

**PG91**  
**PG92**  
**PG93**

# **Double-stage Light oil Burners**

**MANUAL OF INSTALLATION - USE - MAINTENANCE**

***CIB* UNIGAS**

**BURNERS - BRUCIATORI - BRULERS - BRENNER - QUEMADORES - ГОРЕЛКИ**

## DANGERS, WARNINGS AND NOTES OF CAUTION

**THIS MANUAL IS SUPPLIED AS AN INTEGRAL AND ESSENTIAL PART OF THE PRODUCT AND MUST BE DELIVERED TO THE USER.**

**INFORMATION INCLUDED IN THIS SECTION ARE DEDICATED BOTH TO THE USER AND TO PERSONNEL FOLLOWING PRODUCT INSTALLATION AND MAINTENANCE.**

**THE USER WILL FIND FURTHER INFORMATION ABOUT OPERATING AND USE RESTRICTIONS, IN THE SECOND SECTION OF THIS MANUAL. WE HIGHLY RECOMMEND TO READ IT.**

**CAREFULLY KEEP THIS MANUAL FOR FUTURE REFERENCE.**

### 1) GENERAL INTRODUCTION

- The equipment must be installed in compliance with the regulations in force, following the manufacturer's instructions, by qualified personnel.
- Qualified personnel means those having technical knowledge in the field of components for civil or industrial heating systems, sanitary hot water generation and particularly service centres authorised by the manufacturer.
- Improper installation may cause injury to people and animals, or damage to property, for which the manufacturer cannot be held liable.
- Remove all packaging material and inspect the equipment for integrity.

In case of any doubt, do not use the unit - contact the supplier.

The packaging materials (wooden crate, nails, fastening devices, plastic bags, foamed polystyrene, etc), should not be left within the reach of children, as they may prove harmful.

- Before any cleaning or servicing operation, disconnect the unit from the mains by turning the master switch OFF, and/or through the cut-out devices that are provided.
- Make sure that inlet or exhaust grilles are unobstructed.
- In case of breakdown and/or defective unit operation, disconnect the unit. Make no attempt to repair the unit or take any direct action.

Contact qualified personnel only.

Units shall be repaired exclusively by a servicing centre, duly authorised by the manufacturer, with original spare parts.

Failure to comply with the above instructions is likely to impair the unit's safety.

To ensure equipment efficiency and proper operation, it is essential that maintenance operations are performed by qualified personnel at regular intervals, following the manufacturer's instructions.

- When a decision is made to discontinue the use of the equipment, those parts likely to constitute sources of danger shall be made harmless.
- In case the equipment is to be sold or transferred to another user, or in case the original user should move and leave the unit behind, make sure that these instructions accompany the equipment at all times so that they can be consulted by the new owner and/or the installer.
- For all the units that have been modified or have options fitted then original accessory equipment only shall be used.
- This unit shall be employed exclusively for the use for which it is meant. Any other use shall be considered as improper and, therefore, dangerous.

The manufacturer shall not be held liable, by agreement or otherwise, for damages resulting from improper installation, use and failure to comply with the instructions supplied by the manufacturer. The occurrence of any of the following circumstances may cause explosions, polluting unburnt gases (example: carbon monoxide CO), burns, serious harm to people, animals and things:

- Failure to comply with one of the WARNINGS in this chapter
- Incorrect handling, installation, adjustment or maintenance of the burner
- Incorrect use of the burner or incorrect use of its parts or optional supply

### 2) SPECIAL INSTRUCTIONS FOR BURNERS

- The burner should be installed in a suitable room, with ventilation openings complying with the requirements of the regulations in force, and sufficient for good combustion.
- Only burners designed according to the regulations in force should be used.
- This burner should be employed exclusively for the use for which it

was designed.

- Before connecting the burner, make sure that the unit rating is the same as delivery mains (electricity, gas oil, or other fuel).
- Observe caution with hot burner components. These are, usually, near to the flame and the fuel pre-heating system, they become hot during the unit operation and will remain hot for some time after the burner has stopped.

When the decision is made to discontinue the use of the burner, the user shall have qualified personnel carry out the following operations:

- a) Remove the power supply by disconnecting the power cord from the mains.
- b) Disconnect the fuel supply by means of the hand-operated shut-off valve and remove the control handwheels from their spindles.

#### Special warnings

- Make sure that the burner has, on installation, been firmly secured to the appliance, so that the flame is generated inside the appliance firebox.
- Before the burner is started and, thereafter, at least once a year, have qualified personnel perform the following operations:
  - a) set the burner fuel flow rate depending on the heat input of the appliance;
  - b) set the flow rate of the combustion-supporting air to obtain a combustion efficiency level at least equal to the lower level required by the regulations in force;
  - c) check the unit operation for proper combustion, to avoid any harmful or polluting unburnt gases in excess of the limits permitted by the regulations in force;
  - d) make sure that control and safety devices are operating properly;
  - e) make sure that exhaust ducts intended to discharge the products of combustion are operating properly;
  - f) on completion of setting and adjustment operations, make sure that all mechanical locking devices of controls have been duly tightened;
  - g) make sure that a copy of the burner use and maintenance instructions is available in the boiler room.
- In case of a burner shut-down, reset the control box by means of the RESET pushbutton. If a second shut-down takes place, call the Technical Service, **without trying to RESET further**.
- The unit shall be operated and serviced by qualified personnel only, in compliance with the regulations in force.

### 3) GENERAL INSTRUCTIONS DEPENDING ON FUEL USED

#### 3a) ELECTRICAL CONNECTION

- For safety reasons the unit must be efficiently earthed and installed as required by current safety regulations.
- It is vital that all safety requirements are met. In case of any doubt, ask for an accurate inspection of electrics by qualified personnel, since the manufacturer cannot be held liable for damages that may be caused by failure to correctly earth the equipment.
- Qualified personnel must inspect the system to make sure that it is adequate to take the maximum power used by the equipment shown on the equipment rating plate. In particular, make sure that the system cable cross section is adequate for the power absorbed by the unit.
- No adaptors, multiple outlet sockets and/or extension cables are permitted to connect the unit to the electric mains.
- An omnipolar switch shall be provided for connection to mains, as required by the current safety regulations.
- The use of any power-operated component implies observance of a few basic rules, for example:
  - do not touch the unit with wet or damp parts of the body and/or with bare feet;

- do not pull electric cables;
- do not leave the equipment exposed to weather (rain, sun, etc.) unless expressly required to do so;
- do not allow children or inexperienced persons to use equipment;
- The unit input cable shall not be replaced by the user.

In case of damage to the cable, switch off the unit and contact qualified personnel to replace.

When the unit is out of use for some time the electric switch supplying all the power-driven components in the system (i.e. pumps, burner, etc.) should be switched off.

### 3b) FIRING WITH GAS, LIGHT OIL OR OTHER FUELS

#### GENERAL

- The burner shall be installed by qualified personnel and in compliance with regulations and provisions in force; wrong installation can cause injuries to people and animals, or damage to property, for which the manufacturer cannot be held liable.
- Before installation, it is recommended that all the fuel supply system pipes be carefully cleaned inside, to remove foreign matter that might impair the burner operation.
- Before the burner is commissioned, qualified personnel should inspect the following:
  - a the fuel supply system, for proper sealing;
  - b the fuel flow rate, to make sure that it has been set based on the firing rate required of the burner;
  - c the burner firing system, to make sure that it is supplied for the designed fuel type;
  - d the fuel supply pressure, to make sure that it is included in the range shown on the rating plate;
  - e the fuel supply system, to make sure that the system dimensions are adequate to the burner firing rate, and that the system is equipped with all the safety and control devices required by the regulations in force.
- When the burner is to remain idle for some time, the fuel supply tap or taps should be closed.

#### SPECIAL INSTRUCTIONS FOR USING GAS

Have qualified personnel inspect the installation to ensure that:

- a the gas delivery line and train are in compliance with the regulations and provisions in force;
  - b all gas connections are tight;
  - c the boiler room ventilation openings are such that they ensure the air supply flow required by the current regulations, and in any case are sufficient for proper combustion.
- Do not use gas pipes to earth electrical equipment.
  - Never leave the burner connected when not in use. Always shut the gas valve off.
  - In case of prolonged absence of the user, the main gas delivery valve to the burner should be shut off.

#### Precautions if you can smell gas

- a do not operate electric switches, the telephone, or any other item likely to generate sparks;
  - b immediately open doors and windows to create an air flow to purge the room;
  - c close the gas valves;
  - d contact qualified personnel.
- Do not obstruct the ventilation openings of the room where gas appliances are installed, to avoid dangerous conditions such as the development of toxic or explosive mixtures.

## DIRECTIVES AND STANDARDS

### Gas burners

#### European directives

- 2009/142/EC (Gas Directive)
- 2006/95/CEC (Low Tension Directive)
- 2004/108/EC (Electromagnetic compatibility Directive)
- 2006/42/EC (Machinery Directive)

#### Harmonized standards

- UNI EN 676 (Automatic forced draught burners for gaseous fuels)
- EN 55014-1 (Electromagnetic compatibility- Requirements for household appliances, electric tools and similar apparatus)
- CEI EN 60335-1 (Specification for safety of household and similar electrical appliances);
- EN 50165 (Electrical Equipment of non-electric appliances for household and similar purposes).
- EN 60335-2-102 (Household and similar electrical appliances. Safety. Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections).

### Light oil burners

#### European directives

- 2006/95/EC (Low Tension Directive)
- 2004/108/EC (Electromagnetic compatibility Directive)
- 2006/42/EC (Machinery Directive)

#### Harmonized standards

- UNI EN 267 (Automatic forced draught burners for liquid fuels)
- EN 55014-1 (Electromagnetic compatibility- Requirements for household appliances, electric tools and similar apparatus)
- CEI EN 60335-1 (Specification for safety of household and similar electrical appliances)
- EN 50165 (Electrical Equipment of non-electric appliances for household and similar purposes)

#### National Standard

- UNI 7824 (Atomizing burners of the monobloc type. Characteristics and test methods)

### Heavy oil burners

#### European Directives

- 2006/95/EC (Low Tension Directive)
- 2004/108/EC (Electromagnetic compatibility Directive)
- 2006/42/EC (Machinery Directive)

#### Harmonized standards

- EN 55014-1 (Electromagnetic compatibility- Requirements for household appliances, electric tools and similar apparatus)
- UNI EN 267 (Automatic forced draught burners for liquid fuels)
- CEI EN 60335-1 (Specification for safety of household and similar electrical appliances);
- EN 50165 (Electrical Equipment of non-electric appliances for household and similar purposes).

#### Norme nazionali / National Standard

- UNI 7824 (Atomizing burners of the monobloc type. Characteristics and test methods).

### Gas - Light oil burners

#### European Directives

- 2009/142/EC (Gas Directive)
- 2006/95/EC (Low Tension Directive)
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#### Norme nazionali / National Standard

- UNI 7824 (Atomizing burners of the monobloc type. Characteristics and test methods).

### Gas - Heavy oil burners

#### European directives:

- 2009/142/EC (Gas Directive)

- 2006/95/EC (Low Tension Directive)
- 2004/108/EC (Electromagnetic compatibility Directive)
- 2006/42/EC (Machinery Directive)

#### Harmonized standards

- UNI EN 676 (Automatic forced draught burners for gaseous fuels)
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- EN 50165 (Electrical equipment of non-electric appliances for household and similar purposes. Safety requirements)

#### National Standard

- UNI 7824 (Atomizing burners of the monobloc type. Characteristics and test methods.

