FB 2 K LN

LOW NOx KEROSENE BURNERS

ErP READY

Instructions to Assembly, Commissioning and Maintenance

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

Firebird by elco

EN

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 2 K 18 LN	415633	3147699
FB 2 K 20 LN	415634	3147700
FB 2 K 26 LN	415635	3147701
FB 2 K 35 LN	415636	3147702

BURNER DESIGNATION

FB 2 K 26 LN

FB 2 **Burner Series**

K **Kerosene**

BOILER MODEL

26 Boiler nominal power (max)

EMISSION

LN Low NOx

NOx < 120 mg/kWh according to European Commission Regulation No 813/2013 and to pr EN267/2016 Class 4.

CONTENTS

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 the 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

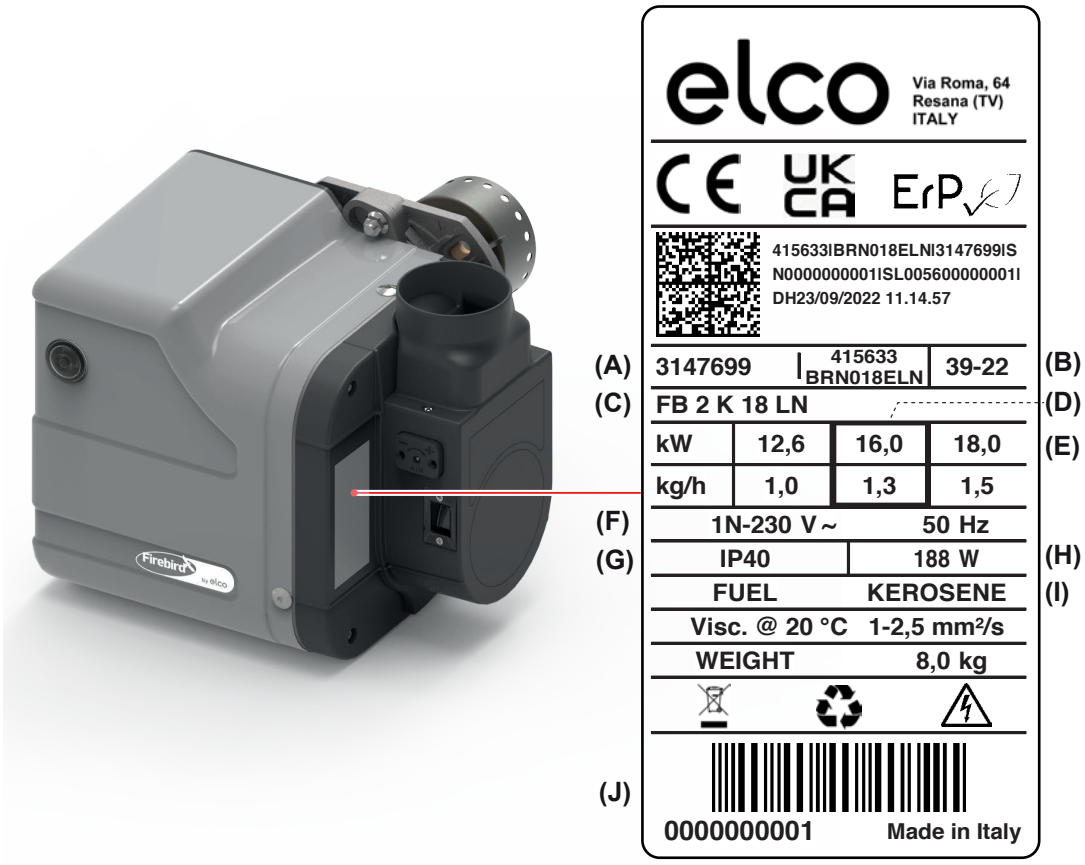
FB 2 K LN is a latest generation single-stage burner fuelled by kerosene. The innovative combustion head ensures low NOx and CO emissions within the emission limits set out by European Regulations for energy related products (ErP).
The burner uses functional components that, in addition to ensuring a 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 2 K 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 2 K LN** includes the following equipments:
- n°1 flange with fixing bolt
- n°1 gasket
- n°1 flexible oil pipe L=900 mm
- n°1 nipple G3/8-1/4 (for flexible oil pipes)
- cable kit with 7 and 5 pin connectors (already mounted)
- 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”).



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

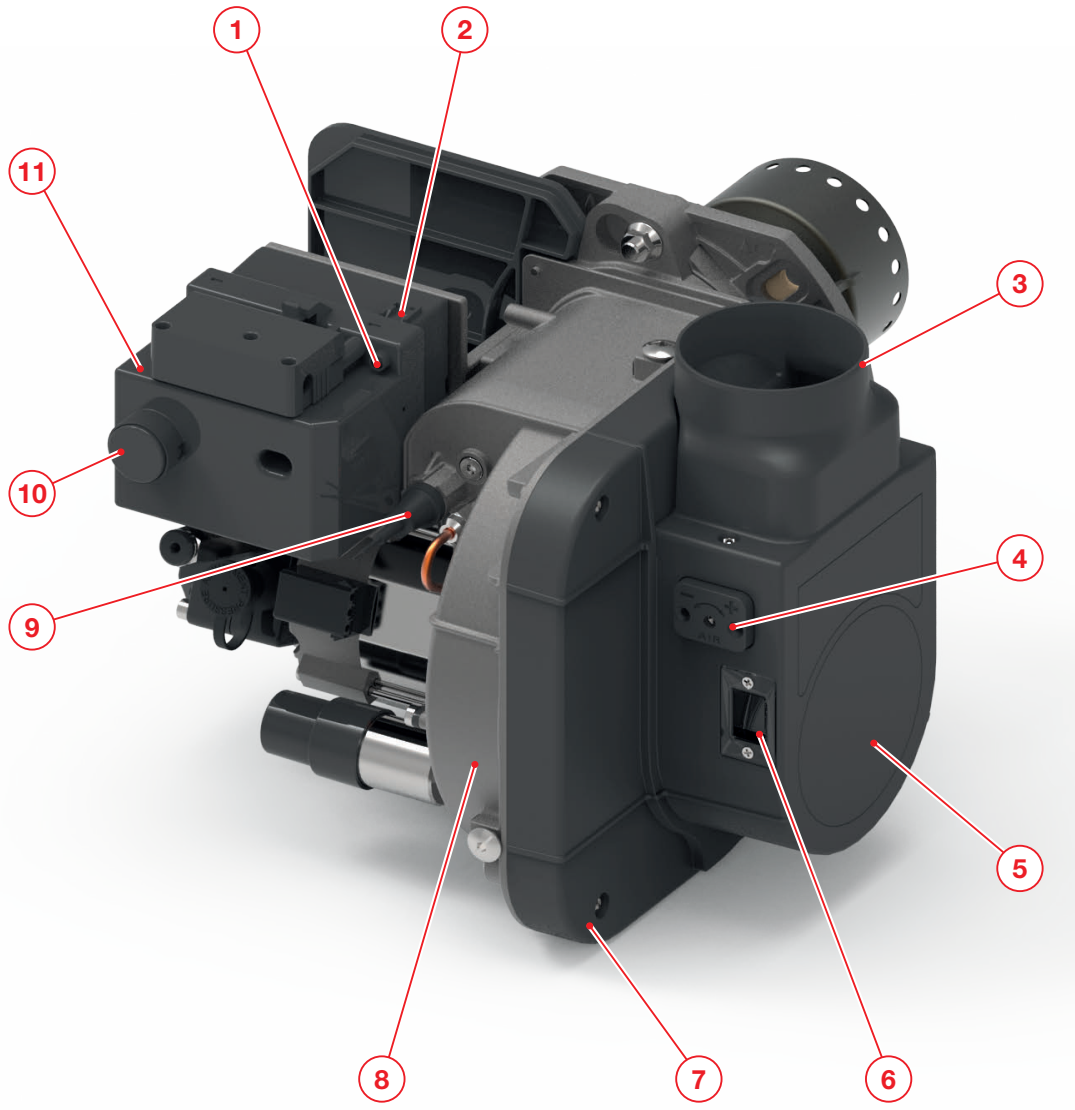
Fig. 1

CAUTION

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.

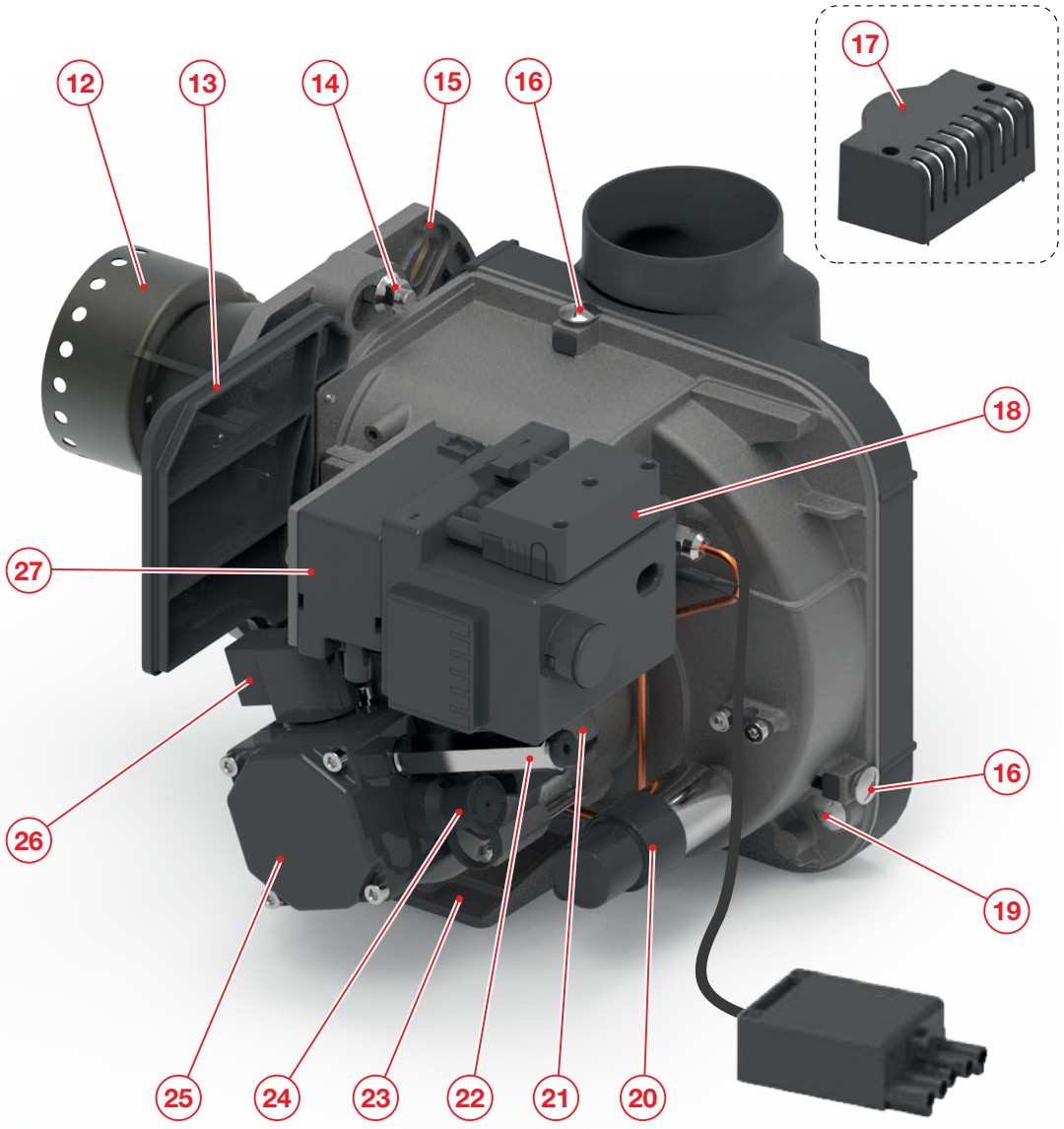
2.4 Structure

2.4.1 Structure of the burner



1	Power indication LED	**7**	Fastening screws for equipment plate
2	Connection PLUG-IN between equipment and ignition transformer	**8**	Housing for internal rotor
3	Snorkel	**9**	Flame sensor
4	Air setting	**10**	Reset button
5	Air intake	**11**	Control box
6	Air valve indicator		

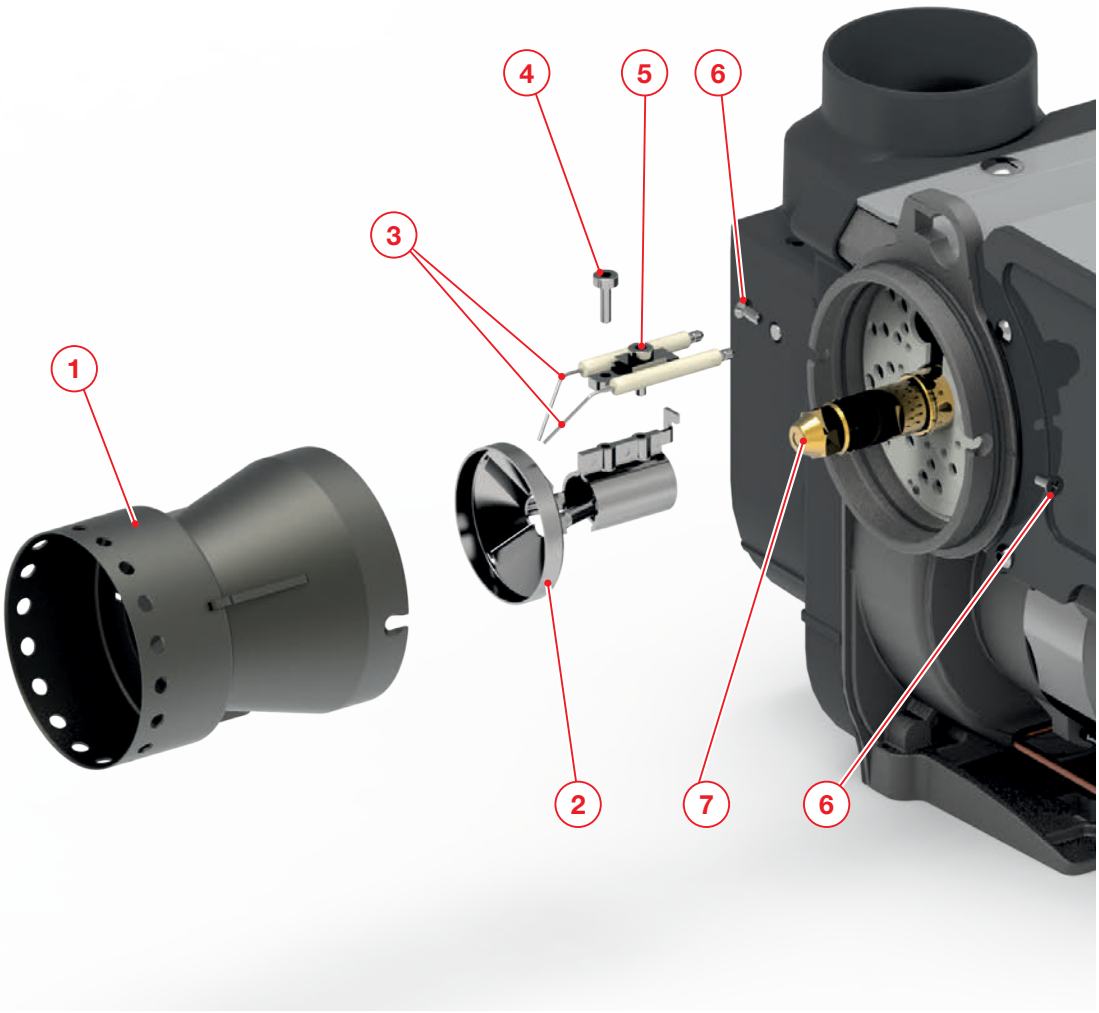
Fig. 2



12	Combustion head	**21**	Electric motor for pump and fan
13	Front panel	**22**	Extended pressure port
14	Burner fixing bolt	**23**	Burner base
15	Burner flange	**24**	Oil pressure regulator
16	Burner cover fixing screw	**25**	Fuel-oil pump
17	Conventional flue carter (optional)	**26**	Solenoid valve
18	Cable kit with 7 and 5 pin connectors	**27**	Ignition transformer
19	Cover fixing screw (additional)		
20	Capacitor		

Fig. 3

2.4.2 Structure of the combustion head



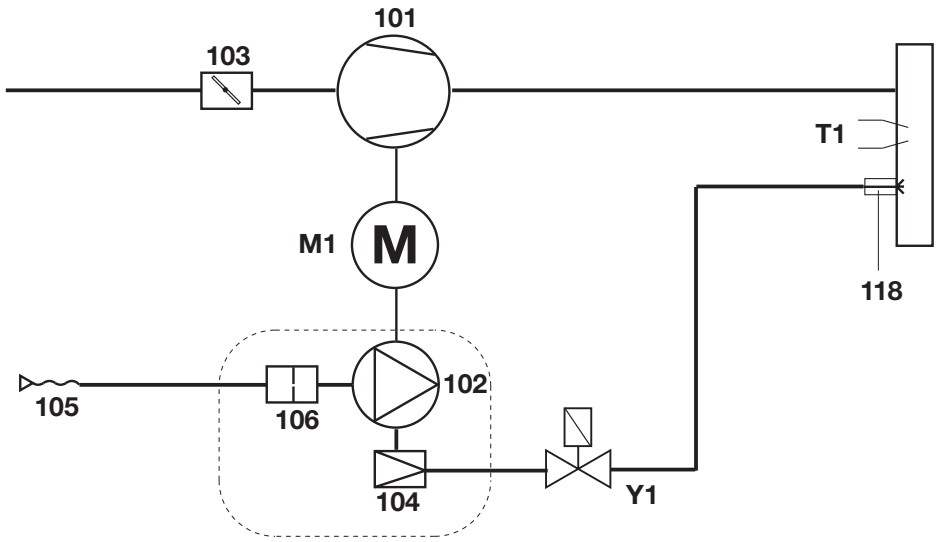
1	Blast tube	**5**	Electrode group fixing screw
2	Diffuser	**6**	Blast tube fixing screw
3	Electrode group	**7**	Nozzle
4	Diffuser fixing screw		

Fig. 4

2.5 Control box

The EBR-M1 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 ± 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 ± 8 V.

