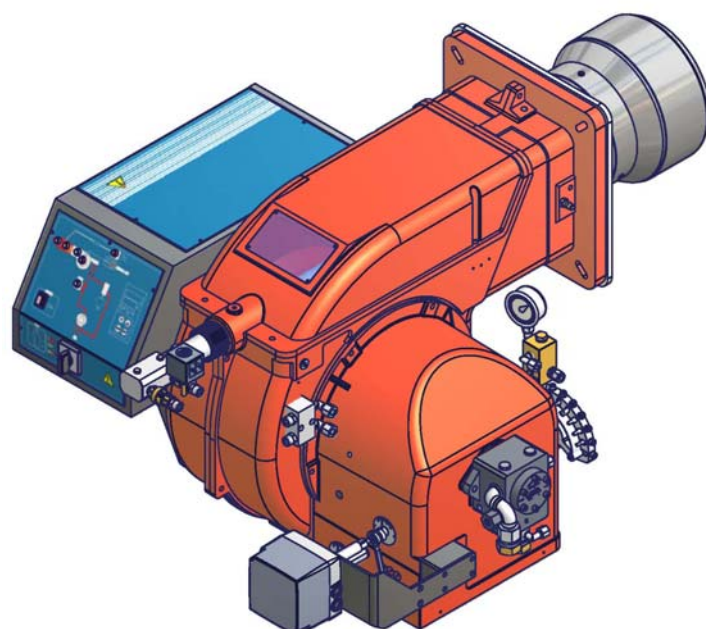


PG91 PG92 PG93



Progressive, Fully-modulating Light oil burners

MANUAL OF INSTALLATION - USE - MAINTENANCE

CIB UNIGAS

BURNERS - BRUCIATORI - BRULERS - BRENNER - QUEMADORES - ГОРЕЛКИ

TABLE OF CONTENTS

WARNINGS	3
PART I: INSTALLATION	5
GENERAL FEATURES.....	5
<i>How to interpret the burner's "Performance curve".....</i>	6
<i>Technical specifications</i>	7
<i>Performance curves</i>	7
<i>Overall dimensions</i>	8
MOUNTINGS AND CONNECTIONS	9
<i>Packing</i>	9
<i>Fitting the burner to the boiler</i>	9
<i>Handling the burner</i>	10
<i>Hydraulic diagrams for light oil supplying circuits</i>	10
<i>Installation diagram of light oil pipes</i>	11
<i>Light oil pumps</i>	12
<i>Assembling the light oil flexible hoses</i>	13
<i>About the use of fuel pumps</i>	13
<i>Light oil circuit</i>	14
<i>Electrical connections</i>	15
<i>Motor rotation</i>	15
<i>Light oil nozzles</i>	16
<i>Adjustments - brief description.....</i>	18
<i>Adjustment procedure</i>	18
<i>Oil Flow Rate Settings by means of Berger STM30.. actuator</i>	18
<i>Adjustment by the Siemens SQL33.. actuator</i>	21
<i>Fully modulating burners</i>	24
<i>Calibration of air pressure switch (when provided)</i>	24
PART II: OPERATION	25
OPERATION	25
<i>Burner control panel</i>	26
PART III: MAINTENANCE	27
ROUTINE MAINTENANCE	31
<i>Light oil filter maintenance</i>	27
<i>Removing the combustion head</i>	28
<i>Removing the oil gun</i>	28
<i>Correct position of electrodes and nozzle.....</i>	29
<i>Replacing the ignition electrodes</i>	29
<i>Cleaning and replacing the detection photoresistor</i>	29
<i>Seasonal stop</i>	30
<i>Burner disposal</i>	30
TROUBLESHOOTING	31
SPARE PARTS	32
BURNER EXPLODED VIEW	34
ELECTRICAL WIRING DIAGRAMS	35
APPENDIX	

WARNINGS

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.

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 repeated burner shut-downs, do not continue re-setting the unit manually. Contact qualified personnel to take care of such defects.
- 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:

- Directive 90/396/CEE - Gas Appliances;
- Directive 2006/95/EC on low voltage;
- Directive 2004/108/CEE on electromagnetic compatibility

Harmonised standards :

- UNI EN 676 (Gas Burners;
- CEI EN 60335-1(Household and similar electrical appliances - Safety. Part 1: General requirements;
- EN 50165 (Electrical equipment of non-electric appliances for household and similar purposes. Safety requirements.

Light oil burners

European directives:

- Directive 2006/95/EC on low voltage;
- Directive 2004/108/CEE on electromagnetic compatibility

Harmonised standards :

- CEI EN 60335-1(Household and similar electrical appliances - Safety. Part 1: General requirements;
- EN 50165 (Electrical equipment of non-electric appliances for household and similar purposes. Safety requirements.

National standards :

- UNI 7824: Monobloc nebulizer burners for liquid fuels. Characteristics and test methods

Heavy oil burners

European directives:

- Directive 2006/95/EC on low voltage;
- Directive 2004/108/CEE on electromagnetic compatibility

Harmonised standards :

- CEI EN 60335-1 Household and similar electrical appliances - SafetyPart 1: General requirements;
- EN 50165 Electrical equipment of non-electric appliances for household and similar purposes. Safety requirements.

National standards :

- UNI 7824: Monobloc nebulizer burners for liquid fuels. Characteristics and test methods

Gas - Light oil burners

European directives:

- Directive 90/396/CEE Gas Appliances;
- Directive 2006/95/EC on low voltage;
- Directive 2004/108/CEE on electromagnetic compatibility

Harmonised standards :

- UNI EN 676 Gas Burners
- CEI EN 60335-1(Household and similar electrical appliances - Safety. Part 1: General requirements;
- EN 50165 Electrical equipment of non-electric appliances for household and similar purposes. Safety requirements.

National standards :

- UNI 7824: Monobloc nebulizer burners for liquid fuels. Characteristics and test methods

Gas - Heavy oil burners

European directives:

- Directive 90/396/CEE - Gas Appliances;
- Directive 2006/95/EC on low voltage;
- Directive 2004/108/CEE on electromagnetic compatibility

Harmonised standards :

- UNI EN 676 (Gas Burners;
- CEI EN 60335-1(Household and similar electrical appliances - Safety. Part 1: General requirements;
- EN 50165 Electrical equipment of non-electric appliances for household and similar purposes. Safety requirements.