#### Industrial burners

#### European directives

- 2009/142/EC (Gas Directive)
- 2006/95/EC (Low Tension Directive)
- 2004/108/EC (Electromagnetic compatibility Directive)
- 2006/42/EC (Machinery Directive)

#### Harmonized standards

- EN 55014-1 (Electromagnetic compatibility- Requirements for household appliances, electric tools and similar apparatus)
- EN 746-2 (Industrial thermoprocessing equipment - Part 2: Safety requirements for combustion and fuel handling systems)
- EN 50165 (Electrical equipment of non-electric appliances for household and similar purposes. Safety requirements)




#### Burner data plate

For the following information, please refer to the data plate:

- burner type and burner model: must be reported in any communication with the supplier
- burner ID (serial number): must be reported in any communication with the supplier
- date of production (year and month)
- information about fuel type and network pressure

Type	--
Model	--
Year	--
S.Number	--
Output	--
Oil Flow	--
Fuel	--
Category	--
Gas Pressure	--
Viscosity	--
El.Supply	--
El.Consump.	--
Fan Motor	--
Protection	--
Drwaing n°	--
P.I.N.	--

#### SYMBOLS USED

	<b>WARNING!</b>	Failure to observe the warning may result in irreparable damage to the unit or damage to the environment
	<b>DANGER!</b>	Failure to observe the warning may result in serious injuries or death.
	<b>WARNING!</b>	Failure to observe the warning may result in electric shock with lethal consequences

## PART I: INSTALLATION

### GENERAL FEATURES

The burners of this series represent monoblock burners made in die-cast aluminium housing with relative flange to work on heating generators.

They can be provided in progressive or fully-modulating version.

The fuel coming from the supply line, is pushed by the pump to the nozzle and then into the combustion chamber, where the mixture between fuel and air takes place and consequently the flame.

In the burners, the mixture between fuel and air, to perform clean and efficient combustion, is activated by atomisation of oil into very small particles. This process is achieved making pressurised oil pass through the nozzle.

The pump main function is to transfer oil from the tank to the nozzle at required quantity and pressure. To adjust pressure, pumps are provided with a pressure governor.

The electric actuator moves the air damper and allows the optimisation of the gas flue values, as to get an efficient combustion. The position of the combustion head determines the burner output. The air (comburent) and fuel (light oil) are forced into the combustion chamber, as to let the flame light up.

### How to interpret the burner's "Performance curve"

To check if the burner is suitable for the boiler to which it must be installed, the following parameters are needed:

- furnace input, in kW or kcal/h ( $\text{kW} = \text{kcal/h} / 860$ );
- backpressure (data are available on the boiler ID plate or in the user's manual).

Example:

Furnace input: 600kW

Backpressure: 4mbar

In the "Performance curve" diagram (Fig. 1), draw a vertical line matching the furnace input value and an horizontal line matching the backpressure value. The burner is suitable if the intersection point A is inside the performance curve.

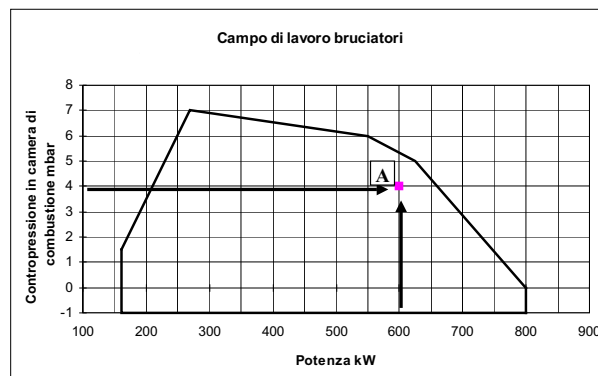


Fig. 1

Data are referred to standard conditions: atmospheric pressure at 1013mbar, ambient temperature at 15°C.

### Burner model identification

Burners are identified by burner type and model. Burner model identification is described as follows.

Type <b>PG92</b>	Model	<b>K-.</b>	<b>AB.</b>	<b>S.</b>	<b>*.</b>	<b>A.</b>
(1)		(2)	(3)	(4)	(5)	(6)
(1) BURNER TYPE	<b>PG91 - PG92 - PG93</b>					
(2) FUEL	<b>K</b> - Kerosene					
(3) OPERATION (Available versions)	<b>AB</b> - Double-stage					
(4) BLAST TUBE	<b>S</b> - Standard <b>L</b> - Extended					
(5) DESTINATION COUNTRY	<b>*</b> - see data plate					
(6) BURNER VERSION	<b>A</b> - Standard					

## SPECIFICATIONS

BURNERS		PG91	PG92	PG93
Output	min. -max. kW	698 - 2093	849 - 2558	550 - 4100
Kerosene rate	min. -max. kg/h	58 - 175	71 - 214	46 - 342
Fuel		Kerosene		
Viscosity	cSt @ 40 °C	2 - 7,4		
Density	kg/m <sup>3</sup>	840		
Power supply		400V 3N ~ 50Hz		
Electric motor	kW	4	5,5	9,6
Total power consumption	kW	5,6	7,1	8
Pump motor	kW	1,1	1,1	1,1
Index of protection		IP40		
Approx. weight	kg	220	220	230
Operation		High-low flame		
Operating temperature	°C	-10 ÷ +50		
Storage temperature	°C	-20 ÷ +60		
Working service *		Intermittent		



\* **NOTE ON THE WORKING SERVICE:** the Siemens LMO.. control box automatically stops after 24h of continuous working. The control box immediately starts up, automatically. If the burner is provided with Siemens LOA.. or LAL.. control box one controlled shutdown must be performed after 24 hours of continuous operation, for safety reasons.

## Overall dimensions (mm)

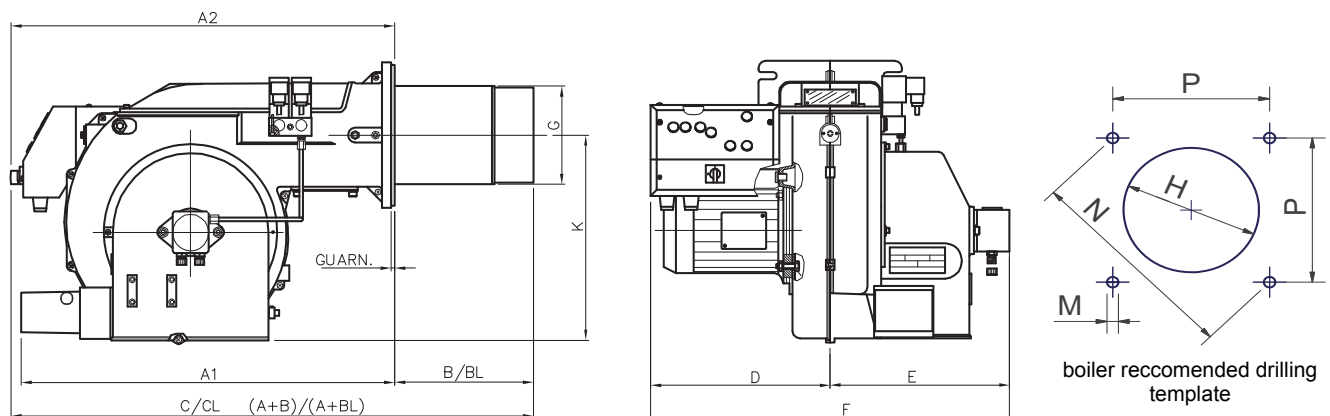
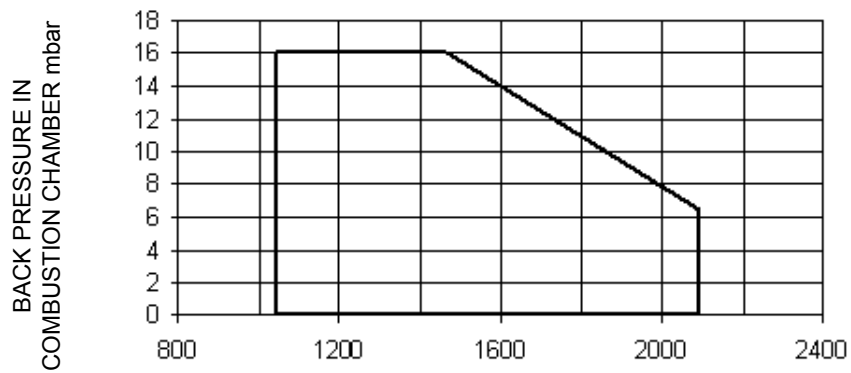


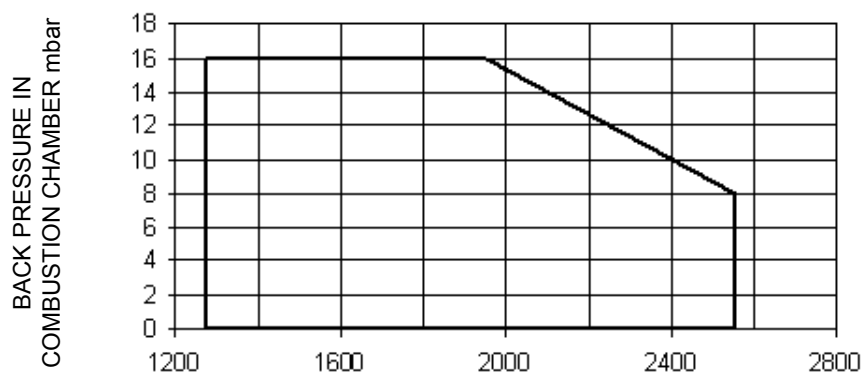
Fig. 1

	A2	B	BL*	C	CL*	D	E	F	G	K	H	P	M	N
PG91	850	300	473	1150	1323	420	485	905	238	360	268	295	M12	417
PG92	850	294	467	1144	1317	420	485	905	266	360	296	295	M12	417
PG93	850	301	491	1151	1341	420	485	905	292	360	322	300	M12	424

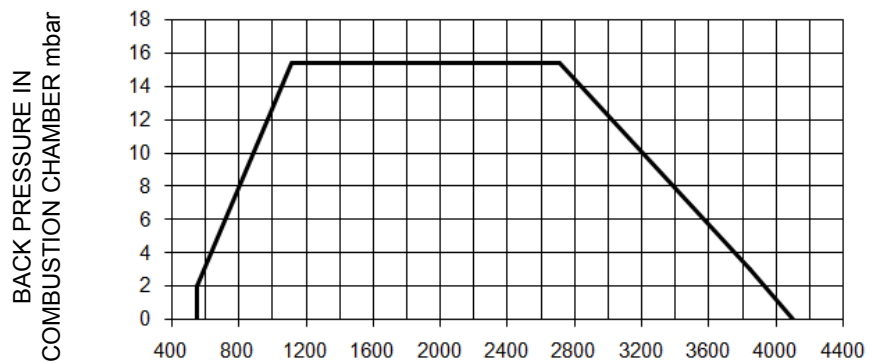
\*BL/CL: measure referred to burner with extended blast tube provided

**Performance curves****PG91**

kW

**PG92**

kW

**PG93**

kW

Data are referred to standard conditions: atmospheric pressure at 1013mbar, ambient temperature at 15°C.

## MOUNTINGS AND CONNECTIONS

### Packing

Burners are dispatched in cardboard packages whose dimensions are:

**1600 x 1000 x 860 mm (L x P x H)**

Packing cases of this kind are affected by humidity and are not suitable for stacking. The following are placed in each packing case.

