pressures cannot be achieved. At higher negative pressures, the fuel oil gasifies, which causes pump cavitation in the pump and ultimately leads to pump damage.

**5.6.3 Cleaning the pump filter**

To be able to clean the filter (H), it is necessary to remove the pump cover. Check the pump cover seal and replace the gasket if necessary.

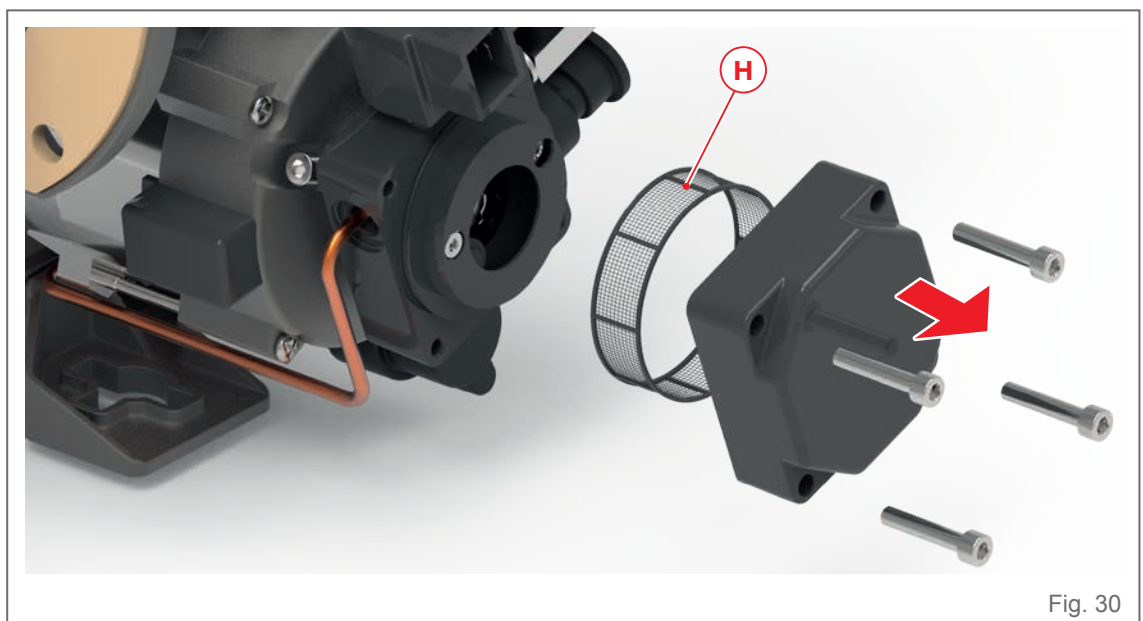


Fig. 30

## 5.6.4 Check pump rotation

**CAUTION**

If the pump is blocked, proceed as follows.

- Disconnect the oil pipe from the pump
- remove the pump (1) from the motor loosening screws (3) using the key supplied (2)

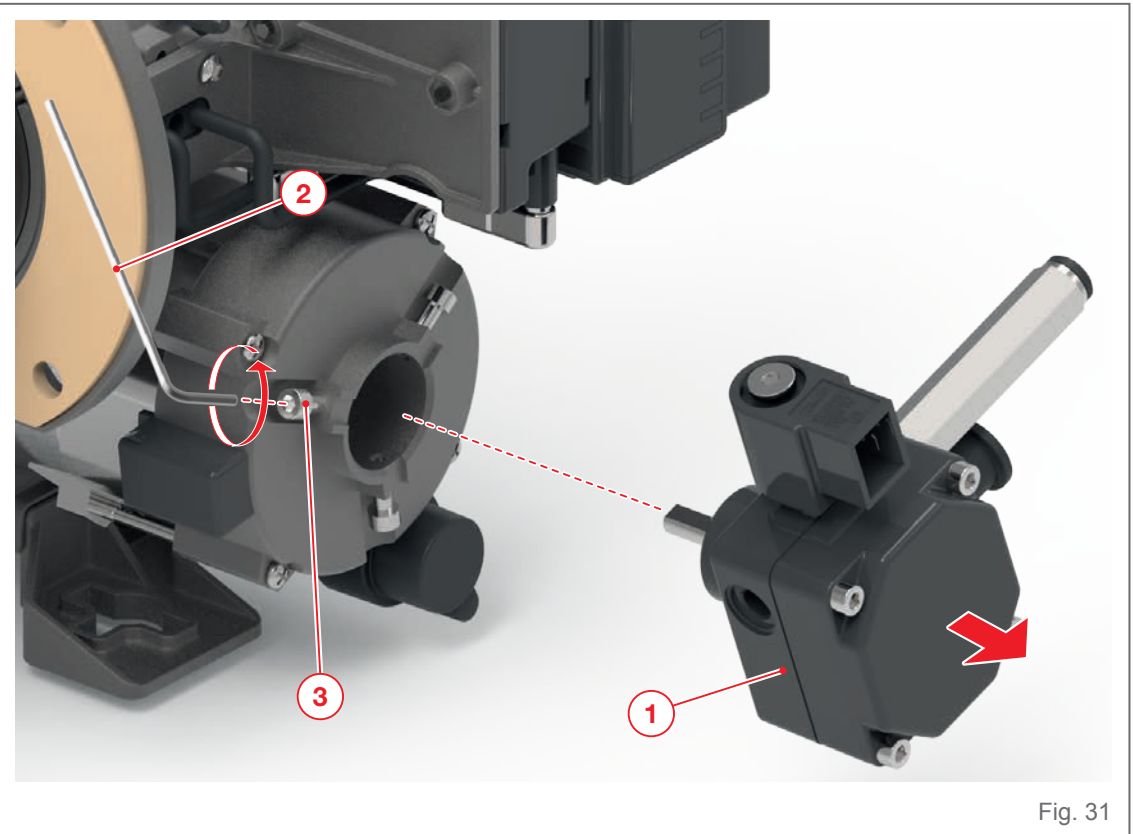


Fig. 31

- manually rotate the shaft (3-4 rotations both clockwise and anticlockwise)



Fig. 32

- refit the pump to the motor
- reconnect the oil pipe to the pump. Check that there is no oil leakage on the pump side after this operation.

Replace the pump in the event it remains blocked or if there was any sticking during manual rotation.

**5.7 Commissioning record**

Confirm the work carried out in the commissioning report below by marking and X or an ✓ .

Commissioning work	Note	Done
Check the heating system has been filled correctly and the air has been removed		
Check the flue system		
Check there are no leaks in the fuel supply system		
Start the burner and check that it is operating normally		
Measure the parameters of the combustion system and record all the main data pertaining to the first ignition		
Explain to the proprietor and person responsible for the domestic heating system the burner is installed on, the importance of ensuring good inflow of combustion air and combustion product evacuation. They should also highlight that no modification should be made to the heating system (comprised of air intake, burner, boiler and flue pipe) that could alter the correct operation of the system		

Confirmation of correct commissioning:

Stamp / date / company signature: \_\_\_\_\_

## 5.7.1 Setting and values recorded

Customer: \_\_\_\_\_

Heating system: \_\_\_\_\_

BOILER	
Type	
Output	kW
	kcal/h

BURNER				
Type		FB 4 R 20 LN	FB 4 R 26 LN	FB 4 R 35 LN
Serial number				
Output	kW			
Nozzle size	gph			
Spray angle/cone type				
Fan pressure	mbar			
Combustion chamber pressure	mbar			
Air flap	scale			
Oil throughput	kg/h			
Oil pressure (oil pump)	bar			
CO <sub>2</sub>	Vol. %			
CO	mg / kWh			
	ppm			
NO <sub>x</sub>	mg / kWh			
	ppm			
Room temperature	°C			
Flue gas temperature (gross)	°C			
Pressure at the base of chimney	mbar			
Firing Efficiency factor	%			

Date: \_\_\_\_\_

Signature: \_\_\_\_\_

## 6 MAINTENANCE

### 6.1 Safety during maintenance

The periodic maintenance is important for safety, good operation and long life cycle of the burner, reducing also consumption and polluting emissions.

The burner must be serviced at least once a year. Only qualified and authorised personnel shall carry out maintenance and the calibration of the burner, in accordance with this manual and in compliance with the local standards and regulations.



**DANGER**

**Danger of death!**

- Contact with live electrical components may cause serious incidents.
- Only professionally-trained and qualified personal can operate on the electrical system.
- Before any operation, switch off the power supply to the system by operating the main switch.



**CAUTION**

**Hot surfaces - Risk of burns!**

- Contact with components at high temperatures may cause more or less serious superficial burns.
- Operators should wear suitable clothing and personal protective equipment.
- They should ensure that all components are at ambient temperature before carrying out any maintenance operations.



**FUEL LEAKS**

- Fuel leaks may cause fire to break out.
- They may be toxic via inhalation and cause skin irritation.
- Act swiftly to remove the cause of the leak. If it is connected to a maintenance operation, use the dedicated personal protective equipment.



**PRECAUTION**

**Danger of injury caused by improper use!**

- Danger of personal injury such as contusions, bruises and cuts due to incorrect handling.
- Use personal protective equipment as required by applicable legislation, such as safety shoes and gloves.



**CAUTION**

- Installation, commissioning and maintenance activities must only be carried out by the personnel of dedicated heating companies specifically qualified to perform these tasks.



**IMPORTANT INFORMATION**

- Inspect threaded joints to identify leaks during annual maintenance checks.
- Replace defective or worn gaskets.

## 6.2 Important components for safety

In order to ensure the long working life of the burner, we recommend periodically carrying out component checks.