National standards :

- UNI 7824: Monobloc nebulizer burners for liquid fuels. Characteristics and test methods

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. The output range is from 700kW to 4000kW (according to the model).

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

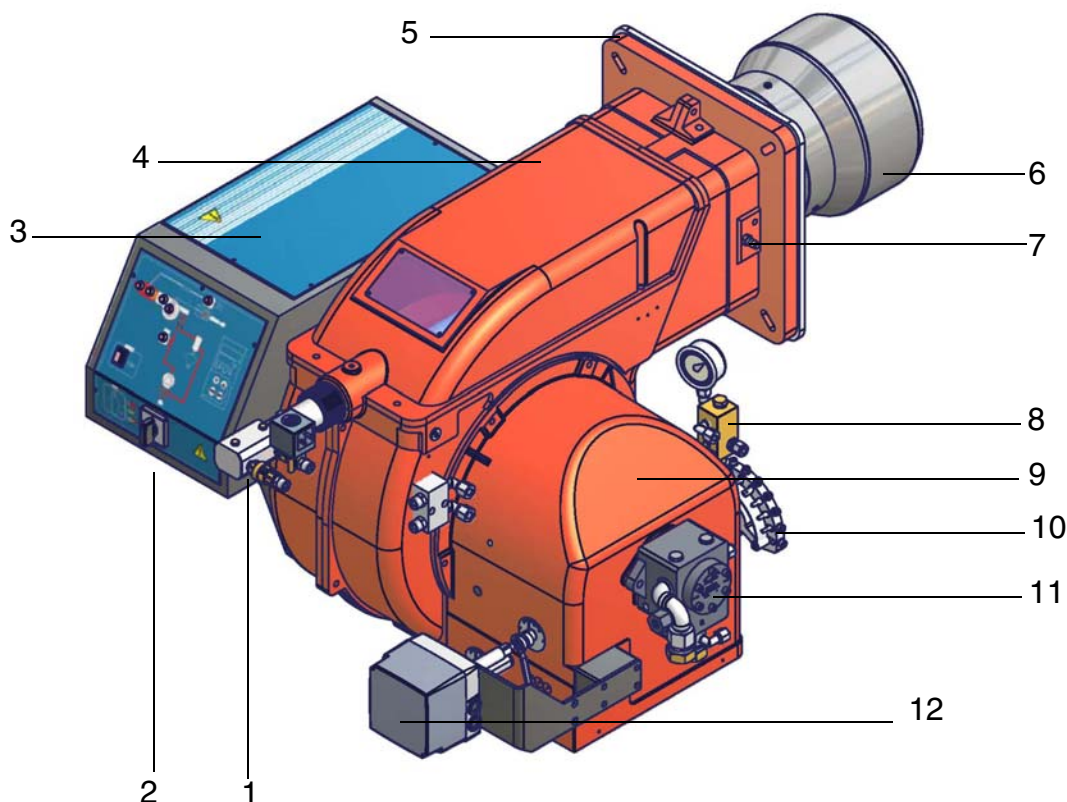


Fig. 1

- 1 Gun and head adjusting ring nut
- 2 Control panel
- 3 Electrical panel
- 4 Burner cover
- 5 Burner flange
- 6 Blast tube-combustion head ass.y
- 7 Photoresistance
- 8 Pressure governor
- 9 Air intake
- 10 Adjusting cam
- 11 Pump
- 12 Actuator

The fuel coming from the supply line, is pushed by the pump (11) 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 (11) 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 (12) 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. 2), 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.

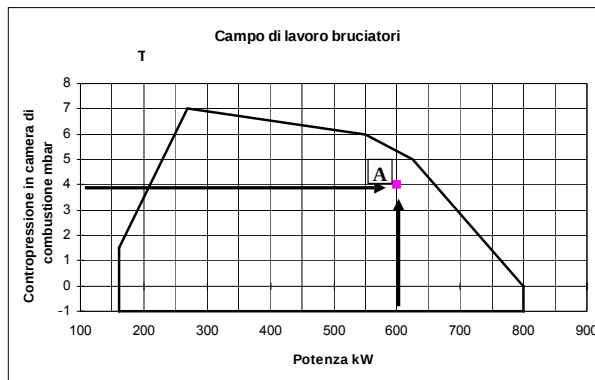


Fig. 2

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 PG92	Model	G-.	PR.	S.	*.	A.
(1)		(2)	(3)	(4)	(5)	(6)
(1) BURNER TYPE				PG91-PG92-PG93		
(2) FUEL				G - Light oil		A - Biodiesel
(3) OPERATION (Available versions)				PR - Progressive		MD - Fully modulating
(4) BLAST TUBE				S - Standard		L - Extended
(5) DESTINATION COUNTRY				* - see data plate		
(6) BURNER VERSION				A - Standard		

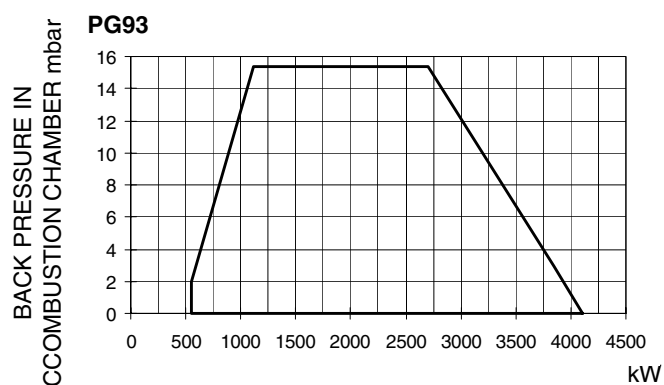
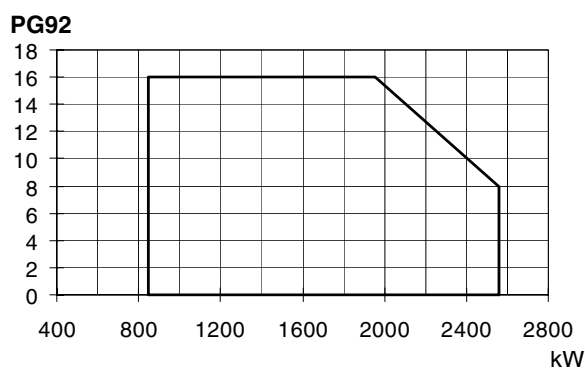
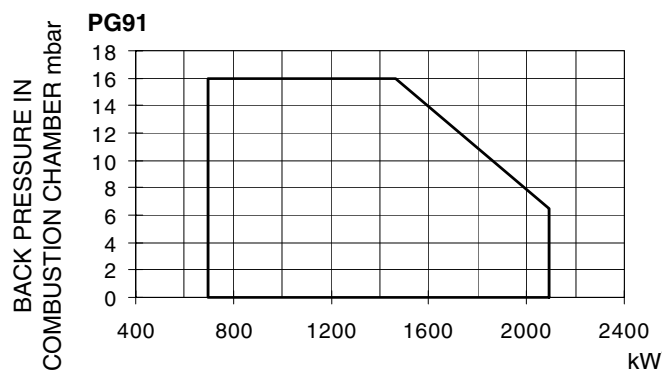
Technical specifications