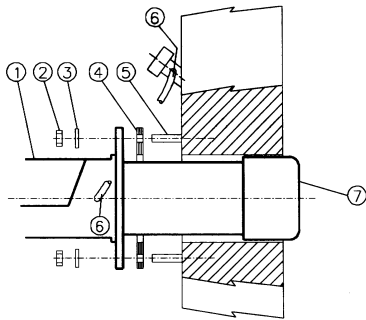
- 1 burner;
- 2 light oil flexible hoses;
- 1 light oil filter;
- 1 gasket to be inserted between the burner and the boiler;
- 1 envelope containing this manual.

To get rid of the burner's packing, follow the procedures laid down by current laws on disposal of materials.

### Fitting the burner to the boiler

To install the burner into the boiler, proceed as follows:

- 1 make a hole on the closing door of the combustion chamber as described on paragraph "Overall dimensions")
- 2 place the burner to the boiler: lift it up and handle it according to the procedure described on paragraph "Handling the burner";
- 3 place the stud bolts (5) on boiler's door, according to the burner drilling template described on paragraph "Overall dimensions";
- 4 fasten the stud bolts;
- 5 place the gasket on the burner flange;
- 6 install the burner into the boiler;
- 7 fix the burner to the stud bolts, by means of the fixing nuts, according to the next picture.
- 8 After fitting the burner to the boiler, ensure that the gap between the blast tube and the refractory lining is sealed with appropriate insulating material (ceramic fibre cord or refractory cement).



#### Keys

- 1 Burner
- 2 Fixing nut
- 3 Washer
- 4 Sealing gasket
- 5 Stud bolt
- 7 Blast tube



## ELECTRICAL CONNECTIONS



**WARNING!** Respect the basic safety rules. make sure of the connection to the earthing system. do not reverse the phase and neutral connections. fit a differential thermal magnet switch adequate for connection to the mains.

**WARNING!** before executing the electrical connections, pay attention to turn the plant's switch to OFF and be sure that the burner's main switch is in 0 position (OFF) too. Read carefully the chapter "WARNINGS", and the "Electrical connections" section.

**ATTENTION:** Connecting electrical supply wires to the burner terminal block MA, be sure that the ground wire is longer than phase and neutral ones.

To execute the electrical connections, proceed as follows:

- 1 remove the cover from the electrical board, unscrewing the fixing screws;
- 2 execute the electrical connections to the supply terminal board as shown in the attached wiring diagrams;
- 3 check the direction of the fan motor (see next paragraph);
- 4 refit the panel cover.



**WARNING:** (only for double stage and progressive burners) The burner is provided with an electrical bridge between terminals 6 and 7; when connecting the high/low flame thermostat, remove this bridge before connecting the thermostat.

### Rotation of electric motor

Once the electrical connection of the burner is executed, remember to check the rotation of the electric motor. The motor should rotate according to the "arrow" symbol on the body. In the event of wrong rotation, reverse the three-phase supply and check again the rotation of the motor.



**CAUTION:** check the motor thermal cut-out adjustment

NOTE: the burners are supplied for three-phase 380 V or 400 V supply, and in the case of three-phase 220 V or 230 V supply it is necessary to modify the electrical connections into the terminal box of the electric motor and replace the overload tripped relay.

### Diesel filters



	Item	Note	Connection	Max. operating pressure	Max. operating temperature	Filtering degree	Protection
5	20151PE (*)	-	3/8"	1 bar	-20, 60 °C	100 µ	-
6	20201PL (*)	-	3/8"	1 bar	-20, 60 °C	100 µ	-
7	GA70501	-	1"	4 bar	90 °C	100 µ	IP65

(\*) Supplied per pilot diesel fuel if present

## Installation diagram of light oil pipes

**⚠ PLEASE READ CAREFULLY THE “WARNINGS” CHAPTER AT THE BEGINNING OF THIS MANUAL.**

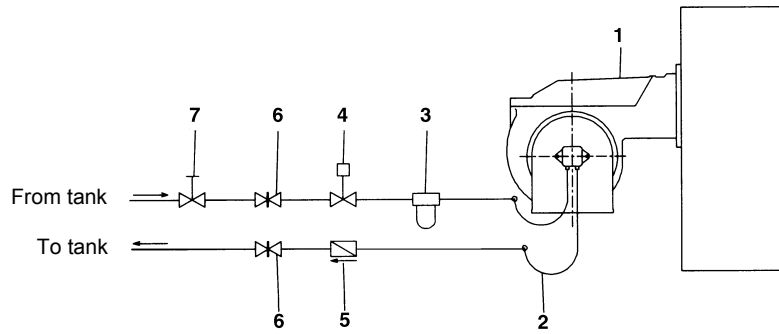


Fig. 2 - Double-pipe system

The burner is supplied with filter and flexible hoses, all the parts upstream the filter and downstream the return flexible hose, must be installed by the customer. As far as the hoses connection, see the related paragraph.

### Key

- 1 Burner
- 2 Flexible hoses (fitted)
- 3 Light oil filter (fitted)
- 4 Automatic interceptor (\*)
- 5 One-way valve (\*)
- 6 Gate valve
- 7 Quick-closing gate-valve (outside the tank or boiler rooms)

(\*) Only for installations with gravity, siphon or forced circulation feed systems. If the device installed is a solenoid valve, a timer must be installed to delay the valve closing.

The direct connection of the device without a timer may cause pump breaks.

## Hidraulic system

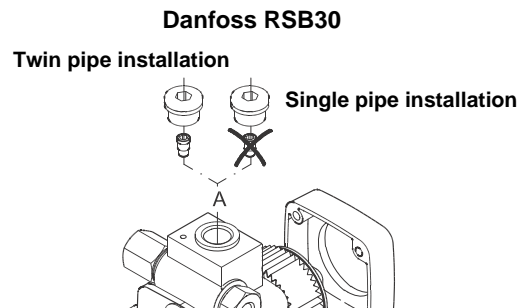
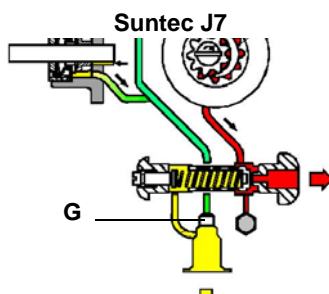
The pumps that are used can be installed both into single-pipe and double-pipe systems.

**Single-pipe system:** a single pipe drives the oil from the tank to the pump's inlet. Then, from the pump, the pressurised oil is driven to the nozzle: a part comes out from the nozzle while the other part goes back to the pump. In this system, the by-pass plug, if provided, must be removed and the optional return port, on the pump's body, must be sealed by steel plug and washer.

**Double-pipe system:** as for the single pipe system, a pipe that connects the tank to the pump's inlet is used besides another pipe that connects the pump's return port to the tank, as well. The excess of oil goes back to the tank: this installation can be considered self-bleeding. If provided, the inside by-pass plug must be installed to avoid air and fuel passing through the pump.

Burners come out from the factory provided for double-stage systems. They can be suited for single-pipe system (recommended in the case of gravity feed) as described before. To change from a 1-pipe system to a 2-pipe-system, insert the by-pass plug **G** (as for ccw-rotation- referring to the pump shaft).

**Caution:** Changing the direction of rotation, all connections on top and side are reversed.



## Bleed

Bleeding in two-pipe operation is automatic. In one-pipe operation, the plug of a pressure gauge port must be loosened until the air is evacuated from the system.

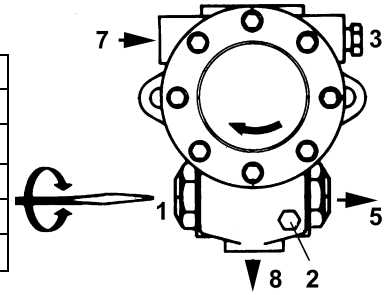
### Light oil pump

The pumps provided with these burners can be:

- Suntec J7 / Danfoss RSB30 / HP - Technick

#### Suntec J7

Oil viscosity	2.8 - 200 cSt
Oil temperature	0 - 90°C
Min. suction pressure	- 0,45 bar to avoid gasing
Max. suction pressure	1.5 bar
Max. return pressure	1.5 bar
Rotation speed	3600 rpm max.

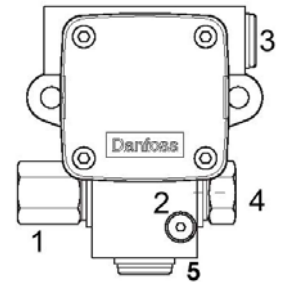


#### Key

- 1 Pressure governor
- 2 Pump pressure gauge
- 3 Vacuum pressure gauge
- 4 To the nozzle
- 5 Suction
- 6 Return

#### Danfoss RSB

Oil viscosity	2,5 ÷ 200 cSt
Oil temperature	-10 ÷ 120°C
Inlet maximum pressure	4 bar
Maximum return pressure	4 bar
Minimum inlet pressure	- 0,45 to avoid gasing
Rotation speed max.	3600 rpm



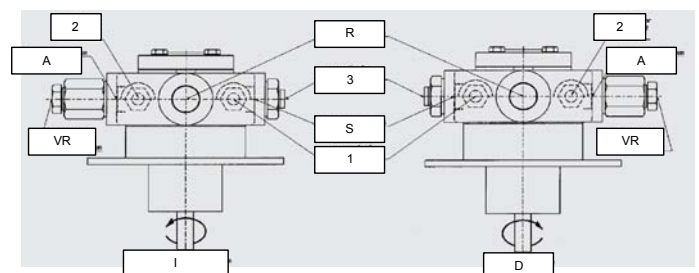
#### Key

- 1 Pressure regulator
- 2 Pump Pressure gauge
- 3 Suction
- 4 To the nozzle
- 5 Return

#### HP-Technick UHE-A..

Oil viscosity	3 ÷ 75 cSt
Oil temperature	0 ÷ 150°C
Min. suction pressure	- 0.45 bar to avoid gasing
Max. suction pressure	5 bar
Max. return pressure	5 bar
Rotation speed	3600 rpm max.

- 1. Connection for manometer 1 – delivery (M1) – G1/4
- 2. Connection for manometer 2 – suction (M2) – G1/4
- 3. Connection for manometer 3 (M3)
- A. Suction connection– G1/2
- D. Direct - clockwise
- I. Indirect – counter clockwise
- R. By-pass connection– G1/2
- S. Delivery connection – G1/2
- VR. After removal of cover screw: pressure regulation

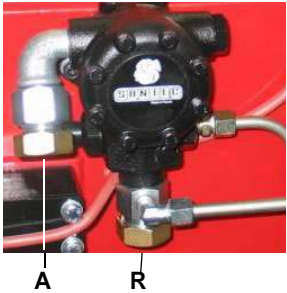
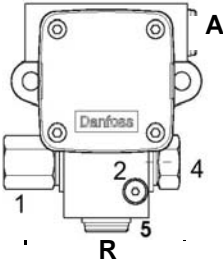



### Assembly of flexible light oil hoses

To connect the flexible light oil hoses to the pump, proceed as follows, according to the pump provided:

- 1 remove the closing nuts **A** and **R** on the inlet and return connections of the pump;

- 2 screw the rotating nut of the two flexible hoses on the pump **being careful to avoid exchanging the inlet and return lines**: see the arrows marked on the pump that show the inlet and the return (see previous paragraph).