2.6 Operating logic



M1 Burner motor
T1 Ignition transformer
Y1 Solenoid valve
101 Fan
102 Oil pump
103 Air flap
104 Oil pressure regulator
105 Flexible oil pipe
106 Filter
118 Nozzle

Fig. 5

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 20 s starts.
- 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.

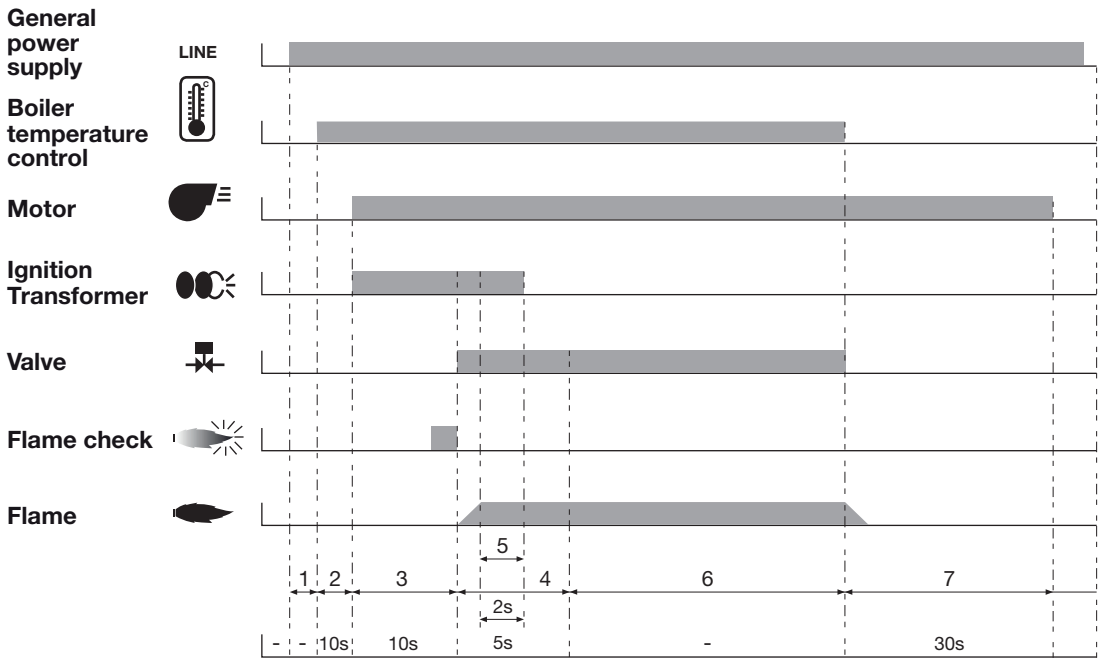
2.6.2 Controlled shutdown

- 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 30 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).

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.



1 Stand-by
2 Circuit stabilisation period
3 Prepurge time
4 Safety time
5 Post-Ignition time
6 Working phase
7 Post-purge

Fig. 6

IMPORTANT INFORMATION
After a maximum number of 3 ignition attempts (full recycles), burner in case of loss of flam goes to lockout not volatile.

3 TECHNICAL DATA

3.1 Dimensions and weights

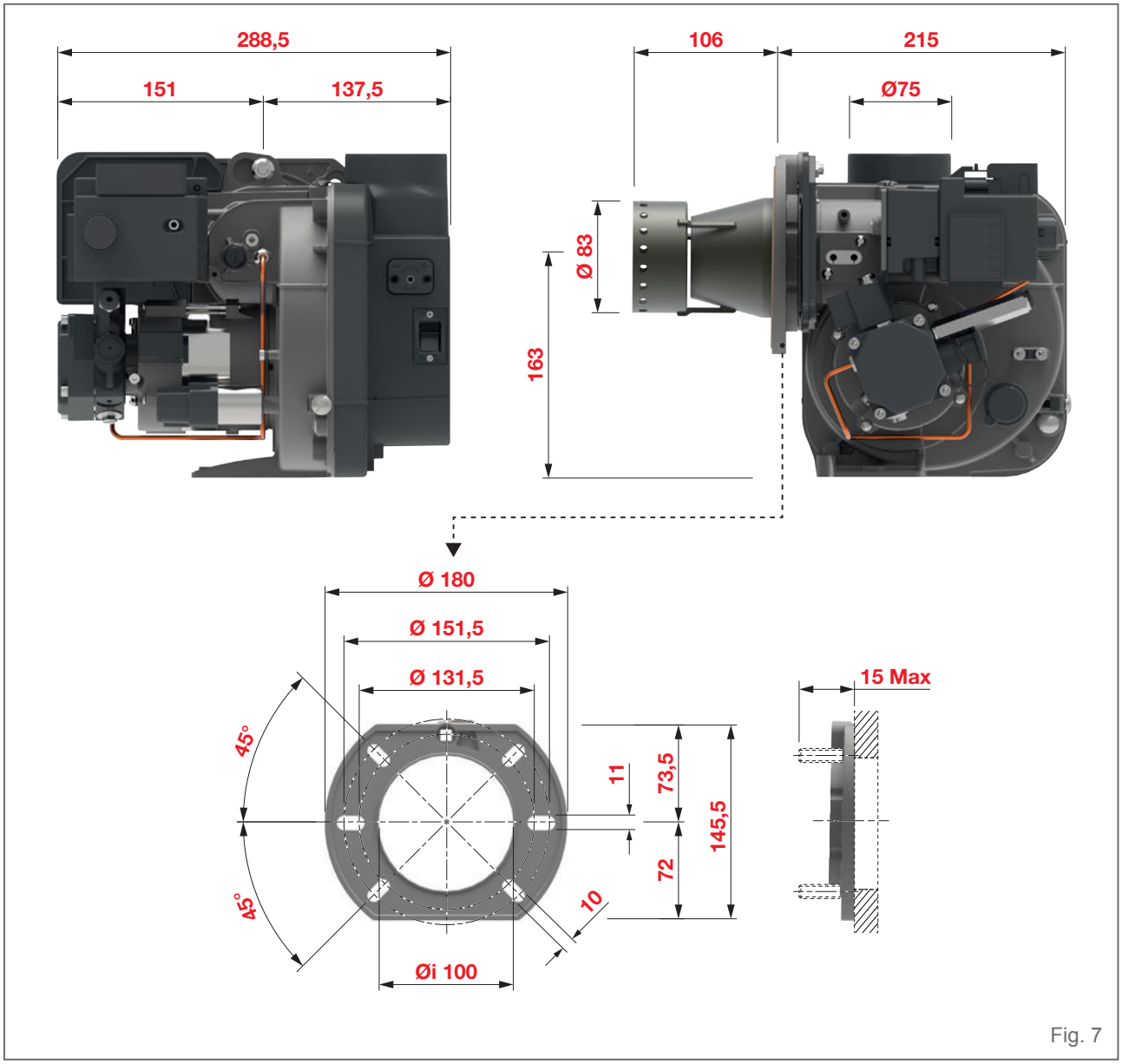


Fig. 7

Model	Weight (kg)	
	net	with packaging
FB 2 K 18 LN	8	9,8
FB 2 K 20 LN	8	9,8
FB 2 K 26 LN	8	9,8
FB 2 K 35 LN	8	9,8

All measurements are given in millimetres.

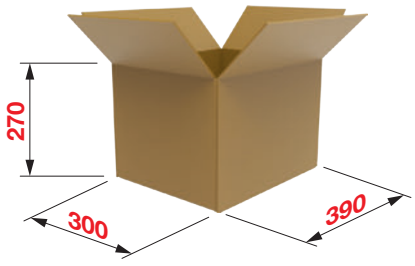


Fig. 8

3.2 Technical data

	FB 2 K 18 LN	FB 2 K 20 LN	FB 2 K 26 LN	FB 2 K 35 LN
Burner output factory setting (1)	16,0 kW	18,6 kW	24,0 kW	31,7 kW
	13.760 kcal/h	16.000 kcal/h	20.640 kcal/h	27.260 kcal/h
Oil throughput factory setting (1)	1,3 kg/h	1,5 kg/h	2,0 kg/h	2,6 kg/h
Fuel oil (2)	Kerosene, visc 1÷2,5 mm^2/s at 20°C (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-M1 10-30			
Flame sensor	E.B.R. FTEB (GREEN)			
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 Ph / 230 V / 50 Hz			
Power consumption (operation) (+/- 5W) (2)	188 W	190 W	185 W	175 W
Protection level	IP40			
Sound pressure level	65 dB(A)			
Ambient temperature for storage	-20°C ... +70°C			
Temperature for use	-10°C ... +60°C			

(1) Reference conditions: Ambient temperature 20 °C – Barometric pressure 1013 mbar – Altitude 0 m. a.s.l.
(2) At least after 5 hours cumulative working.

WARNING
(2) The burner is suitable for kerosene with bio content up to 30%. It is a minimum requirement that the fuel blend (up to 30% Bio) is obtained with kerosene in accordance with the relevant standards and regional regulations.
In case of Bio oil content higher that 30% please contact the manufacturer.

3.3 Electrical diagram

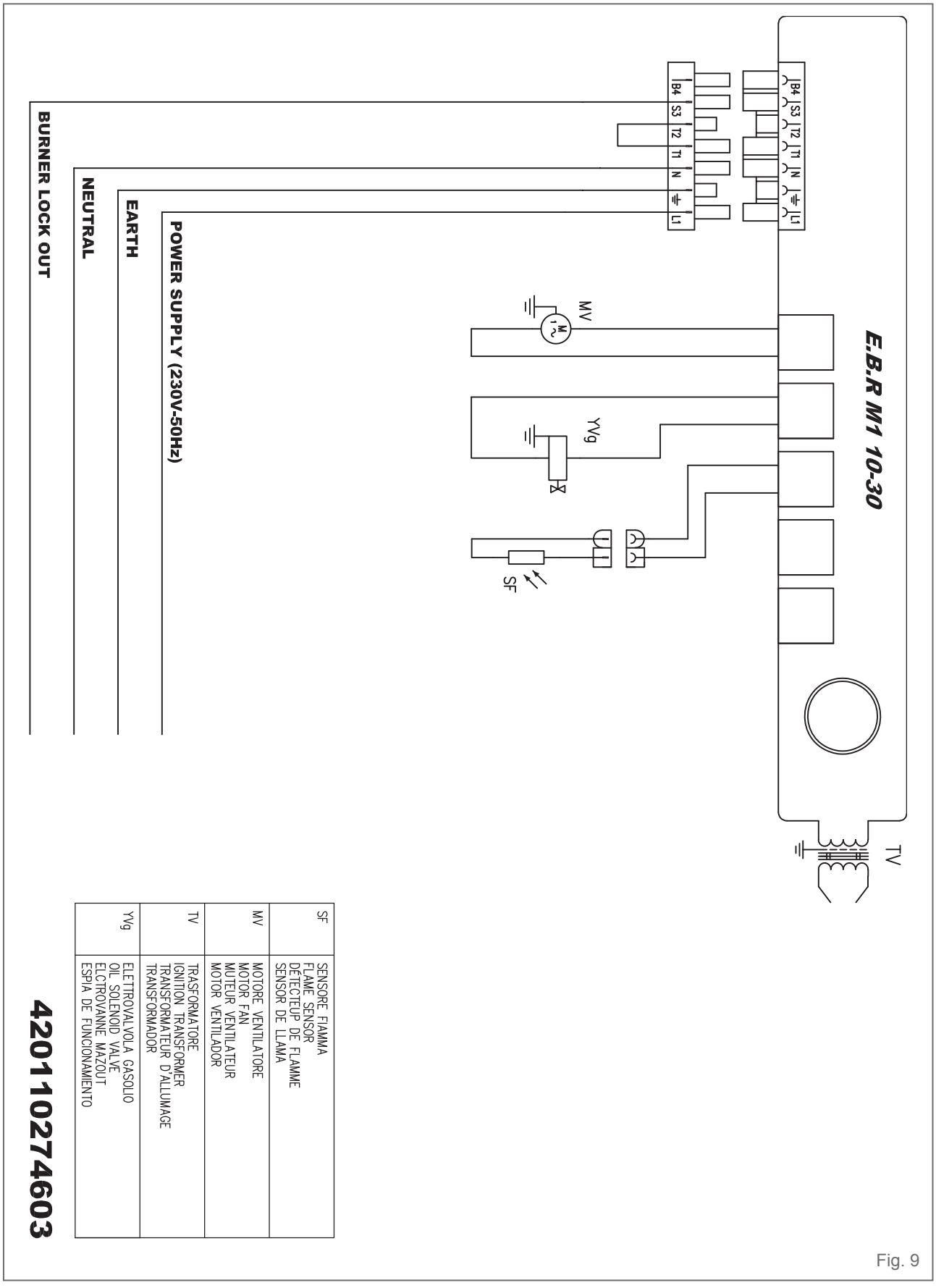


Fig. 9

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
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
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
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.

