178 143 35-5 P93783 2022-10-14

Installation- and maintenance instruction

BF 1 FU/FUV

LMO14.113C2E

AS47CK

Translation of the original instructions.

Bentone®

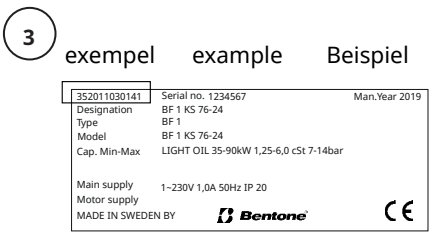

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Table of contents

1. General Information

The burner may only be used for its intended purpose in accordance with the product's technical data.

We reserve the right to make design changes and cannot be held liable for any misprints or typographical errors.

Modifying the design or using accessories or components that have not been approved by Enertech in writing is strictly prohibited.

This Installation and Maintenance manual:

- is to be regarded as part of the burner and must always be kept near the installation site.
- must be read prior to installation.
- is intended for use by authorised personnel.

1.1 Delivery inspection

- Make sure everything is delivered and the goods have not been damaged during transit.
  Transport damage must be reported to the shipping company.
- If something is wrong with a delivery, report it to the supplier.

1.2 Safety

- before installation:

- Installation and work on the burner and associated system components may only be carried out by persons who have undergone relevant training.
- The product is packaged to prevent damage from occurring when handled – Handle the product with care! Lifting equipment must be used to lift larger packages.
- The products must be transported/stored on a level surface in a dry environment, max. 80% relative humidity, no condensation. Temperature -20 to +60 °C.

- installation:

- The burner must be installed in accordance with local regulations for fire safety, electrical safety, and fuel distribution.
- The premises must comply with local regulations pertaining to use of the burner, and must have adequate air supply.
- The installation site must be free of chemicals.
- Fire extinguisher with Class BE recommended.
- Make sure when installing the burner that there is enough space to service the burner.
- The electrical installation must be professionally carried out in accordance with current mains electricity regulations and in a professional manner.
- Make sure that the burner is suitable for the application (see Technical Data).
- All components must be installed without being bent, twisted or subjected to mechanical or thermal forces that affect components.

- Care must be taken by the installer to ensure that no electrical cables or fuel lines are pinched or otherwise damaged during installation or service.
- Flame tubes, fan wheels and air dampers, for example, may contain sharp edges.

- before first start:

- The burner must not be put into operation without proper safety and protection devices.
- Permitted ambient temperature during operation -10 to +60 °C. Max. 80% relative humidity, no condensation.
- The surface temperature of the burner's components may exceed 60 °C.
- Handle with caution – the burner has moving parts, and there is risk of crushing injuries.
- Seal inspections must be performed during installation and servicing to prevent leakage.
- fitting and installation work has been completed and approved.
- electrical installation has been correctly performed.
- flue gas ducts and combustion air ducts are not blocked.
- all actuators and control and safety devices are in working order and correctly set.
- If the boiler is equipped with an access hatch, this must be equipped with a hatch opening switch connected to the burner's safety system.
- When in operation, the burner's noise level can exceed 85 dBA – use hearing protection!

- Operation:

- Carry out all stipulated settings, service and inspection work within the set time.
- If the oil burner control has a solid red light, contact your installer.

2. Technical data

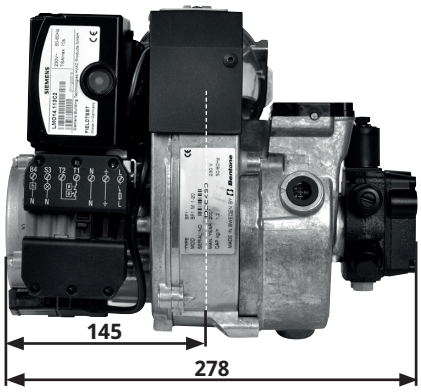
The burner is intended for:

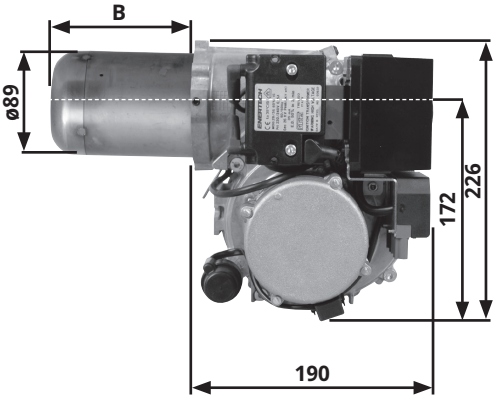
- Operation in installations according to EN 303 and EN 267.
  When operating with a hot air boiler, the LMO24.255 or LMO44.255 control unit must be used.

Fuels:

- HVO/XTL according to EN 15940.
- Fuel oil according to DIN 51603-1.
- Fuel oil A Bio 10 according to DIN 51603-6.

2.1 Dimensions BF 1 FU/FUV

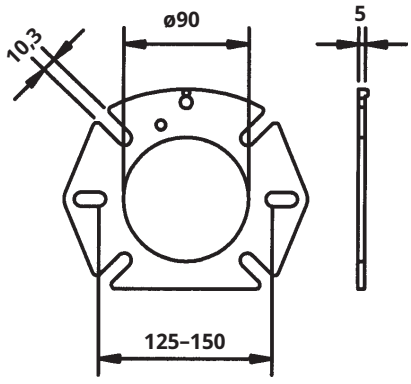




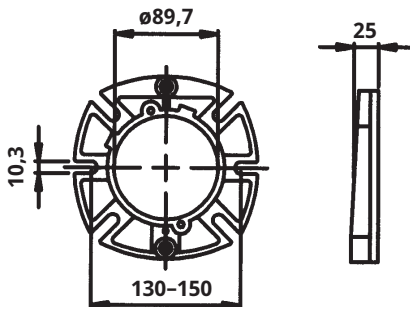
Length of flame tube	Protrusion from flange, measurement B	
	Flange 1	Flange 2
102	85	69
132	115	99

2.1.1 Dimensions, flanges

Flange 1



Flange 2



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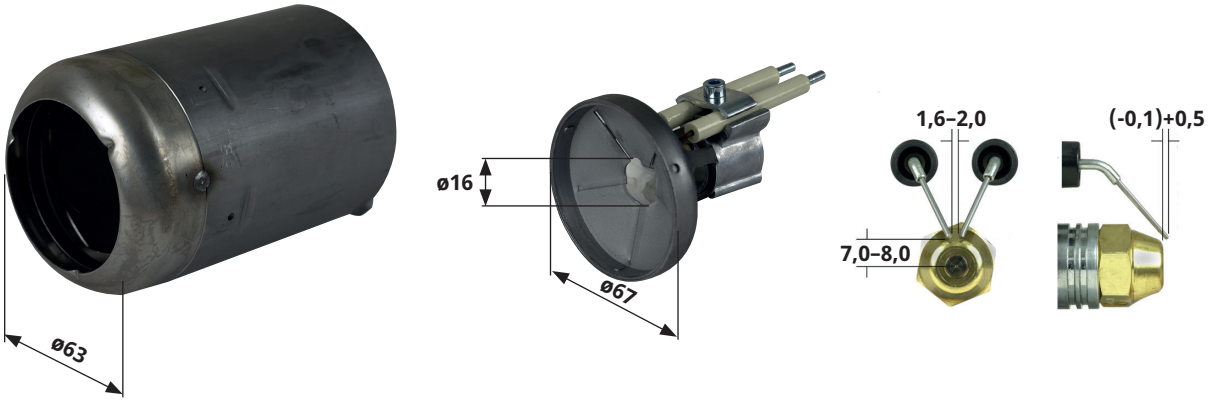
2.2 Model BF 1 FU/FUV 63-16



2.3 Technical specification

	BF 1
Main supply [1]	230V, 1~, 1.1/1.7A, 50/60Hz, IP20
Max fuse rating	8A
EI_{min} preheater included	0.88A, 193W
EI_{max} preheater included	1.01A, 220W
EI_{min} preheater excluded	0.66A, 137W
EI_{max} preheater excluded	0.67A, 139W
P_{SB}	0
NO_X-class	4
NO_X (GCV) preheater included	101mg/kWh
NO_X (GCV) preheater excluded	94mg/kWh
Noise level	75dBA

[1] Max operating current, see data plate.

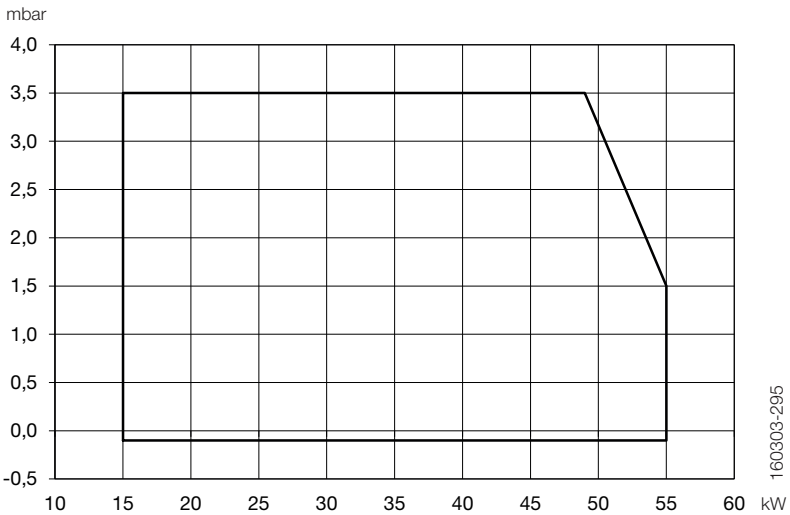
Measurements according to EN 15036-1:2006

Alt.1 The noise level of the burner can be reduced by equipping the burner with silencer. Installation must be done so it does not prevent air supply to the burner.

Alt.2 The burner's noise level can be reduced by connecting the burner's air intake to the air duct that opens into an appropriate location. Installation must be done so it does not prevent air supply to the burner.