Suntec J7	Danfoss RSB30	HP Technik UHE-A
		

### About the use of fuel pumps

- Make sure that the by-pass plug is not used in a single pipe installation, because the fuel unit will not function properly and damage to the pump and burner motor could result.
- Do not use fuel with additives to avoid the possible formation over time of compounds which may deposit between the gear teeth, thus obstructing them.
- After filling the tank, wait before starting the burner. This will give any suspended impurities time to deposit on the bottom of the tank, thus avoiding the possibility that they might be sucked into the pump.
- On initial commissioning a "dry" operation is foreseen for a considerable length of time (for example, when there is a long suction line to bleed). To avoid damages inject some lubrication oil into the vacuum inlet.
- Care must be taken when installing the pump not to force the pump shaft along its axis or laterally to avoid excessive wear on the joint, noise and overloading the gears.
- Pipes should not contain air pockets. Rapid attachment joint should therefore be avoided and threaded or mechanical seal junctions preferred. Junction threads, elbow joints and couplings should be sealed with removable seal component. The number of junctions should be kept to a minimum as they are a possible source of leakage.
- Do not use PTFE tape on the suction and return line pipes to avoid the possibility that particles enter circulation. These could deposit on the pump filter or the nozzle, reducing efficiency. Always use O-Rings or mechanical seal (copper or aluminium gaskets) junctions if possible.
- An external filter should always be installed in the suction line upstream of the fuel unit.

## ADJUSTING AIR AND LIGHT OIL FLOW RATE



**ATTENTION:** before starting the burner up, be sure that the manual cutoff valves are open and check that the pressure upstream the gas train complies the value quoted on paragraph "Technical specifications". Be sure that the mains switch is closed.

**ATTENTION:** During commissioning operations, do not let the burner operate with insufficient air flow (danger of formation of carbon monoxide); if this should happen, make the gas decrease slowly until the normal combustion values are achieved.



**IMPORTANT!** the combustion air excess must be adjusted according to the in the following chart:

Recommended combustion parameters		
Fuel	Recommended (%) CO <sub>2</sub>	Recommended (%) O <sub>2</sub>
Light oil	11.5 ÷ 13	2.9 ÷ 4.9

### Adjusting the Fuel rate

The fuel rate is adjusted by choosing the properly sized nozzles for the first and the second stage and by adjusting the pump delivery pressure (see the Suggested oil circuit on Fig.6). As far as the choice of nozzles, refer to the Tab. 1 chart; as far as the pump pressure adjustment, see page 13.

**Note:** all pumps are adjusted at 12bar pressure. The 1st stage nozzle rate must not be lower than the rate referred to the burner lowest output.

The fuel rate is setting choosing properly sized nozzles and adjusting the fuel pressure at the pump inlet (see the diagram Fig. 10). To choose the nozzles refer to tables below; for pump pressure regulation see next tables.

#### Key

EVG1	1st stge fuel solenoid valve
EVG2	2ndstge fuel solenoid valve
M	Pressure gauge
P	Pump

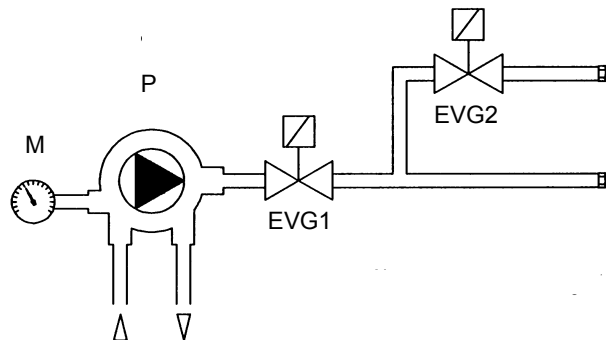


Fig. 3

## CHOOSING THE LIGHT OIL NOZZLES

Rate		Output	Nozzle size (GPH)		
kg/h	kcal/h	kW	10bar	12bar	14bar
90	918.900	1.068	14.00+9.50	13.00+8.00	12.00+8.00
95	969.950	1.128	15.00+10.00	14.00+8.00	13.00+8.00
100	1.021.000	1.187	16.00+10.00	15.00+9.00	13.00+9.00
105	1.072.050	1.247	16.00+11.00	16.00+9.00	14.00+9.00
110	1.123.100	1.306	17.00+12.00	16.00+10.00	14.00+10.00
115	1.174.150	1.365	18.00+12.00	17.00+10.00	15.00+10.00
120	1.225.200	1.425	19.00+12.00	17.00+11.00	16.00+10.00
125	1.276.250	1.484	20.00+13.00	18.00+12.00	16.00+11.00
130	1.327.300	1.543	21.00+13.00	19.00+12.00	17.00+12.00
135	1.378.350	1.603	22.00+13.00	19.00+13.00	18.00+12.00
140	1.429.400	1.662	24.00+13.00	20.00+13.00	19.00+12.00
145	1.480.450	1.721	24.00+14.00	20.00+14.00	19.00+13.00
150	1.531.500	1.781	25.00+14.00	22.00+14.00	19.00+14.00
155	1.582.550	1.840	24.00+16.00	22.00+15.00	20.00+14.00
160	1.633.600	1.900	26.00+16.00	22.00+16.00	20.00+15.00
165	1.684.650	1.959	27.00+16.00	24.00+16.00	22.00+14.00
170	1.735.700	2.018	28.00+16.00	24.00+17.00	22.00+15.00
175	1.786.750	2.078	29.00+17.00	24.00+18.00	23.00+16.00
180	1.837.800	2.137	30.00+17.00	26.00+17.00	24.00+16.00
185	1.888.850	2.196	30.00+18.00	26.00+18.00	26.00+15.00
190	1.939.900	2.256	30.00+20.00	26.00+19.00	26.00+16.00
195	1.990.950	2.315	30.00+21.00	28.00+19.00	28.00+15.00
200	2.042.000	2.374	30.00+22.00	28.00+20.00	28.00+16.00
205	2.093.050	2.434	32.00+22.00	30.00+20.00	28.00+17.00
210	2.144.100	2.493	32.00+24.00	32.00+19.00	28.00+18.00

Tab. 1

**Example:** if a 200kg/h rate is required (output at 2347kW), with the pump adjusted at 12bar, the following nozzles are to be choosed:

- 1st stage nozzle: 28.00 GPH
- 2 ndstage nozzle: 20.00 GPH

## LIGHT OIL NOZZLE RATE CHART

NOZZLE SIZE (G.P.H.)	PUMP PRESSURE (bar)										
	10	11	12	13	14	15	16	17	18	19	20
9.50	36.09	37.85	39.53	41.14	42.70	44.20	45.65	47.05	48.41	49.74	51.03
10.50	39.88	41.83	43.69	45.48	47.19	48.85	50.45	52.00	53.51	54.98	56.41
12.00	45.58	47.81	49.93	51.97	53.93	55.83	57.66	59.43	61.16	62.83	64.46
13.80	52.42	54.98	57.42	59.77	62.02	64.20	66.31	68.35	70.33	72.26	74.13
15.30	58.12	60.95	63.66	66.26	68.77	71.18	73.51	75.78	77.97	80.11	82.19
16.00	60.78	63.74	66.58	69.30	71.91	74.44	76.88	79.24	81.54	83.77	85.95
17.00	64.57	67.73	70.74	73.63	76.41	79.09	81.68	84.20	86.64	89.01	91.32
18.00	68.37	71.71	74.90	77.96	80.90	83.74	86.49	89.15	91.73	94.25	96.69
19.00	72.17	75.69	79.06	82.29	85.40	88.39	91.29	94.10	96.83	99.48	102.07
20.00	75.97	79.68	83.22	86.62	89.89	93.04	96.10	99.05	101.93	104.72	107.44
22.00	83.57	87.65	91.54	95.28	98.88	102.35	105.71	108.96	112.12	115.19	118.18
24.00	91.16	95.61	99.87	103.94	107.87	111.65	115.32	118.86	122.31	125.66	128.93
26.00	98.76	103.58	108.19	112.61	116.86	120.96	124.92	128.77	132.50	136.13	139.67
28.00	106.36	111.55	116.51	121.27	125.85	130.26	134.53	138.67	142.70	146.61	150.41
30.00	113.96	119.52	124.83	129.93	134.83	139.57	144.14	148.58	152.89	157.08	161.16
32.00	121.55	127.49	133.15	138.59	143.82	148.87	153.75	158.49	163.08	167.55	171.90

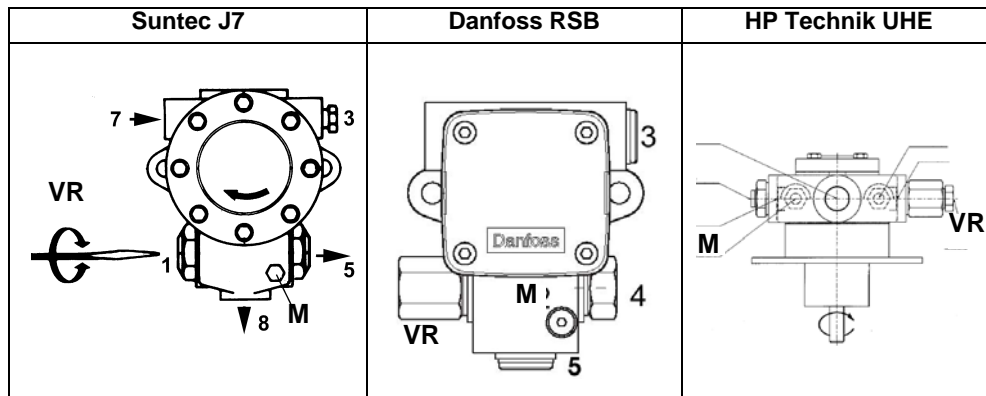
Tab. 2



Prior to start up the burner, make sure that the return pipe to the tank is not obstructed. Any obstruction would cause the pump seal to break.

**Oil Flow Rate Settings by means of Berger STM30..actuator**

- 1 prime the oil pump, by means of a screwdriver on its solenoid starter: check the motor rotation and keep pressed for some seconds until the oil circuit is charged
- 2 bleed the air from the **M** pressure gauge port of the pump (see picture below), loosening the cap without removing it; then release the solenoid starter;



- 1 Remove the actuator cover.
- 2 Turn the burner on by means of its main switch **A** (Fig. 6): if the burner locks (LED **B** on in the control panel) press the RESET button (**C**) on the control panel (Fig. 6);
- 3 start the burner up by means of the thermostat series and wait until the pre-purge time comes to an end;
- 4 Keep the burner to the low flame stage by disconnecting the **TAB** thermostat (remove the bridge between terminals 6 and 7).n
- 5 Proceed as follows acting on the ST1 actuator cam to adjust the air flow rate in the low flame stage, checking the combustion values:

Berger STA12 B 3.41	Siemens SQN72
ST2 = High flame cam ST1 = Low flame and ignition position MV = Auxiliary cam for the second valve enabling	I = High flame cam (red) II = Ignition and low flame position (blue) IV = Auxiliary cam for the second valve enabling (black)



**ATTENTION! Berger actuator: cams can be moved manually. Siemens actuator: set the MAN/AUTO lever to MAN to move the cams, remember to set it to AUTO once the adjustment is accomplished.**

- 6 by removing the bridge between the 6 and 7 terminals of the **TAB** thermostat, the actuator moves to the position (degrees) set for the ST1 cam (low flame cam);
- 7 to decrease the low flame position (and then decrease the opening angle of the actuator), move the cam to a lower position: the actuator will close to the new position of ST1;
- 8 to increase the low flame position, move the cam higher to the required position, make the bridge between the 6 and 7 terminals only for a while and then remove it immediately: the actuator will move for just few degrees towards the high flame, then it will move down to the new ST1 low flame position;
- 9 now, charge the oil circuit of the second nozzle by pressing the P1 button (see next picture);





- 10 the 3rd cam drives the opening of the 2nd stage solenoid valve (EVG2) and must be set between the other two cams, however near to ST1;
- 11 The cycle goes on and if the thermostat **TAB** is connected, the control box drives the burner to high flame. If there is not the TAB thermostat, place a bridge between terminals 6 and 7 on the MA terminal block (see picture above).
- 12 By means of ST2 cam, adjust the air flow rate in high flame stage;
- 13 to increase the high flame position (and consequently to increase the degrees), move the cam to a higher position: the actuator will close to the new ST2 position;
- 14 to decrease the high flame position, move the cam to a lower position, remove the bridge between 6 and 7 terminals only for a while, then replace it: the actuator will shift just few degrees towards the low flame position and then will move to the new high flame position.
- 15 Once the adjustment is performed, check again that the combustion parameters are in the set limits.
- 16 Replace the actuator cover.