4.2 Installation area

Before installation, make sure that the installation area satisfies the following requirements:
- operating temperature between -10°C and +60°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
- 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)

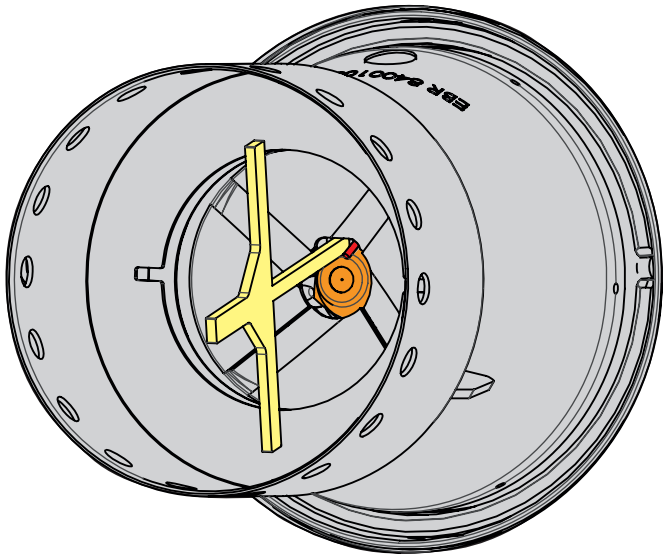


Fig. 10

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

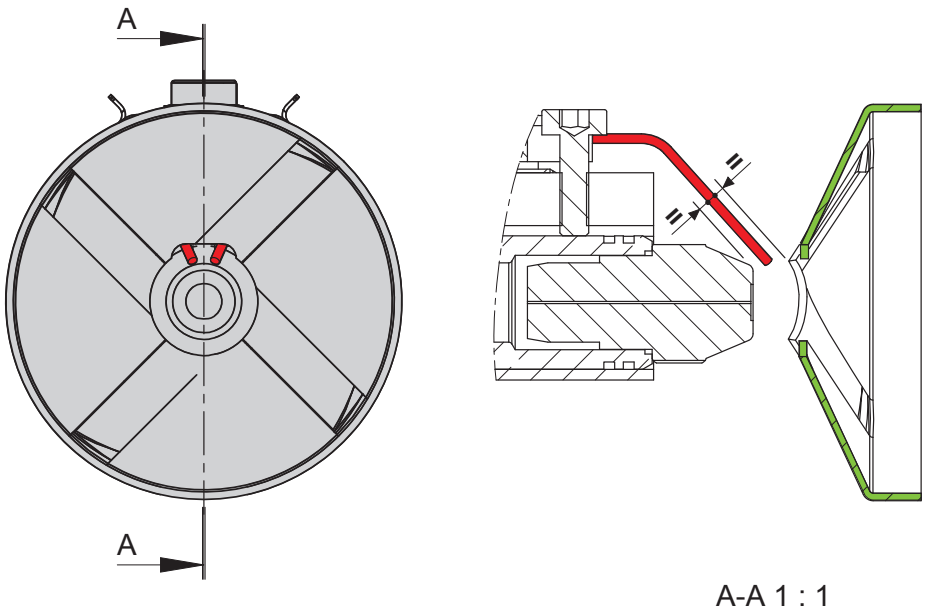


Fig. 11

4.5 Burner assembly

CAUTION

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.

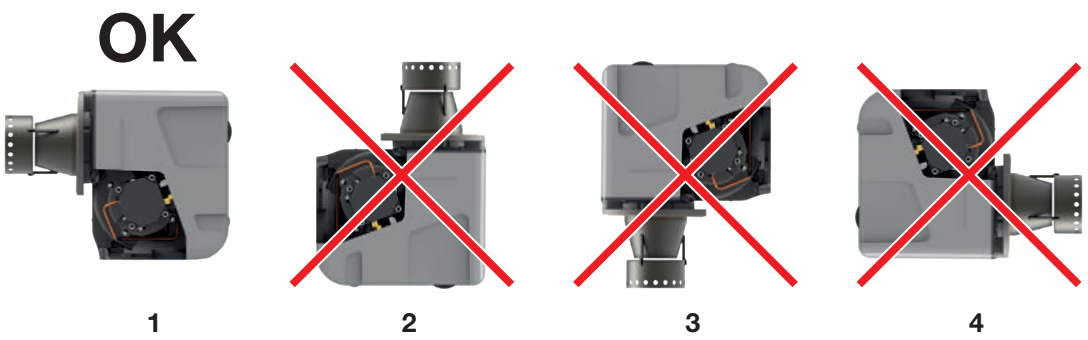


Fig. 12

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).

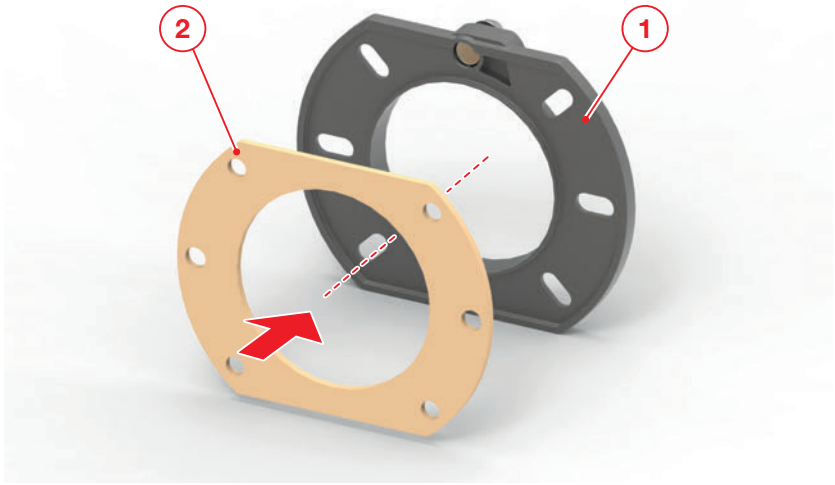


Fig. 13

- 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

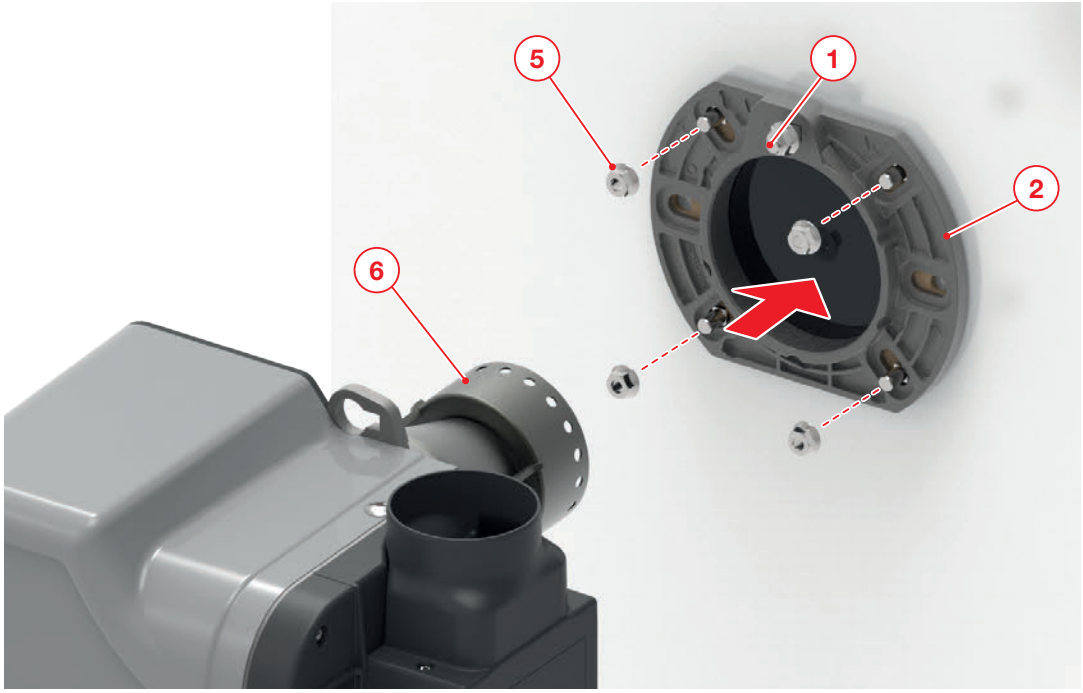


Fig. 14

- 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

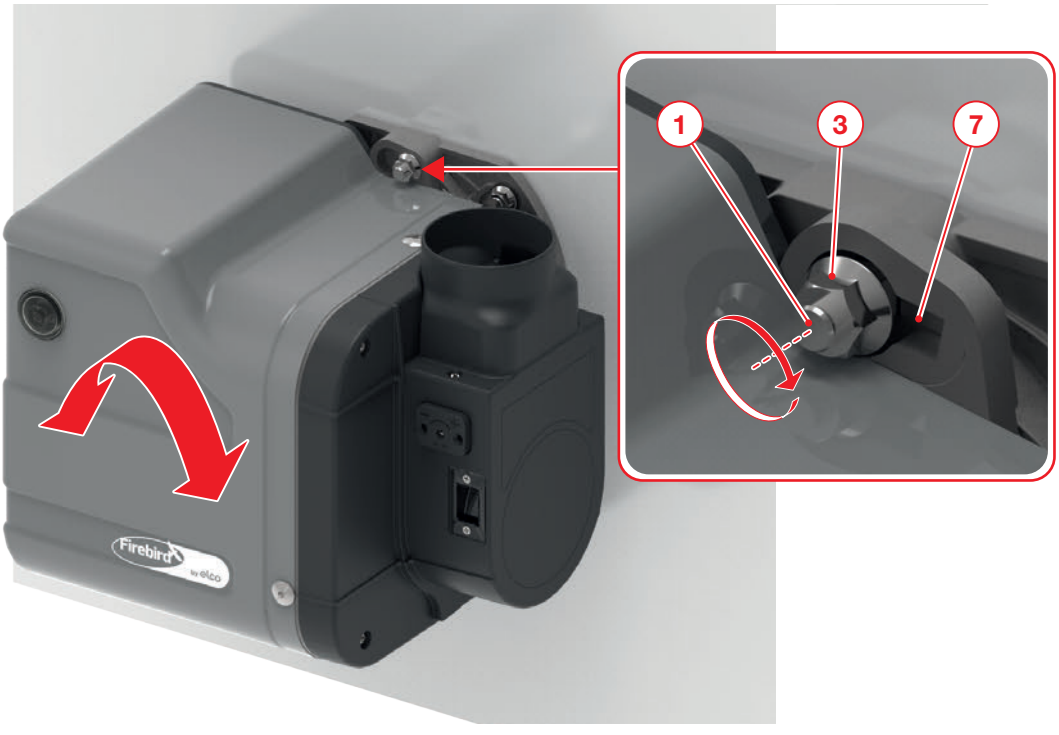


Fig. 15

- insert the air intake pipe (8) and secure it using a pipe clamp (9), not supplied
- in case of conventional flue applications remove snorkel and air conveyor (10) and replace with the conventional flue carter (11) (optional).

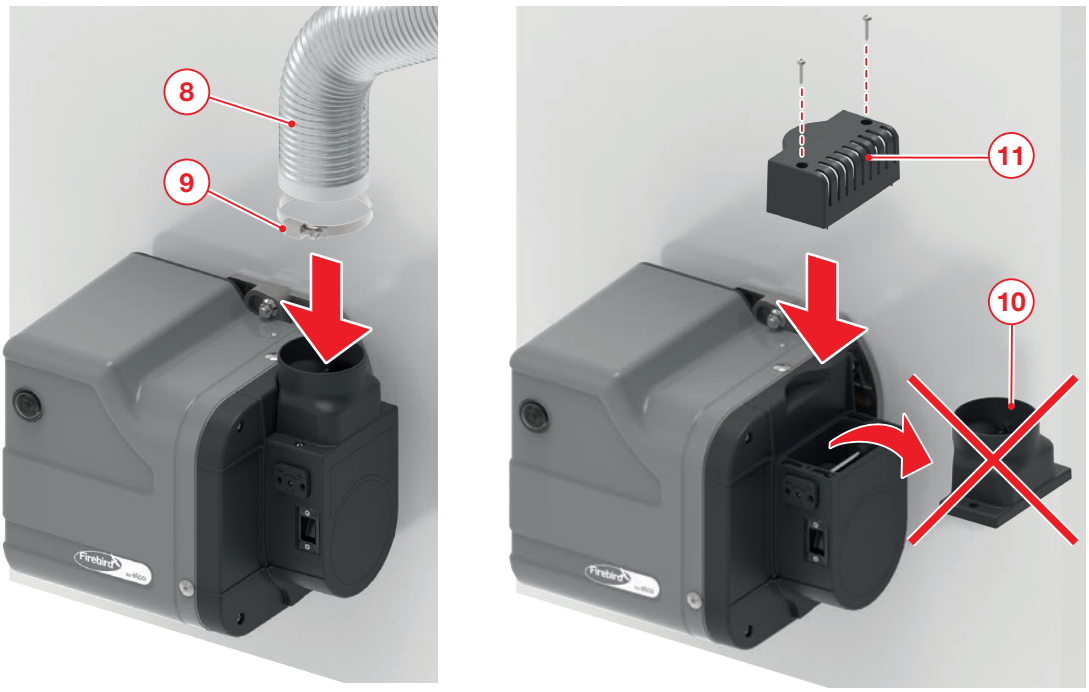


Fig. 16

4.6 Removing and fitting the burner cover

- To remove the burner cover, loosen the two screws (1) and then slide out the burner cover (2) taking care not to damage it.
- To refit it, invert the procedure above.

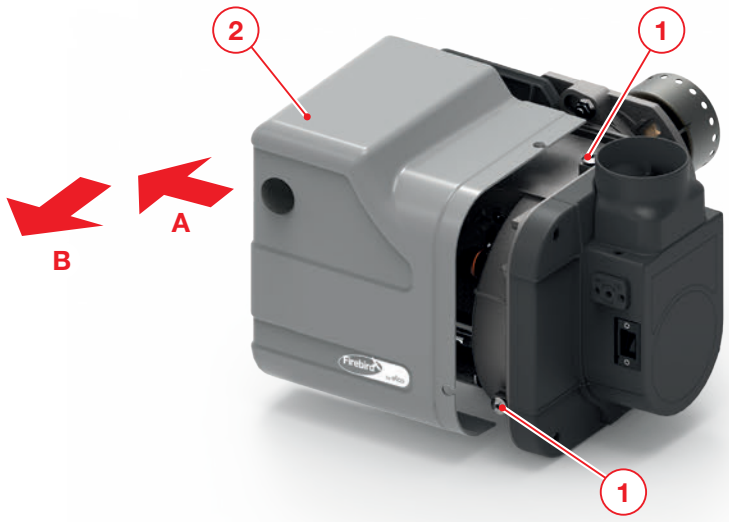


Fig. 17

4.7 Oil systems

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.

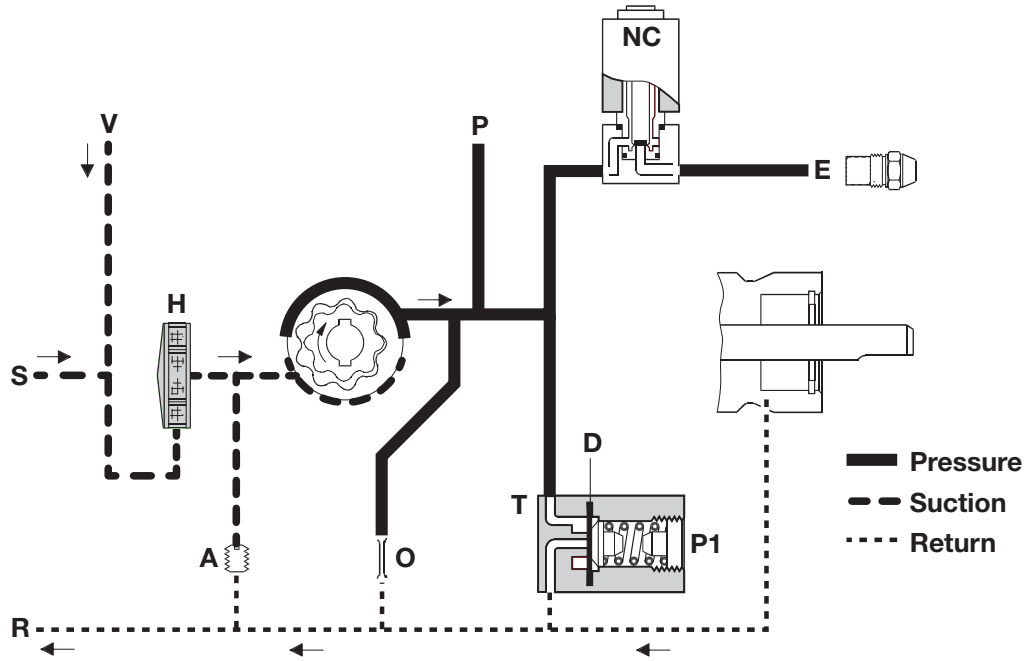
WARNING
Danger of injury from gas in the atmosphere!
To prevent the formation of gas caused by worst combustion/deflagration:
- when filling the tank, switch off the burner and leave it switched off for approximately 3 hours to ensure degassing of the fuel and the deposit of suspended particles
- have 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.