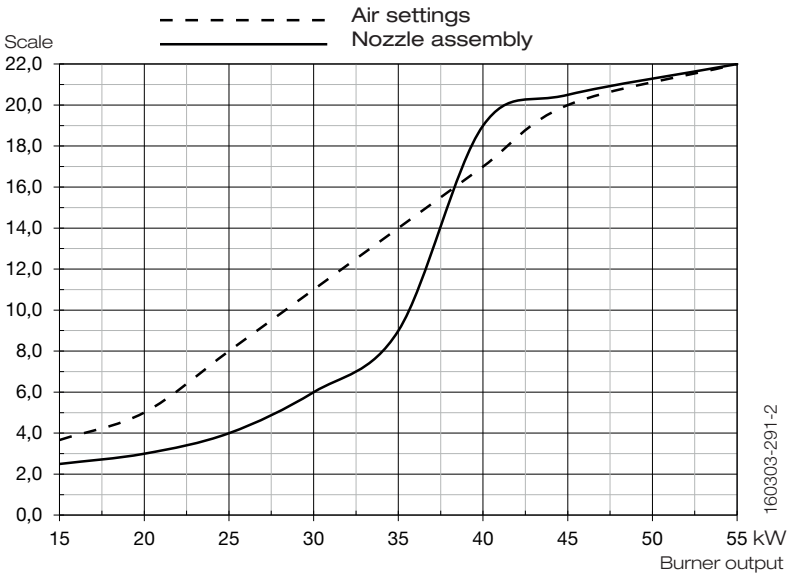
2.4 Working area

1.3-4.6 kg/h
15-55 kW



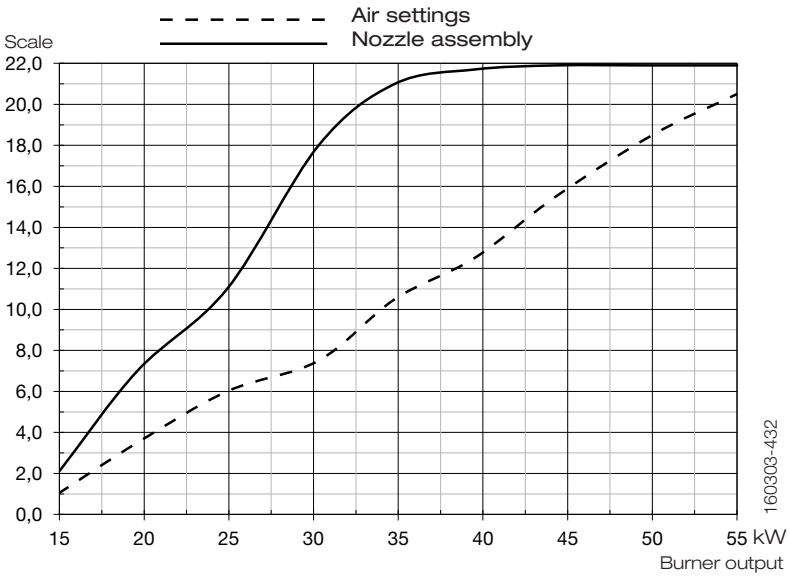
! Do not exceed the working area.

2.5 Basic settings - Fuel oil



Scale value applies to 0 mbar furnace pressure.

2.6 Basic settings - HVO/XTL



Scale value applies to 0 mbar furnace pressure.

Flame signal

When operating at high power or low air excess and HVO/XTL is used as fuel, the flame signal may deteriorate (blue flame), the signal lamp in the reset button flashes green.

By lowering the air velocity or changing the flame detector to QRC1 A1, the flame signal can be improved.

2.7 Nozzle and pump pressure

Due to different furnace geometries and capacities, it is not possible to recommend a nozzle model.

Nozzle	60° Solid/Hollow cone 80° Solid/Hollow cone
Pump pressure	10 bar (8–14 bar) Fuel oil 10 bar (7–12 bar) Kerosene

Nozzle table

Pump pressure, bar

Gph	8		9		10		11		12		13		14		15	
	kg/h	kW	kg/h	kW	kg/h	kW	kg/h	kW	kg/h	kW	kg/h	kW	kg/h	kW	kg/h	kW
0,40	1,33	16	1,41	17	1,49	18	1,56	18	1,63	19	1,70	20	1,76	21	1,82	21
0,50	1,66	20	1,76	21	1,86	22	1,95	23	2,04	24	2,12	25	2,20	26	2,28	27
0,60	2,00	24	2,12	25	2,23	26	2,34	28	2,45	29	2,55	30	2,64	31	2,73	32
0,65	2,16	26	2,29	27	2,42	29	2,54	30	2,65	31	2,75	33	2,86	34	2,96	35
0,75	2,49	29	2,65	31	2,79	33	2,93	35	3,08	36	3,18	38	3,30	39	3,42	40
0,85	2,83	33	3,00	36	3,16	37	3,32	39	3,47	41	3,61	43	3,74	44	3,87	46
1,00	3,33	39	3,53	42	3,72	44	3,90	46	4,08	48	4,24	50	4,40	52	4,56	54
1,10	3,66	43	3,88	46	4,09	48	4,29	51	4,48	53	4,67	55	4,84	57	5,01	59
1,20	3,99	47	4,24	50	4,47	53	4,68	55	4,89	58	5,09	60	5,29	63	5,47	65
1,25	4,16	49	4,40	52	4,65	55	4,88	58	5,10	60	5,30	63	5,51	65	5,70	68
1,35	4,49	53	4,76	56	5,02	59	5,27	62	5,50	65	5,73	68	5,95	70	6,15	73
1,50	4,98	59	5,29	63	5,58	66	5,85	69	6,11	72	6,36	75	6,60	78	6,83	81
1,65	5,49	65	5,82	69	6,14	73	6,44	76	6,73	80	7,00	83	7,27	86	7,52	89
1,75	5,82	69	6,18	73	6,51	77	6,83	81	7,14	85	7,42	88	7,71	91	7,97	94
2,00	6,65	79	7,06	84	7,45	88	7,81	93	8,18	97	8,49	101	8,81	104	9,12	108
2,25	7,49	89	7,94	94	8,38	99	8,78	104	9,18	109	9,55	113	9,91	117	10,26	122

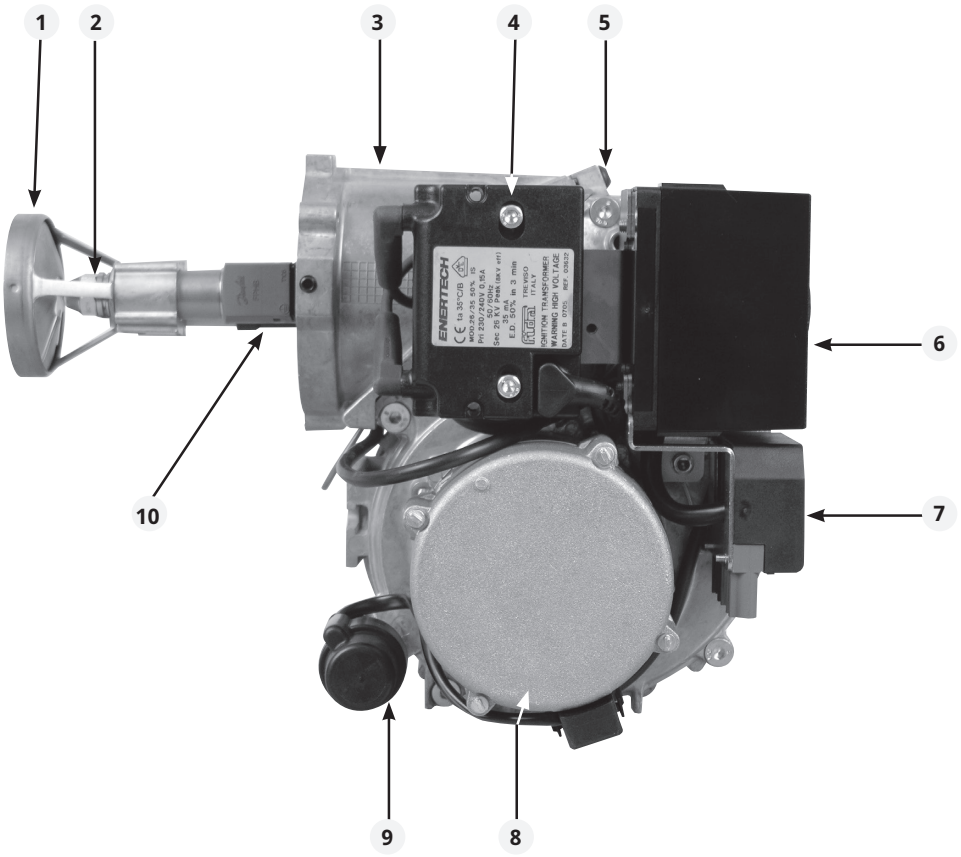
The table applies to oils with a viscosity of 4.4 mm^2/s (cSt) at a density of 830 kg/m^3.

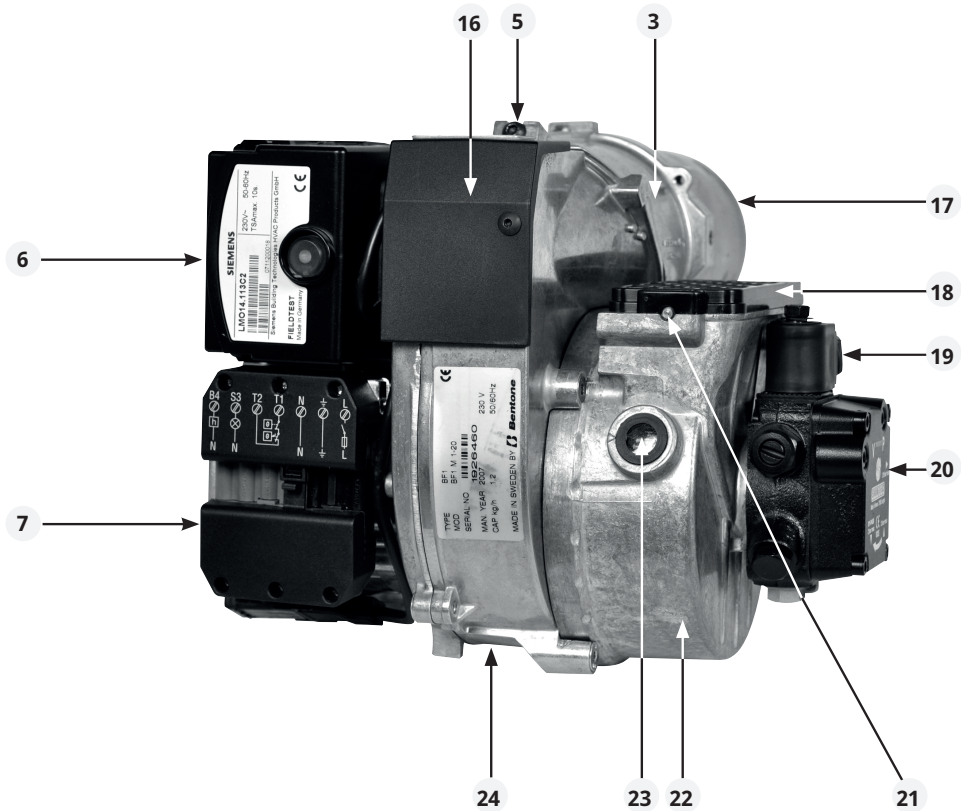
Burner with preheater

Allow for a reduction in oil quantity of 5–20% with preheating owing to:

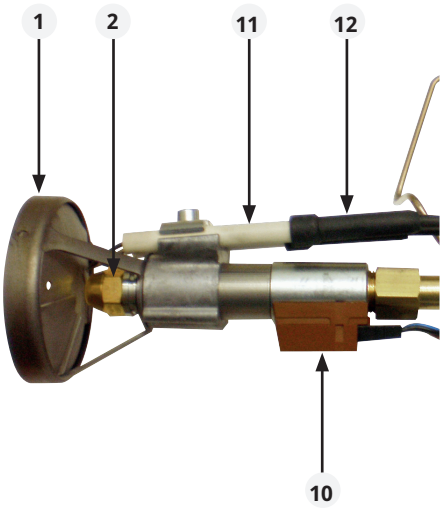
- Temperature increases at the nozzle.
- Nozzle design.
- Capacity (the higher the capacity the lower the difference).