### Adjusting the combustion head

The combustion head is factory-set at its "MAX." position, referred to the highest output. As far as the operation at lower output, move the combustion head progressively back towards the "MIN." position, by CW turning the VRT screw..

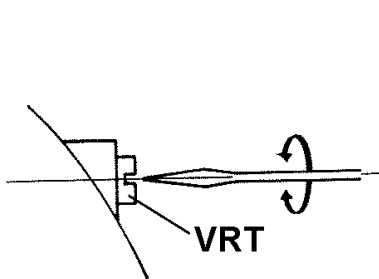


Fig. 4

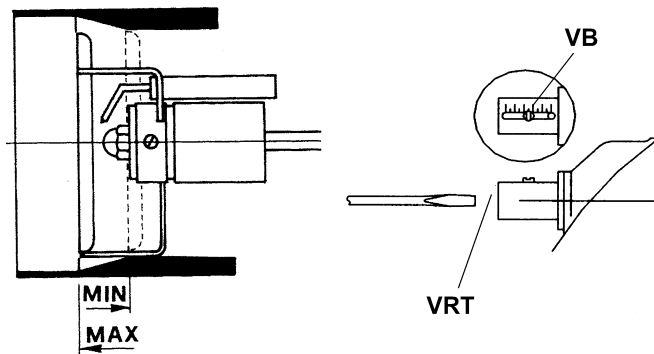


Fig. 5

**Note:** loosen VB screw to free the VRT screw; adjust the head and then remember to fasten VB again.

**Attention!** if it is necessary to change the head position, repeat the air and gas adjustments described above.



### Technical procedure of self cleaning filters substitution (valid for all models)

- 1 Close the bowl valve before the self cleaning filter
- 2 Switch off any electrical equipment on board on the filter (example motorization or heaters)



**WARNING! Drain the system by unscrewing the drain screw on the bottom of the self cleaning filter**

- 3 Disconnect the outlet pipe from the cover of the self cleaning filter
- 4 Remove the cover with all the filter pack, leaving only the bowl on the line
- 5 Clean any residue on the bottom of the bowl and clean the seat of the O-ring seal



**WARNING! Replace the O-ring seal between the bowl and cover**

- 6 Insert the filter pack again making sure to respect the correct inlet/outlet direction or any references on the cover and tray
- 7 Replace the filter by following the reverse order operations
- 8 Make sure there is no leakage and give the power to any electrical equipment on the filter

### Removing the combustion head and the oil gun



## PART II: OPERATION

### LIMITATIONS OF USE

THE BURNER IS AN APPLIANCE DESIGNED AND CONSTRUCTED TO OPERATE ONLY AFTER BEING CORRECTLY CONNECTED TO A HEAT GENERATOR (E.G. BOILER, HOT AIR GENERATOR, FURNACE, ETC.), ANY OTHER USE IS TO BE CONSIDERED IMPROPER AND THEREFORE DANGEROUS.

THE USER MUST GUARANTEE THE CORRECT FITTING OF THE APPLIANCE, ENTRUSTING THE INSTALLATION OF IT TO QUALIFIED PERSONNEL AND HAVING THE FIRST COMMISSIONING OF IT CARRIED OUT BY A SERVICE CENTRE AUTHORIZED BY THE COMPANY MANUFACTURING THE BURNER.

A FUNDAMENTAL FACTOR IN THIS RESPECT IS THE ELECTRICAL CONNECTION TO THE GENERATOR'S CONTROL AND SAFETY UNITS (CONTROL THERMOSTAT, SAFETY, ETC.) WHICH GUARANTEES CORRECT AND SAFE FUNCTIONING OF THE BURNER.

THEREFORE, ANY OPERATION OF THE APPLIANCE MUST BE PREVENTED WHICH DEPARTS FROM THE INSTALLATION OPERATIONS OR WHICH HAPPENS AFTER TOTAL OR PARTIAL TAMPERING WITH THESE (E.G. DISCONNECTION, EVEN PARTIAL, OF THE ELECTRICAL LEADS, OPENING THE GENERATOR DOOR, DISMANTLING OF PART OF THE BURNER).

NEVER OPEN OR DISMANTLE ANY COMPONENT OF THE MACHINE.

OPERATE ONLY THE MAIN SWITCH, WHICH THROUGH ITS EASY ACCESSIBILITY AND RAPIDITY OF OPERATION ALSO FUNCTIONS AS AN EMERGENCY SWITCH, AND ON THE RESET BUTTON.

IN CASE OF A BURNER SHUT-DOWN, RESET THE CONTROL BOX BY MEANS OF THE RESET PUSHBUTTON. IF A SECOND SHUT-DOWN TAKES PLACE, CALL THE TECHNICAL SERVICE, WITHOUT TRYING TO RESET FURTHER.

**WARNING:** DURING NORMAL OPERATION THE PARTS OF THE BURNER NEAREST TO THE GENERATOR (COUPLING FLANGE) CAN BECOME VERY HOT, AVOID TOUCHING THEM SO AS NOT TO GET BURNT.

### OPERATION



**ATTENTION:** before starting the burner up, be sure that the manual cutoff valves are open. Be sure that the mains switch is closed.

- Set to the ON position the switch A on the control panel of the burner.
- Check the thermostats (or pressure switches) let the burner starts up.
- The burner start up cycle begins: the control box enables the burner fan and the ignition transformer as well (LED H on); the pre-purge phase lasts some seconds according to the control box model.
- At the end of pre-purge time, the first stage solenoid valve EVG1 is energised, (LED D on) and the flame lights.
- The ignition transformer remains on for some seconds after the flame is lit (post-ignition time): after the post-ignition time it is cut out and the light H turns off.
- The burner is on at the low flame stage (LED G on); after some sec. (according to the control box model), it drives to the double-stage mode and turns automatically to high flame or remains in low flame, according to the system demands. High or low flame operation is showed by LED F (high flame) and LED G (low flame). LED E is on when the solenoid valve of the high flame is open, supplying the second stage nozzle (high flame).

## Control panel

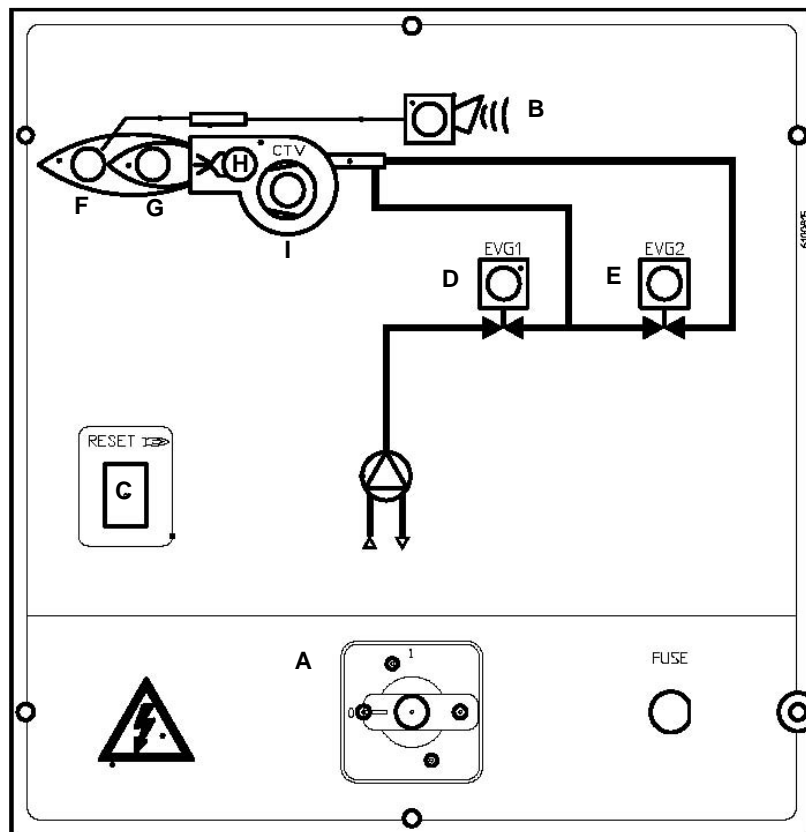


Fig. 6

### Key

- A Main switch
- B Burner lockout light
- C Reset button for control box
- D Signalling light of the opening of 1st stage solenoid valve
- E Signalling light of the opening of 2nd stage solenoid valve
- F High flame operation signalling light
- G Low flame operation signalling light
- H Ignition transformer in operation signalling light
- I Thermal cutout relay signalling light

## Calibration air and gas pressure switches

The **air pressure switch** locks the control box if the air pressure is not the one requested. If it happens, unlock the burner by means of the control box unlock pushbutton, placed on the burner control panel.

The **gas pressure switches** check the pressure to avoid the burner operate when the pressure value is not in the requested pressure range.



## Calibration of low gas pressure switch

As for the gas pressure switch calibration, proceed as follows:

- Be sure that the filter is clean.
- Remove the transparent plastic cap.
- While the burner is operating at the maximum output, test the gas pressure on the pressure port of the minimum gas pressure switch.
- Slowly close the manual cutoff valve (placed upstream the pressure switch, see gas train installation diagram), until the detected pressure is reduced by 50%. Pay attention that the CO value in the flue gas does not increase: if the CO values are higher than the limits laid down by law, slowly open the cutoff valve as to get values lower than these limits.
- Check that the burner is operating correctly.
- Clockwise turn the pressure switch adjusting ring nut (as to increase the pressure value) until the burner stops.
- Slowly fully open the manual cutoff valve.
- Refit the transparent plastic cover on the pressure switch.

### **Calibration the maximum gas pressure switch (when provided)**

To calibrate the maximum pressure switch, proceed as follows according to its mounting position:

- remove the pressure switch plastic cover;
- if the maximum pressure switch is mounted upstream the gas valves: measure the gas pressure in the network, when flame is off; by means of the adjusting ring nut **VR**, set the value read, increased by the 30%.
- if the maximum pressure switch is mounted downstream the “gas governor-gas valves” group and upstream the butterfly valve: light the burner, adjust it according to the procedure in the previous paragraph. Then, measure the gas pressure at the operating flow rate, downstream the “gas governor-gas valves” group and upstream the butterfly valve; by means of the adjusting ring nut **VR**, set the value read on step 2, increased by the 30%;
- replace the plastic cover.