BURNERS		PG91	PG92	PG93
Output	min. -max. kW	698 - 2093	849 - 2558	550 - 4100
Light oil rate	min. -max. kg/h	59 - 176	72 - 215	46 - 345
Fuel		Light oil		
Viscosity	cSt @ 40 °C	2 - 7.4		
Density	kg/m ³	0.84		
Power supply		400V 3N ~ 50Hz		
Electric motor	kW	4	5.5	7.5
Total power consumption	kW	4.5	6	8
Index of protection		IP40		
Approx. weight	kg	220	220	230
Operation		Progressive - Fully modulating		
Operating temperature	°C	-10 ÷ +50		
Storage temperature	°C	-20 ÷ +60		
Working service *		Intermittent		

NOTE: Choosing the nozzle for light oil, consider Hi equal to 10200 kcal/kg.

*** NOTE ON THE WORKING SERVICE:** the Siemens LMO.. control box automatically stops after 24h of continuous working. The control box immediately starts up, automatically.

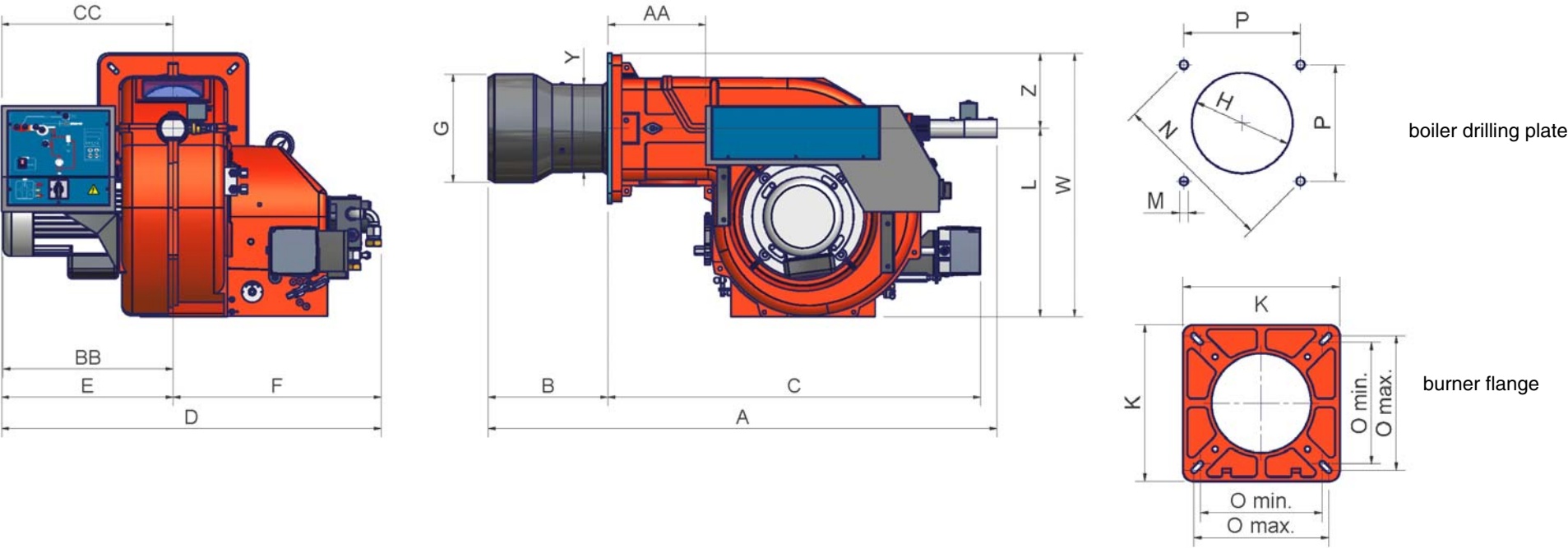
Performance curves



To get the input in kcal/h, multiply value in kW by 860.

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

Overall dimensions (mm)



	AS	AL	AA	BS*	BL*	BB	C	CC	D	E	F	G	H	K	L	M	N	Omin	Omax	P	W	Y	Z
PG91	1259	1432	242	300	473	419	918	422	935	422	513	238	268	360	464	M12	417	280	310	295	649	196	185
PG92	1253	1426	242	294	467	419	918	422	935	422	513	266	296	360	464	M12	417	280	310	295	649	213	185
PG93	1253	1426	243	294	467	460	918	422	935	422	513	266	296	360	464	M12	417	280	310	295	649	213	185

*BS: standard blast tube
*BL: extended blast tube

MOUNTINGS AND CONNECTIONS

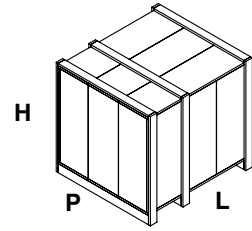
Packing

The burners are dispatched in wooden packages whose dimensions are: 1730mm x 1280mm x 1020mm (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.

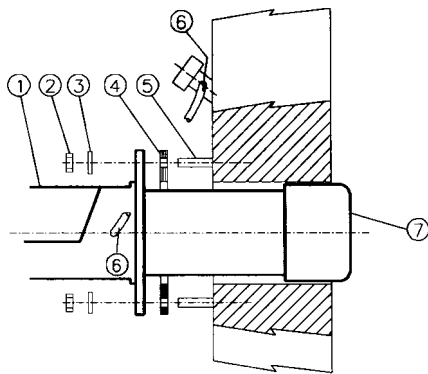
To get rid of the burner packing, follow the procedures laid down by current laws on disposal of materials.