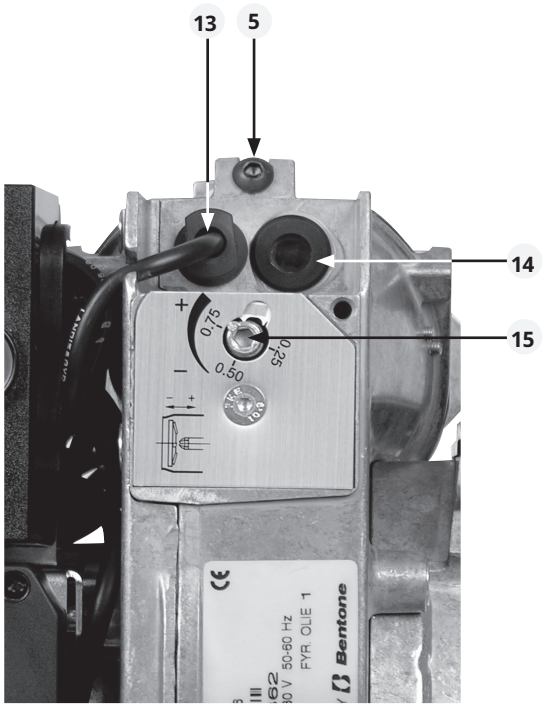
2.8 Components





1. Brake plate
2. Nozzle
3. Fan housing, front
4. Ignition transformer
5. Separating screw
6. Oil burner control
7. Electrical contact X1, see Wiring diagram
8. Motor
9. Capacitor
10. Preheater (where fitted)
11. Ignition electrode
12. Ignition cable
13. Photoresistor
14. Inspection glass
15. Nozzle assembly adjustment
16. Cover plate
17. Flame tube
18. Grid
19. Solenoid valve
20. Oil pump
21. Air regulator
22. Air intake
23. Air flow indicator
24. Fan housing, rear





3. Installation

3.1 Delivery checks

Check that everything has been delivered and that the goods are not transport damaged. Any delivery faults must be reported to the supplier. Transport damage must be reported to the forwarder.

3.2 Preparations for installation

Check that the burner's measurements and capacity range is suitable for the boiler in question. The power information on the data plate refers to the burner's max. and min. power.

3.3 Oil supply

In order to achieve good operational reliability it is important that the oil supply system is laid out correctly.

Observe the following:

- Choice of pipe diameters, pipe lengths and height differences (refer to
pump instructions).
- Piping should be run with a minimum of joints/compression fittings.
- Pipework must be laid out so that oil hoses are not subjected to tension or overbending when the burner is swung out or removed for service.
- The oil filter should be installed so that the filter cartridge can easily be replaced

3.4 Electrical connection

Before electrical installation is begun, electricity must be switched off at the main switch. If the boiler has a 7-pole or a 4-pole Eurostecker (only on 2-stage burners), these often fit directly to the burner. Otherwise use the connectors supplied. The operating thermostat, the max. thermostat and the inspection hatch (where fitted) interlock can then be wired in series on the incoming phase connected to L1 or connected between T1 and T2. In the first mentioned case a jumper is installed between T1 and T2.

(Refer to connection in the section Electrical equipment).

If any electrical connection is used other than that recommended by Enertech, there may be a risk of equipment damage and personal injury.

3.5 Choice of nozzle

(Technical data): Recommended nozzle and nozzle table.

3.6 Brake plate and airflow setting

Before operations basic burner setting may be made according to the diagram. (Refer to basic settings). Note that this only refers to the basic setting; the setting must be adjusted after the burner has been started.
At this time flue gas analysis and soot measurement must be carried out.

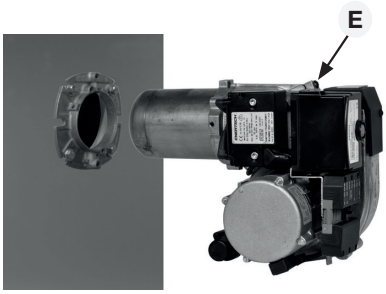
3.7 Burner installation

3.7.1 Hole pattern

Check that the hole pattern matches the flange supplied.
(Refer to Technical data.)

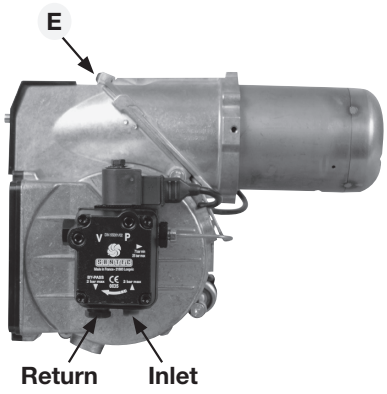
3.7.2 Burner installation

1. Install the flange and the gasket on the boiler.
2. Attach the front piece to the flange.
3. Insulate between the burner register and the boiler cover for reduced heat radiation.
4. Install the selected nozzle. (Refer to Technical data.)
5. Install the brake plate and check the ignition electrodes (refer to Burner service.).
6. Install the burner body to the front piece and lock with screw (E).



3.7.3 Oil pipes

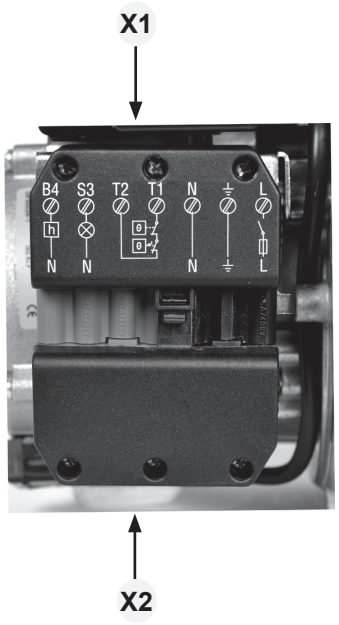
1. Check the oil pipe dimensions. (Refer to Pump Instructions.)
2. The oil filter should be installed in the oil supply line. If an air separator is fitted, the oil filter should be installed before the air filter to increase the life span of the filter.
3. For one-pipe systems the return plug must be removed. (Refer to Pump Instructions.)
4. When installing oil hoses, check that the supply and return hoses are connected to the correct connections on the oil pump. The hoses must be run so that they are not bent or tensioned.
5. Purge the oil system. The oil pump will be damaged if it is run dry.
6. The vacuum should not be lower than 0.3 bar depression in the suction line at start up.



3.7.4 Electrical connection

If the boiler lacks ready-connected plugs, connect using the supplied plug, X2 in accordance with the wiring diagram.

1. Disconnect the power at the main switch.
2. Wire the Eurostecker X2 as in alt. 1–3 (refer to Electrical equipment).
3. Connect the Eurostecker X2 to the burner.
4. Switch on the power at the main switch.



4. Settings

4.1 Example of basic setting

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Burner output:	33 kW		
Estimated nozzle output:	33 / 11.86*	=	2.78 kg/h

(* Calorfic value Fuel oil = 11.86 kWh/kg)

This provides the following nozzle according to the nozzle table, (see Technical data).

Nozzle:	0.75 Gph
Pump pressure:	10.0 bar

Setting values for 33 kW according to basic setting diagram, (see Technical data).

Air setting:	=	13.0
Insert setting:	=	7.0

BF 1 FUV 63-16

Burner output:	33 kW		
Output increase, for burners with preheater:	33 x 1.06	=	35 kW
Estimated nozzle output:	35 / 11.86*	=	2.95 kg/h

(* Calorfic value Fuel oil = 11.86 kWh/kg)

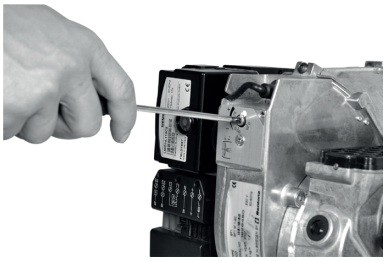
This provides the following nozzle according to the nozzle table, (see Technical data).

Nozzle:	0.75 Gph
Pump pressure:	11.0 bar

Setting values for 33 kW according to basic setting diagram, (see Technical data).

Air setting:	=	13.0
Insert setting:	=	7.0

4.2 Nozzle assembly adjustment



The burner is fitted with a regulator which changes the brake plate position in the flame tube. This is used to set the correct pressure drop across the combustion assembly and thereby achieve good combustion without pulsation.

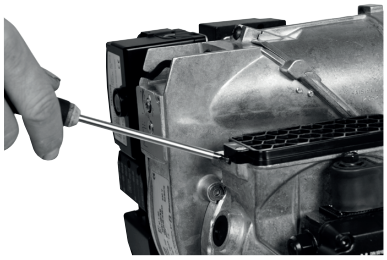
The setting to be chosen is dependent among other things on set output and furnace pressure.

Brake plate setting

- Less diffusion: turn screw to left.
- More diffusion: turn to right.

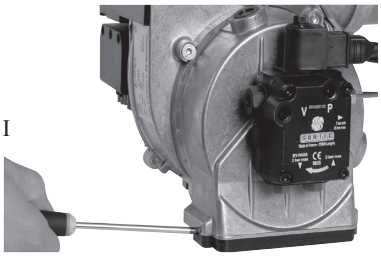
Setting brake plate position affects air flow. It is therefore always necessary to adjust the air with the burner air regulator afterwards.

4.3 Air intake adjustment



Air settings are very important for achieving good combustion with neither too much, nor too little, air. Adjustment of combustion airflow is carried out by turning the air regulator with an Allen key. How far open the air regulator must be is determined by output, furnace pressure and other burner settings such as flame tube position.

4.4 Method of adjusting air quantity



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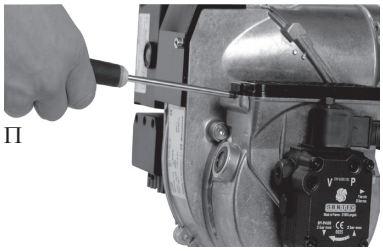

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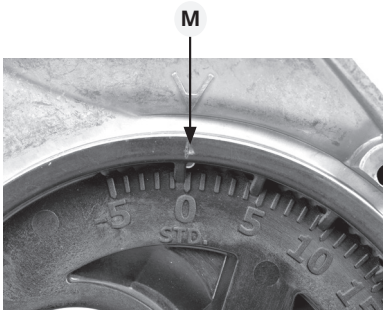
Setting the air regulator is dependent on how the screw (with which air regulation is adjusted) is installed. If the air intake is installed underneath as shown in illustration I, turning the screw clockwise will reduce airflow, and anticlockwise increase it. If the air intake is installed on top as shown in illustration Π, clockwise adjustment increases airflow, and anticlockwise reduces it.

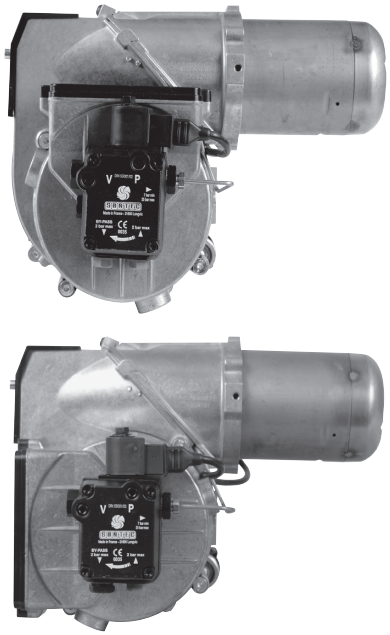
4.5 Inlet cone, air adjustment



Airflow is also affected by the position of the inlet cone. However, it is extremely rare that this needs to be adjusted; it should be left in the standard STD position to achieve good starts and operations. (A cast-in arrow on the fan housing indicates the position of the inlet cone. In addition to the scale on the inlet cone casting, there is also a mark (M) indicating the factory setting.)