### **Calibration of air pressure switch**

To calibrate the air pressure switch, proceed as follows:

- Remove the transparent plastic cap.
- Once air and fuel setting have been accomplished, startup the burner.
- During the pre-purge phase of the operation, turn slowly the adjusting ring nut **VR** in the clockwise direction (to increase the adjusting pressure) until the burner lockout, then read the value on the pressure switch scale and set it to a value reduced by 15%.
- Repeat the ignition cycle of the burner and check it runs properly.
- Refit the transparent plastic cover on the pressure switch.

### **Calibration gas leakage pressure switch (PGCP)**

- remove the pressure switch plastic cover;
- adjust the PGCP pressure switch to the same value set for the minimum gas pressure switch;
- replace the plastic cover.

## **PART III: MAINTENANCE**

At least once a year carry out the maintenance operations listed below. In the case of seasonal servicing, it is recommended to carry out the maintenance at the end of each heating season; in the case of continuous operation the maintenance is carried out every 6 months.



**WARNING: ALL OPERATIONS ON THE BURNER MUST BE CARRIED OUT WITH THE MAINS DISCONNECTED AND THE FUEL MANUAL CUTOFF VALVES CLOSED!**

**ATTENTION: READ CAREFULLY THE “WARNINGS” CHAPTER AT THE BEGINNING OF THIS MANUAL.**

### **ROUTINE MAINTENANCE**

- Check and clean the cartridge of the fuel filter, replace it if necessary (see next paragraph);
- carefully check for leaks, the fuel flexible hoses;
- check and clean the filter on the fuel pump: filter must be thoroughly cleaned at least once in a season to ensure correct working of the fuel unit. To remove the filter, unscrew the four screws on the cover. When reassemble, make sure that the filter is mounted with the feet toward the pump body. If the gasket between cover and pump housing should be damaged, it must be replaced;
- remove, check and clean the combustion head (page 25); when reassembling, carefully observe the measures on page 55;
- check the ignition electrodes and their ceramic insulators, clean, adjust and replace if necessary Fig. 30;
- remove and clean the oil nozzles (IMPORTANT: do not clean the nozzles using metallic or sharp utensils, use only solvents or steam); at the end of maintenance operations, refit the burner, turn it on and check the combustion. If in doubt, replace the defective nozzle/s. In case of intensive use of the burner, the nozzles must be replaced at the end of the working season;
- check and carefully clean the flame detection photoresistor, if necessary replace it and, if in doubt, check the detection current following the scheme in Fig. 31;
- clean and grease levers and rotating parts.

### **Light oil filter maintenance**

For correct and proper servicing, proceed as follows:

- 1 shut off fuel in the line section being serviced;
- 2 unscrew the tray;
- 3
- 4 reassemble the tray and restore fuel flow.



remove the filter cartridge from its support and wash it with petrol or replace if necessary; check seal O-Ring, replace if necessary;

### Removing the combustion head

- 1 Remove the top cover **h**;
- 2 remove the photoresistor from its seat;
- 3 disconnect the electrodes and the oil flexible hoses;
- 4 unscrew the revolving connectors (**E** in figure) on the fuel pipes (use 2 spanners to avoid loosening the connections attached to the distributor block);
- 5 loosen **VRT** screw to free the threaded rod **AR**, then screw out the 2 screws **V** holding the washer **R** and the screw **VRT** again;
- 6 remove the whole assembly as shown in figure;
- 7 clean the combustion head by means of a vacuum cleaner; to scrape off the scale use a metallic brush.

**Note:** to replace the combustion head reverse the procedure described above.

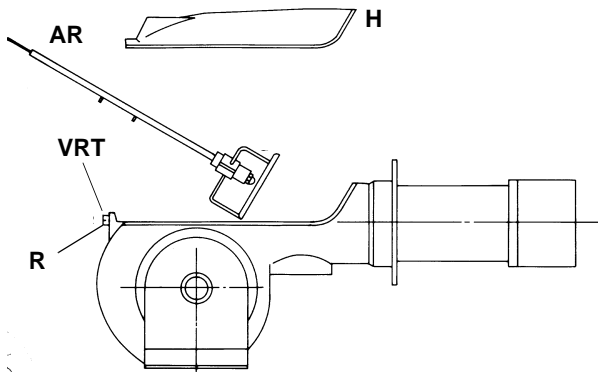


Fig. 8

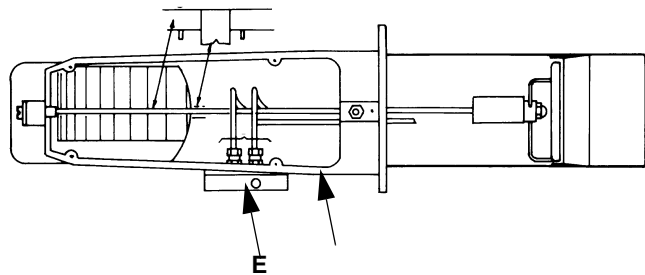


Fig. 9

### Correct position of electrodes and combustion head

To guarantee satisfactory ignition observe the measures (in mm) showed on Fig. 20.

Be sure to tighten the screw on the electrode group before reassembling the combustion head.

- A 9 ÷ 11
- B 3.5 ÷ 4.5
- C 8
- D 3

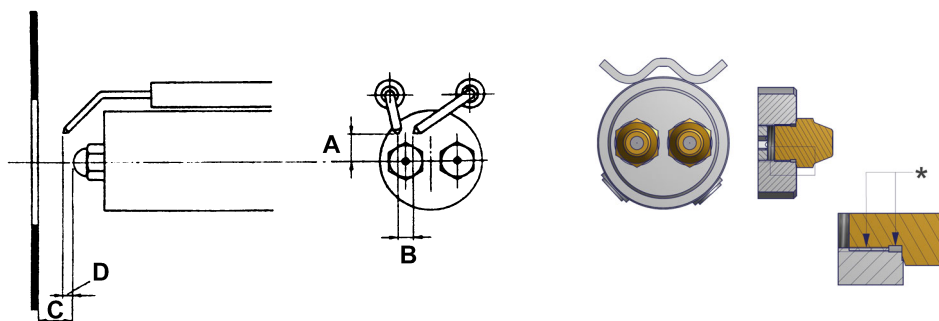


Fig. 10

### Cleaning and replacing the detection photoresistor

To clean/replace the detection photoresistor, proceed as follows:

- 1 Disconnect the system from the electrical power supply.
- 2 Shut off the fuel supply
- 3 remove the photoresistor from its slot;
- 4 clean if dirty;
- 5 if necessary, replace it;
- 6 replace the photoresistor into its slot.

## Checking the detection current

To measure the detection signal follow the diagram on the next picture.

If the signal is not in the advised range, check the electrical contacts, the cleaning of the combustion head, the position of the photoreistor and if necessary replace it.

Control box	Flame sensor	Minimum detection signal
LMO44	QRB4	45 $\mu$ A
LAL2..	QRB1	95 $\mu$ A

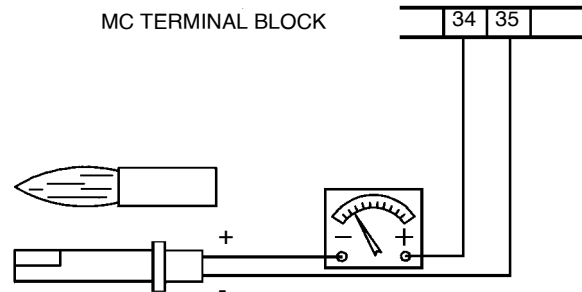


Fig. 13

Fig. 14

## Seasonal stop

To stop the burner in the seasonal stop, proceed as follows:

- 1 turn the burner main switch to 0 (Off position)
- 2 disconnect the power mains
- 3 close the fuel valve of the supply line

## Burner disposal

In case of disposal, follow the instructions according to the laws in force in your country about the "Disposal of materials".

## TROUBLESHOOTING

CAUSE / TROUBLE	THE BURNER DOESN'T START	THE BURNER REPEATS PRE- PURGE	NOISY FUEL PUMP	THE BURNER DOESN'T START AND STOPS	THE BURNER STARTS AND STOPS	THE BURNER DOESN'T SWITCH TO HIGH FLAME	THE BURNER STOPS DURING OPERATION	THE BURNER STOPS AND REPE- ATS THE CYCLE DURING OPERA- TION
MAIN SWITCH OPEN	1							
LINE FUSE INTERVENTION	1							
MAX. PRESSURE SWITCH FAULT	1							1
FAN THERMAL CUTOUT INTERVENTION	1							
AUXILIARY RELAIS FUSES INTERVEN- TION	1							
FLAME CONTROL DEVICE FAULT	1	1		1	1		1	
SERVOCONTROL FAULT						1		
SMOKEY FLAME					1		1	
IGNITION TRANSFORMER FAULT				1				
IGNITION ELECTRODE DIRTY OR BADLY POSITIONED				1				
DIRTY NOZZLE				1				
FUEL SOLENOID VALVE DEFECTIVE				1			1	
PHOTORESISTOR DIRTY OR DEFEC- TIVE					1		1	
HI-LO FLAME THERMOSTAT DEFEC- TIVE						1		
WRONG POSITION OF SERVOCON- TROL CAMS						1		
FUEL PRESSURE TOO LOW				1				
DIRTY FUEL FILTERS			1	1			1	

## APPENDIX

### SIEMENS OIL BURNERS AUTOMATIC CONTROLLER SIEMENS LMO14 - LMO24 - LMO44

The LMO... burner controls are designed for the start-up and supervision of single- or 2-stage forced draught oil burners in intermittent operation. Yellow-burning flames are supervised with photoresistive detectors QRB..., blue-burning flames with blue-flame detectors QRC...

In terms of housing dimensions, electrical connections and flame detectors, the LMO... are identical to the LOA... oil burner controls.

#### Preconditions for startup

- Burner control is reset
- All contacts in the line are closed
- No undervoltage
- Flame detector is darkened, no extraneous light

#### Undervoltage

- Safety shut-down in the operating position takes place should the mains voltage drop below about AC 165 V
- Restart is initiated when the mains voltage exceeds about AC 175 V

#### Time supervision oil pre-heater

If the oil pre-heater's release contact does not close within 10 minutes, the burner control will initiate lock-out.

#### Controlled intermittent operation

After no more than 24 hours of continuous operation, the burner control will initiate an automatic safety shut-down followed by a restart.

#### Control sequence in the event of fault

If lock-out occurs, the outputs for the fuel valves and the ignition will immediately be deactivated (< 1 second).

Cause	Response
After a mains failure	Restart
After voltage has fallen below the undervoltage threshold	Restart
In the event of a premature, faulty flame signal during «t1»	Lock-out at the end of «t1»
In the event of a premature, faulty flame signal during «tw»	Prevention of start-up, lock-out after no more than 40 seconds
If the burner does not ignite during «TSA»	Lock-out at the end of TSA
In the event the flame is lost during operation	Max. 3 repetitions, followed by lock-out
Oil pre-heater's release contact does not close within 10 min.	Lock-out

#### Lock-out

In the event of lock-out, the LMO... remains locked (lock-out cannot be changed), and the red signal lamp will light up. This status is also maintained in the case of a mains failure.

#### Resetting the burner

Whenever lock-out occurs, the burner control can immediately be reset. To do this, keep control the lock-out reset button depressed for about 1 second (< 3 seconds).

#### Ignition program with LMO24.113A2

If the flame is lost during «TSA», the burner will be reignited, but not later than at the end of «TSAmx.». This means that several ignition attempts can be made during TSA (refer to «Program sequence»).

#### Limitation of repetitions

If the flame is lost during operation, a maximum of 3 repetitions can be made. If the flame is lost for the 4th time during operation, the burner will initiate lock-out. The repetition count is restarted each time controlled switching on by «R-W-SB» takes place.