### 6.2.1 List of parts typically subject to wear

Parts subject to wear should be regularly checked by the technician during maintenance operations and if necessary replaced.

<b>Worn components</b>	<b>Replacement intervals / years (non-binding factory recommendation)</b>
Nozzles	1
Gaskets	2
Fuel delivery pipes	2
Flame monitoring devices	3
Ignition electrodes	2
Ignition cable	5

**6.3 Removing the burner**



**DANGER**  
**Danger of death caused by live components!**  
 Before carrying out any operations on the burner, operate the main power switch for the system to cut off the power supply.

To remove the burner from the boiler, proceed as follows:

- close the fuel taps upstream of the burner
- detach the 7 pins plug (1) from the burner

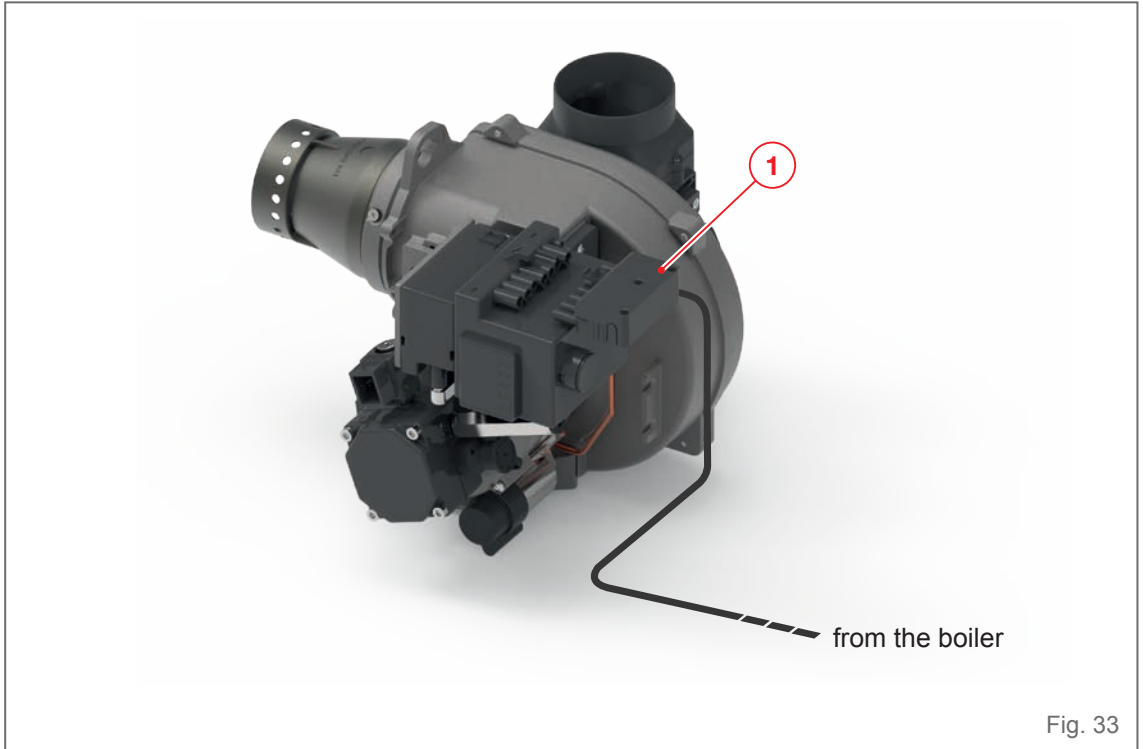


Fig. 33

- remove the fuel delivery pipe (5) and the return pipe (6)

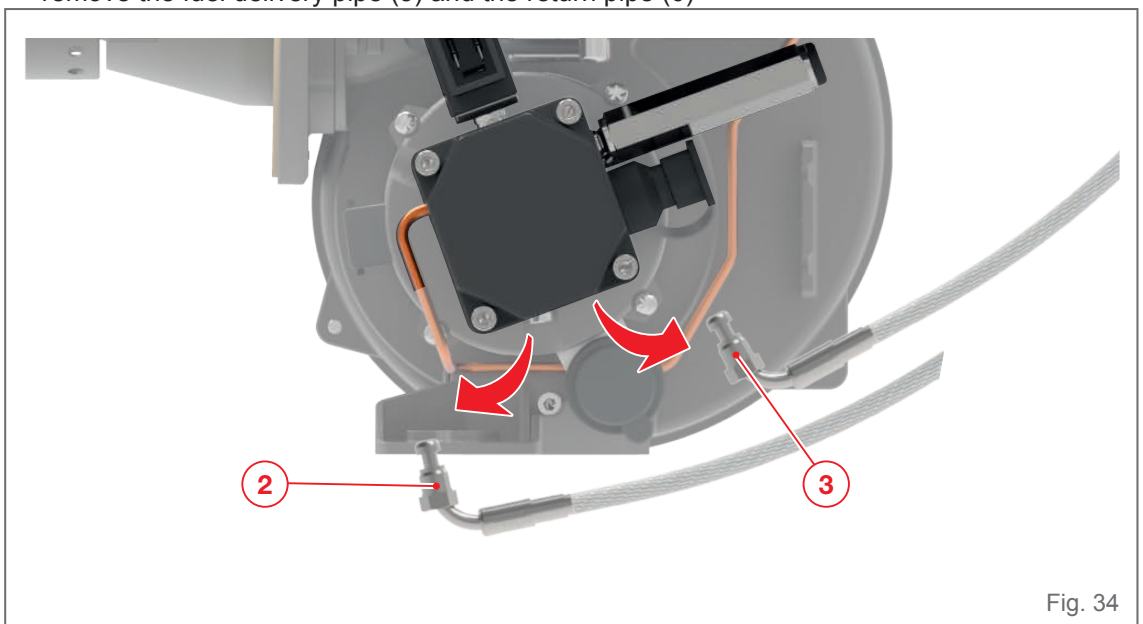


Fig. 34

- drain any fuel still inside the burner and in the fuel delivery pipe and collect it in a basin
- loosen the pipe clamp (7) and remove the air intake pipe (8)

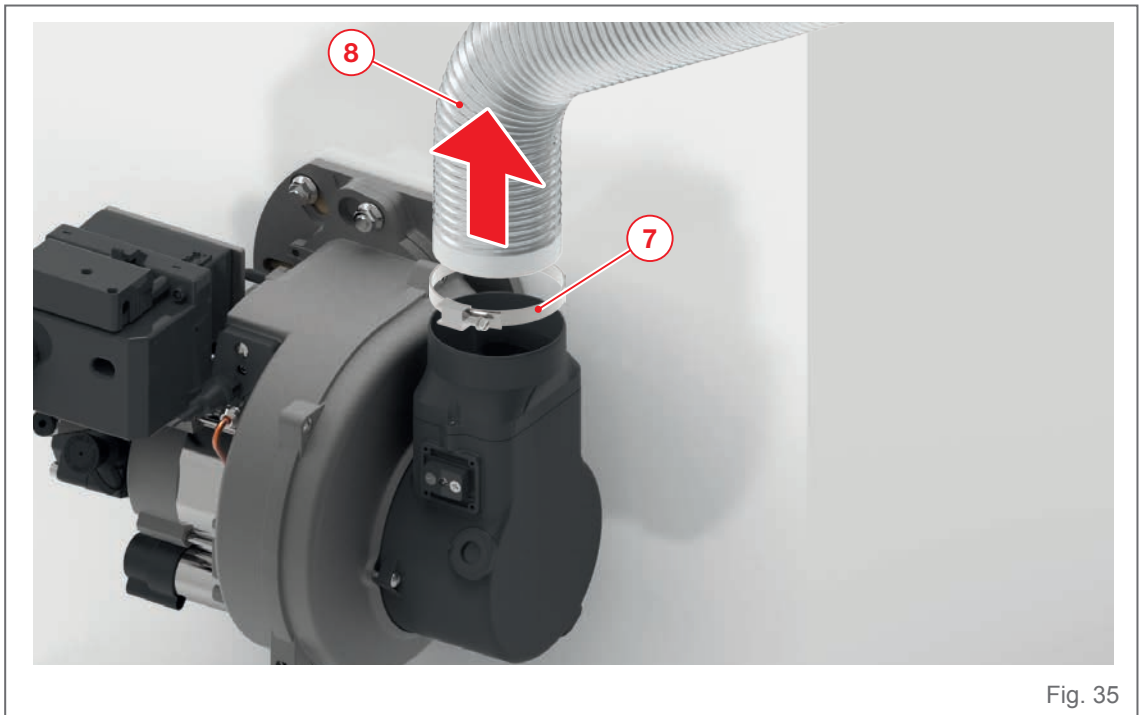


Fig. 35

- loosen the nut (9) securing the burner to the boiler and, rotating the burner (10) slightly to the right, slide it off the boiler.