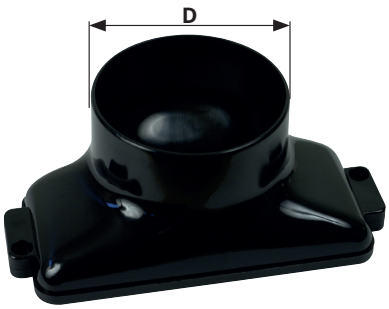
4.6 Air intake rotation

It is possible to rotate the air intake to adapt the burner to different surroundings. It is possible to rotate the air intake to a number of positions, not just the positions shown to the left.
To rotate the air intake, undo the three screws that fasten the air intake and the two screws which retain the pump. Then rotate the air intake to the desired position and tighten the screws.The position of the air intake affects the airflow through the burner somewhat.
The position which provides best airflow is with the air intake pointing downwards.



4.7 Air duct

A hose connection air duct is available in three different dimensions: 48, 68, and 78 mm outer diameter (D). The air duct is installed on the air intake at the place where the grille is attached in the standard model



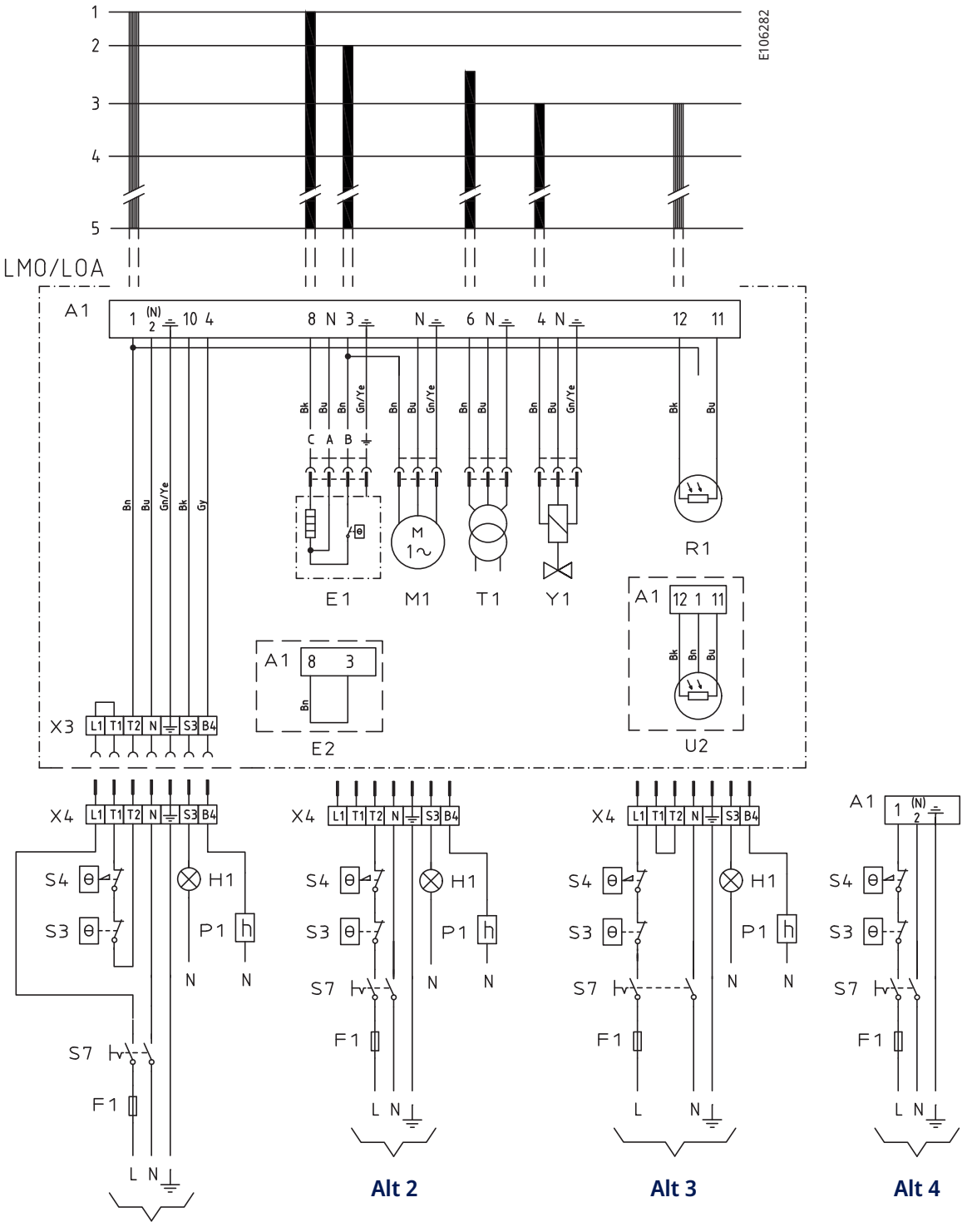
5. Electric equipment

5.1 Safety system

The safety system (safety switch for hatches, doors, water level, pressure, temperature and other safety devices) must be installed in the safety circuit in accordance with current regulations for the system.

The cables of the safety system must be separated so that the outgoing signal is not placed in the same cable as the incoming signal.

5.2 Wiring diagram



Enl DIN 4791

Bn	Brown
Bu	Blue
Gn/Ye	Ground/Yellow
Bk	Black
Gy	Grey

5.2.1 List of components

A1	Oil burner control	U2	UV-cell QRC
E1	Preheater	S3	Control thermostat
E2	Burner without preheater	S4	Temperature limiter
F1	Fuse max. 10 A	S7	Main switch
H1	Lamp, low capacity	T1	Ignition transformer
M1	Burner motor	Y1	Solenoid valve
P1	Time meter, low capacity (optinal)	X3	Plug-in contact, burner
R1	Flame detector QRB	X4	Plug-in contact, boiler

5.3 Function LMO14/24

1 **Switch on operating switch and twin thermostat**

A spark is formed. The air damper motor opens the damper to low load position. The burner motor starts, the prepurge goes on till the prepurge period expires and the solenoid valve 1 opens (2).

2. **Solenoid valve 1 opens**

Oil mist is formed and ignited. The photocell indicates a flame. The ignition spark goes out after flame indication (See Technical data oil burner control).

3. **The safety time expires**

a If no flame is established before this time limit the control cuts out.

b

If for some reasons the flame disappears after this time limit, the burner will make an attempt to re-start.

4 **High/Low thermostat ON**

The burner is in operating position and can now change between full load and low load.

4-5 **Operating position**

If the burner operation is interrupted by means of the main switch or the thermostat, a new start takes place when the conditions in accordance with point 1 are fulfilled.

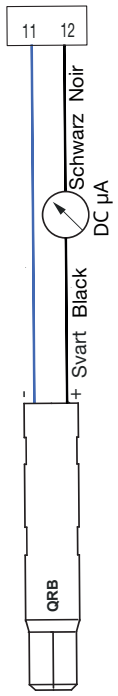
The oil burner control cuts out

A red lamp in the control is lit. Press the reset button and the burner re-starts.

! Mains connection and fuse in accordance with local regulations.

5.3.1 Technical data

	LMO14.113...	LMO24.255...
Preiginition time	15 s	25 s
Prepurge time	16 s	26 s
Postignition time	3 s	5 s
Safety lockout time	< 10 s	< 5 s
Reset time after lockout	< 1 s	< 1 s
Reaction time on flame failure	< 1 s	< 1 s
Ambient temperature	-5 - +60°C	-20 - +60°C
Min detector current required (with flame)	45 µA dc	45 µA dc
Max perm. detector current (without flame)	5.5 µA dc	5.5 µA dc



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5.4 Colour codes LMO14/24

When the burner starts, the light in the reset switch indicates the normal sequence, and also indicates whether something abnormal is happening as per the following table:

Preheater in operation	Solid yellow
Ignition switched on	Flashing yellow
Normal operation	Solid green
Operation, poor flame signal	Flashing green
Undervoltage	Flashing yellow-red
Fault, alarm	Solid red
False light	Flashing red-green
Communication mode	Fluttering red

5.5 Fault codes LMO14/24

When the red light for a blocked relay box comes on, you can get information about what has caused the problem by pressing and holding the reset button for 3 seconds.

The number of flashes below is repeated with a pause in between.

2 flashes	No flame signal when safety time expires
4 flashes	False light during start
7 flashes	3 x Losses of flame during operation
8 flashes	Time-out for preheater *
10 flashes	Incorrect wiring, internal fault or simultaneous occurrence of two faults

* In order for this fault code to occur, the preheater shall not reach its cut-off temperature within 10 mins. from switch on.

To return to normal operation: Press the reset button for 1 second.

If the reset button is instead kept pressed a second time for at least 3 seconds, you can, via an interface, obtain the corresponding information on a computer or flue gas analyser.

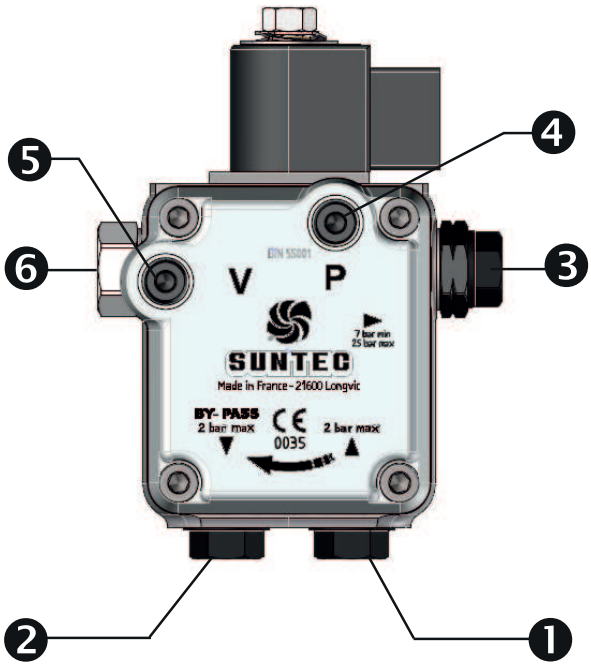
To return to normal operation: Press the reset button for 1 second.

6. Pump

6.1 SUNTEC AS

Technical data AS47CK		
One or two-pipe system		
Viscosity range:	1-12 mm²/s	
Pressure range:	7-14 bar	
Rated voltage of coil:	220/240V	50/60 Hz
Oil temperature:	max 60°C	

Technical data AS67C		
One or two-pipe system		
Viscosity range:	1-12 mm²/s	
Pressure range:	10-15 bar	
Rated voltage of coil:	220/240V	50/60 Hz
Oil temperature:	max 60°C	



Components

1. Suction line G 1/4”
2. Return line G 1/4”and internal by-pass plug
3. Nozzle outlet G 1/8”
4. Pressure gauge port G 1/8”
5. Vacuum gauge port G 1/8”
6. Pressure adjustment

Applications for SUNTEC AS

The SUNTEC AS oil pump has a built in solenoid valve which controls the regulator cut-off valve giving fast cut-off and cut-on function independent of the rotational speed.

Applications

Light oil, B10 heating oil/biofuel blend (as defined in DIN V51603-6) and kerosene.
- One or two-pipe system.

Pump operating principle

The gear set draws oil from the tank through the built-in filter and transfers it to the valve that regulates the oil pressure to the nozzle line. All oil that does not go through the nozzle line will be dumped through the valve back to the return line in two pipe installation or, if it is a one-pipe installation, back to suction port in the gear set.

In that case, the by-pass plug must be removed from the return port, and the return port sealed by steel plug and washer.

The solenoid valve of the AS pump is of the ”normally opened” type.

When the solenoid valve is non-activated, the by-pass channel between the pressure and return sides of the valve is open. No pressure will then be built up to open the valve; it does not matter which speed the gear set has.