#### Operation

Lock-out reset button «EK...» is the key operating element for resetting the burner control and for activating / deactivating the diagnostic functions.



The multicolour «LED» is the key indicating element for both visual diagnosis and interface diagnosis.

s Red  
l Yellow  
o Green

Colour code table		
Status	Colour code	Colour
Oil pre-heater heats, waiting time «tw»	llllllllll	Yellow
Ignition phase, ignition controlled	lmlmlmlml	Yellow-off
Operation, flame o.k.	oooooooooooo	Green
Operation, flame not o.k.	omomomomomo	Green-off
Undervoltage	lslslslslsl	Yellow-red
Fault, alarm	ssssssssss	Red
Output of fault code (refer to Fault code table)	smsmsmsmsm	Red-off
Extraneous light prior to burner start-up	osososososo	Green-red
Interface diagnosis	ssssssssssssss	Red flicker light

#### Key

m Off  
l Yellow  
o Green  
s Red

#### Diagnosis of cause of fault

After lock-out, the red fault signal lamp remains steady on.

In that condition, the visual diagnosis of the cause of fault according to the error code table can be activated by pressing the lock-out reset button for more than 3 seconds.

Error code table	
Blink code	Possible cause
2 blinks **	No establishment of flame at the end of TSA <ul style="list-style-type: none"> <li>● Faulty or soiled fuel valves</li> <li>● Faulty or soiled flame detector</li> <li>● Poor adjustment of burner, no fuel</li> <li>● Faulty ignition</li> </ul>
3 blinks ***	Free
4 blinks ****	Extraneous light on burner startup
5 blinks *****	Free
6 blinks ****	Free
7 blinks *****	Too many losses of flame during operation (limitation of the number of repetitions) <ul style="list-style-type: none"> <li>● Faulty or soiled fuel valves</li> <li>● Faulty or soiled flame detector</li> <li>● Poor adjustment of burner</li> </ul>
8 blinks *****	Time supervision oil pre-heater
9 blinks *****	Free
10 blinks *****	Wiring error or internal error, output contacts

During the time the cause of fault is diagnosed, the control outputs are deactivated.

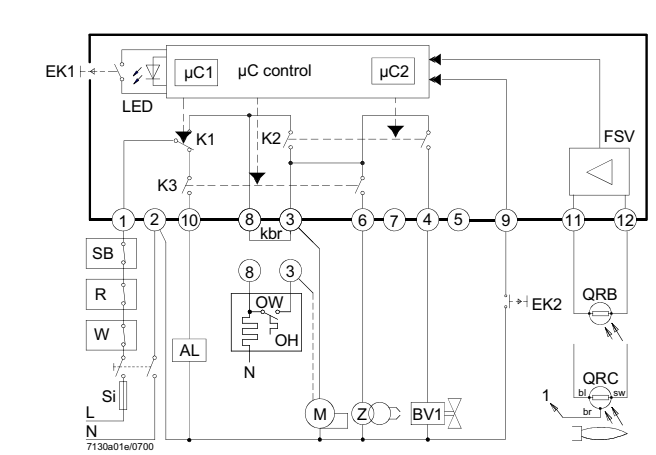
- Burner remains shut down
- Fault status signal «AL» at terminal 10 is activated

The diagnosis of the cause of fault is quit and the burner switched on again by resetting the burner control.

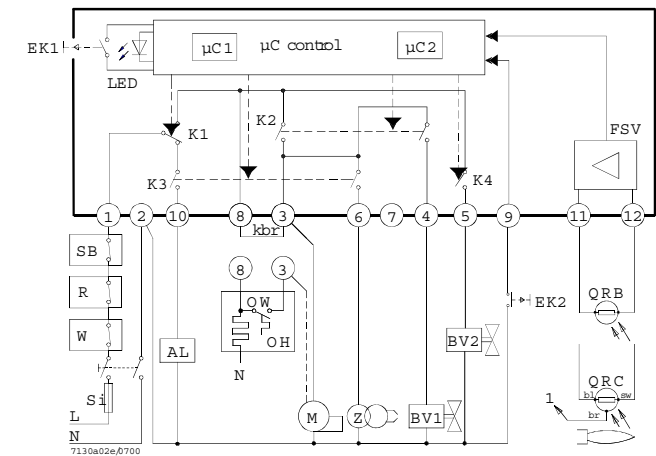
Press lock-out reset button for about 1 second (< 3 seconds).

#### Connection diagram and internal diagram

LMO14

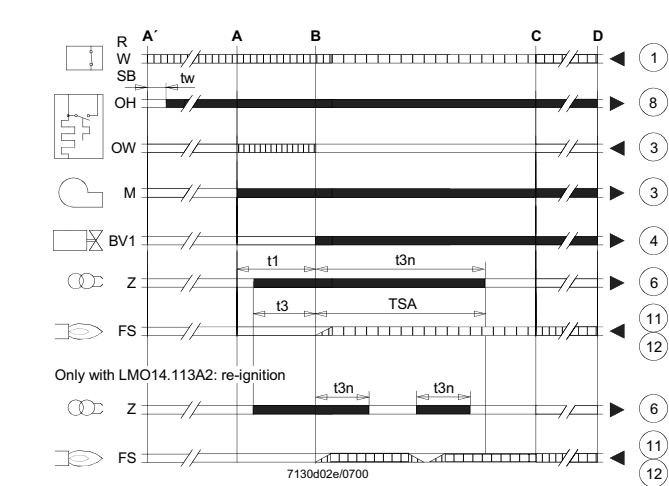


LMO24 - LMO44

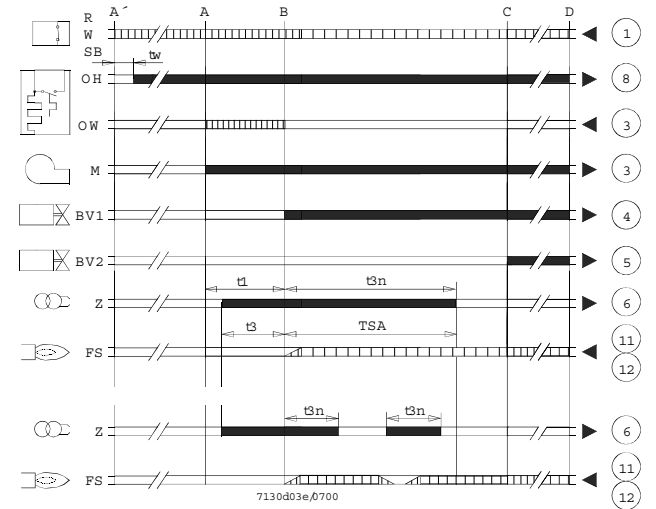


Control sequence

LMO14



LMO24 - LMO44



Key

- AL Alarm device
- kbr... Cable link (required only when no oil pre-heater is used)
- BV... Fuel valve
- EK1 Lock-out reset button
- EK2 Remote lock-out reset button
- FS Flame signal
- FSV Flame signal amplifier
- K... Contacts of control relay
- LED 3-colour signal lamps
- M Burner motor
- OW Release contact of oil pre-heater
- t1 Pre-purge time
- t3 Pre-ignition time
- t3n Post-ignition time
- A' Beginning of start-up sequence with burners using an oil pre-heater
- A Beginning of start-up sequence with burners using no oil pre-heater
- Controller output signals
- Required input signals
- OH Oil pre-heater
- QRB Photoresistive detector
- QRC Blue-flame detector
- bl = blue
- br = brown
- sw = black
- R Control thermostat or pressurestat
- SB Safety limit thermostat
- Si External primary fuse
- W Limit thermostat or pressure switch
- Z Ignition transformer
- t4 Interval from flame signal to release «BV2»
- TSA Ignition safety time
- tw Waiting time for oil pre-heating
- B Time of flame establishment
- C Operating position
- D Controlled shut-down by «R»
- μC1 Microcontroller 1
- μC2 Microcontroller 2



## General unit data

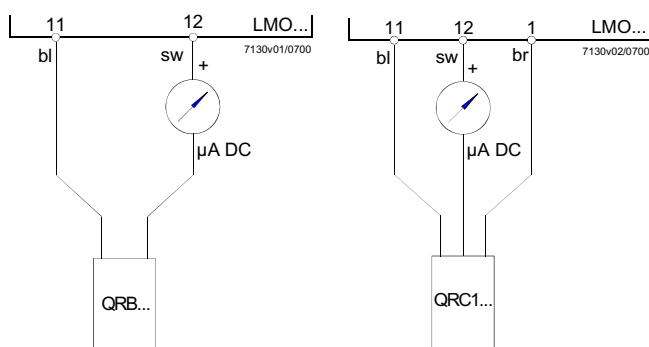
Mains voltage	AC 230 V +10 % / -15 %
	AC 120 V +10 % / -15 %
Mains frequency	50...60 Hz $\pm$ 6 %
External primary fuse (Si)	6.3A (slow)
Power consumption	12 VA
Mounting orientation	optional
Weight	approx. 200 g
Degree of protection	IP40 (to be ensured through mounting)
Perm. cable lengths	max. 3m at line capacitance of 100 pF/m
Detector cable laid separately	10 m
Remote reset laid separately	20m

	LMO14	LMO24	LMO44
Terminal 1	5 A	5 A	5 A
Terminals 3 and 8	3 A	5 A	5 A
Terminals 4, 5 and 10	1 A	1 A	1 A
Terminals 6	1 A	1 A	2A

## Flame supervision with QRB and QRC

	QRB	QRC
Min. detector current required (with flame)	45 $\mu$ A	70 $\mu$ A
Min detector current permitted (without flame)	5.5 $\mu$ A	5.5 $\mu$ A
Max. possible with flame (typically)	100 $\mu$ A	100 $\mu$ A

## Measurement circuit for detector current



## Key

$\mu$ A DC	DC microamperometer with an internal resistance of 5 k $\Omega$ max.
bl	Blue
sw	Black
br	Brown

## SIEMENS LAL... CONTROL BOX

### Use

- Control and supervision of oil atomization burners
- For burners of medium to high capacity
- For intermittent operation (at least one controlled shutdown every 24 hours)
- Universally applicable for multistage or modulating burners

### Housing and plug-in base

- Made of impact-proof and heat-resistance black plastic
- Lockout reset button with viewing window; located behind it:
- Lockout warning lamp
- Lockout indicator coupled to the spindle of the sequence switch and visible in the transparent lockout reset button
- uses easy-to-remember symbols to indicate the type of fault and the point in time lockout occurred

Base and plug-in section of the LAL... are designed such that only burner controls of the LAL... family can be plugged in.

- 24 connection terminals
- Auxiliary terminals «31» and «32»
- 3 earth terminals terminating in a lug for earthing the burner
- 3 neutral conductor terminals prewired to terminal 2
- 14 knockout holes for cable entry by means of cable glands
- 8 at the side
- 6 in the bottom of the base

- 6 lateral threaded knockout holes for cable entry glands Pg11 or M20

## Operation

Flame detector and flame simulation test are made automatically during burner off times and the prepurge time «t1». If loss of flame occurs during operation, the burner control will initiate lockout. If automatic repetition of the startup sequence is required, the clearly marked wire link on the plug-in section of the LAL... must be cut away.