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

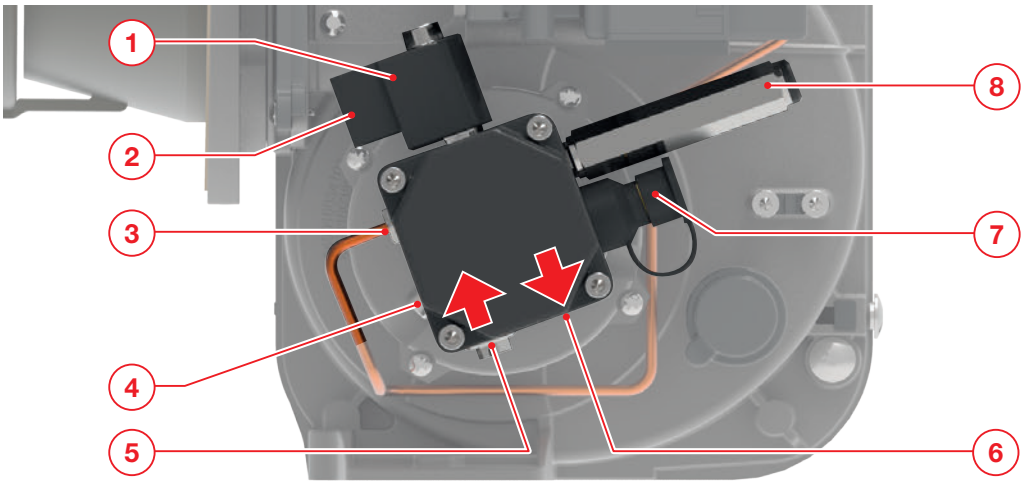
4.7.1 Hydraulic diagram



A	Bypass screw	**P**	Pressure gauge port
D	Diaphragm	**P1**	Pressure adjustment
E	Nozzle outlet	**R**	Return outlet
H	Filter	**S**	Suction inlet
NC	Valve	**T**	Pressure regulator
O	Constriction	**V**	Vacuum gauge port

Fig. 18

4.7.2 Oil pump



1	Fuel-oil solenoid valve	**5**	Suction connection
2	Solenoid valve electrical connection	**6**	Return connection
3	Fuel delivery pipe	**7**	Oil pressure regulator
4	Vacuum port pressure gauge connection	**8**	Oil pressure gauge connection

Fig. 19

- **One-pipe system (standard)**

The pump is supplied for operation with one pipe. The return connection is capped. Inside the pump, there is a screw with a by-pass washer (10) which allows the fuel to recirculate inside the pump.
To apply the fuel delivery pipe, proceed as follows:
– remove the plastic cap (12) and screw in the delivery pipe (13) supplied with the burner.

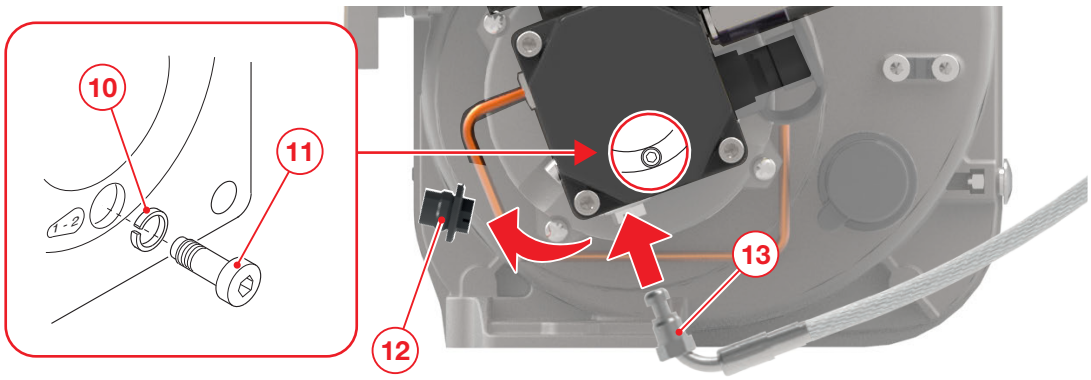


Fig. 20

CAUTION

CAUTION
- Only approved fuel lines are to be used.
- In case of one-pipe systems only one flexible pipe is required.
- The second flexible oil pipe is to be used in case of two-pipe systems.

- **Two-pipe system (optional)**

For two-pipe operation it is necessary to remove the by-pass washer.
To apply the fuel return pipe, proceed as follows:
– remove the cap (14) from the connection and screw in the additional return pipe (15), supplied with the burner
– unscrew the four screws (17) and remove the cover (16) from the pump
– unscrew screw (11) and remove the by-pass washer (10)
– screw in screw (11) and the cover (16).

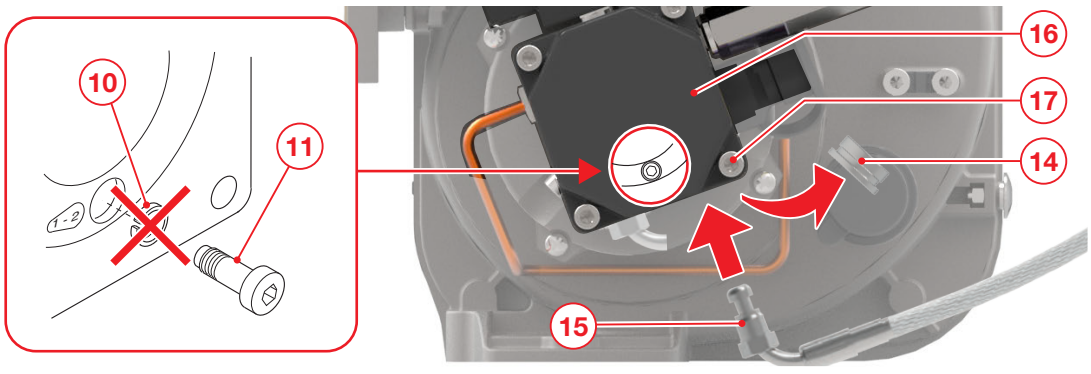


Fig. 21

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.

WARNING

WARNING
The pump vacuum should not exceed a maximum of 0.4 bar (30cm Hg).
Beyond this limit gas is released from the oil.

CAUTION

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

4.7.3 Oil feed and suction line with one-pipe system

Burner lower than tank

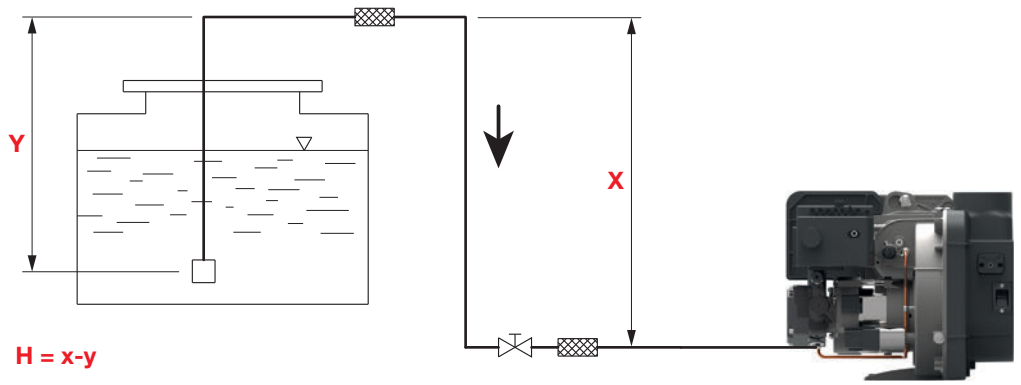


Fig. 22

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

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

Burner higher than tank

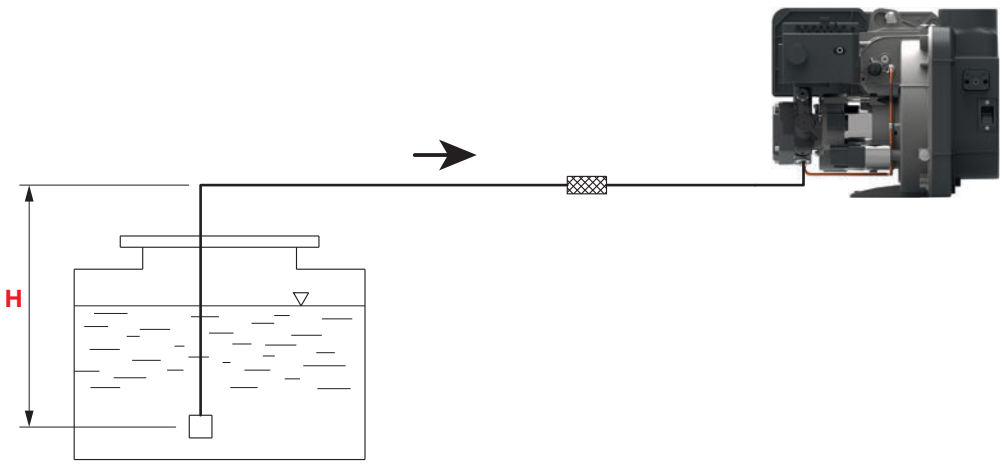


Fig. 23

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
-	-	-	-

4.7.4 Oil feed and suction line with two-pipe system

Burner lower than tank

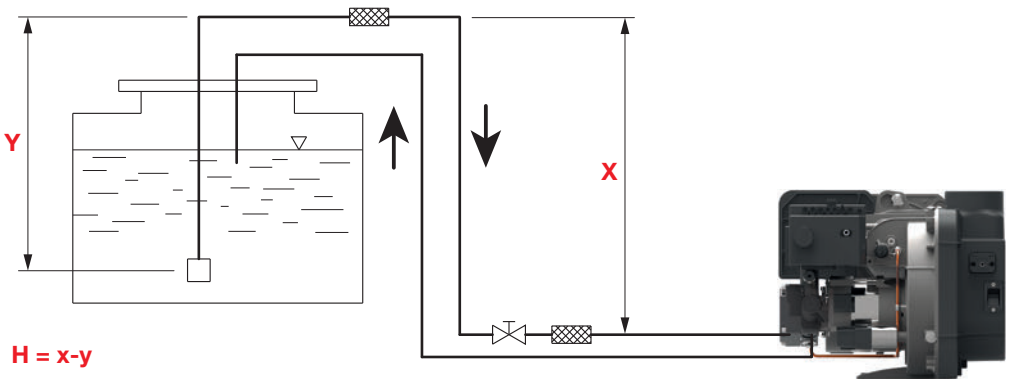


Fig. 24

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

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

Burner higher than tank

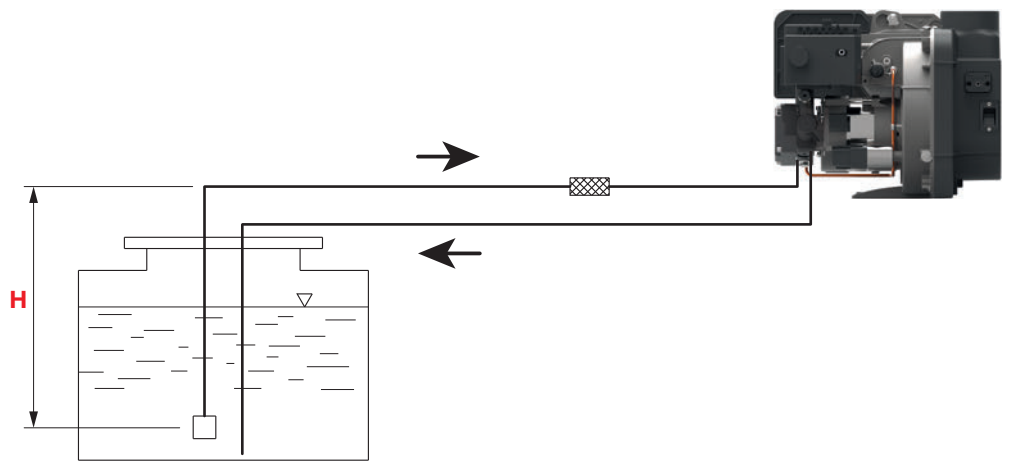


Fig. 25

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
-	-	-	-

4.8 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^2 (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.

4.8.1 Electrical connection to the boiler

Burner **FB 2 K LN** leaves the factory configured for connection to a 7 pin electrical cable.
An adaptor cable kit from 7 pins to 5 pins is also supplied and factory mounted.

Proceed as follows to connect the burner to the boiler:
- remove the burner cover (1) as described in paragraph “4.6 Removing and fitting the burner cover” on page 23
- cut the band (2) and unwind the cable (3).

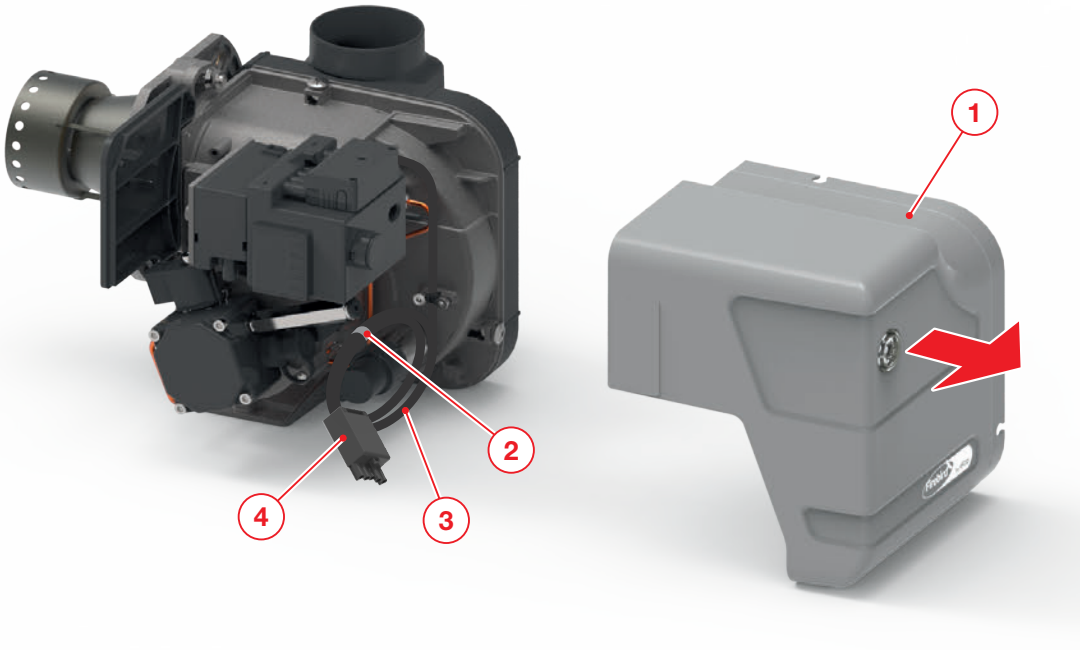


Fig. 26

- refit the burner cover (1), inverting the procedure above
- connect the 5-pin plug (4) to the boiler.

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 35
- 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	bar
FB 2 K 18 LN	0,40	80° SF	Fluidics	9,3
FB 2 K 20 LN	0,50	80° ES	Danfoss	9,8
FB 2 K 26 LN	0,65	80° ES	Danfoss	9,3
FB 2 K 35 LN	0,85	60° ES	Danfoss	8,6

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.

The pump setting foresees the tank at same level of the burner. If, during installation, there is a difference's level between tank and burner, the pump must be setting accordingly.

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.