When the solenoid is activated, this by-pass channel is closed and because of the full speed of the gear set, the pressure necessary to open the valve will be built up very rapidly, which gives a very sharp cut-on function.

Cut-off

When the burner stops, the solenoid opens the by-pass at the same moment, which drains all the oil down to the return, and the nozzle valve closes immediately.

This gives a very sharp cut-off function. The cut-on and cut-off can be actuated regardless of motor speed and have an extremely fast response.

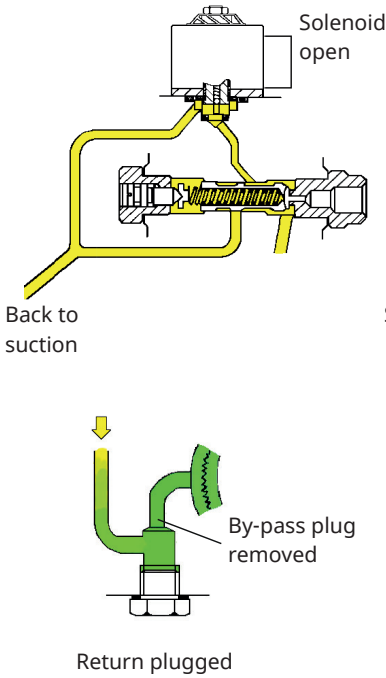
When the solenoid is not activated, the torque requirement is low up to full motor speed.

Bleeding

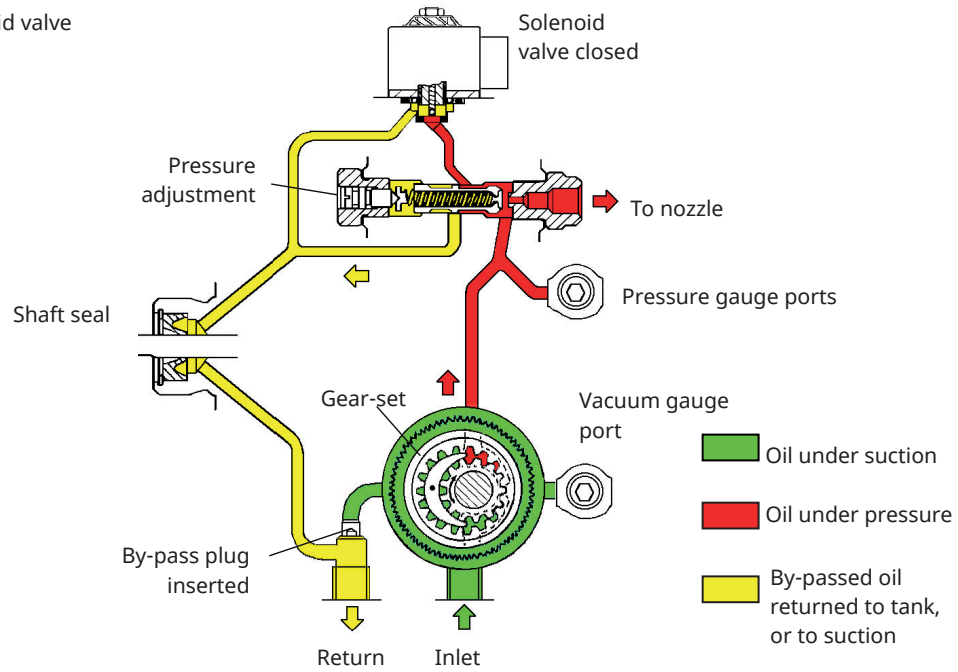
Bleeding of pumps with two-pipe systems takes place automatically, but bleeding can be accelerated by opening a pressure port.

On pumps with a single-pipe system, a pressure port must be opened to empty the system of air.

One pipe installation



Two pipe installation



6.1.1 Suction line tables

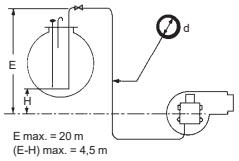
6.1.1.1 Overlying tank

1-pipe system

Nozzle*/Düse* Gicleur*/Ugello* (US GPH)	0,50	0,60	0,80	1,00	1,50		2,00		4,00			6,00			9,50			
d (mm) / H (m)	4	4	4	4	4	6	4	6	4	6	8	4	6	8	4	6	8	10
0	90	75	56	45	30	150	22	113	11	56	150	7	37	119	4	23	74	150
0,5	100	83	63	50	33	150	25	126	12	63	150	8	41	133	4	26	83	150
1	110	92	69	55	37	150	27	139	13	69	150	8	46	146	5	28	92	150
2	131	109	82	65	44	150	33	166	16	82	150	10	55	150	6	34	109	150
3	152	126	95	76	50	150	38	192	18	96	150	12	63	150	7	39	127	150
4	172	144	108	86	57	150	43	218	21	109	150	14	72	150	8	45	144	150

**A2L pumps : sum up the 2 nozzles / A2L-Pumpen : Summe der zwei Düsen*
pompe A2L : somme des 2 gicleurs / Per le pompe A2L aggiungere n.2 ugelli

One pipe siphon feed system
Einstranginstallation - Tank höher als Pumpe
Installation monotube en charge
Impianti monotubo a sifone



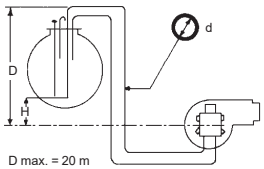
E max. = 20 m
(E-H) max. = 4,5 m

Two-pipe system

Pump/Pumpe Pompe/Pompa Q** (l/h)		35/45 60				55 77				65 102			75 130				95 150			
H (m)	d (mm)	4	6	8	10	6	8	10	12	6	8	10	12	8	10	12	14	8	10	12	14
0		2	15	50	124	11	38	96	150	7	27	71	150	20	54	116	150	16	46	100	150
0,5		2	16	56	138	12	42	107	150	8	31	79	150	23	61	130	150	19	52	112	150
1		2	18	61	150	13	47	118	150	9	34	88	150	26	68	144	150	21	57	124	150
2		3	22	73	150	16	56	141	150	11	41	105	150	31	81	150	150	26	69	148	150
3		4	26	85	150	19	66	150	150	13	48	122	150	36	94	150	150	31	81	150	150
4		4	30	97	150	22	75	150	150	16	55	139	150	42	108	150	150	35	92	150	150

***Q = pump capacity @ 0 bar / Pumpenleistung bei 0 bar*
capacité de l'engrenage à 0 bar/portata della pompa a 0 bar.

Two pipe siphon feed system
Zweistranginstallation - Tank höher als Pumpe
Installation bitube en charge
Impianti bitubo a sifone



D max. = 20 m
(D-H) max. = 4,5 m

6.1.1.2 Underlying tank

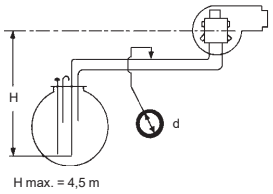
1-pipe system

With an underlying tank a 1-pipe-system is not recommended

Two-pipe system

Pump/Pumpe Pompe/Pompa Q** (l/h)	35/45 60				55 77				65 102				75 130				95 150			
d (mm) / H (m)	6	8	10	12	6	8	10	12	6	8	10	12	8	10	12	14	8	10	12	14
0	15	50	124	150	11	38	96	150	7	27	71	150	20	54	116	150	16	46	100	150
0,5	13	44	109	150	9	33	84	150	6	24	62	132	17	48	103	150	14	40	88	150
1	11	38	95	150	8	29	73	150	4	20	54	115	15	41	89	150	12	34	76	144
2	7	26	66	138	5	19	51	107	2	13	37	80	9	28	61	116	7	23	52	100
3	3	14	37	79		10	28	60		6	20	44	4	14	33	65		11	28	55
4			8	19			5	14				9			6	14			4	11

Two pipe lift system
Zweistranginstallation - Tank tiefer als Pumpe
Installation bitube en aspiration
Impianti bitubo in aspirazione



H max. = 4,5 m

The suction line tables consist of theoretically calculated values where the pipe dimensions and oil velocity have been matched so that tur-bulences will not occur. Such tur-bulences will result in increased pressure losses and in acoustic noise in the pipe system. In addition to drawn copper piping a pipe system usually comprises 4 elbows, a non-return valve, a cut-off valve and an external oil filter.

The sum of these individual resi-stances is so insignificant that they can be disregarded. The tables do not include any lengths exceeding 100 m as experience shows that longer lengths are not needed.

The tables apply to a standard fuel oil of normal commercial quality accor-ding to current standards. On commis- sioning with an empty tube system the oil pump should not be run without oil for more than 5 min. (a condition is that the pump is being lubricated during operation).

The tables state the total suction line length in metres at a nozzle capacity of 9,5 Gph. Max. permissible pressure at the suction and pressure side is 2,0 bar.

6.1.2 Check oil line seals

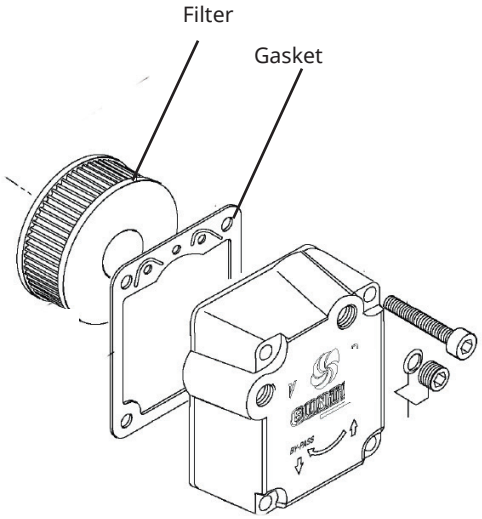
When the burner has been installed and put into operation, the tightness of the various coupling elements should be checked (A), in case of leakage - retighten the coupling elements.

Use caution when operating the burner, surfaces may be hot.

When servicing oil bearing components, check for oil leakage when the burner are put into operation.

6.1.3 Replacement of pump filter

1. Close the oil supply to the burner.
2. Loosen the pump cover's screws.
3. Remove the filter and gasket.
4. Mount new gasket and filter.
5. Refit the cover.
6. Open the oil supply.
7. Start the burner, check seals and combustion.



When servicing/replacing components that affect combustion, flue gas analysis and soot test must be carried out following installation.