## Pre-conditions for burner startup

- Burner control is not in the lockout position
- Sequence switch is in its start position (with LAL2 voltage is present at terminals 11 and 12.
- Air damper is closed; end switch «Z» for the CLOSED position must feed power from terminal 11 to terminal8.
- Contact of the limit thermostat or pressure switch «W» and the contacts of any other switching devices in the control loop between terminals 4 and 5 must be closed e.g. a control contact for the oil preheater's temperature
- Normally closed contact of the air pressure switch must be closed.

## Startup sequence

Start command by «R»:

«R» closes the start control loop between terminals 4 and 5

- The sequence switch starts to run
- Only prepurging, fan motor at terminal 6 receives power
- Pre- and postpurging, fan motor or flue gas fan at terminal 7 receives power on completion of «t7»
- On completion of «t16», the control command for opening the air damper is delivered via terminal 9
- Terminal 8 receives no power during the positioning time
- The sequence switch continues to run only after the air damper has fully closed.

t1 Prepurge time with air damper fully open:

- The correct functioning of the flame supervision circuit is checked during «t1»
- The burner control will initiate lockout if correct functioning is not ensured.

With LAL2:

Shortly after the beginning of «t1», the air pressure switch must change over from terminal 13 to terminal 14 otherwise, the burner control will initiate lockout start of the air pressure check.

t3 Short preignition time:

«Z» must be connected to terminal 16, release of fuel via terminal 18.

t3' Long preignition time: «Z» connected to terminal 15.

t3n Postignition time:

- «Z» must be connected to terminal 15

- With short preignition, «Z» remains on until «TSA» has elapsed connection to terminal 16.

t4 Interval «BV1 – BV2» or «BV1 - LR»: On completion of «t4», voltage is present at terminal 19. The voltage is required to power «BV2» connected to auxiliary switch «v» in the actuator.

t5 Interval: On completion of «t5», terminal 20 receives power. At the same time, control outputs 9 to 11 and input 8 are galvanically separated from the LAL...s control section.

LAL... is now protected against reverse voltages from the load control circuit. With the release of «LR» at terminal 20, the startup sequence of the LAL... ends. After a few idle steps (steps with no contact position changes), the sequence switch switches itself off.

B Operating position of the burner

B-C Burner operation: during burner operation, «LR» drives the air damper to the nominal load or low-fire position, depending on heat demand; the release of the nominal load takes place via auxiliary switch «v» in the actuator and in the event of loss of flame during operation, the LAL... will initiate lockout. For automatic start repetition, the clearly marked wire link «B» on the plugin section of the LAL... must be cut away.

C Controlled shutdown: in the case of controlled shutdown, «BV...» will immediately be closed. At the same time, the sequence switch is started to program «t6»

C-D Sequence switch travels to start position «A»

t6 Postpurge time: fan «M2» connected to terminal 7. Shortly after the start of «t6», terminal 10 receives power and the air damper is driven to the MIN position. Full closing of the air damper starts only shortly before «t6» has elapsed initiated by the control signal at terminal 11. During the following burner off time, terminal 11 is live.

t13 Permissible afterburn time: during «t13», the flame signal input may still receive a flame signal.

D-A End of control program: start position

As soon as the sequence switch has reached the start position – having thereby switched itself off – the flame detector and flame simulation test will start again.

During burner off times, the flame supervision circuit is live.

### Lockout and indication of the stop position

Whenever a fault occurs, the sequence switch stops and with it the lockout indicator. The symbol appearing above the reading mark indicates the type of fault:

◀ No start. One of the contacts is not closed (also refer to «Preconditions for burner startup»):

Extraneous light:

Lockout during or after completion of the control program

Examples: nonextinguished flame, leaking fuel valves faulty flame supervision circuit.

▲ Interruption of startup. No OPEN signal at terminal 8 from the changeover end switch «a». Terminals 6, 7 and 15 are live until fault has been corrected

P Lockout. No air pressure indication at the beginning of the air pressure check. Air pressure failure after the air pressure check.

■ Defect in the flame supervision circuit.

▼ Interruption of the startup sequence. No positioning signal at terminal 8 from the auxiliary switch «m» for the low-fire position. Terminals 6, 7 and 15 are live until fault has been corrected.

1 Lockout. No flame signal at the end of the safety time.

| Flame signal has been lost during operation.

A Consenso all'avviamento (ad esempio tramite il termostato o il pressostato R dell'impianto)

B Operating position of the burner

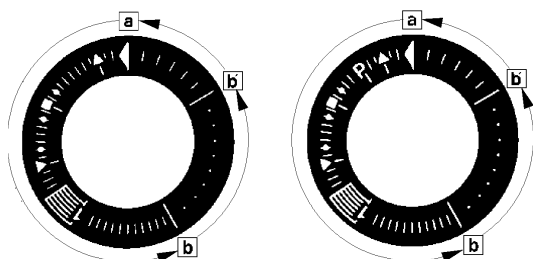
B-C Burner operation: during burner operation, «LR» drives the air damper to the nominal load or low-fire position, depending on heat demand; the release of the nominal load takes place via auxiliary switch «v» in the actuator and in the event of loss of flame during operation, the LAL... will initiate lockout. For automatic start repetition, the clearly marked wire link «B» on the plugin section of the LAL... must be cut away.

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C-D Sequence switch travels to start position «A».

During burner off times, the flame supervision circuit is live.

### Lockout indication



a-b Startup sequence

b-b' Idle step (with no contact confirmation)

b(b')-a Postpurge program

Burner control can immediately be reset after lockout:

Do not press the lockout reset button for more than 10 seconds

The sequence switch always travels to the start position first

After resetting

After rectification of a fault that led to shutdown

After each power failure

During this period of time, power is only fed to terminals 7 and 9...11.

Then, the LAL... will program a new burner startup sequence

### Specifications

Power supply AC 230 V -15 / +10 %

for LAL2... on request AC 100 V -15 %...AC 110 V +10 %

Frequency 50 Hz -6 %...60 Hz +6 %

Absorption AC 3.5 VA

Mounting position

Protection

Perm. input current at terminal 1

optional

IP 40

AC 5 A max., 20 A peak

Perm. current rating of control terminals 3, 6, 7, 9...11, 15...20

4 A max., 20 A peak

Internal fuse T6,3H250V according to IEC 127

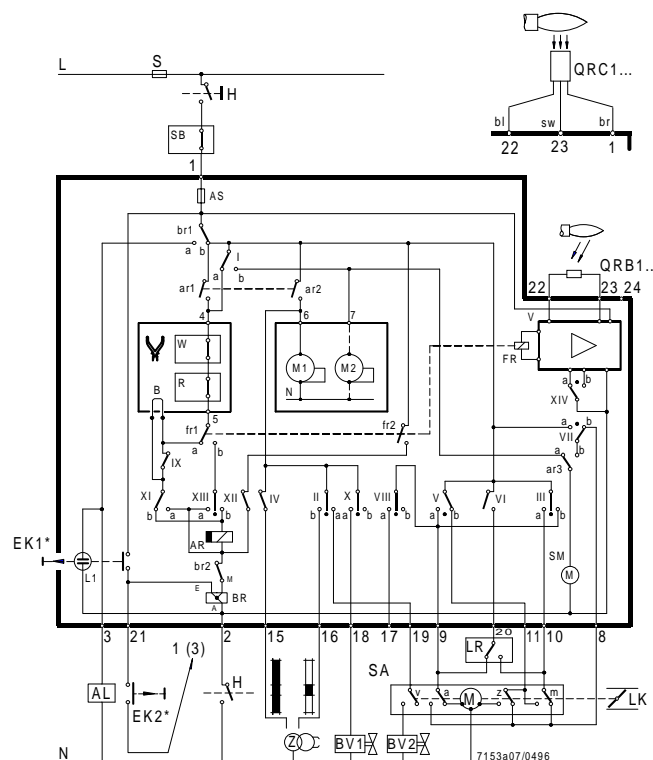
max. 10 A

External fuse

Device 1000 g

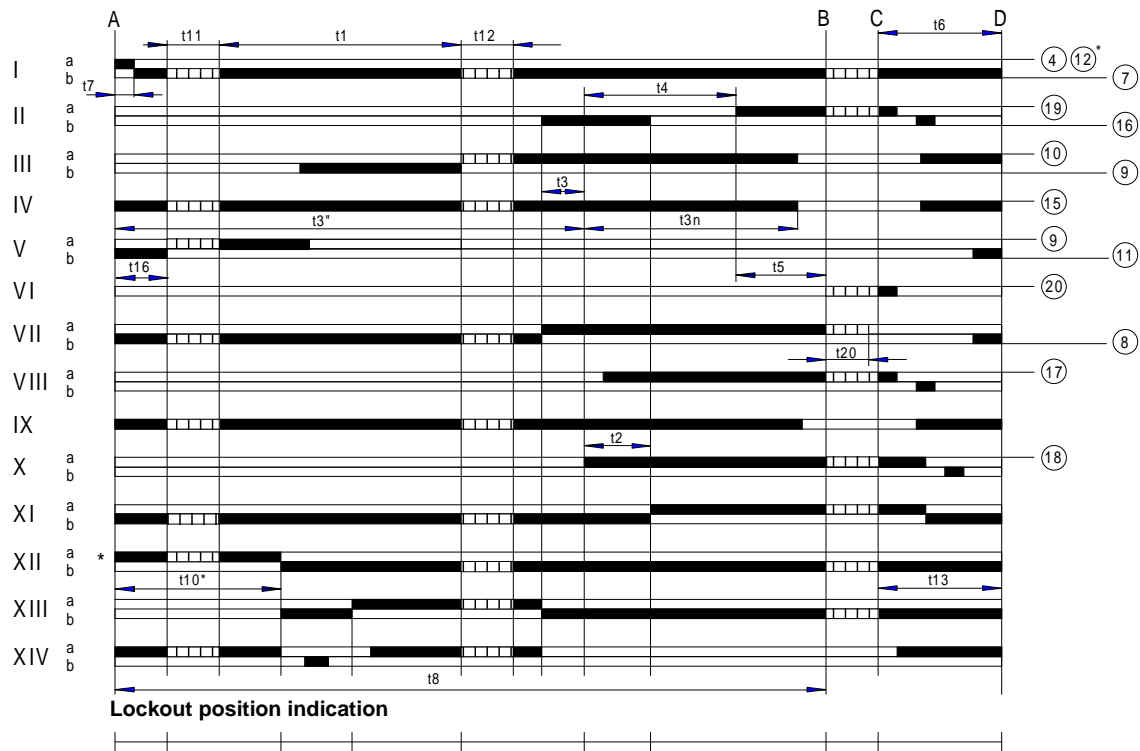
Weight

Plug-in base 165 g



Sequence diagram

# Control output at terminal



## Key

- t1 Prepurge time with air damper fully open
- t2 Safety time
- t3 Preignition time, short («Z» connected to terminal 16)
- T3' Preignition time, long («Z» connected to terminal 15)
- t3n Postignition time («Z» connected to terminal 15)
- t4 Interval between voltage at terminals 18 and 19 («BV1-BV2»)
- t5 Interval between voltage at terminals 19 and 20 («BV2» load controller)
- t6 Postpurge time (with «M2»)
- t7 Interval between start command and voltage at terminal 7 (start delay time for «M2»)
- t8 Duration of startup sequence (excluding «t11» and «t12»)
- t10 Interval from startup to the beginning of the air pressure check
- t11 Air damper running time to the OPEN position
- t12 Air damper running time to the low-fire position (MIN)
- t13 Permissible afterburn time
- t16 Interval to the OPEN command for the air damper
- t20 For self-shutdown of the sequence switch



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Note: specifications and data subject to change. Errors and omissions exceptd.