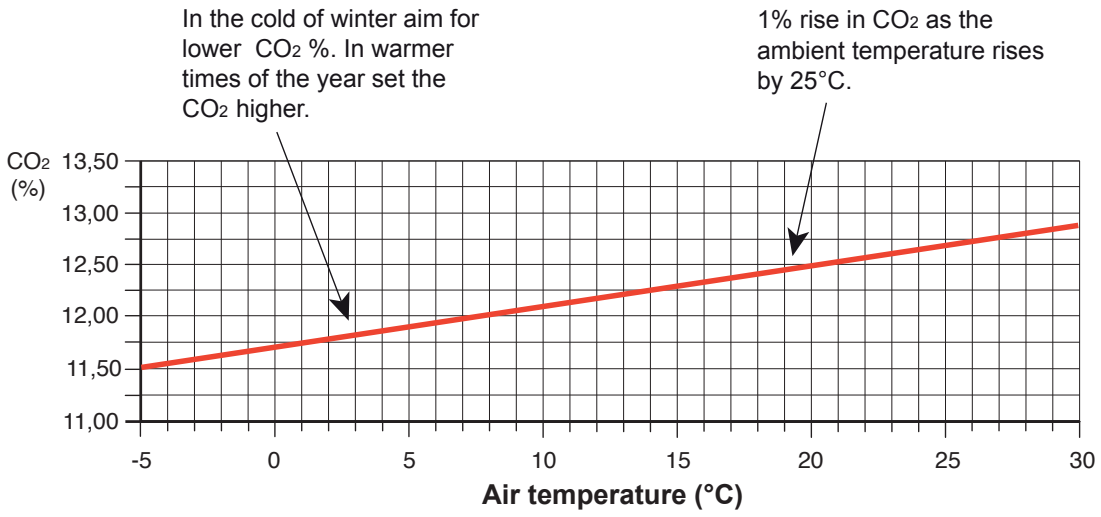


Fig. 27

5.4.1 Air flap position

Turn the hex key (1) supplied:
- clockwise to increase the air flap opening (O_2 rises, CO_2 decreases).
- counterclockwise to reduce the air flap opening (O_2 decreases, CO_2 rises).

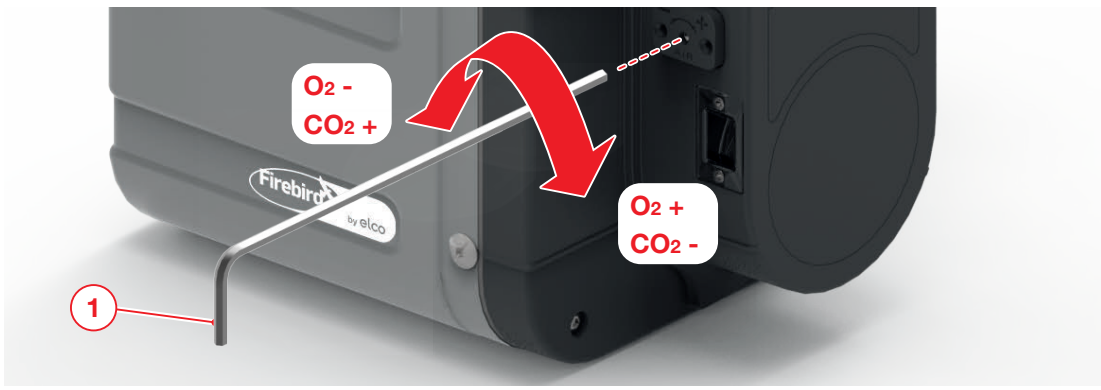
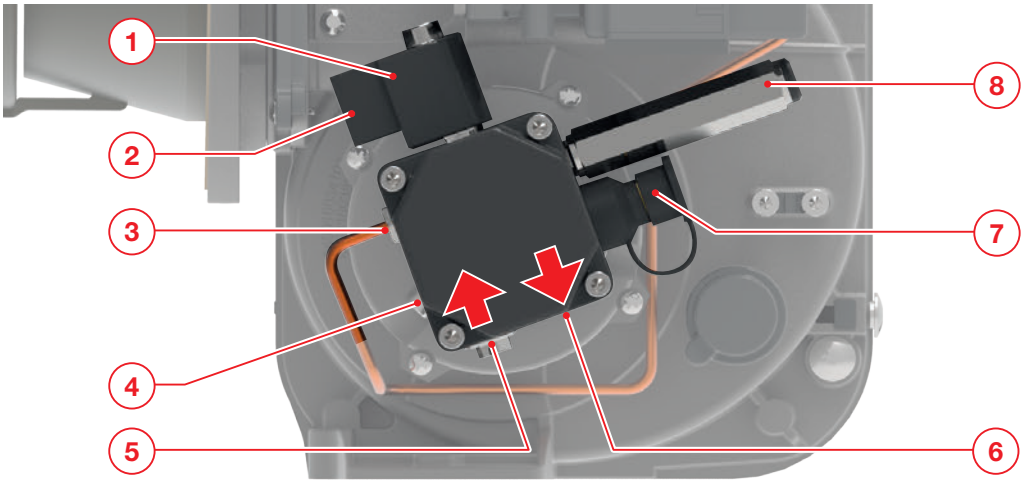


Fig. 28

5.5 Adjusting burner output



1	Fuel-oil solenoid valve	**5**	Suction connection
2	Solenoid valve electrical connection	**6**	Return connection
3	Fuel delivery pipe	**7**	Oil pressure regulator
4	Vacuum port pressure gauge connection	**8**	Oil pressure gauge connection

Fig. 29

WARNING

WARNING
Continuously check CO, CO_2 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_2, 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.

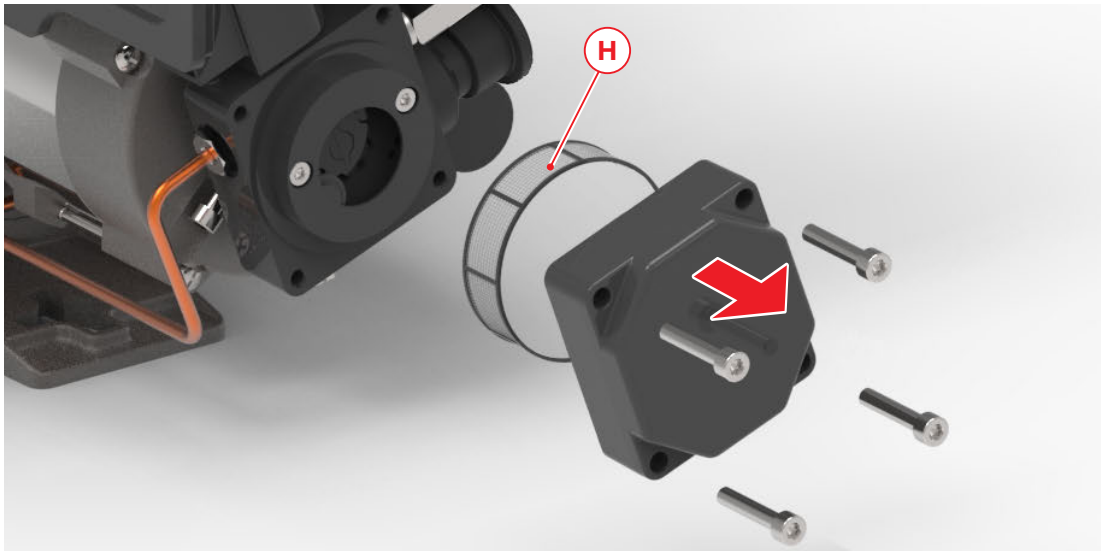


Fig. 30

5.6.4 Check pump rotation

CAUTION

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)

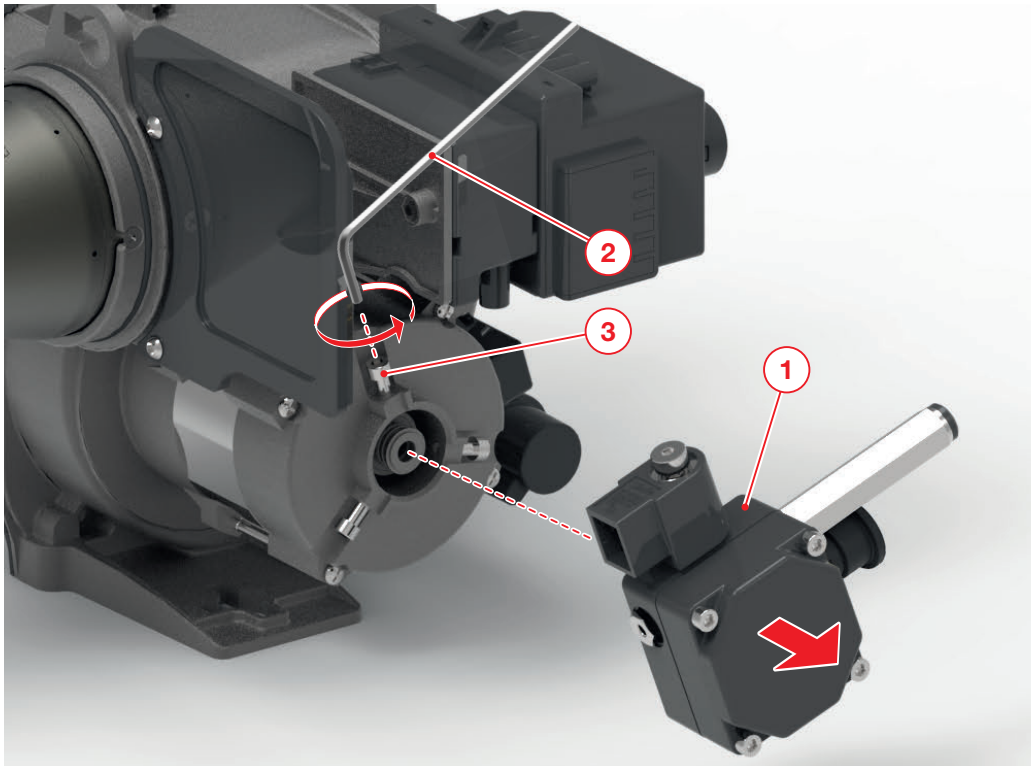


Fig. 31

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

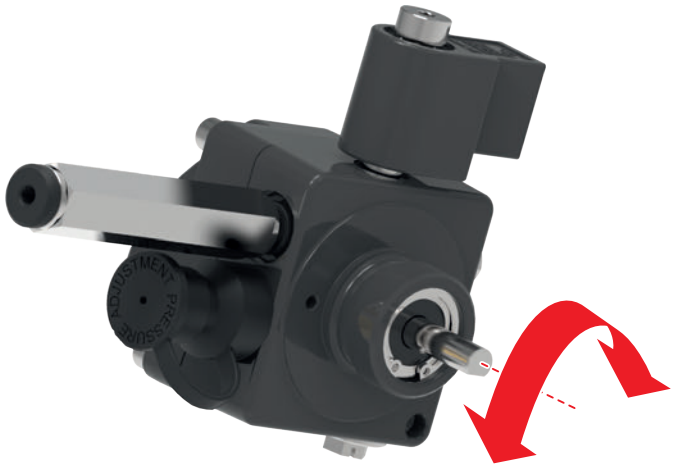


Fig. 32

- 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 2 K 18 LN	FB 2 K 20 LN	FB 2 K 26 LN	FB 2 K 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_2	Vol.%				
CO	mg / kWh				
	ppm				
NOx	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 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
- loosen the two screws (1) and then slide out the burner cover (2) taking care not to damage it.

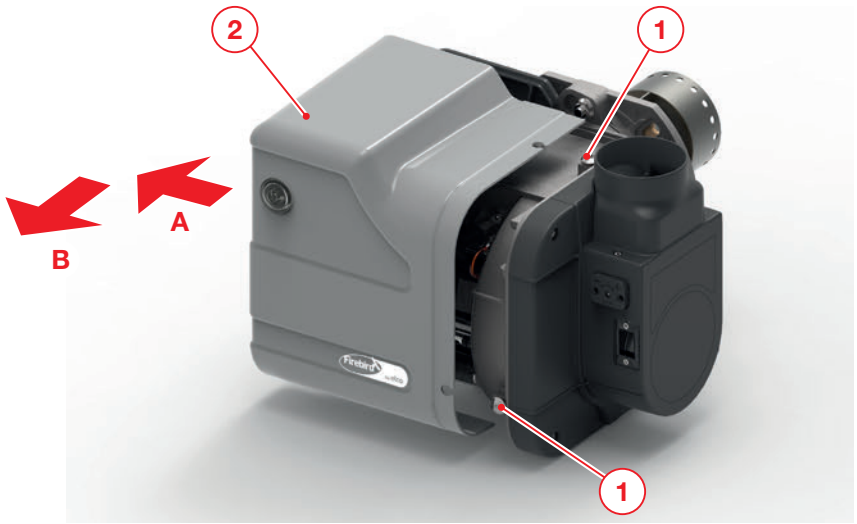


Fig. 33

- detach the electrical connector (3) from the boiler

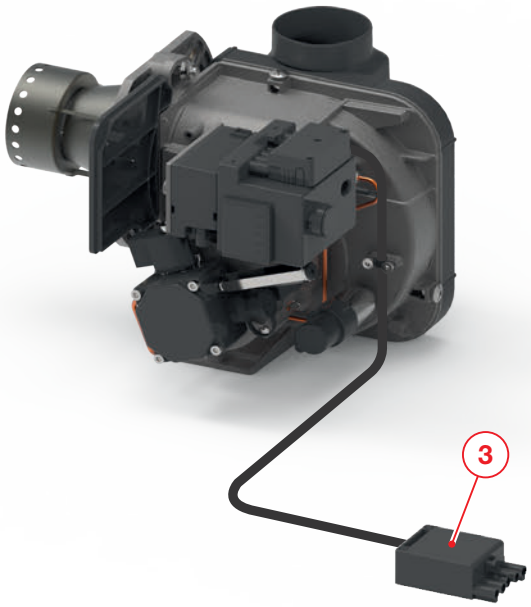


Fig. 34

– remove the fuel delivery pipe (5) and the return pipe (6), only for two pipes system