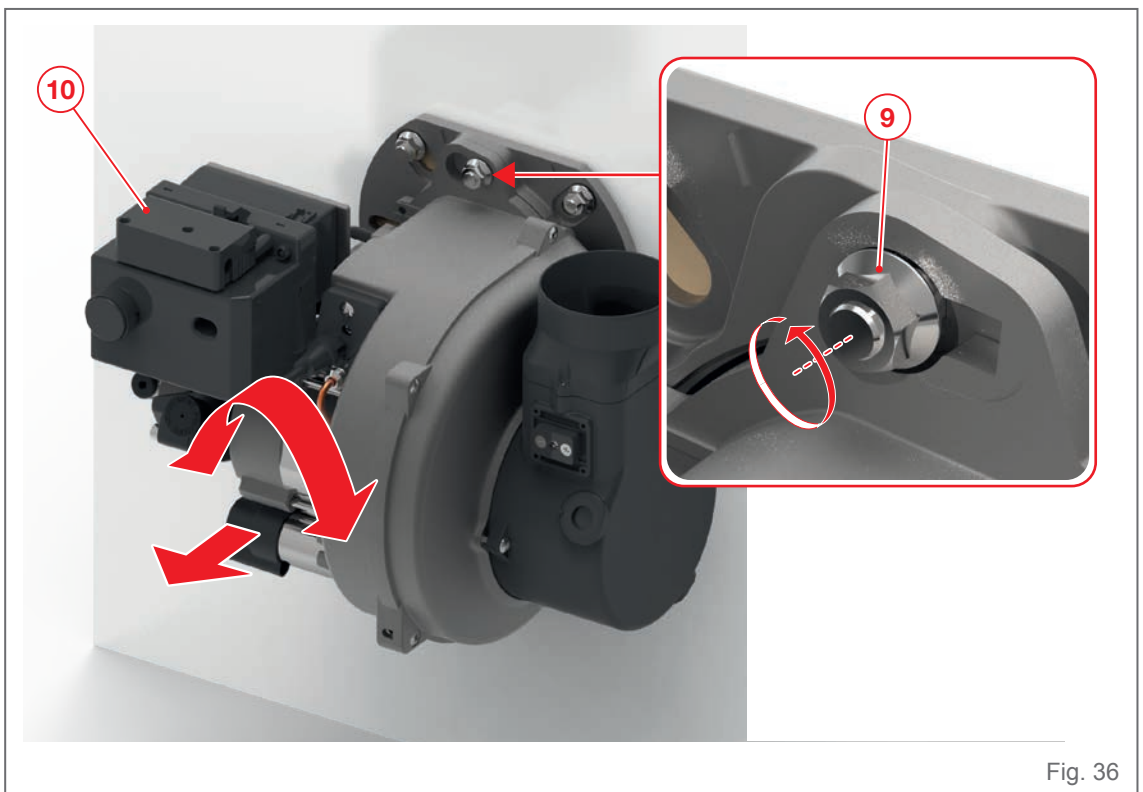


Fig. 36



CAUTION

**CAUTION**

Dispose of any fuel that comes out of the burner in accordance with applicable legislation in the destination country. Separated waste management avoids potential damage to the environment and peoples' health. It also allows many recyclable materials to be recovered, with significant economic and energy savings.





**IMPORTANT INFORMATION**

Once the burner has been removed from the boiler, it can be rested on a rigid, level surface. The burner should be placed on the ground only if resting on the burner base and should never be turned upside down.

To facilitate maintenance operations, secure the burner to the boiler by inserting the fastening screw (11) into the hole (12) on the burner base. Use one of the three square grooves on the burner base to secure the burner, which should be rotated to the best position for the maintenance operation to be carried out.

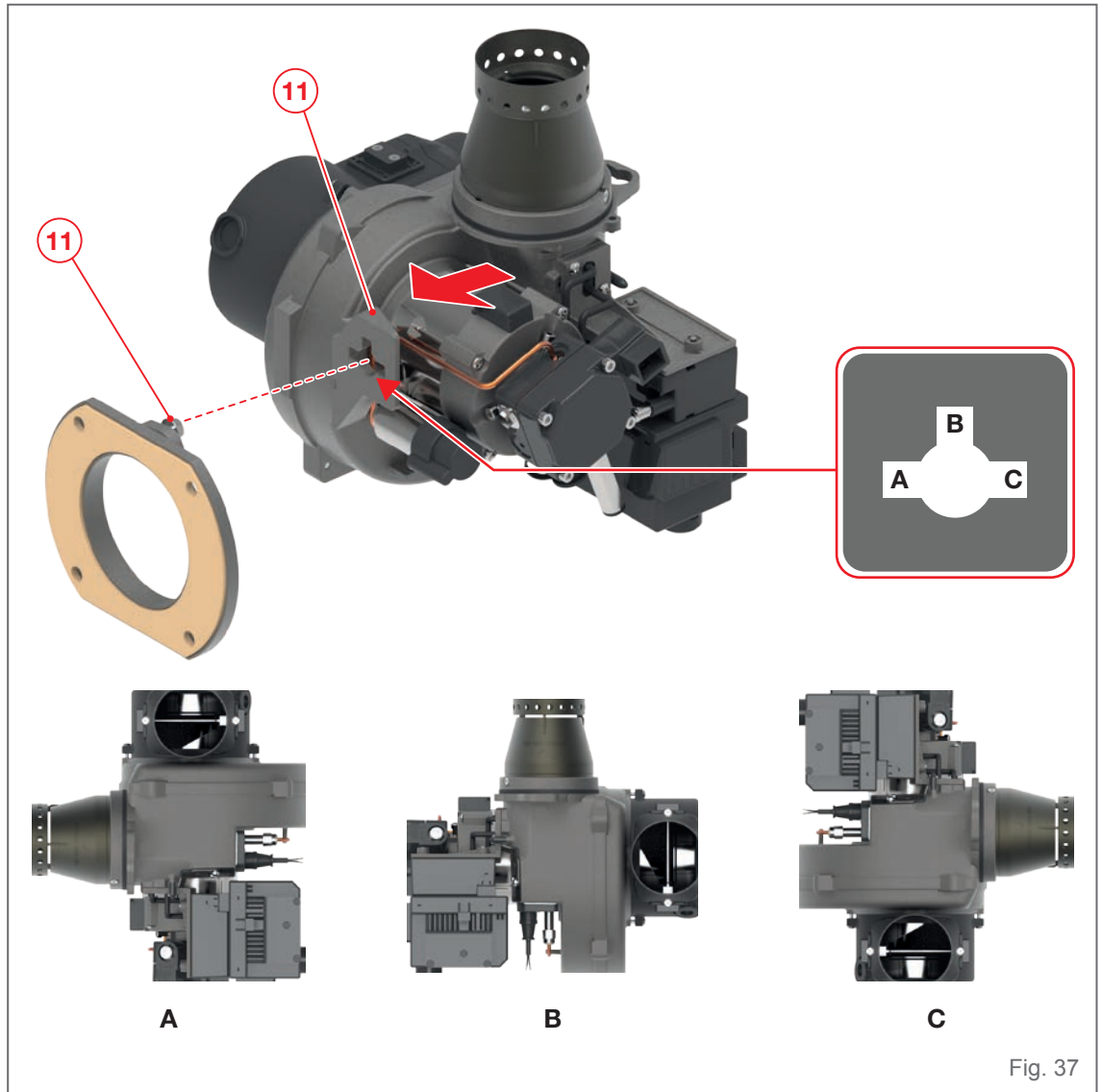


Fig. 37

**Position A:**

- inspection and cleaning of the internal rotor.

**Position B:**

- inspection of the combustion head
- inspection and maintenance of the nozzle
- inspection and maintenance of the electrode group.

**Position C:**

- inspection and maintenance of the pump
- inspection and maintenance of the coil
- inspection and maintenance of the capacitor.

## 6.4 Burner maintenance

- Check the fuel supply components (pipe, pump, fuel delivery pipe) and their connections for leaks and signs of wear, replace parts as necessary.
- Check that the electrical connection and connection cables are not damaged, replace them if necessary.
- Check the pump filter and clean it if necessary.
- Clean the fan and its housing and check for damage.
- Check and clean the combustion head.
- Check the ignition electrodes, adjust or replace them if necessary.
- Replace the nozzle.
- Fit the combustion head. Observe the adjustment dimensions.
- Mount the burner.
- Start the burner, check the exhaust gas data, adjust the burner settings if necessary.
- Fuel pipes should be checked annually and replaced after 2 years.
- Check and clean the components on the main burner.

### 6.4.1 Cleaning and replacing combustion head components

- Remove screws (1) using a screwdriver and slide out the combustion head (2)
- loosen screw (3) using the hex key supplied and remove the diffuser (4) together with the electrode group (5)
- a suitable spanner of the correct size should be used on the fuel line for removing the nozzle (6)