6.1.4 Replacing the solenoid valve (pump)

1. Disconnect the main power and shut off the fuel supply.

> **Before obtaining access to terminals, all supply circuits must be disconnected.**

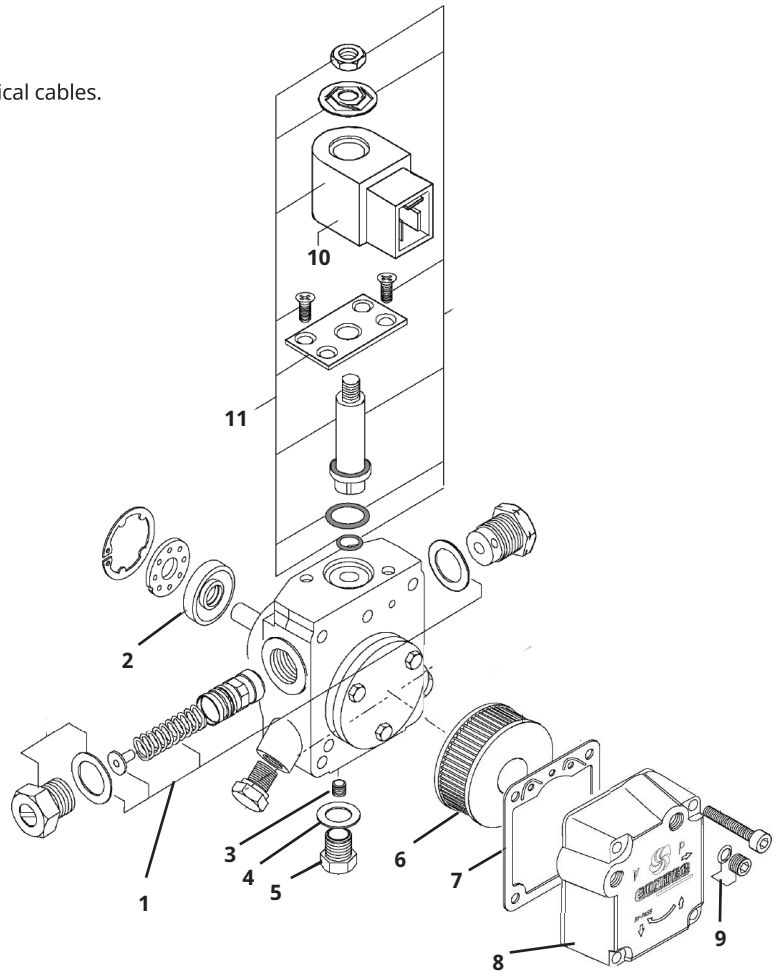
1. Disconnect power cables to solenoid valves.
2. Loosen nut holding the solenoid coil.
3. Loosen screws that secures the valve mounting plate.
4. Remove valve.
5. Check that it is the correct valve. NO
6. Install the new valve and refit the other parts in the reverse order.
7. Check functionality.

6.1.5 Replacing the gasket seal (pump)

1. Disconnect hoses, oil lines, and electrical cables.
2. Loosen pump (screw J).
3. Loosen locking rings for gasket seal.
4. Remove the old gasket seal (2).
5. Install the new gasket seal.
6. Connect hoses, oil lines, and electrical cables.
7. Test run and check seals.

Components Oil pump

1. Pressure regulator
2. Shaft seal kit (lip seal + protective cone)
3. By-pass plug
4. G 1/4 gasket
5. G 1/4 steel plug (1-pipe system)
6. Filter
7. Cover gasket
8. Cover
9. Pressure gauge port or vacuum gauge port screw, O-ring
10. Coil
11. Tube assy



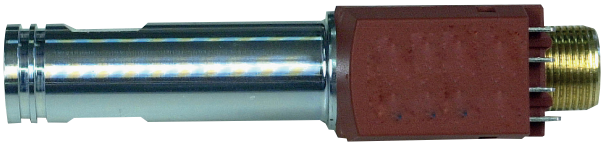
7. Preheater

7.1 Function FPHE 5

When the boiler thermostat connects, the PTC element is energized and oil begins to preheat. When the oil has reached the correct temperature, the preheater thermostat closes and the burner receives the start signal.

During operations the PTC element compensates its output so that the temperature does not become too high.

If the oil temperature is low and the oil flow high, the preheater thermostat may open owing to the PTC element's inability to maintain oil temperature. In this case it is important to use oil burner controls with a preheater holding circuit.



7.2 Function FPHE 5-LE

When the boiler thermostat connects, the PTC element is energized and oil begins to preheat. When the oil has reached the correct temperature, the preheater thermostat closes and the burner receives the start signal.

During operations the PTC element compensates its output so that the temperature does not become too high. If the oil temperature is low and the oil flow high, the preheater thermostat may open owing to the PTC element's inability to maintain oil temperature.

In this case it is important to use oil burner controls with a preheater holding circuit.

7.2.1 LE-valve

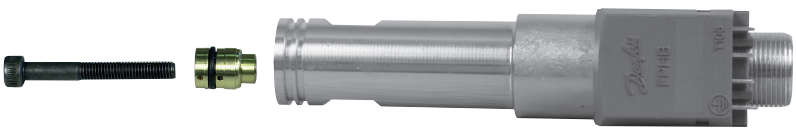
FPHE 5-LE has an integrated shut-off valve which prevents oil drips at start and stop. When a normal preheater is used before start, the oil expands and a small quantity of oil flows out of the nozzle orifice and wets the outside of the nozzle.

Also, when the burner stops, a small quantity of oil forces its way out after the flame has gone out, especially when there are hot components which radiate heat back to the nozzle.

The cut-off valve in the FPHE 5-LE is located immediately behind the nozzle. It opens at ≈ 6.5 bar and closes at ≈ 2.5 bar.

In order to achieve the intended effect when the pressure of the trapped oil increases, it must be evacuated back to the pump. This is made possible by the pump solenoid valve's return-valve function.

The cut-off valve can be pulled out of the preheater with the aid of an M5 screw as illustrated. When the valve is re-installed, oil pressure pushes it to a position all the way forward behind the nozzle filter so that the volume in front of the valve is as small as possible.



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8. Service

Service and maintenance work may only be performed by qualified personnel. Perform operational check of all safety systems and components at each service. Only Enertech original parts should be used when replacing components.

! Use caution when operating the burner, surfaces may be hot.

8.1 Burner Service Schedule, Oil

Servicing must be carried out once a year or after 3,000 hours of operation.

Burner	1 year	3,000 h
Filter	1 year replacement	3,000 h replacement
Oil hose	1 year inspection/replacement	
Nozzle	1 year replacement	3,000 h replacement
Electrodes	Replacement/cleaning 1 year	Replacement/ceaning 3,000 h
Brake disc	Replacement/cleaning 1 year	Replacement/ceaning 3,000 h
Motor	1 year	3,000 h
Drive shaft	Check/replace in the event of damage	Check/replace in the event of damage
Fan wheel	“1 year Replace if need for cleaning/imbalance”	“3000 h Replace if need for cleaning/imbalance”
Oil filter	Once a year	3,000 h replacement
Oil valve	Tightness check once a year	Replace if leakage detected

8.2 Component replacement intervals

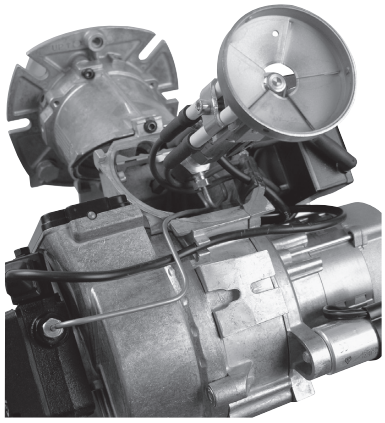
Components	**Service life – Recommended replacement**	**Service life – Recommended replacement Operating cycles**
Control system	10 years	250,000 cycles
Pressure switch	10 years	250,000 cycles
Ignition system with flame guard	10 years	250,000 cycles
UV flame sensor	10,000 h	N/A
Damper motor		500,000 cycles
Contactor	10 years	500,000 cycles

The burner and its components must be recycled according to applicable regulations.

8.3 Service positions

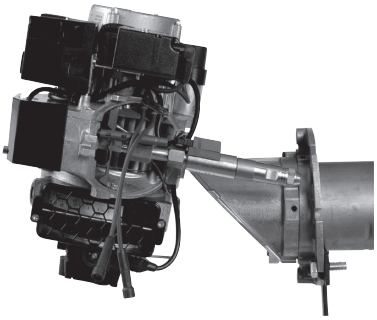
! Before obtaining access to terminals,
all supply circuits must be disconnected.

8.3.1 Service position 1



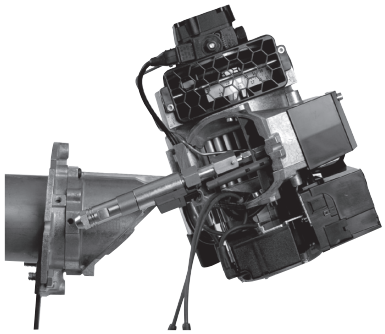
1. Disconnect the main power and shut off the fuel supply.
2. Undo the screw which fastens the burner front piece to the fan housing,
but only so much as to allow the fan housing to be removed from the burner front piece.
3. Remove the fan housing from the burner front piece and pull it backwards until the combustion assembly is free of the burner front piece.
4. Suspend the fan housing by the fan housing attachment point (for joining the front piece to the fan housing) on the screw (for joining the front piece to the fan housing) as illustrated to the left. If necessary, tighten the screw somewhat to ensure that the burner is suspended safely.

8.3.2 Service position 2



1. Disconnect the main power and shut off the fuel supply.
2. Undo the screw which fastens the burner front piece to the fan housing, but only so much as to allow the fan housing to be removed from the burner front piece.
3. Remove the fan housing from the burner front piece and pull it backwards until the combustion assembly is free of the burner front piece.
4. Turn the screw into the front piece until there is a gap of approx. 5 mm between the metal and the screw head.
5. Suspend the fan housing by the fan housing service attachment on the screw used for joining the front piece to the fan housing, with the motor upwards, as shown in the illustration to the left.

8.3.3 Service position 3



1. Disconnect the main power and shut off the fuel supply.
2. Undo the screw which fastens the burner front piece to the fan housing, but only so much as to allow the fan housing to be removed from the burner front piece.
3. Remove the fan housing from the burner front piece and pull it backwards until the combustion assembly is free of the burner front piece.
4. Turn the screw into the front piece until there is a gap of approx. 5 mm between the metal and the screw head.
5. Suspend the fan housing by the fan housing service attachment on the screw used for joining the front piece to the fan housing, with the air intake upwards, as shown in the illustration to the left.

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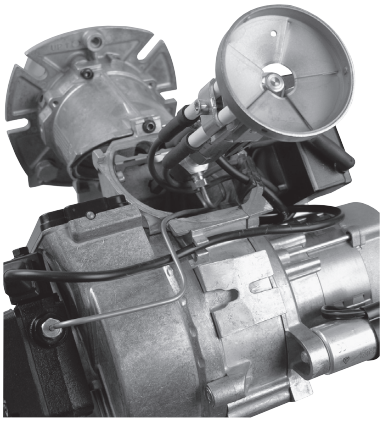
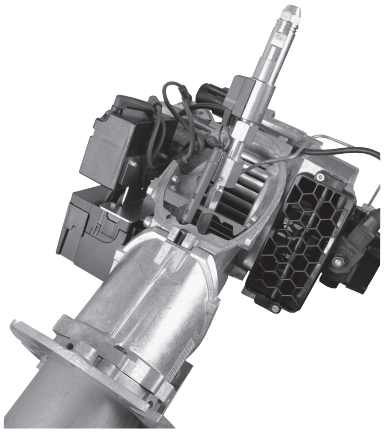
8.4 Combustion device



1. Disconnect the main power and shut off the fuel supply.
2. Service position 1 can be used.
3. Carry out a visual inspection of the combustion assembly and check the various parts for defects.
4. Undo and remove the brake plate and the electrode package from the oil pipe. Clean the brake plate as necessary.
5. Screw off the nozzle.
6. Install the nozzle. The nozzle may not be cleaned; it must be replaced with a new nozzle if the existing one is considered defective.
7. Check the ignition electrodes. Replace as necessary (refer to Technical data for electrode settings).
8. Install the brake plate and electrode package. Check that the distance between the nozzle and brake plate is correct (refer to Technical data).
9. Undo the screw that the fan housing is suspended from. Reassemble the front piece and the fan housing and fasten them together.
10. Switch on the main power and open the fuel supply.
11. Start burner and check/adjust combustion.