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 4 stud bolts (5) on the hole of the boiler's door, according to the burner's drilling plate described on paragraph "Overall dimensions";
- 4 fasten the 4 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).



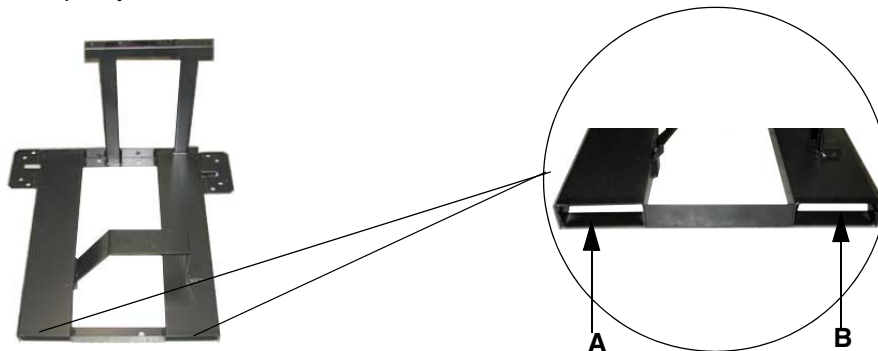
Keys

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

Handling the burner

	ATTENTION! The handling operations must be carried out by specialised and trained personnel. If these operations are not carried out correctly, the residual risk for the burner to overturn and fall down still persists.
	To move the burner, use means suitable to support its weight (see paragraph "Technical specifications").
	The unpacked burner must be lifted and moved only by means of a fork lift truck.

The burner is mounted on a stirrup provided for handling the burner by means of a fork lift truck: the forks must be inserted into the A and B ways. Remove the stirrup only once the burner is installed to the boiler.



Hydraulic diagrams for light oil supplying circuits

Fig. 3 - Gravity circuit

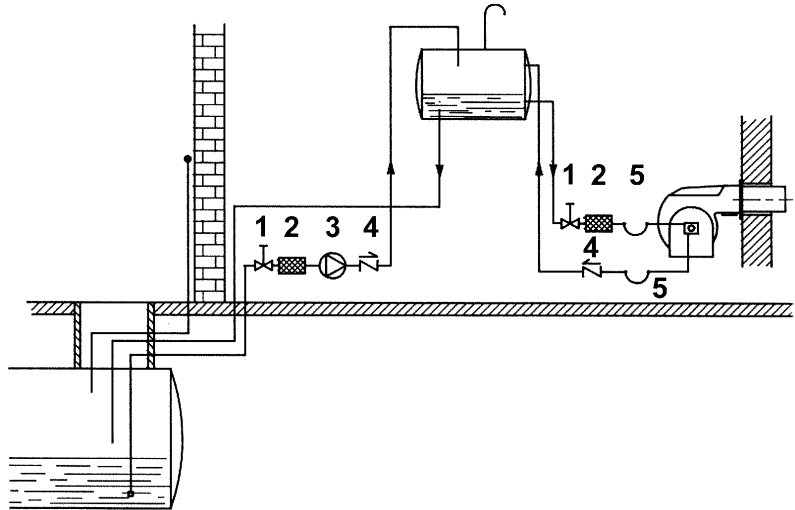


Fig. 4 - Ring circuit

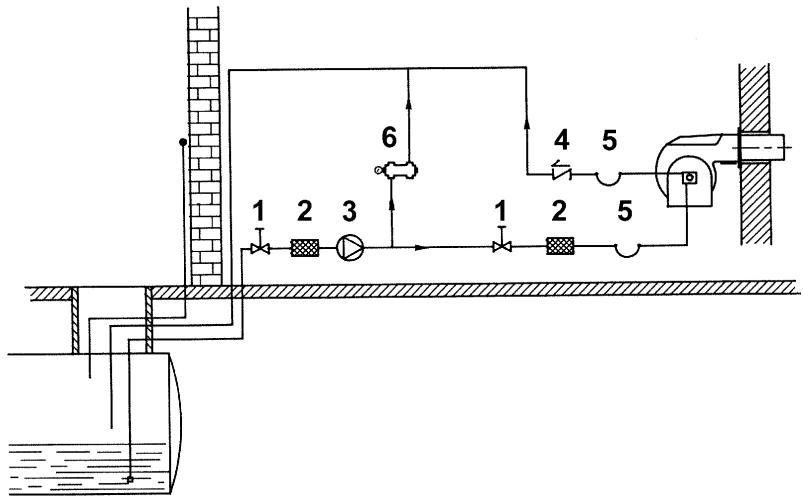
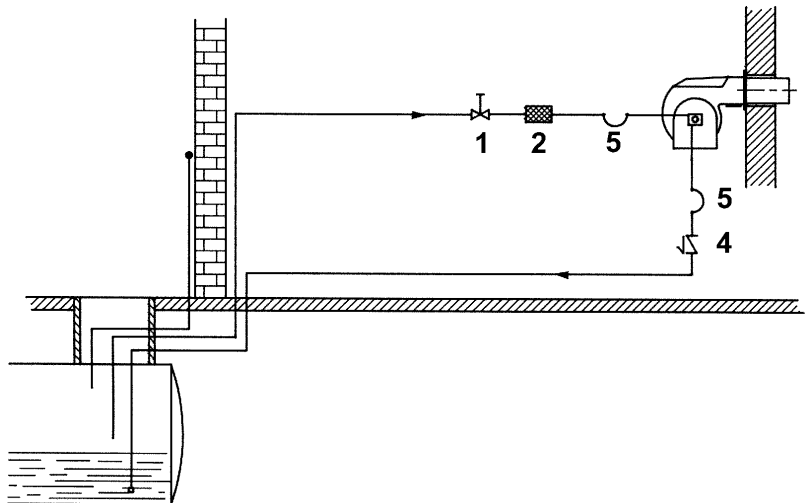


Fig. 5 - Suction circuit



Key

- 1 Manual valve
- 2 Light oil filter
- 3 Light oil feeding pump
- 4 One way valve
- 5 Flexible hoses
- 6 Relief valve

NOTE: in plants where gravity or ring feed systems are provided, install an automatic interception device (see n. 4).