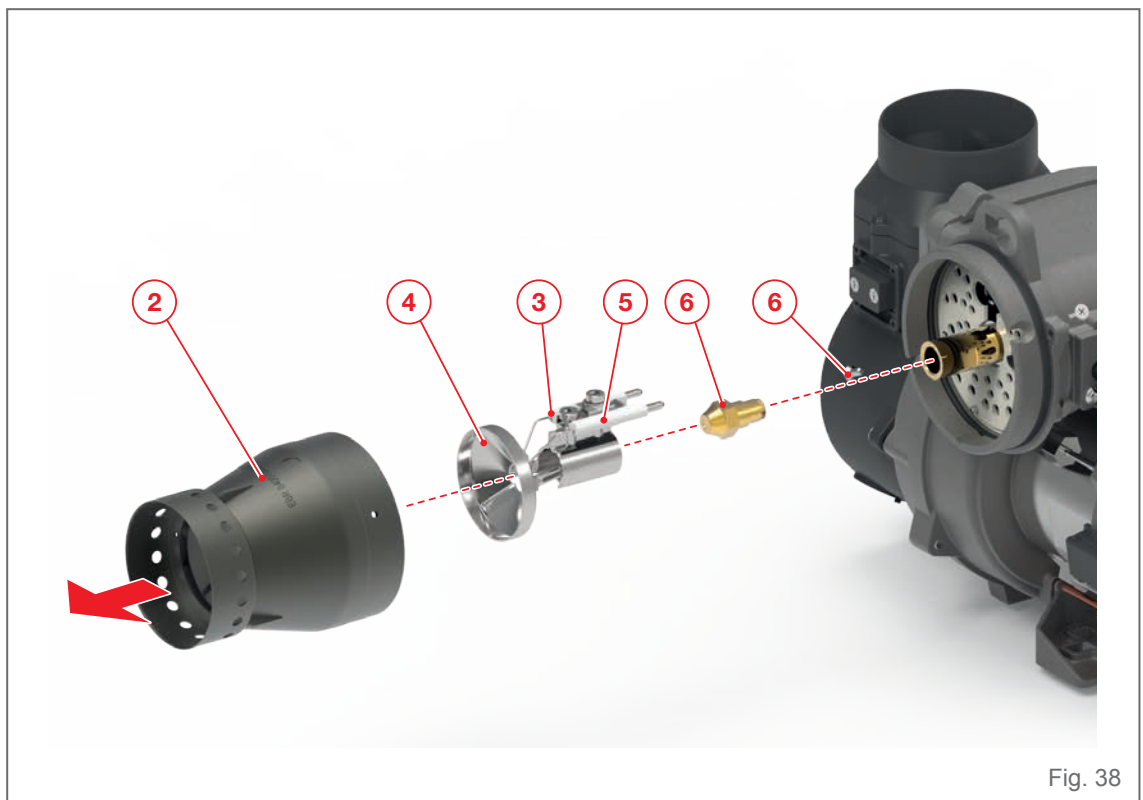


Fig. 38

- ensure that all components are in good condition, undamaged by high temperatures, clean and soot-free. Replace if damaged
- clean all components thoroughly
- refit the components, reversing the procedure above.



**CAUTION**

If the air distributor (1) is removed from its housing, it must be repositioned, making sure that the hole (2) is aligned with the pin (3).

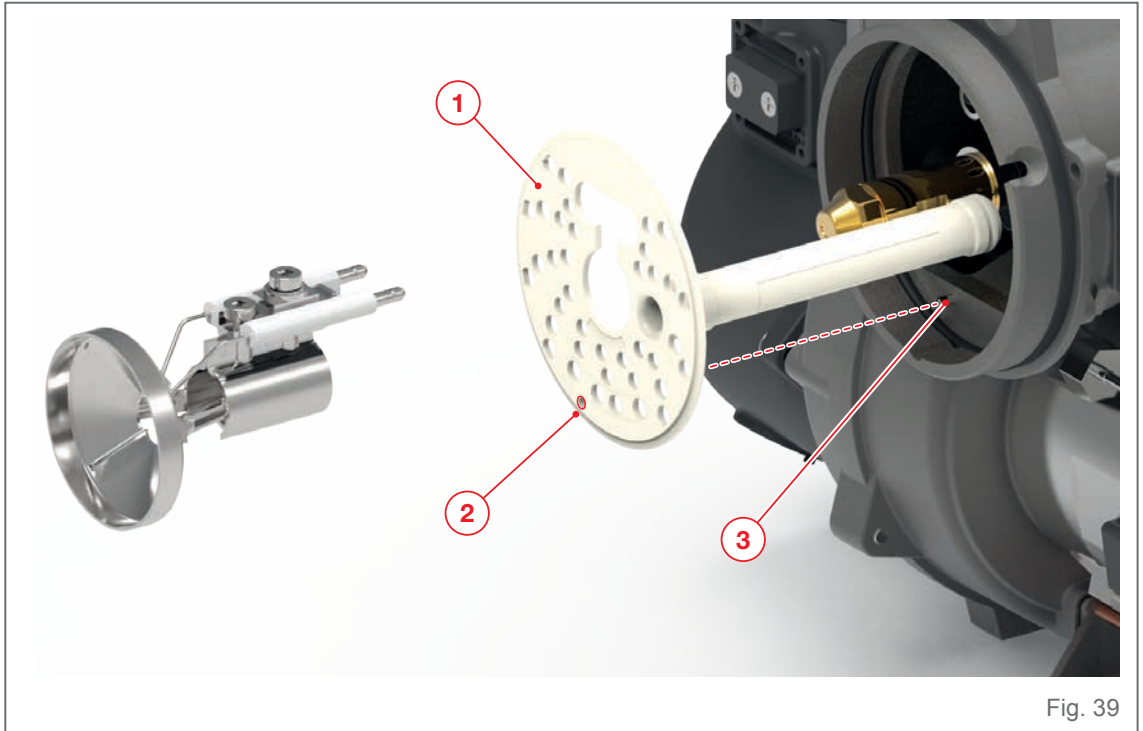


Fig. 39

**6.4.2 Diffuser position check**

To check the position of the diffuser:

- remove the combustion head as described in paragraph “6.4.1 Cleaning and replacing combustion head components” on page 42
- use the key provided to loosen screw (8) and allow the diffuser position check. One turn of the key is sufficient.

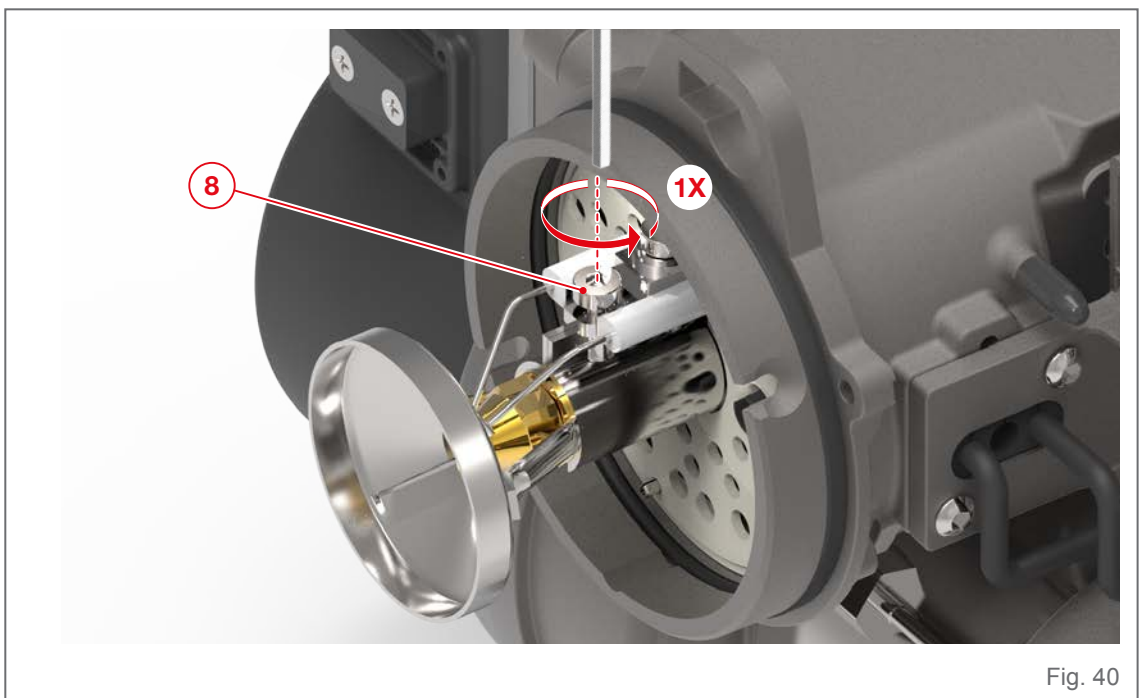
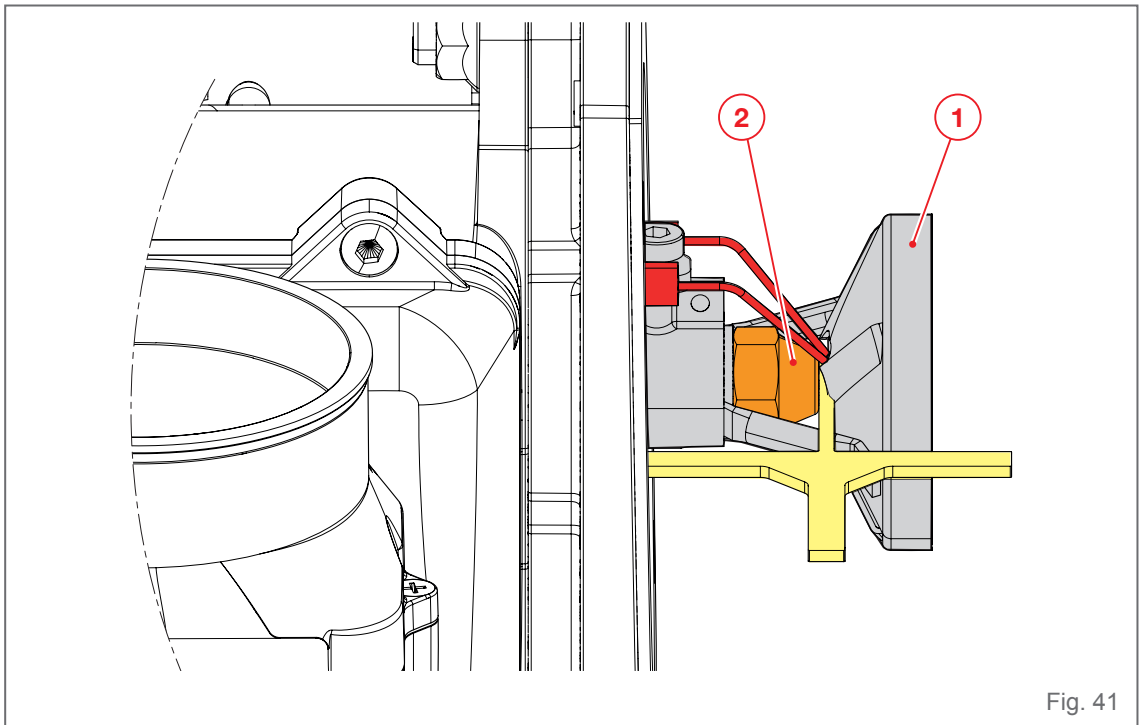
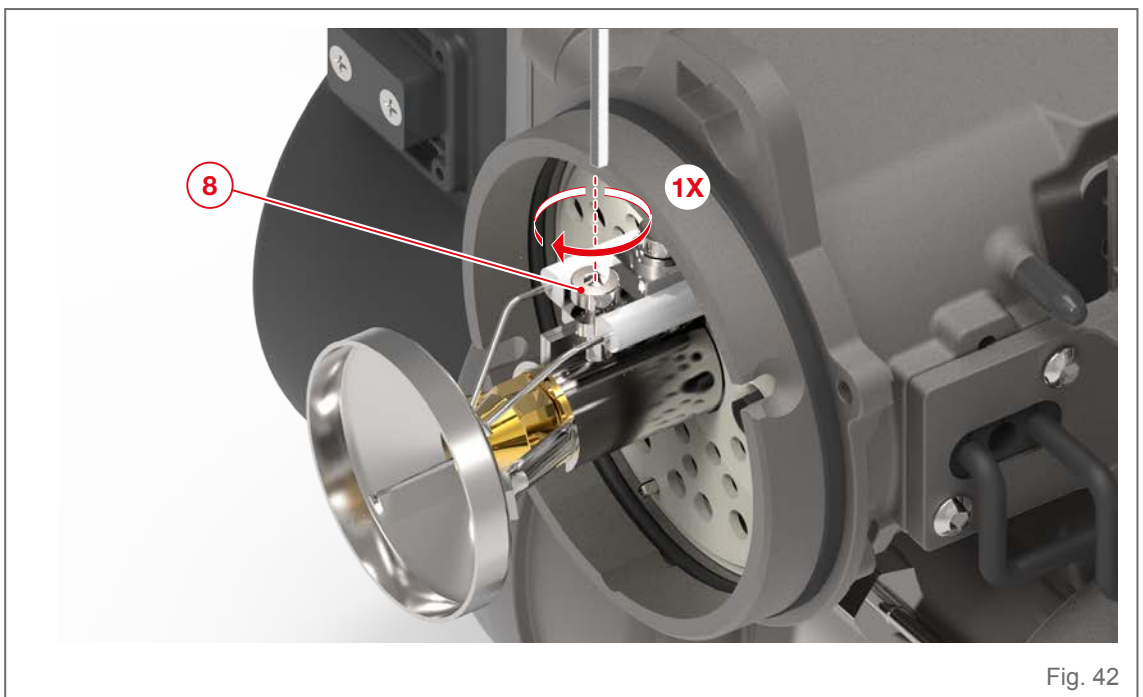