8.5 Preheater replacement

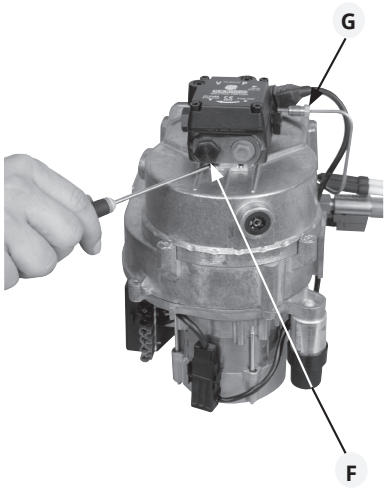


1. Disconnect the main power and shut off the fuel supply.
2. Service position 1 can be used.
3. Remove the brake plate and electrode package.
4. Disconnect the preheater cable from the preheater.
5. Screw off the nozzle.
6. Undo the nut that connects the oil pipe to the preheater.
7. Install the new preheater. Check the condition of the O-ring; replace as necessary.
8. Connect the preheater cable.
9. Install the nozzle.
10. Install the brake plate and electrode package. Check that the distance between the nozzle and brake plate is correct (refer to Technical data).
11. Re-assemble the burner.
12. Switch on the main power and open the fuel supply.
13. Start burner and check/adjust combustion.

! **When servicing/replacing components that affect combustion, flue gas analysis and soot test must be carried out following installation.**

8.6 Oil pump replacement

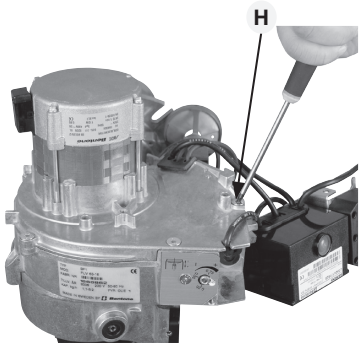
1. Disconnect the main power and shut off the fuel supply.
2. Disconnect the oil hoses from the oil pump.
3. Service position 3 can be used.
4. Remove the solenoid cable from the pump.
5. Remove the connecting pipe (G) from the pump.
6. Undo the screws (F) and pull out the oil pump.
7. Install the oil pump in the burner. Tighten the screws and attach the connecting pipe (G). (It is important that the splines engage the pump coupling correctly.)
8. Connect the oil hoses. (For conversions from one- and two-pipe systems refer to the Pump instructions.)
9. Switch on the main power and open the fuel supply.
10. Start burner, purge pump, adjust to correct pressure and check/ adjust combustion.

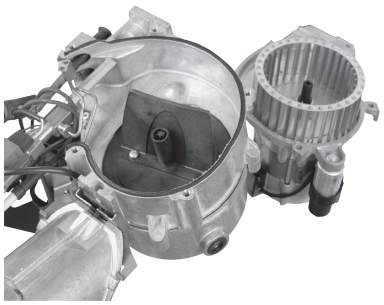


! When servicing/replacing components that affect combustion, flue gas analysis and soot test must be carried out following installation.

8.7 Fan motor replacement

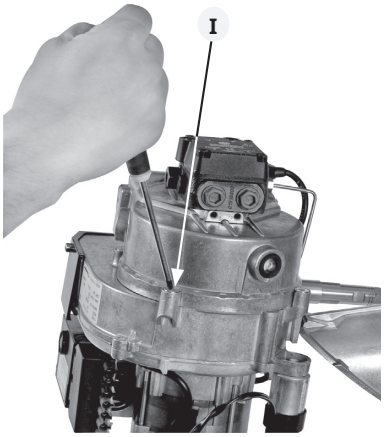
1. Disconnect the main power and shut off the fuel supply.
2. Service position 2 can be used.
3. Remove the electrical connection from the motor.
4. Remove the electrical box retaining screw.
5. Remove the cable conduit entry to the ignition electrodes and the preheater (where fitted) and remove the photocell cable from the motor flange.
6. Undo the screws (H) to the motor flange, 5 pcs.
7. Lift away the motor.
8. Remove the drive coupling end from the motor shaft, loosen and remove the fan wheel.
9. Install the fan wheel on the new motor, tighten the locking screw. The fan wheel must be installed in the bottom position toward the motor shaft. Install the drive coupling end.
10. Align and fit the motor flange to the fan housing. Pay attention to the drive coupling so that it does not fall out, and also that it aligns correctly in the drive coupling end of the motor and pump.
11. Bolt the motor flange and fan housing together. Tighten the screws diagonally, and do not tighten hard one at a time. This is in order to ensure the fan housing and the motor flange assume the correct relative positions.
12. Place the cable conduit entry and the photocell cable in position.
13. Screw the electrical console in place.
14. Connect the motor wiring.
15. Join together the fan housing and the burner front piece.
16. Switch on the main power and open the fuel supply.
17. Start burner and check/adjust combustion.





! When servicing/replacing components that affect combustion, flue gas analysis and soot test must be carried out following installation.

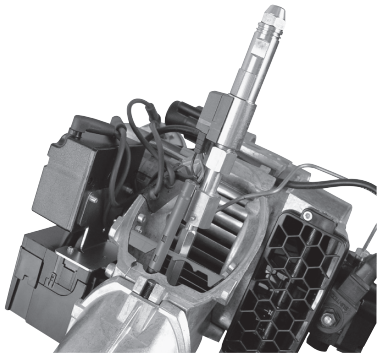
8.8 Air intake and intake cone



1. Disconnect the main power and shut off the fuel supply.
2. Service position 3 can be used.
3. Remove the solenoid cable from the pump.
4. Remove the connecting pipe from the pump.
5. Undo the air intake retaining screws (I).
6. Remove the air intake.
7. Undo the inlet cone retaining screw; make note of the inlet cone position.
8. Remove the inlet cone from the fan housing.
9. Check the function and visual condition of the various air regulator components. Clean and replace components as necessary.
10. Re-assemble the burner. Be especially careful when installing the inlet cone; install it in the same position it had at removal.
11. Fit the O-ring in the groove between the fan housing and inlet cone. Ensure that it is properly located in the groove and is not damaged when the air intake is fitted.
12. Switch on the main power and open the fuel supply.
13. Start burner and check/adjust combustion.

When servicing/replacing components that affect combustion, flue gas analysis and soot test must be carried out following installation.

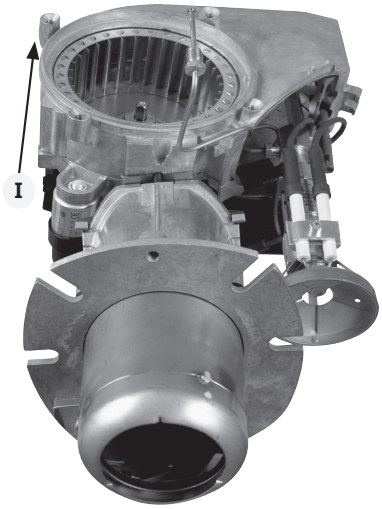
8.9 Fan wheel checks



8.9.1 Inspection

1. Disconnect the main power and shut off the fuel supply.
2. Service position 1 can be used.
3. Perform a visual inspection of the fan wheel. Spin the fan wheel with your finger, or carefully using a tool.
4. If the fan wheel is not very dirty, clean it carefully where possible.
5. If thorough cleaning is considered necessary, see ”Cleaning alternative 1 or 2”.
6. If cleaning is not necessary, re-assemble the burner.
7. Switch on the main power and open the fuel supply.
8. Start burner and check/adjust combustion.

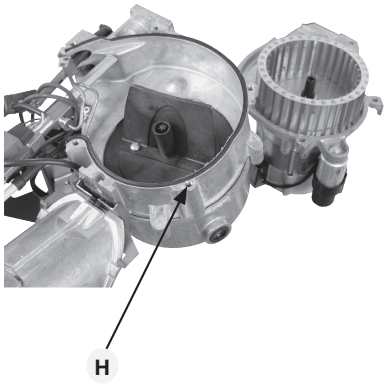
8.9.2 Cleaning, alternative 1



1. Disconnect the main power and shut off the fuel supply.
2. Service position 3 can be used.
3. Remove the solenoid cable from the pump.
4. Remove the connector pipe from the pump.
5. Undo the air intake retaining screws (I).
6. Remove the air intake.
7. Undo the inlet cone retaining screw; make note of the inlet cone position.
8. Remove the inlet cone from the fan housing.
9. Clean the fan wheel. Undo and if necessary remove the fan wheel for more thorough cleaning of the fan and fan housing.
10. Install the fan wheel; tighten the retaining screw. The fan wheel must be installed in the bottom position toward the motor shaft. Install the drive coupling end.
11. Re-assemble the burner. Pay attention to the drive coupling so that it does not fall out, and also that it aligns correctly in the drive coupling end of the motor and pump.
12. Fit the inlet cone in the same position as before disassembly
13. Fit the O-ring in the groove between the fan housing and inlet cone. Ensure that it is properly located in the groove and is not damaged when the air intake is fitted.
14. Switch on the main power and open the fuel supply.
15. Start burner and check/adjust combustion.

When servicing/replacing components that affect combustion, flue gas analysis and soot test must be carried out following installation.

8.9.3 Cleaning, alternative 2



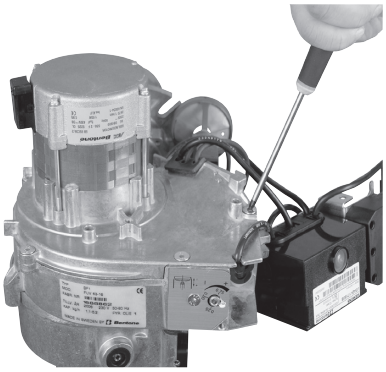
1. Disconnect the main power and shut off the fuel supply.
2. Service position 2 can be used.
3. Remove the electrical connection from the motor.
4. Remove the electrical box retaining screw.
5. Remove the cable conduit entry to the ignition electrodes and the preheater (where fitted) and remove the photocell cable from the motor flange.
6. Undo the motor flange retaining screws (H), 5 pcs.
7. Lift away the motor.
8. Clean the fan wheel and the fan housing. For more thorough cleaning remove the drive coupling from the motor shaft and loosen and remove
the fan wheel.
9. Install the fan wheel on the motor and tighten the locking screw. The fan wheel must be installed in the bottom position toward the motor shaft. Install the drive coupling end.
10. Align and fit the motor flange to the fan housing. Pay attention to the drive coupling so that it does not fall out, and also that it aligns correctly in the drive coupling end of the motor and pump.
11. Screw the motor flange and the fan housing together. Tighten the screws diagonally, and do not tighten hard one at a time. This is in order to ensure the fan housing and the motor flange assume the correct relative positions.
12. Place the cable conduit entry and the photocell cable in position.
13. Screw the electrical box in place.
14. Connect the motor wiring.
15. Join together the fan housing and the burner front piece.
16. Switch on the main power and open the fuel supply.
17. Start burner and check/adjust combustion.

! **When servicing/replacing components that affect combustion, flue gas analysis and soot test must be carried out following installation.**

8.10 Electrical module

Check that the electrical console retaining screw is tight so that good contact to earth is established between the console and the burner body.