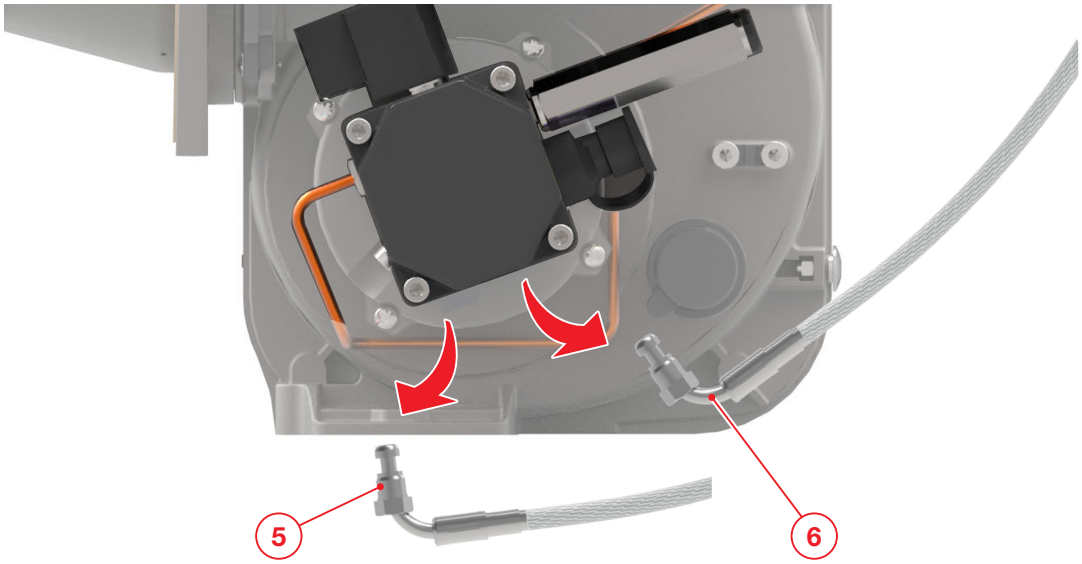


Fig. 35

– 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

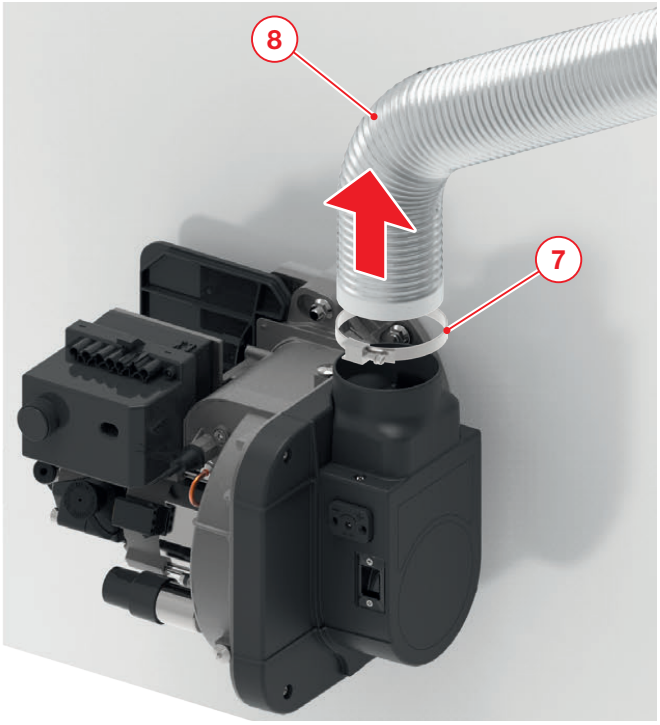


Fig. 36

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

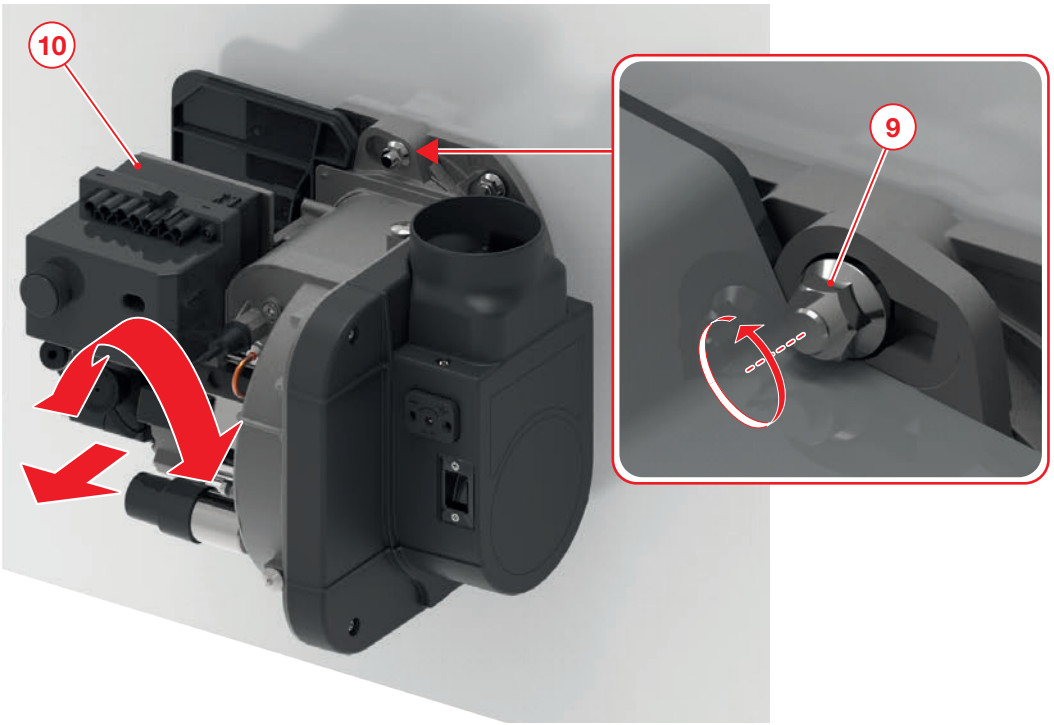


Fig. 37

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 the carried out.

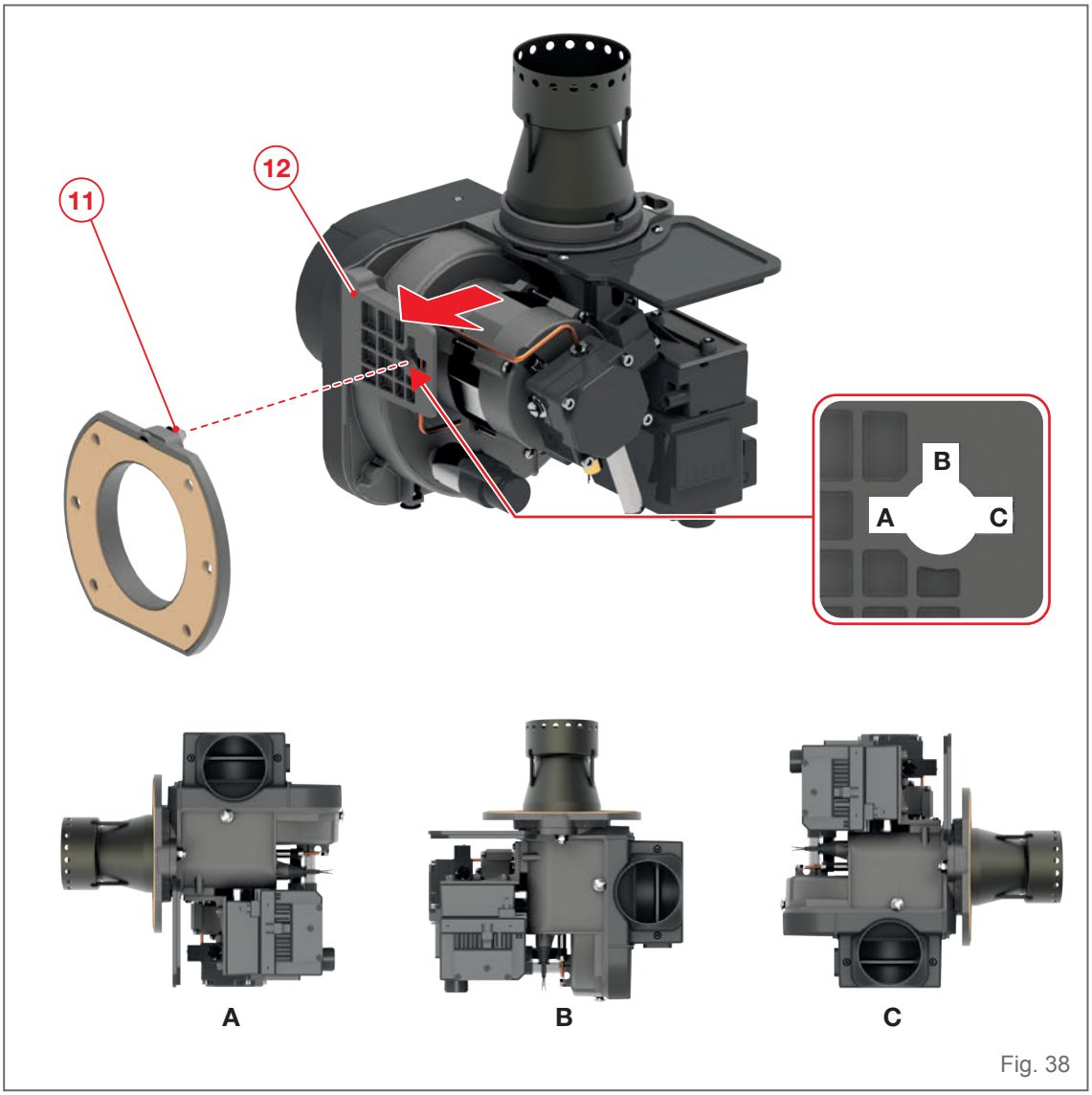


Fig. 38

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.

6.3 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.

6.3.1 Cleaning and replacing combustion head components

- Remove screws (1) using a screwdriver and slide out the blast tube (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)

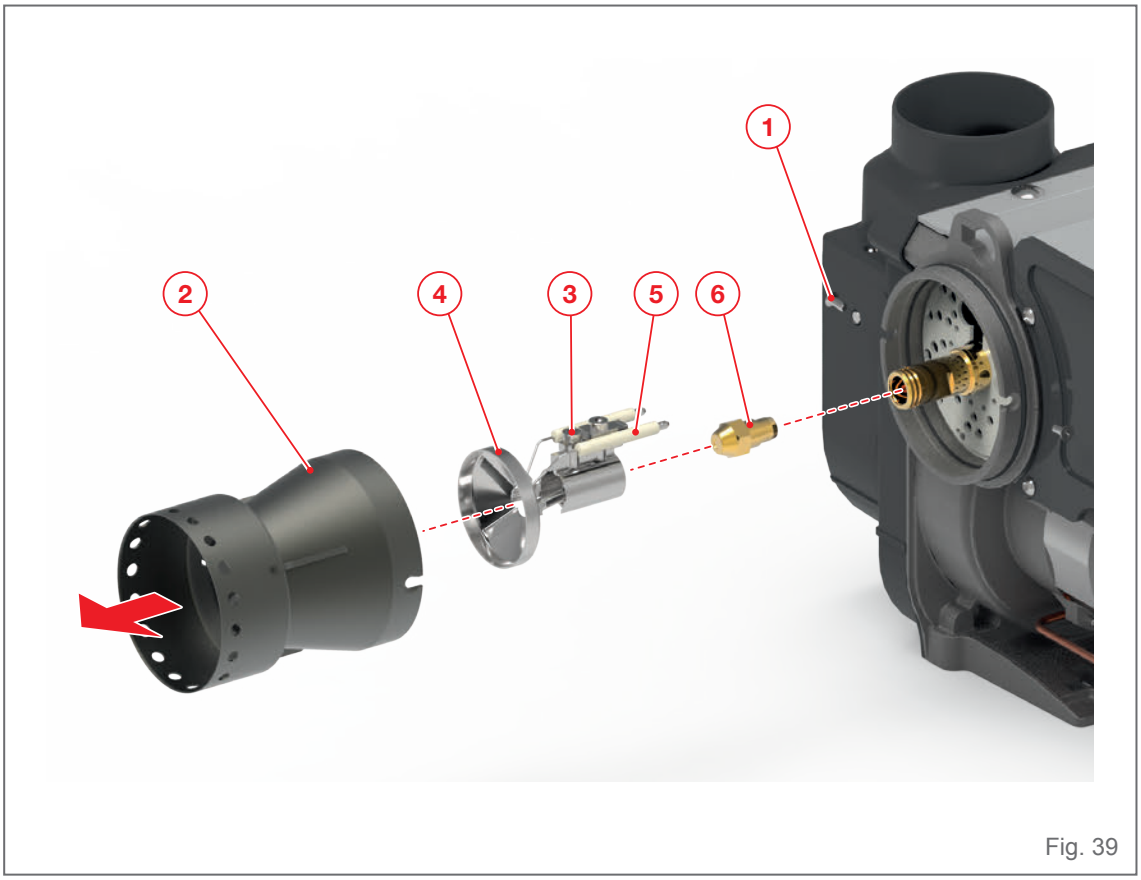


Fig. 39

- 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

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).

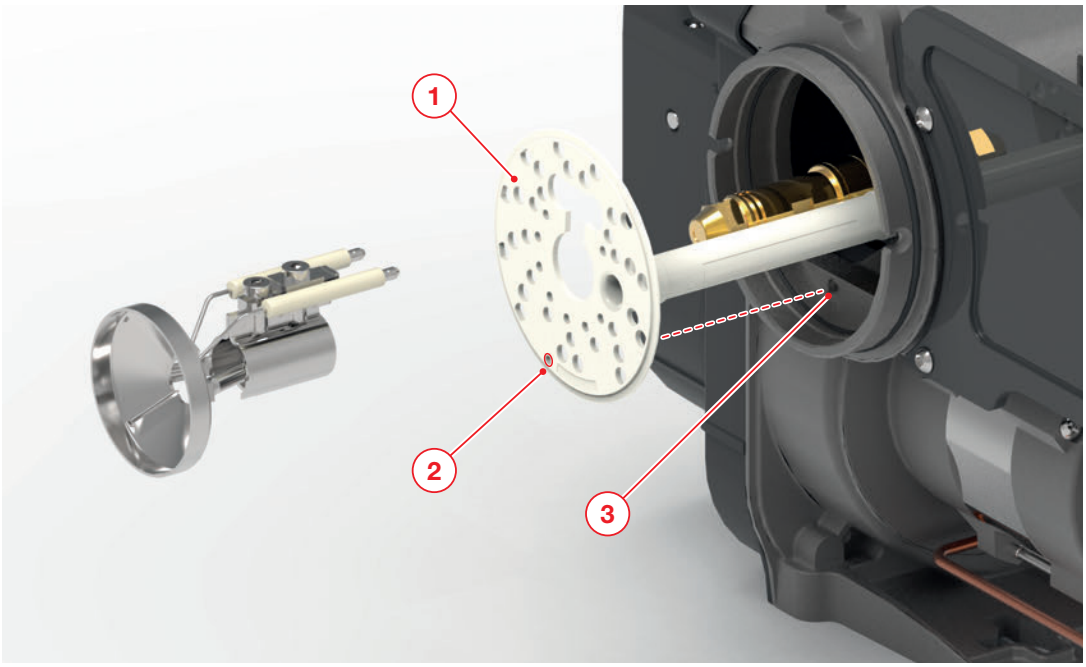


Fig. 40

6.3.2 Diffuser position check

To check the position of the diffuser:
- remove the blast tube as described in paragraph “6.3.1 Cleaning and replacing combustion head components” on page 43
- use the key provided to loosen screw (8) and allow the diffuser position check. One turn of the key is sufficient.

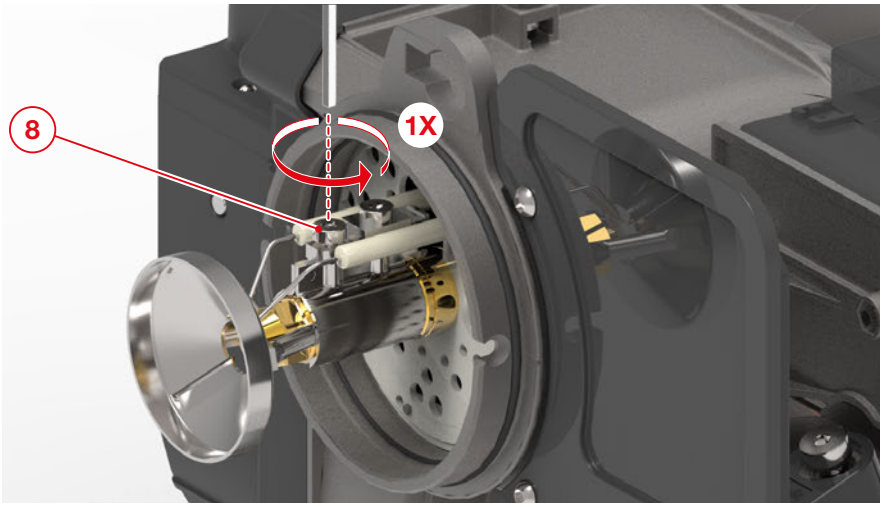


Fig. 41

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

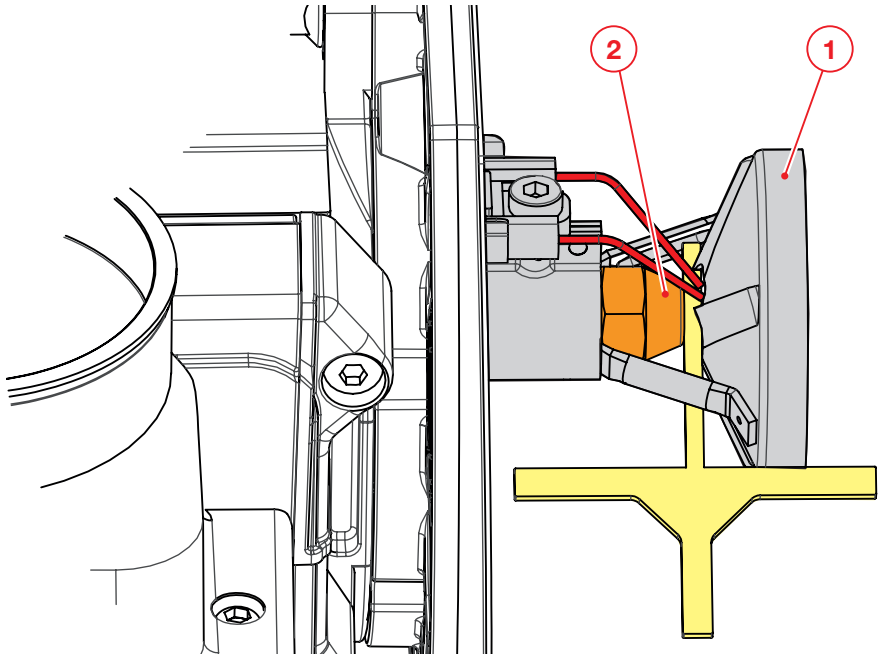


Fig. 42

– after having adjusted the position of the diffuser tighten the screw (8).
– refit the blast tube.