Fig. 40

- check the distance between the diffuser (1) and the nozzle (2) as shown in the figure.



- after having adjusted the position of the diffuser tighten the screw (8).
- refit the combustion head.



**6.4.3 Combustion head position check**

To check the position of the combustion head:

- check the distance between the combustion head (1) and the nozzle (2) as shown in the figure.

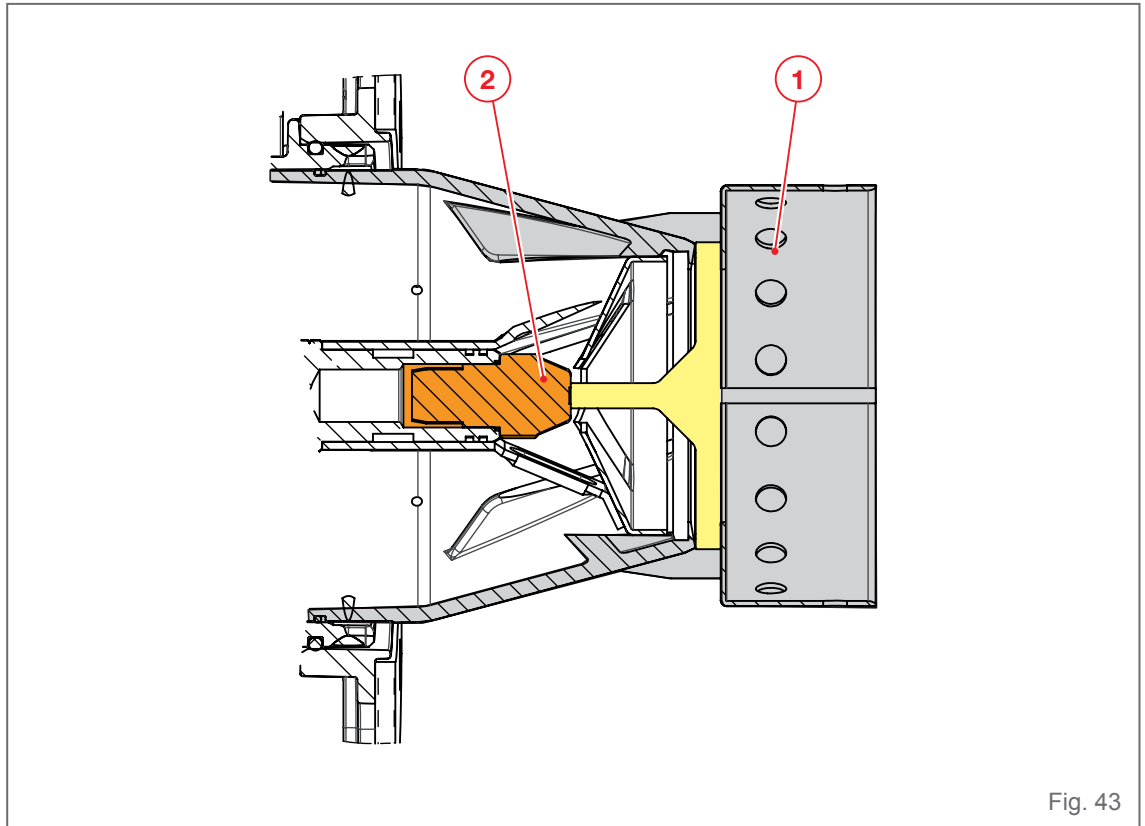


Fig. 43

**6.4.4 Electrode position check**

- Check the distance between tips of electrodes (2 mm)

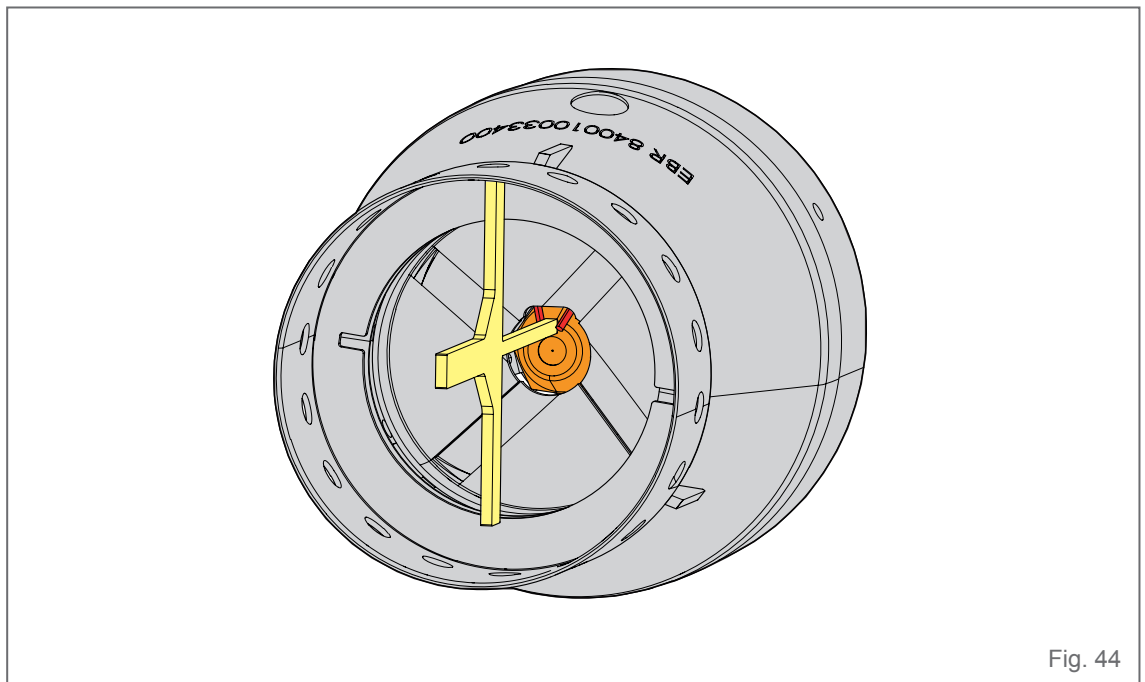
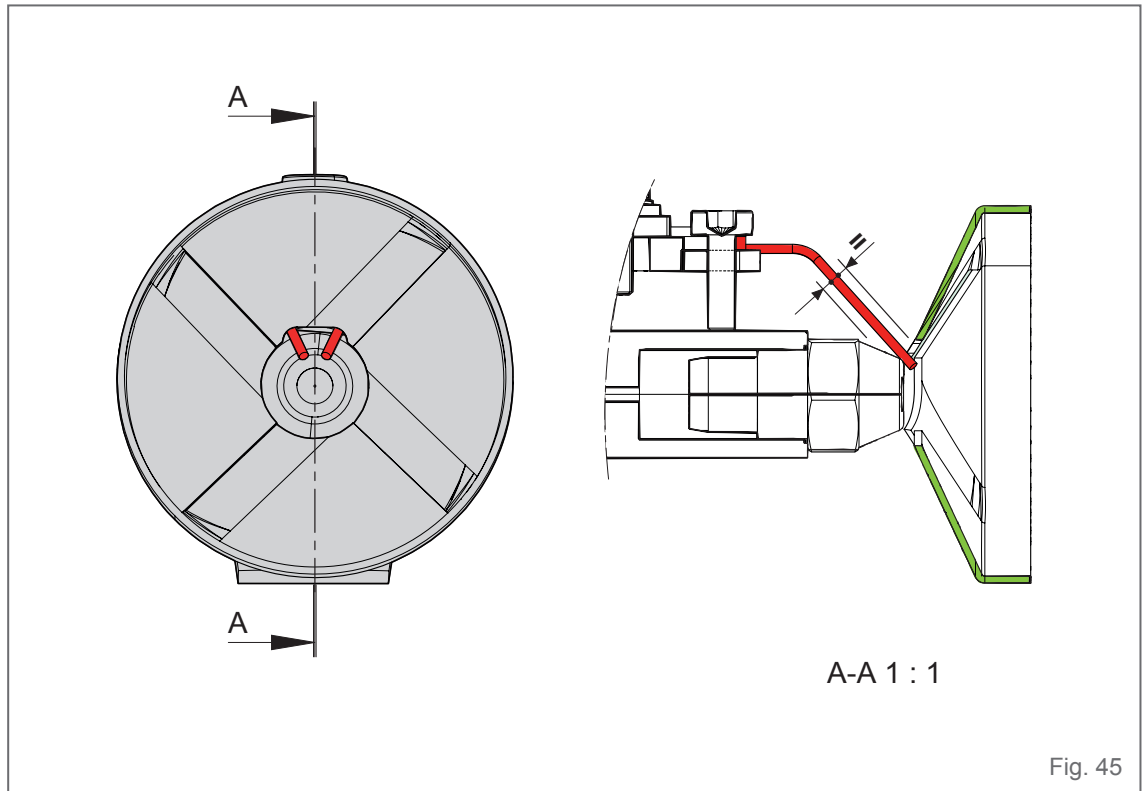