Installation diagram of light oil pipes



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

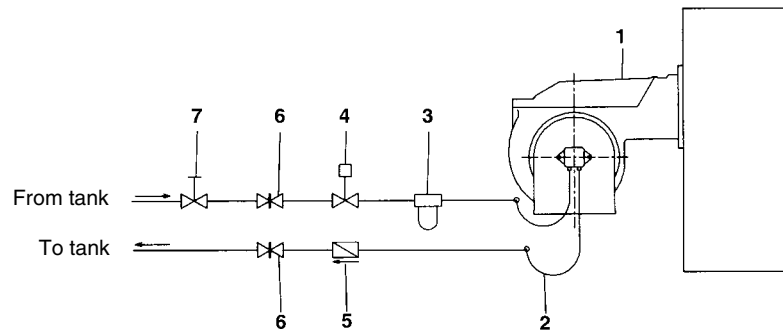


Fig. 6 - Double-pipe system

The burner is supplied with filter and flexible hoses, all the parts upstream the filter 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.

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.

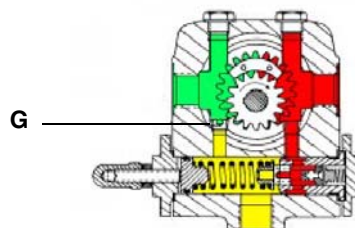
Double-pipe system: as for the single pipe system, a pipe that connects the tank to the pump's inlet is used besides another pipe that connects the pump's return port to the tank, as well. The excess of oil goes back to the tank: this installation can be considered self-bleeding. If provided, the inside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

Burners come out from the factory provided for double-pipe 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.

Suntec TA

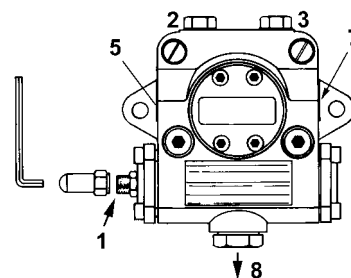


Bleed

Bleeding in two-pipe operation is automatic : it is assured by a bleed flat on the piston. In one-pipe operation, the plug of a pressure gauge port must be loosened until the air is evacuated from the system.

Light oil pumps

Suntec TA..	
Oil viscosity	4 - 450 cSt
Oil temperature	0 - 140°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.

**Key**

- 1 Pressure regulator
- 2 Pressure/Vacuum gauge port to measure inlet pressure/vacuum
- 3 Pressure gauge port
- 5 Suction
- 7 To the nozzle
- 8 Return

Assembling the light oil flexible 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).



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.

Light oil circuit

The fuel is pushed into the pump 1 to the nozzle 3 at the delivery pressure set by the pressure governor. The solenoid valve 2 set the fuel immission into the combustion chamber. The part of fuel that is not burnt goes back to the tank through the return circuit. The fuel amount to be burnt is adjusted by means of the burner actuator according to the adjustments set (see pag. 22).

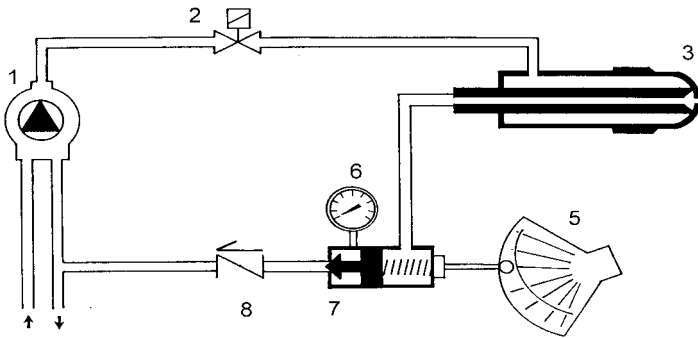


Fig. 7 - Stand-by

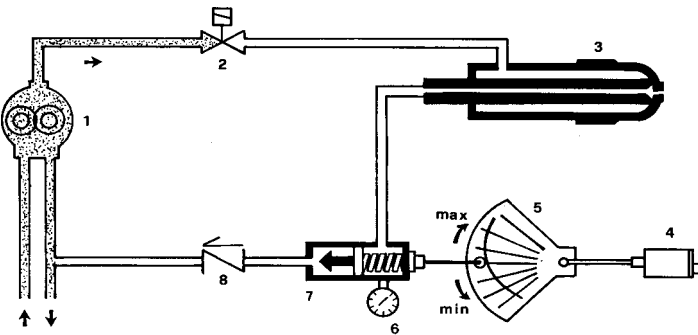


Fig. 8 - Prepurge

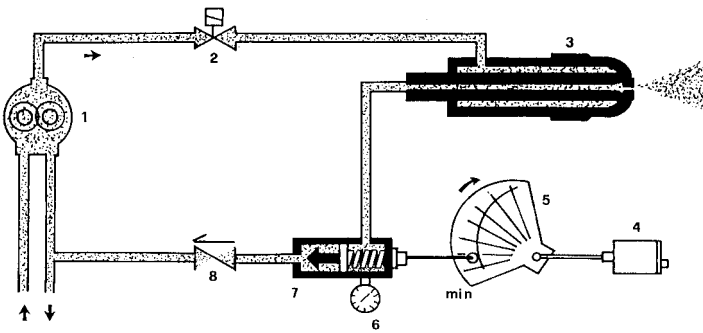


Fig. 9 - Low flame

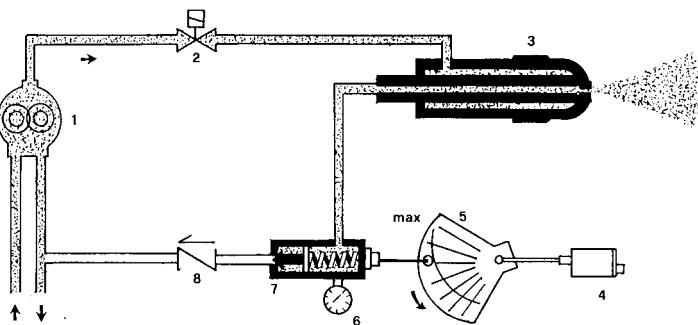


Fig. 10 - High flame

Key

- 1 Light oil pump
- 2 Light oil solenoid valve
- 3 Nozzle
- 4 Actuator
- 5 Adjusting cam
- 6 pressure gauge
- 7 Pressure regulator
- 8 One-way valve

Electrical connections



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. STRICTLY OBSERVE THE DATA PLATE.