8.10.1 Replacement of complete electrical package



1. Disconnect the main power and shut off the fuel supply.
2. Service position 2 can be used.
3. Remove the electrical connection from the motor.
4. Remove the electrical box retaining screw.
5. Remove the cable conduit entry to the ignition electrodes and the preheater (where fitted) and remove the photocell cable from the motor flange.
6. Install the new electrical package.
7. Place the cable conduit entry and the photocell cable in position.
8. Screw the electrical box in place.
9. Connect the motor wiring.
10. Assemble the fan housing and burner front piece.
11. Switch on the main power and open the fuel supply.
12. Start burner and check/adjust combustion.

8.10.2 Replacement of individual electrical components

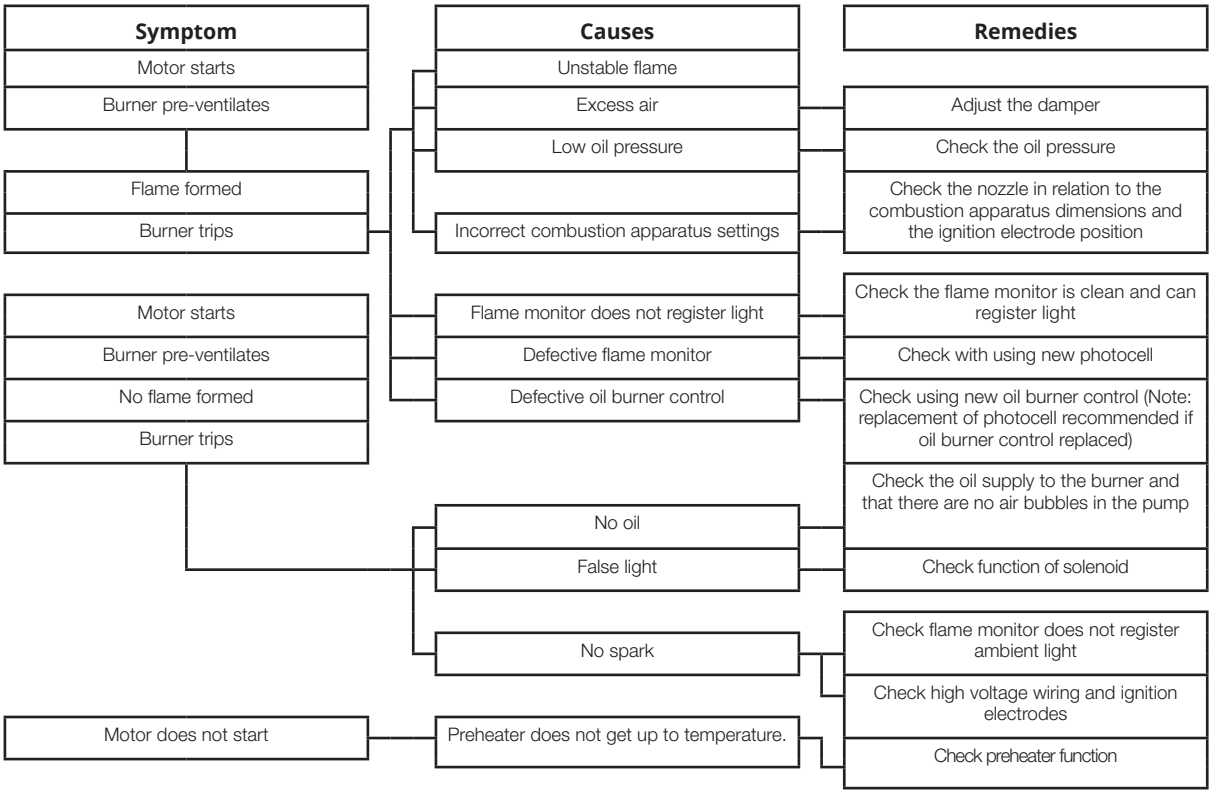
1. Disconnect the main power and shut off the fuel supply.
2. Service position 2 can be used.
3. Remove the oil burner control.
4. Disconnect the wires to the components that are to be replaced.
5. Insert the new wires.
6. Install the oil burner control.
7. Assemble the fan housing and burner front piece.
8. Switch on the main power and open the fuel supply.
9. Start burner and check/adjust combustion.

When replacing the electrical components transformer and control box included in the electrical package, the junction box lid need not be removed.

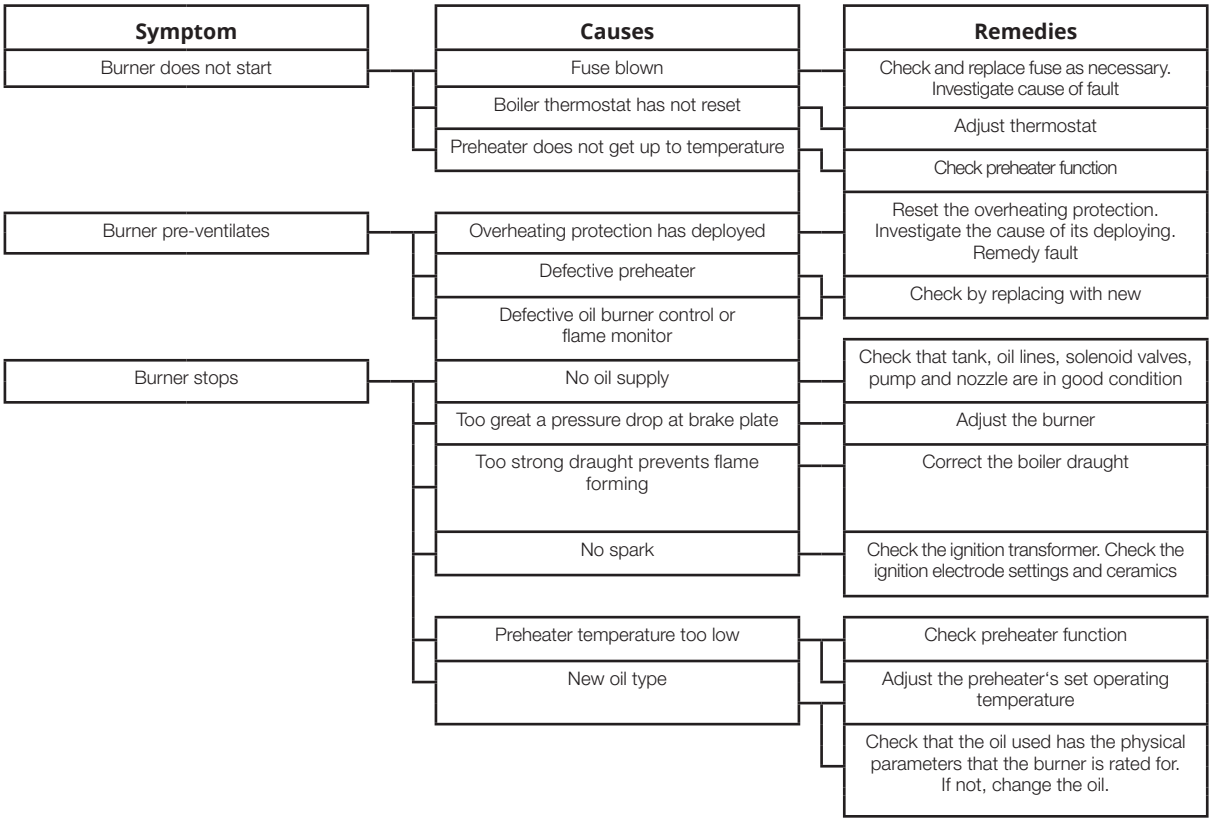
When servicing/replacing components that affect combustion, flue gas analysis and soot test must be carried out following installation.

9. Fault Location

9.1 Burner will not start



9.2 Burner will not start after normal use



9.3 Delayed ignition

Symptom	Causes	Remedies
Burner pulsates at start with hot flue gases	Excessively strong draught	Correct boiler draught
	Excessive pressure drop across the brake plate	Adjust the burner
	Preheater temperature too low	Check preheater function
	New oil type	Adjust the preheater's set operating temperature
		Ensure that the new oil's physical parameters are within the limits for which the burner is designed. If not, change the oil.
Burner pulsates at start	Nozzle partially blocked	Replace nozzle
	Oil pressure too low	Check and adjust
	Flue is blocked or damaged	Check and correct
	The fan wheel is slipping on the shaft	Check and tighten
	Pump coupling loose or worn	Replace
	Preheater blocked	Check the ignition electrode setting, (see technical data)
	Delayed ignition	Check that the ignition electrodes are not damaged
	Excessively strong draught	Check high voltage cables
		Check position of nozzle assembly setting
		Correct boiler draught
	Excessive pressure drop across the brake plate	Adjust the burner
	Preheater temperature too low	Check preheater function
	New oil type	Adjust the preheater's set operating temperature
		Ensure that the new oil's physical parameters are within the limits for which the burner is designed. If not, change the oil.

9.4 Noise in pump

Symptom	Causes	Remedies
The burner pump emits noise during start		Check the oil system in order to reduce pressure drop
The burner pump emits noise during operation	Insufficient negative pressure on the suction side pump	Rebuild the oil system to form a solution with a transport oil pump
		Check that the oil used has the physical parameters that the burner is rated for. If not, change the oil.
		Temperature of the oil from the tank is too low, increase the temperature of oil from tank
		Clean the pump filter

9.5 Pump pressure

Symptom	Causes	Remedies
The burner pump can not build up pressure	No oil	Check that there is oil and that it reaches the pump
	Oil viscosity too low	Check that the oil reaching the pump has the physical parameters that the pump can handle. Change the oil or the pump's oil parameters
	Pump worn	Replace the pump
	Pump run using impure oil that has worn the pump out prematurely	Replace pump and install self-cleaning filter in the oil system
	Blocked pump filter	Check, clean pump filter

10. Log of flue gas analysis

Owner	Adresss	Tel. no:
Installation		Tel. no:

Boiler

Type	Make	Power kW

Burner

Type	Model	Serial no.	Fuel

	Step 1	Step 2	Step 3
Draught in fireplace			
Fan Press mbar			
Filter smoke number			
CO_2			
O_2			
NOx			
CO			
Flue gas temp. °C			
Setting brake disc			
Setting Air damper			
Pump pressure bar			
Nozzle			

Test performed / 20	Address
Test performed by:	Postal address
Company name:	Tel. no:

EU Declaration of conformity

Bentone Oil Burners

Type:

BF 1	**ST 133**	**B 40**	**B 65**
ST 108	**ST 146**	**B 45**	**B 70**
ST 120	**B 30**	**B 55**	**B 80**

This declaration of conformity is issued under the sole responsibility of the manufacturer.
The object of the declaration described above is in conformity with:

- **Machinery Directive 2006/42/EC**
- **EMC 2014/30/EU**
- **The Restriction of the Use of Certain Hazardous Substances (RoHS) Directive 2011/65/EU**

References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared:

EN 267:2020	Excluding the requirements of Annex J/K. Automatic forced draught burners for liquid fuels.

Additional information can be downloaded at: www.bentone.com

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Notified Body: TUV SÜD Product Service GmbH
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Notified Body Number: 0123

Ljungby, 2022-10-10

Joachim Hultqvist
Technical Manager
Enertech AB

Ola Karlsson
Quality Manager
Enertech AB

Bentone®

UK Declaration of conformity

Bentone Oil Burners

Type:

BF 1	**ST 133**	**B 40**	**B 65**
ST 108	**ST 146**	**B 45**	**B 70**
ST 120	**B 30**	**B 55**	**B 80**

This declaration of conformity is issued under the sole responsibility of the manufacturer.
The object of the declaration described above is in conformity with:

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

References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared:

BS EN 267:2020	Excluding the requirements of Annex J/K. Automatic forced draught burners for liquid fuels.

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