Fig. 44

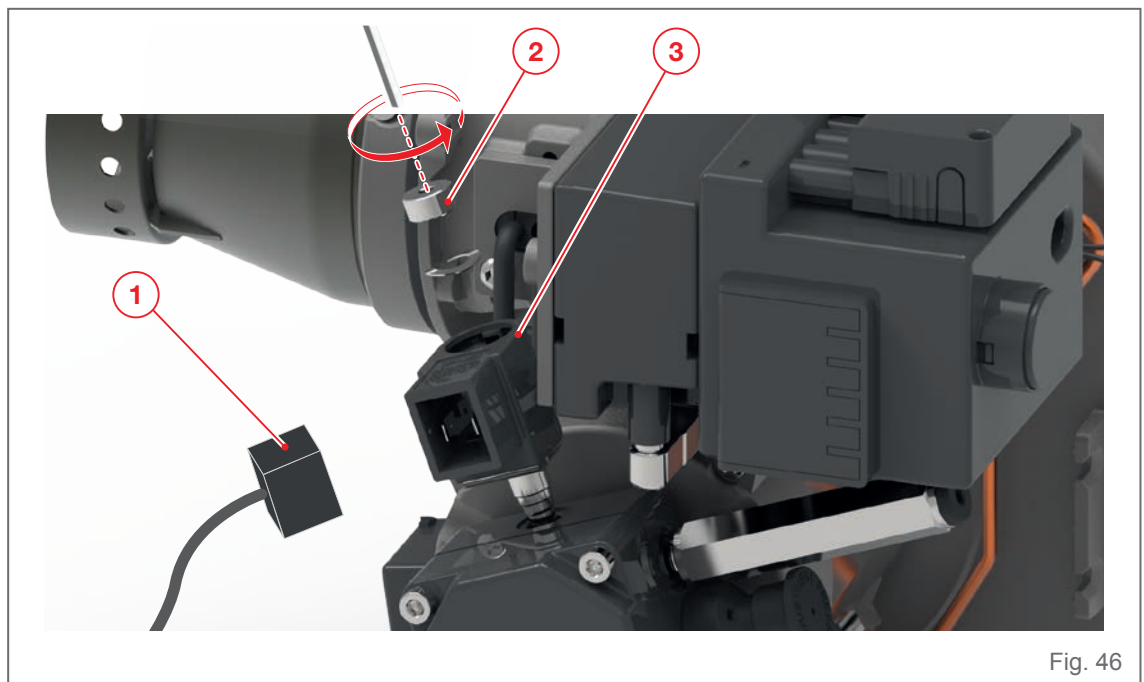
- Check the position of the electrodes assuring that they are centered as shown in "Fig. 45".



#### 6.4.5 Replacing the coil

The pump coil is designed and built to withstand temperatures of up to 85°C. In the event of malfunctions or faults, replace the coil using the following procedure:

- remove the connector (1)
- remove the nut (2) using the key supplied
- slide off the coil (3) and replace it



- refit the components, reversing the procedure above.

**6.4.6 Replacing the capacitor**

Proceed as follows to replace the capacitor:

- detach the electrical connection from the capacitor (1)
- remove the capacitor (2) and replace it

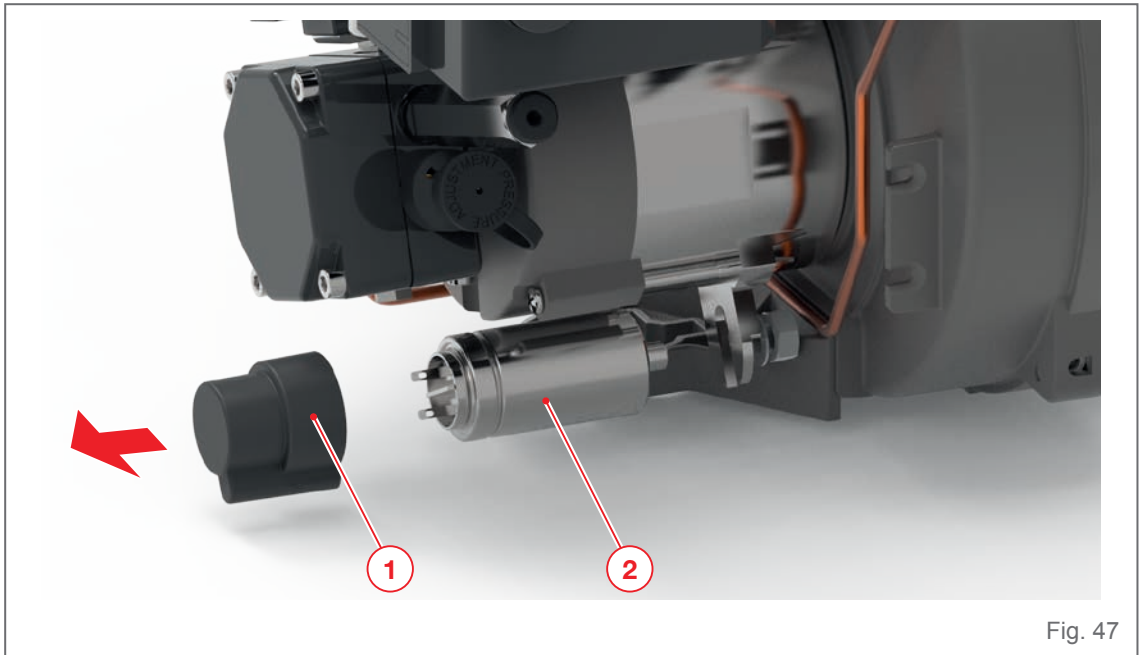


Fig. 47

- refit the components, reversing the procedure above.

**6.4.7 Cleaning the internal rotor**

Check there is no dust inside the fan wheel because this could reduce the combustion performances. Carry out maintenance operations, avoiding to damage the fan. Verify the correct position of fan wheel within the burner housing.

Follow the sequence

- loose the screws (1) and remove the air intake duct (2)
- clean the fan (3) and the inside of the air intake using a brush
- if necessary, disassembly and re-assembly the fan.