- Remove the cover from the burner electrical panel.
- Execute the electrical connections to the power supply terminal board as shown here following, check the direction of the motor (see next paragraph) and replace the cover of the electrical panel.



WARNING: The burner is provided with a jumper between terminals 6 and 7; in the event of connecting the high/low flame thermostat remove this jumper before connecting the thermostat.

IMPORTANT: while connecting electric supply wires to burner's terminal block be sure that ground wire should be longer than phase and neutral ones.

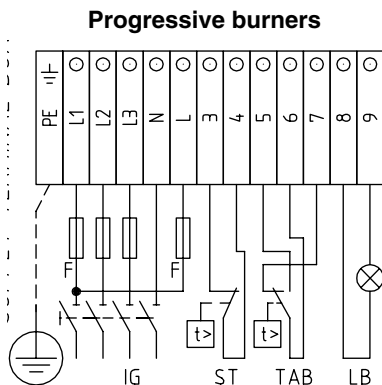


Fig. 11

Fully-modulating burners

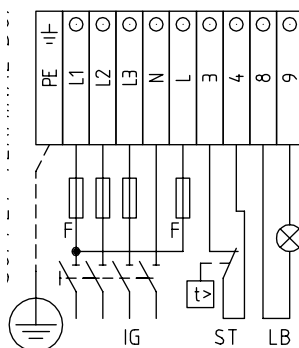


Fig. 13

Probes connection oby means of the 7-pins plug (Fig. 14) - see Fig. 12 for connections.

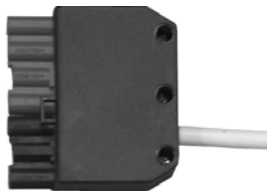


Fig. 14

Probes connection

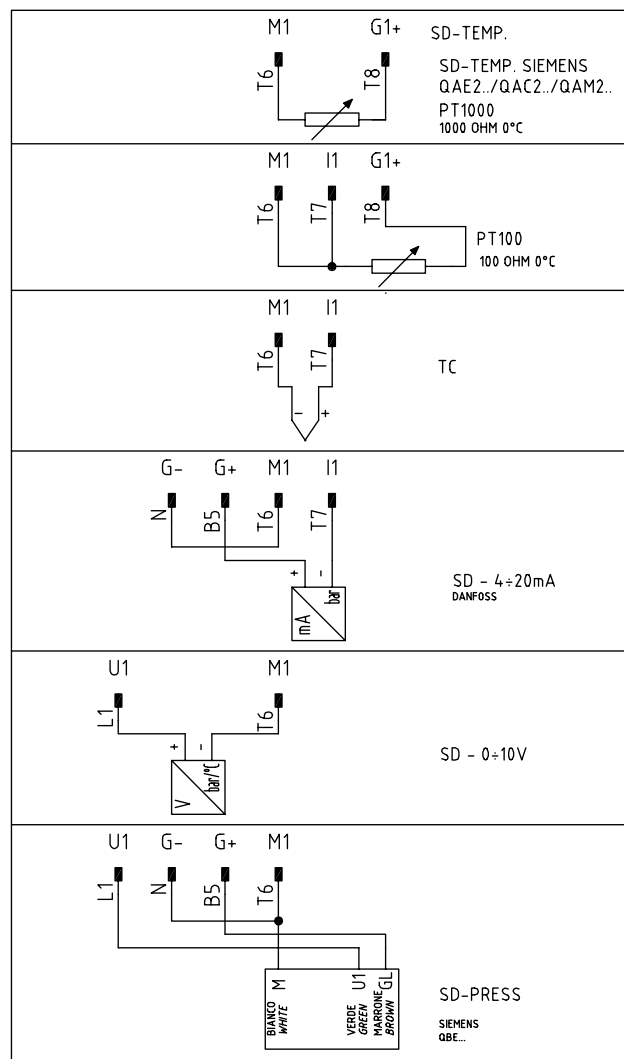


Fig. 12

Motor rotation

Once the burner electrical connection is accomplished, remember to check the rotation of the fan motor.

The motors must rotate in the direction showed on their casing. In the event of wrong rotation, reverse the three-phase supply and check again the motor rotation.

NOTE: Burners are provided for three-phase 400 V supply, and in the case of three-phase 230 V supply it is necessary to modify the electrical connections inside the terminal box of the electric motor and replace the thermal cutout relay.

ADJUSTING LIGHT OIL FOLW RATE

Light oil nozzles

The light oil flow rate can be adjusted choosing a by-pass nozzle that suits the boiler/utilisation's output and setting the delivery and return pressure values according to the values quoted on diagrams on Fig. 15 and Fig. 16, according to the burner type. Nozzles provided are the following according to the burner type. As far as reading the pressure values, see next paragraphs.

PG91 - PG92: Bergonzo A3 (Fig. 16)

PG93: Fluidics WR2 (Fig. 15)

NOZZLE	DELIVERY PRESSURE bar	RETURN PRESSURE MAX. bar	RETURN PRESSURE MIN. bar
BERGONZO A3	20	11 ÷ 13	5 (recommended))
FLUIDICS WR2	25	20	7 (recommended)

Example (Fulidics): as far as over 100kg/h nozzle the 80% of the nozzle rated flow rate is achieved with 18bar return pressure (see picture above).

DIMENSIONS	FLOW RATE kg/h	
	Min	Max
40	13	40
50	16	50
60	20	60
70	23	70
80	26	80
90	30	90
100	33	100
115	38	115
130	43	130
145	48	145
160	53	160
180	59	180
200	66	200
225	74	225
250	82	250
275	91	275
300	99	300
330	109	330
360	119	360
400	132	400
450	148	450
500	165	500
550	181	550
600	198	600
650	214	650
700	231	700
750	250	750
800	267	800