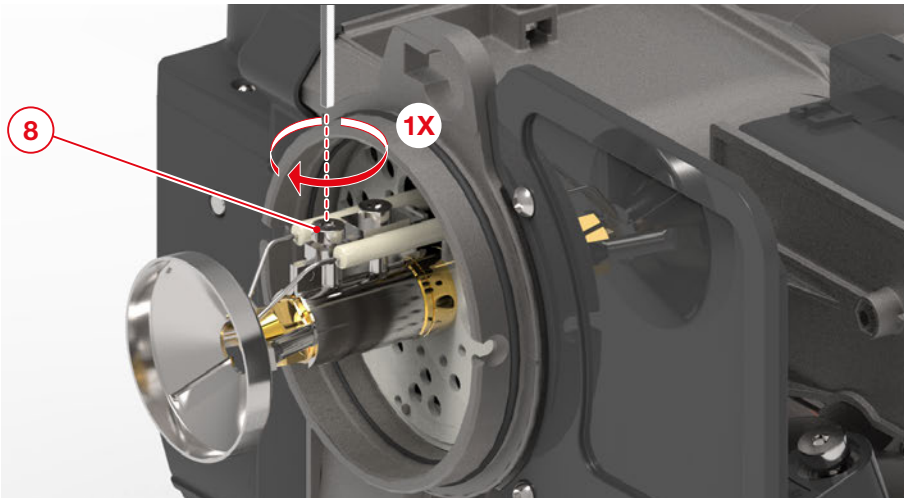


Fig. 43

6.3.3 Combustion head position check

To check the position of the combustion head:
- check the distance between the blast tube (1) and the nozzle (2) as shown in the figure.

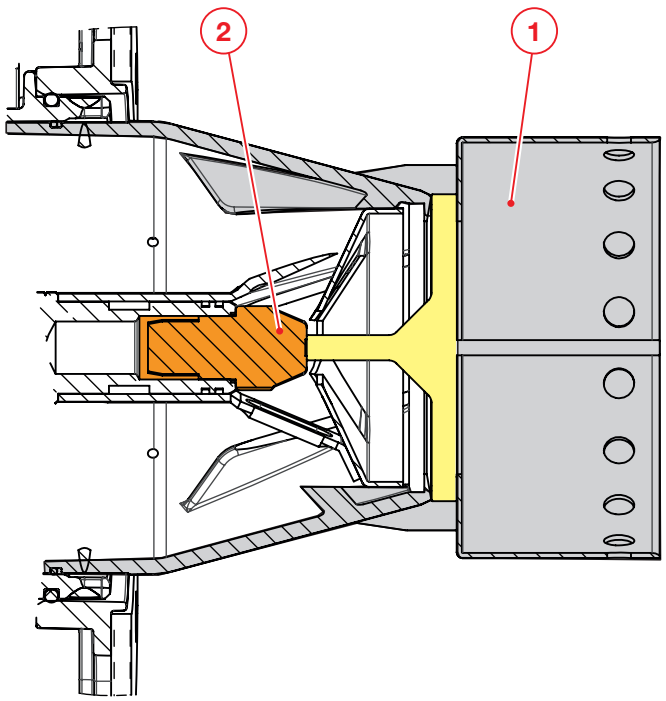


Fig. 44

6.3.4 Electrode position check

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

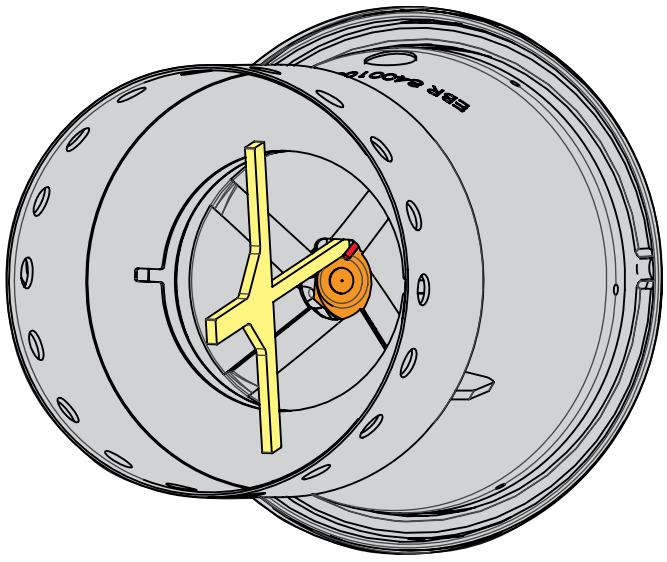


Fig. 45

– Check the position of the electrodes assuring that they are centered as shown in “Fig. 46”.

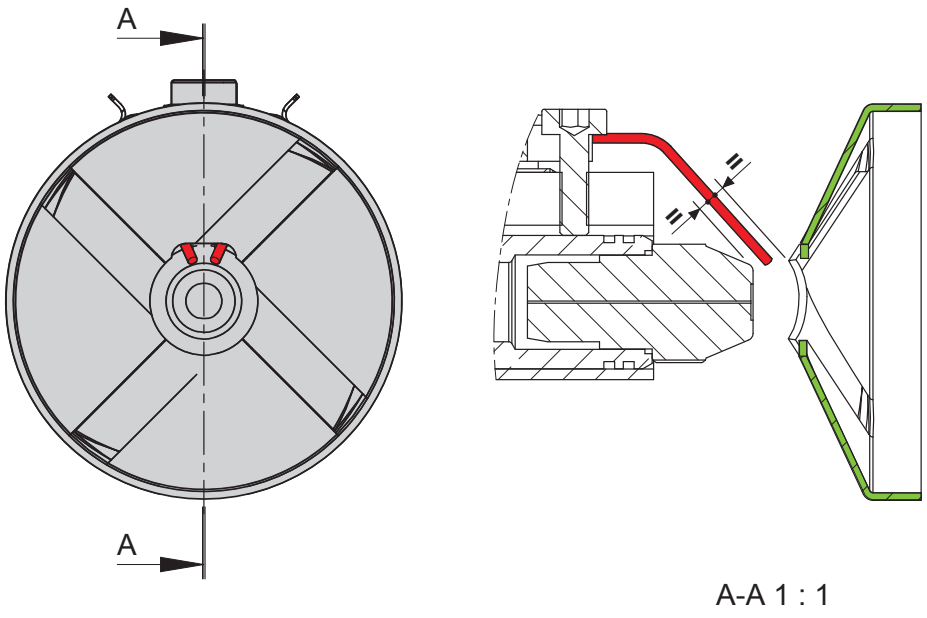


Fig. 46

6.3.5 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

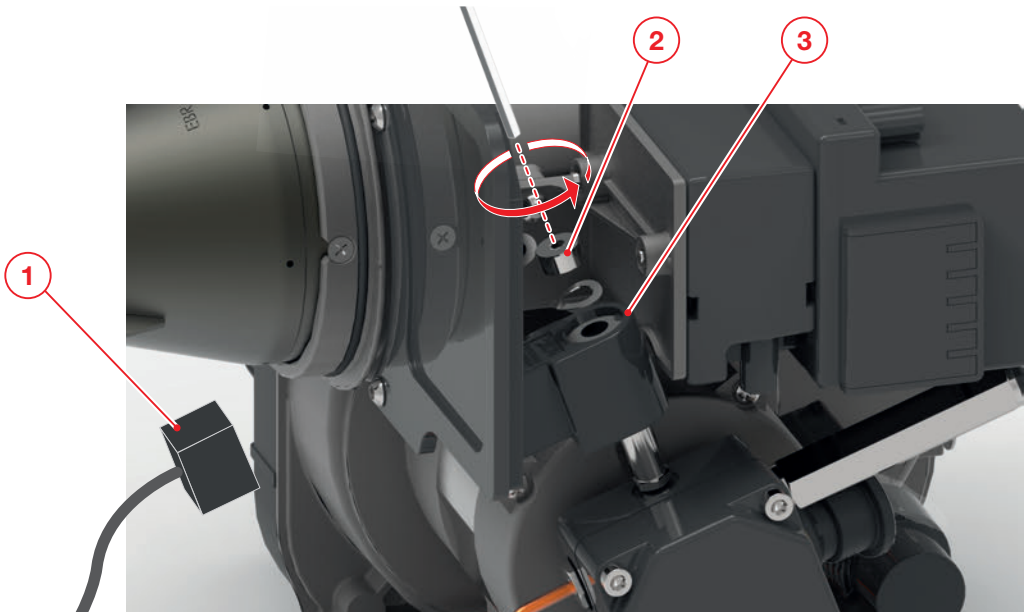


Fig. 47

– refit the components, reversing the procedure above.

6.3.6 Replacing the capacitor

Proceed as follows to replace the capacitor:
- remove the protection cup (1) from the capacitor (2)
- detach the electrical connection from the capacitor
- check with an electrical tester if the capacitor is damaged. Connect the tester to the capacitor pins: if the value read is different from the nominal capacity (+10%) written on the capacitor, it means the capacitor is damaged

Fig. 48

The value shown on the picture refers to a 4 µF capacitor and is indicative only. Please refer to the capacitor characteristics supplied with the burner.
- remove the capacitor (2) and replace it

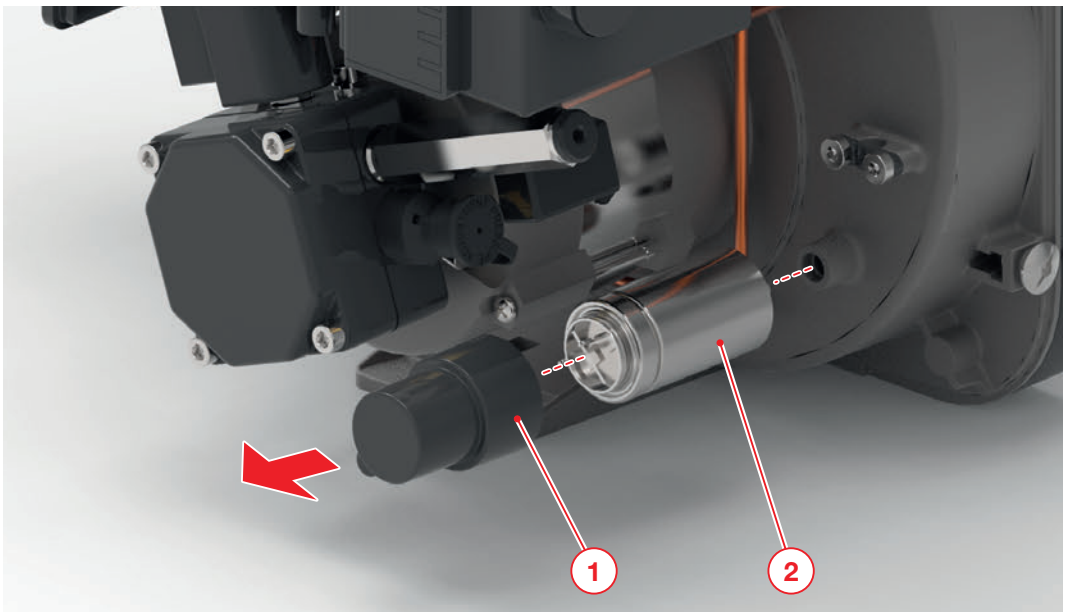


Fig. 49

- refit the components, reversing the procedure above.

6.3.7 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.

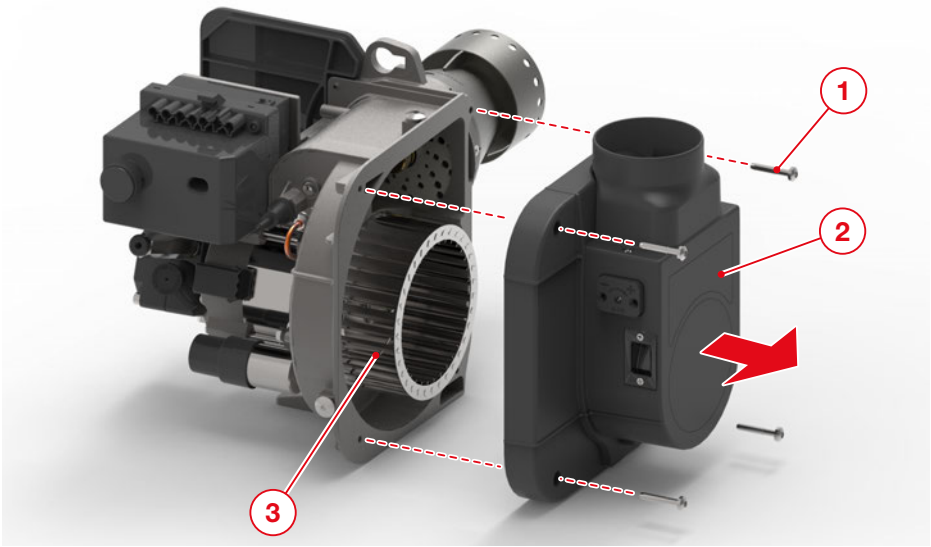
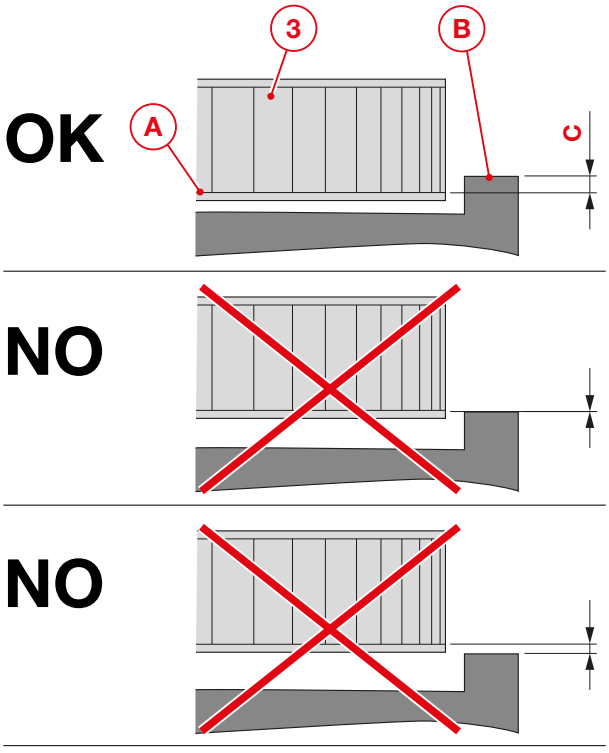


Fig. 50

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.