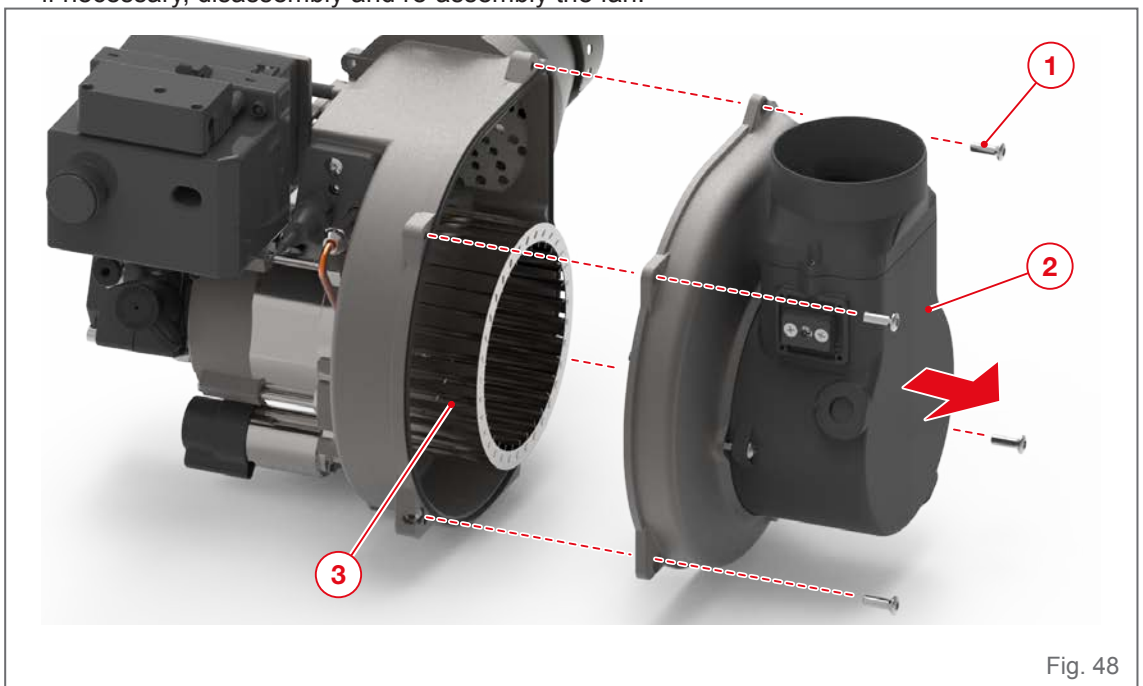


Fig. 48

Observe the positioning diagram below when replacing the motor and blower wheel (3). The inside flange (A) of the blower wheel must be fitted at a lower position (quote C) than the equipment plate (B), tighten the set screw on the blower wheel.

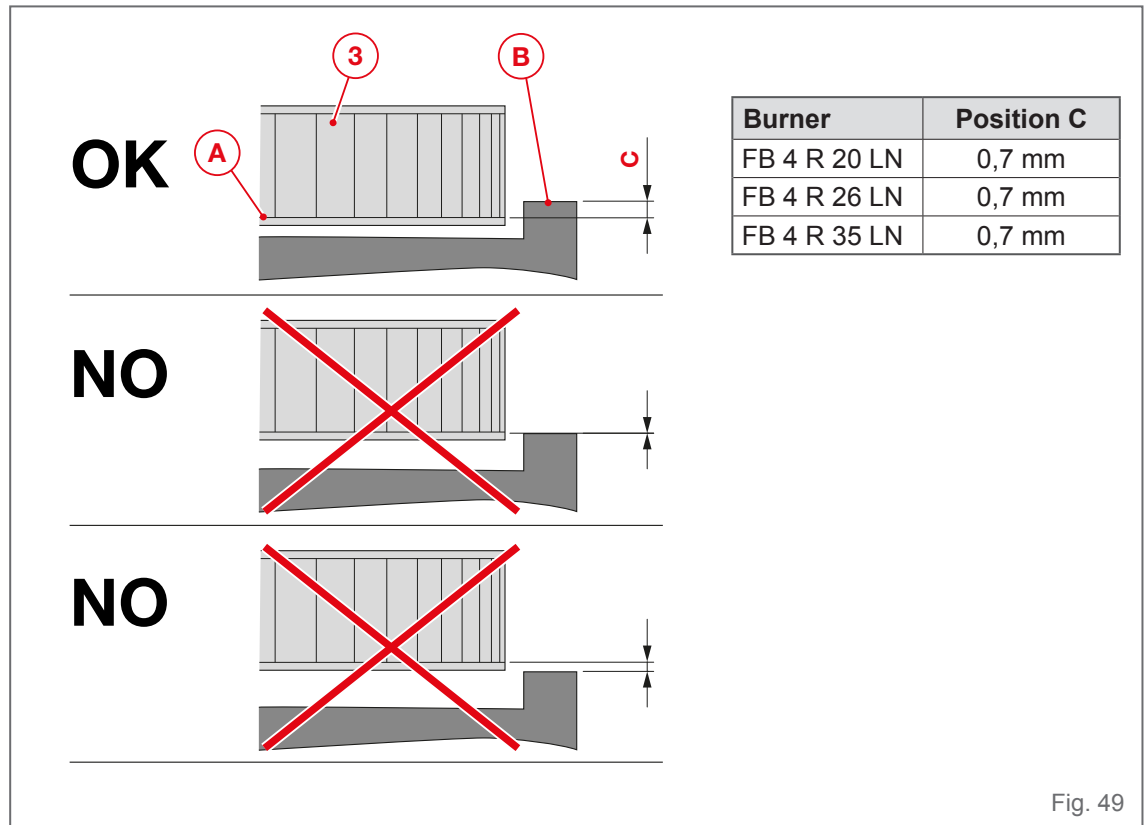


Fig. 49



## 7 TROUBLESHOOTING

### 7.1 Combustion performances

After carrying out commissioning, cleaning or maintenance, combustion parameters must be verified.

Boiler has to maintain in operation at least 15 min. or reach a steady condition of operation, then check:

- pump pressure
- flue gas temperature
- CO<sub>2</sub> (%)
- CO (ppm)
- NO<sub>x</sub> (ppm)
- Bacharach index.

### 7.2 Fault diagnosis and repair

In the event of a malfunction, first check that the prerequisites for correct operation are fulfilled:

- is the system connected to the power supply?
- is there oil in the tank?
- are all shut-off valves open?
- are all control and safety devices, such as the boiler thermostat, low pressure device (if fitted), limit switch, etc. adjusted correctly?

Warranty will be invalidated if genuine parts are not used on replacement. These components must be replaced by parts with the same order number.



**WARNING**

To reset the equipment control, after viewing the visual diagnosis, press the release button.



**WARNING**

In case of burner lock out, to avoid damage to the installation, do not reset the burner more than twice in succession.



**DANGER**

If the burner goes into lock out for the third time, contact manufacturer's service organisation. In the case in which they occur further locks or malfunction burner, interventions must be carried out by qualified and authorized personnel, following the information in this manual and in accordance with the rules and legal regulations.



**IMPORTANT INFORMATION**

Only use original spare parts.



**IMPORTANT INFORMATION**

After each operation:

- Under normal operating conditions (doors closed, cover fitted, etc.), check combustion and check the individual lines for leaks.
- Record the results in the relevant documents.