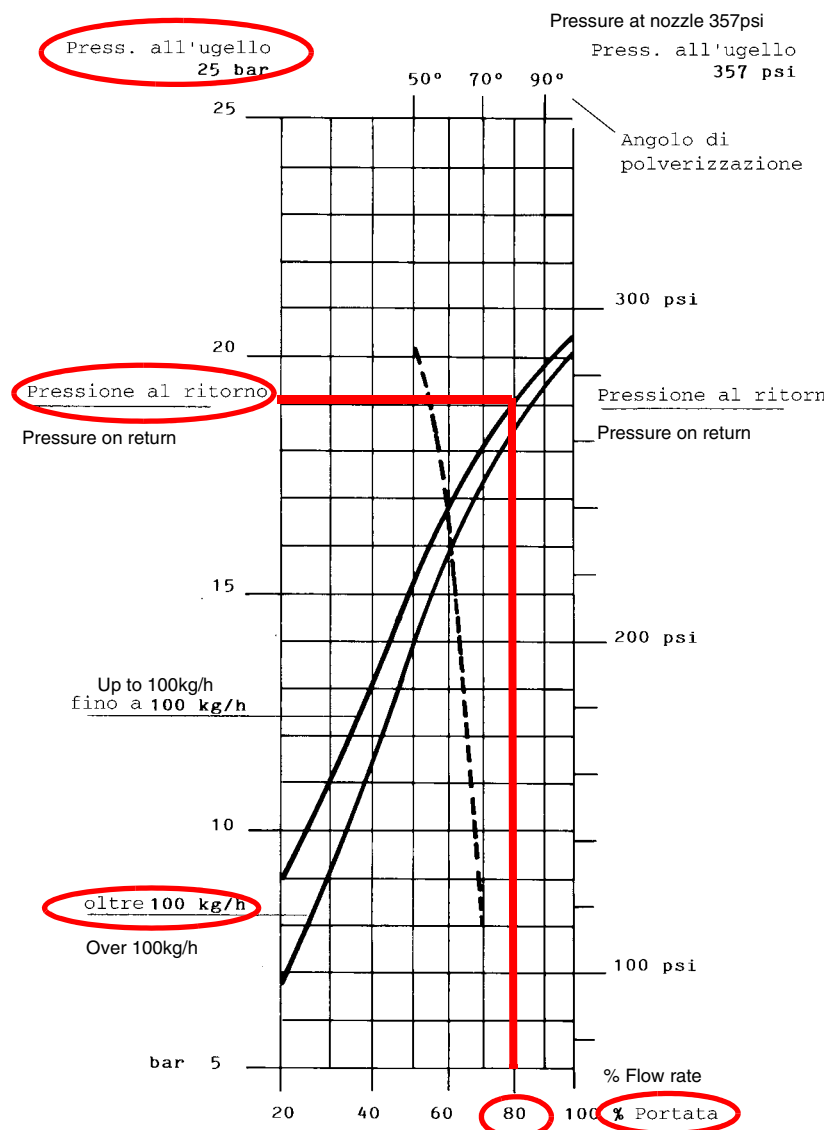


Fig. 15

Example (Bergonzo): if a 220kg/h flow rate BERGONZO nozzle is provided, set the return pressure at 11bar, supply at 20bar on the delivery to get a 220kg/h flow rate. If the return pressure needed is 5bar, instead, act on the V adjusting screw on the pressure regulator (see chapter "ADJUSTMENTS"). The flow rate will then be about 95kg/h (see the example shown on the Bergonzo diagram on next page).

Charles Bergonzo S.A. Moutier (suisse)

Gicleur à débits variables 9/16"

Pression initiale ... 20 atm

TYPE A3 60°

Rücklaufdüsen 9/16"