Burner	Position C
FB 2 K 18 LN	0,5 mm
FB 2 K 20 LN	0,5 mm
FB 2 K 26 LN	0,5 mm
FB 2 K 35 LN	0,5 mm

Fig. 51

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
- CO2 (%)
- CO (ppm)
- NOx (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, 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

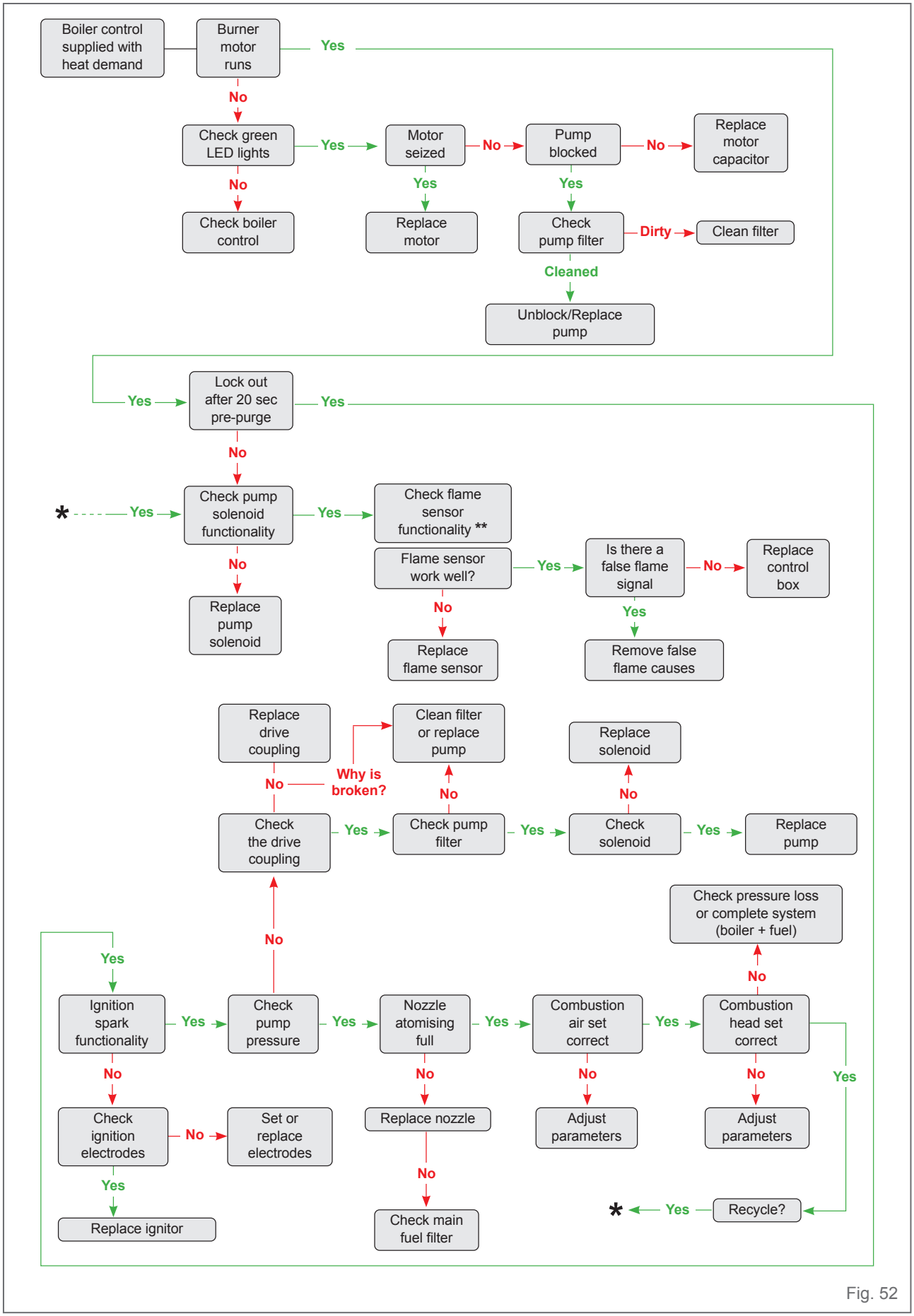


Fig. 52

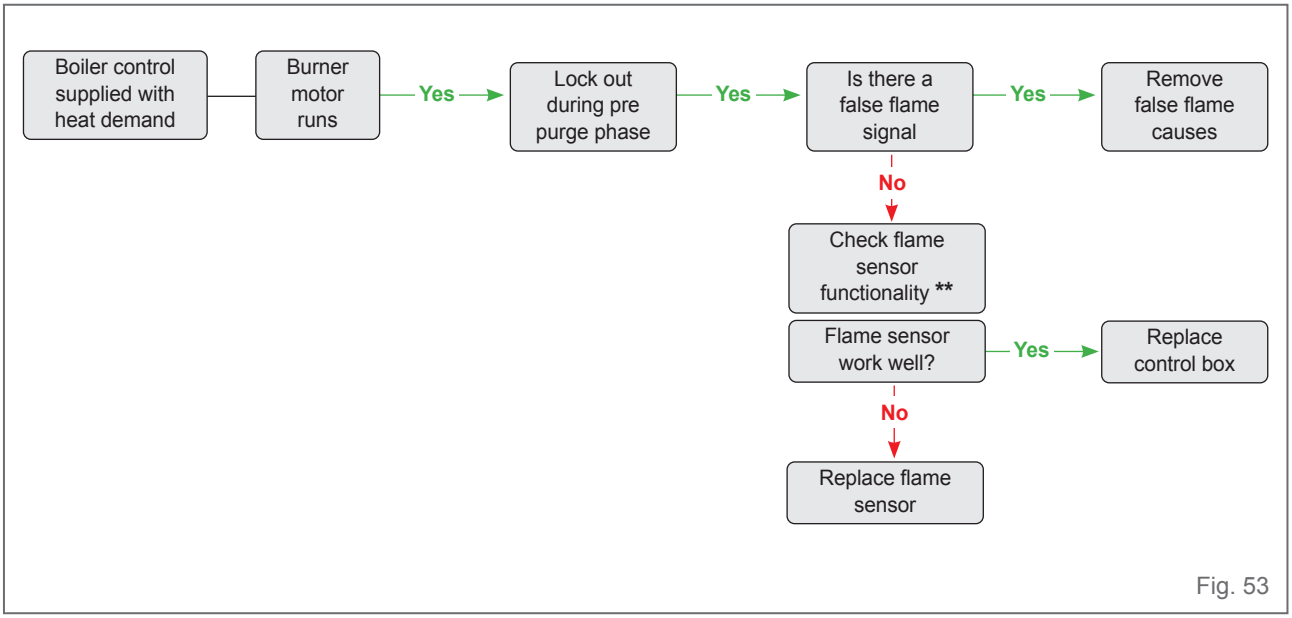


Fig. 53

(**) Check flame sensor functionality

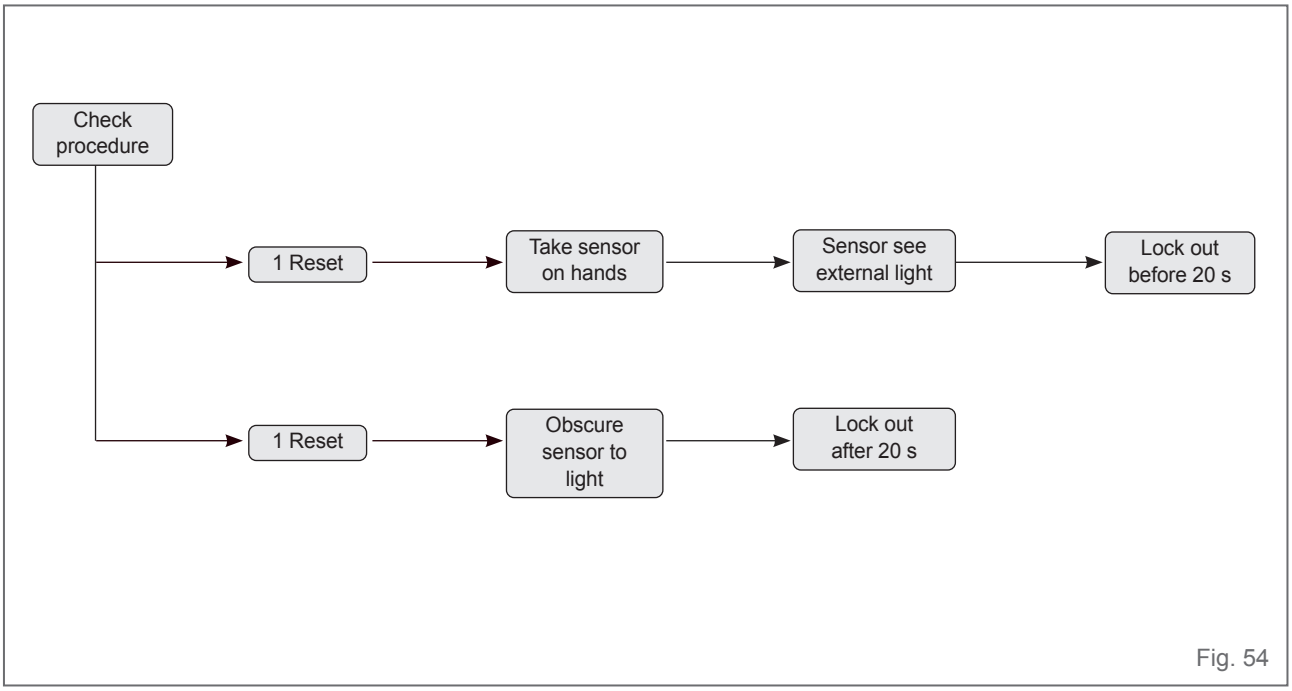


Fig. 54

8 SPARE PARTS LIST

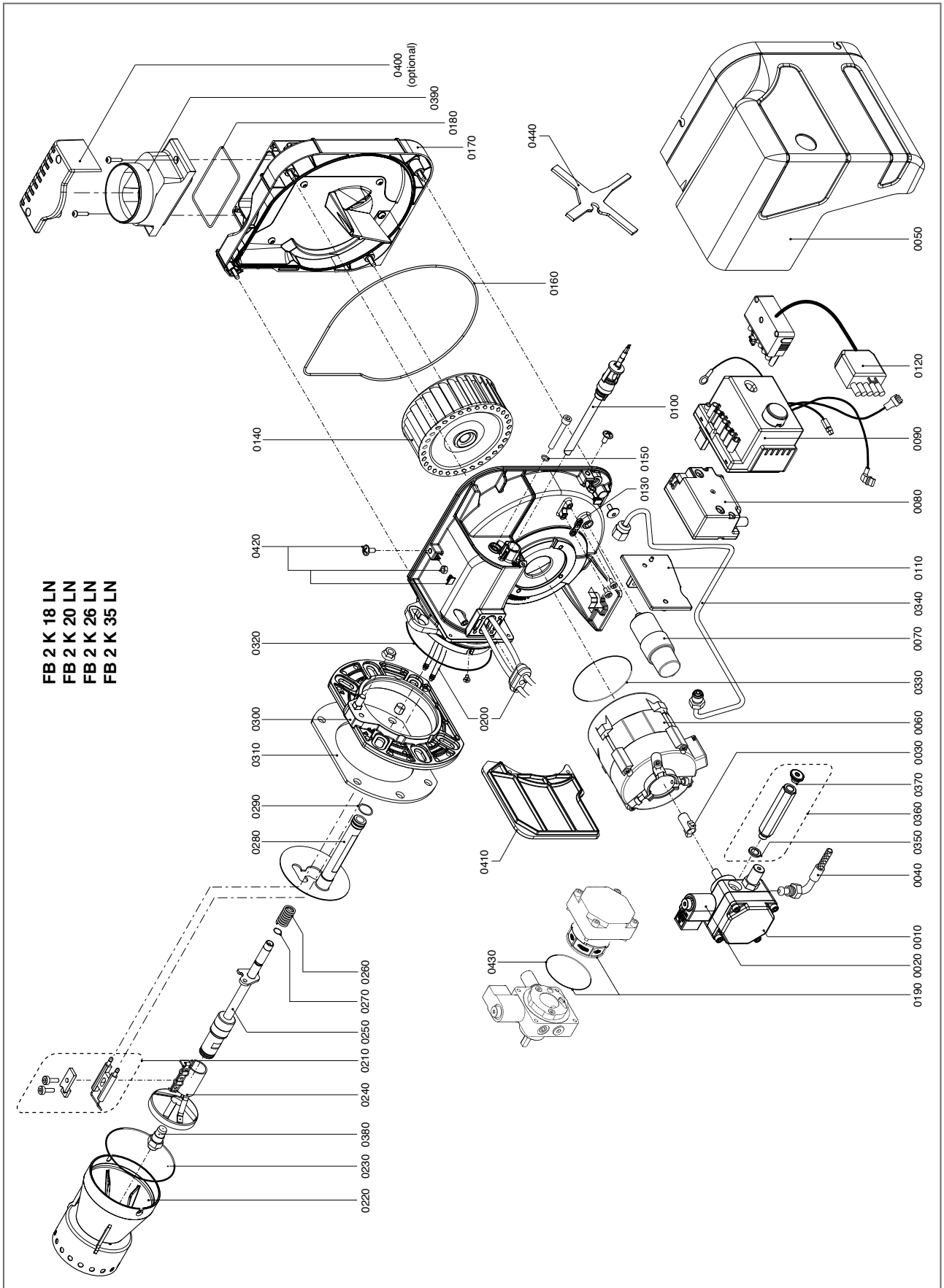


Fig. 55

N°	Description	FB 2 K 18 LN	FB 2 K 20 LN	FB 2 K 26 LN	FB 2 K 35 LN
		3147699	3147700	3147701	3147702
0010	OIL PUMP	65327227	65327227	65327227	65327227
0020	COIL	65327245	65327245	65327245	65327245
0030	COUPLING	65327229	65327229	65327229	65327229
0040	FLEXIBLE HOSE	65328371	65328371	65328371	65328371
0050	BURNER COVER	65327231	65327231	65327231	65327231
0060	MOTOR + CAPACITOR	65327232	65327232	65327232	65327232
0070	CAPACITOR	65327233	65327233	65327233	65327233
0080	IGNITION TRANSFORMER	65327234	65327234	65327234	65327234
0090	CONTROL BOX WITH CABLES	6500773300	6500773300	6500773300	6500773300
0100	FLAME SENSOR E.B.R. FTEB (GREEN)	65327852	65327852	65327852	65327852
0100	FLAME SENSOR QRB1 (YELLOW)	65328148	65328148	65328148	65328148
0110	SUPPORT	65327240	65327240	65327240	65327240
0120	CABLE KIT WITH 7 AND 5-PIN CONNECTORS	65327237	65327237	65327237	65327237
0130	CLAMP	65327241	65327241	65327241	65327241
0140	FAN	65327280	65327280	65327239	65327239
0150	ORING	65327224	65327224	65327224	65327224
0160	AIR INLET COVER GASKET	65327223	65327223	65327223	65327223
0170	AIR INLET ASSEMBLY	65327279	65327279	65327283	65327283
0180	ORING	65327247	65327247	65327247	65327247
0190	SET FILTER+SEAL	65327228	65327228	65327228	65327228
0200	IGNITION CABLES	65327284	65327284	65327284	65327284
0210	ELECTRODE GROUP	65327285	65327285	65327285	65327285
0220	BLAST TUBE	65329735	65329735	65329735	65329735
0230	BLAST TUBE ORING	65327201	65327201	65327201	65327201
0240	DIFFUSER	65327202	65327203	65327203	65327203
0250	NOZZLE HOLDER	65327287	65327287	65327287	65327288
0260	SPRING	65327206	65327206	65327206	65327206
0270	ROD ORING	65327210	65327210	65327210	65327210
0280	AIR DISTRIBUTOR	65327281	65327211	65327282	65327294
0290	AIR DISTRIBUTOR ORING	65327213	65327213	65327213	65327213
0300	FLANGE	65327289	65327289	65327289	65327289
0310	GASKET	65327290	65327290	65327290	65327290
0320	ORING	65327216	65327216	65327216	65327216
0330	MOTOR GASKET	65327222	65327222	65327222	65327222
0340	PIPE	65327217	65327217	65327217	65327217
0350	GASKET	65327205	65327205	65327205	65327205
0360	EXTENDED PRESSURE PORT	65327242	65327242	65327242	65327242
0370	THREADED STOPPER	65327243	65327243	65327243	65327243
0380	NOZZLE	65327218			
0380	NOZZLE		65327219		
0380	NOZZLE			65327220	
0380	NOZZLE				65327221
0390	SNORKEL	65327225	65327225	65327225	65327225
0400	CONVENTIONAL FLUE CARTER	65327226	65327226	65327226	65327226
0410	FRONT PANEL	65327291	65327291	65327291	65327291
0420	COVER SCREW GROUP	65327209	65327209	65327209	65327209
0430	ORING SET	65327846	65327846	65327846	65327846
0440	GAUGE	65329297	65329298	65329299	65329300

9 MANUFACTURER CERTIFICATE

9.1 Manufacturer Certificate / EU Design Conformity Declaration

We, **Firebird,** declare under our sole responsibility that the kerosene burners named **FB 2 K ... 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. Alessandro Rubboli

R&D Director

9.2 UKCA Conformity Declaration

We, **Firebird,** declare under our sole responsibility that the kerosene burners named **FB 2 K ... LN** is conform to the following standards:

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

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

- **Electrical Equipment (Safety) Regulations 2016**
- **Electromagnetic Compatibility Regulations 2016**
- **Supply of Machinery (Safety) Regulations 2008**
- **The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012**

September 2022 / Mr. Alessandro Rubboli

R&D Director

10 APPENDIX

10.1 Use of bio fuel blends

The burner is suitable for kerosene with a biofuel content of up to 30%. It is a minimum requirement that the fuel blend (up to 30% Biofuel) is obtained with kerosene 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 30%, contact the manufacturer.

10.2 Important advice for the use of bio fuel blends

10.2.1 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.

10.2.2 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 (included flexible hose) 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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