7.3 Troubleshooting diagram

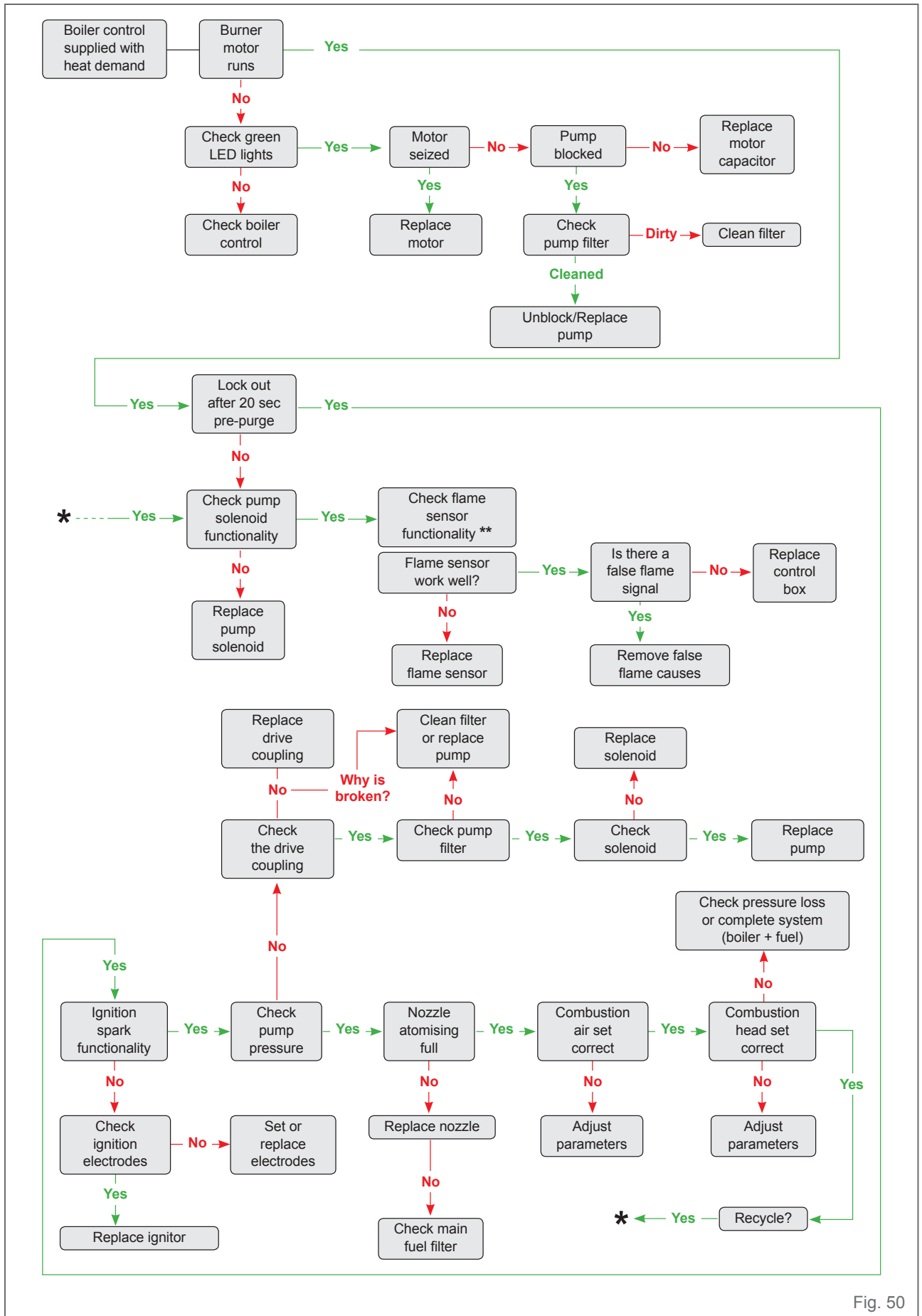
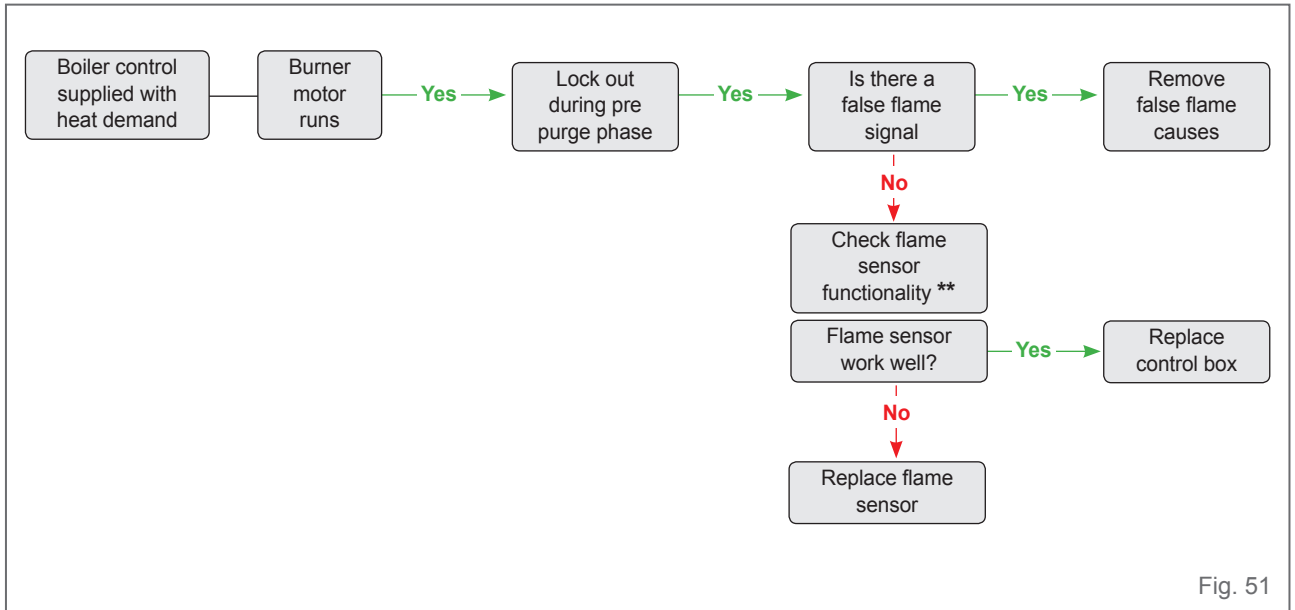
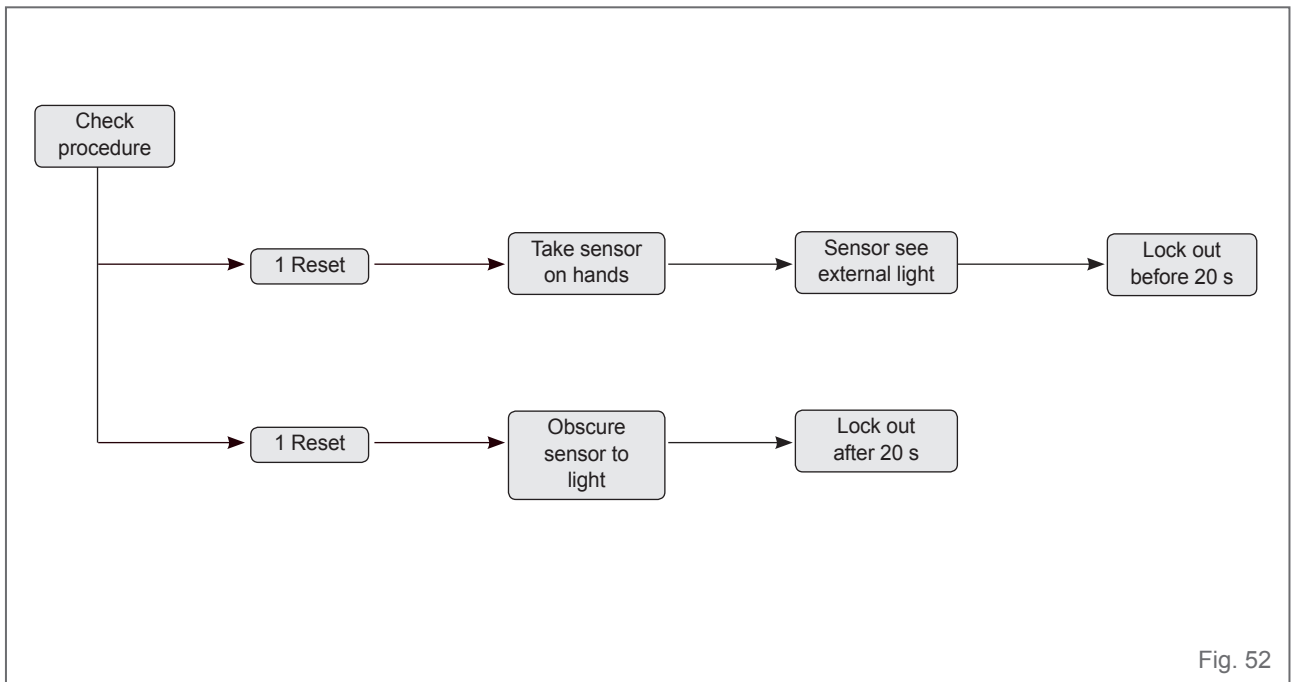


Fig. 50



**(\*\*) Check flame sensor functionality**



## 8 MANUFACTURER CERTIFICATE

### 8.1 Manufacturer Certificate / EU Design Conformity Declaration

We, **Firebird**, declare under our sole responsibility that the light oil burners named **FB 4 R ... LN** is conform to the following standards:

- EN 267
- EN 55014-1
- EN 60335-1
- EN 61000-6-2
- EN 50156-1
- EN 55014-2
- EN 60335-2-102
- EN 61000-6-3

These products bear the **CE** mark in accordance with the stipulations of the following directives:

- 2014/35/UE Low Voltage Directive
- 2014/30/UE EMC Directive
- 2006/42/EC Machine Directive
- 2011/65/EU RoHS2 Directive

*April 2018 / Mr. Filippo Maltempi*

R&D Director



## 9 APPENDIX

### 9.1 Use of bio fuel blends

The burner is suitable for light oil with a biofuel content of up to 10%. It is a minimum requirement that the fuel blend (up to 10% Biofuel) is obtained with light oil in accordance with the relevant standards, regional regulations and FAME in accordance with EN 14214.



#### **IMPORTANT INFORMATION**

In the event that the burner needs to be used with fuels containing biofuel percentages higher than 10%, contact the manufacturer.

### 9.2 Important advice for the use of bio fuel blends

#### 9.2.1 Introduction

The growing attention focussed on renewable and sustainable energy sources would suggest an ever-increasing use of biofuels.

If you plan to make use of these fuels, you need to consider several technical aspects in order to reduce the potential for faults in the burner and heating system and the risk of fuel leaks. The term 'liquid Biofuel' is a broad definition that includes oils made from numerous different raw materials, including recycled cooking oil. These types of oil must be considered and treated differently from common mineral and fossil fuels. This is because they are more acidic, hygroscopic and less stable.

Particular care should be taken in the storage of this fuel, in the supply pipe, in the ancillary equipment, in the filtration and in the choice of burner.

The classification of the biofuel is important for the smooth operation of the equipment.



#### **IMPORTANT INFORMATION**

The proprietor or the system manager is responsible for the detailed analysis of potential risks associated with the introduction of a mixture of biofuels and the suitability of the devices and installation.

#### 9.2.2 General instructions and information

The supplier of the fuel must demonstrate compliance with an accredited quality management system for their storage, mixing and delivery processes.

During installation, make sure that all the materials and sealing devices used on the storage tank and oil delivery pipe to the burner are compatible with biofuels.

The tank must have a good quality biofuel-compatible oil filter and a **60 micron** secondary filter to protect the burner from contaminants.

Wherever an existing tank is to be used to store the oil, in addition to the above mentioned checks on the materials, it is essential that the tank is first inspected to verify its condition and check for the presence of water or other contaminants. If contaminants are found, a deep clean should be carried out. If this is not carried out the hygroscopic nature of the fuel could dissolve and detach complex components and cause faults in the equipment.

Based on the capacity of the storage tank and how the system is used, fuels can be stored inside it for a considerable amount of time. Consult your biofuel distributor for the use of biocidal products to prevent microbial growth inside the tanks and for instructions on fuel filtering.

During the commissioning of the burner, check that all combustion parameters are compliant with the recommendations in the technical manual for the appliance.

Check the filters on the burner oil pipe and oil pump, and if necessary replace them:

- at least every 4 months during burner use
- before starting the burner following a long period of disuse
- more often in the event of contamination.

**CAUTION**

Pay particular attention during the check and inspection to detecting fuel leaks from sealing devices, gaskets and hoses.

**CAUTION**

IF Bio fuel is used consult your Bio fuel distributor.





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