vorlaufdruck konstant ... 20 atü

Référence

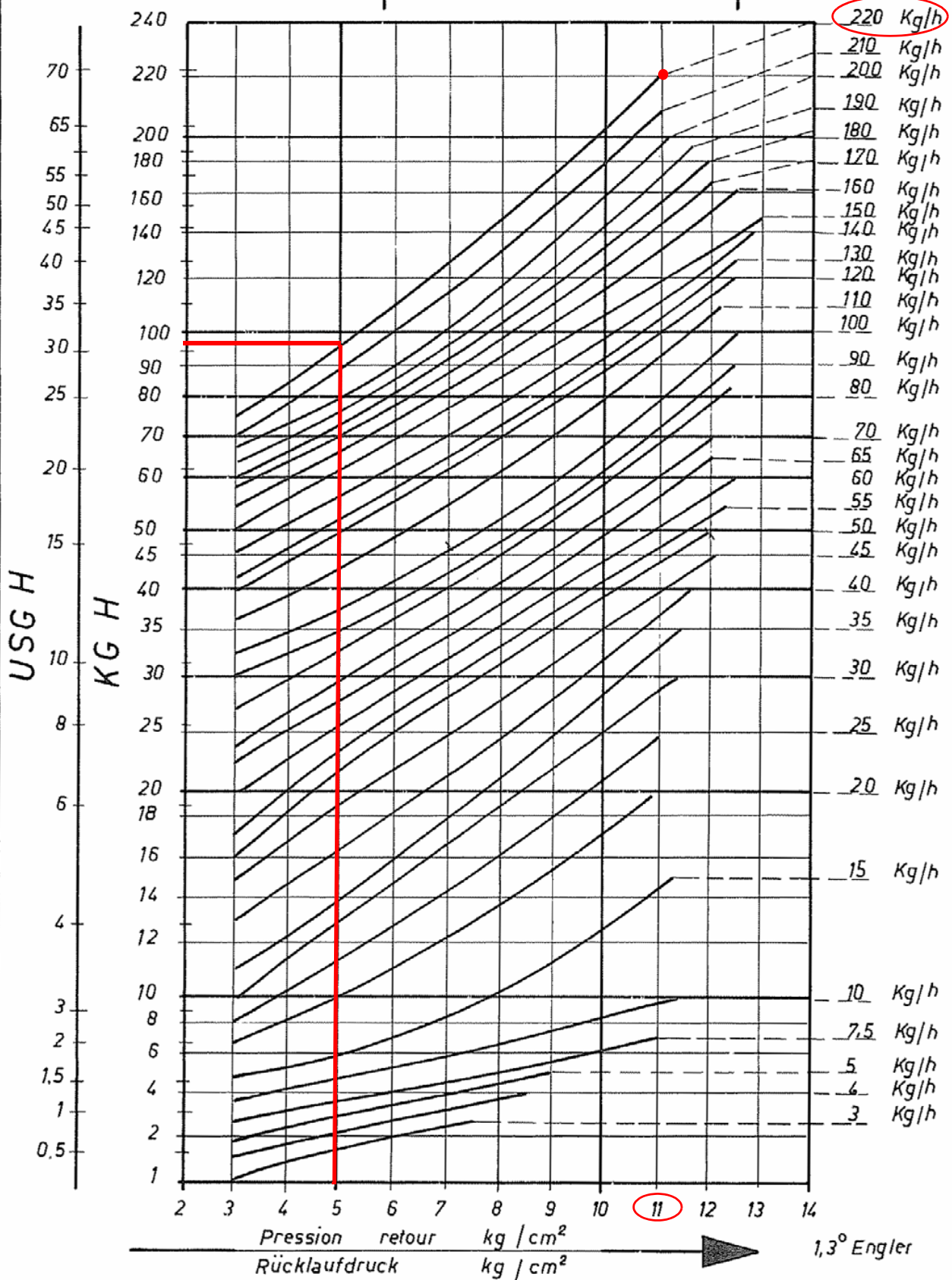


Fig. 16

Adjustments - brief description

	ATTENTION: before starting the burner up, be sure that the manual cutoff valves are open. Be sure that the mains switch is closed.
	Before starting up the burner, make sure that the return pipe to the tank is not obstructed. Any obstruction would cause the pump seal to break.
	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 fuel 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 ₂	Recommended (%) O ₂
Light oil	11.5 ÷ 13	2.9 ÷ 4.9

Adjust the air and fuel flow rates at the maximum output ("high flame") first, by means of the air damper and the adjusting cam respectively.

- Check that the combustion parameters are in the suggested limits.
- Check the flow rate .
- Then, adjust the combustion values corresponding to the points between maximum and minimum: set the shape of the adjusting cam foil. The adjusting cam sets the air/fuel ratio in those points, regulating the opening-closing of the fuel governor.
- Set, now, the low flame output, acting on the low flame microswitch of the actuator in order to avoid the low flame output increasing too much or that the flues temperature gets too low to cause condensation in the chimney.

Adjustment procedure

To change the burner setting during the testing in the plant, follow the next procedure, according to the actuator model provided (mod. Berger STM30.. or mod. Siemens SQL..).

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

- 1 Open the electrical panel to check the fan-pump motor rotation and act directly on its contactor **CV** (see next picture): keep pressed for some seconds until the oil circuit is charged;



- 2 bleed the air from the **M** pressure gauge port (Fig. 17) by loosening the cap without removing it, then release the contactor.

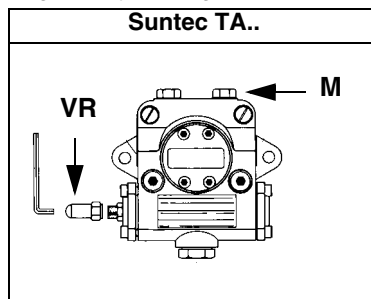
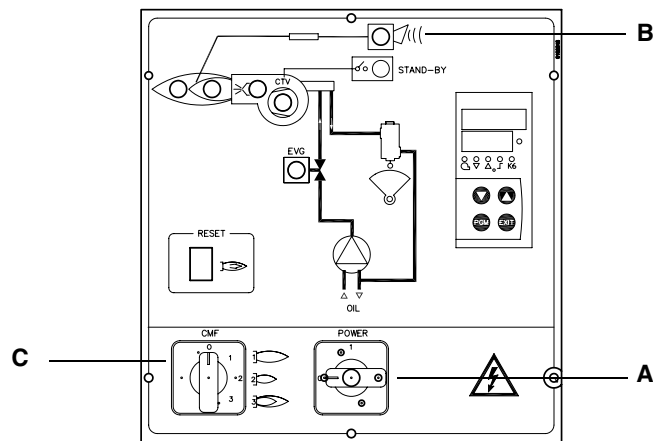
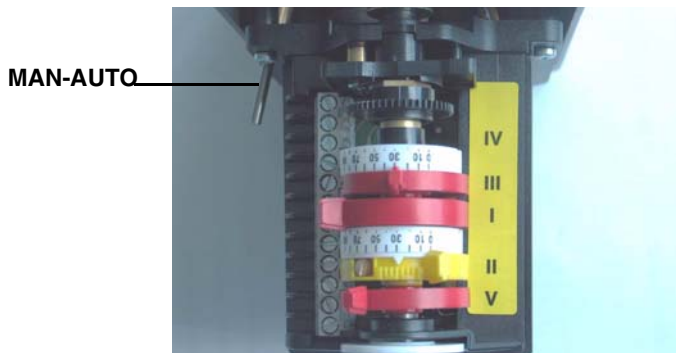


Fig. 17

- 3 Before starting the burner up, drive the high flame actuator microswitch matching the low flame one (in order to let the burner operates at the lowest output) to achieve safely the high flame stage .
- 4 Turn the burner on by means of its main switch **A**: if the burner locks (LED **B** on in the control panel) press the RESET button (**C**) on the control panel (see next picture) - see chapter "OPERATION" on page 26.



- 5 be sure that the actuator cam for the “Startup enabling signal” (when used) is about 5° more than the ignition cam;
6 start the burner up by means of the thermostat series and wait until the pre-purge time comes to an end;
7 drive the burner to high flame stage, by means fo the thermostat **TAB**.
8 Then move progressively the microswitch to higher values until it reaches the high flame position; always check the combustion values and eventually adjusting the oil pressure (see next step).



STM30.. Actuator cams

- | | |
|-----|-----------------------|
| I | High flame |
| II | Stand-by and Ignition |
| III | Low flame |
| V | Start enabling signal |

- 9 the nozzle supply pressure is already factory-set and must not be changed. Only if necessary, adjust the supply pressure as follows (see related paragraph); insert a pressure gauge into the port showed on Fig. 18 and act on on the pump adjusting screw **VR** (see Fig. 17) as to get the nozzle pressure at 20bar or 25bar (according to the nozzle model: Bergonzo or Fluidics nozzle - see page 18).

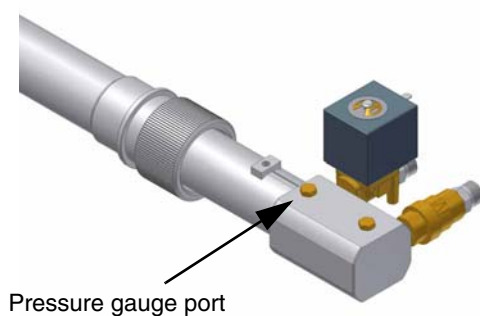


Fig. 18

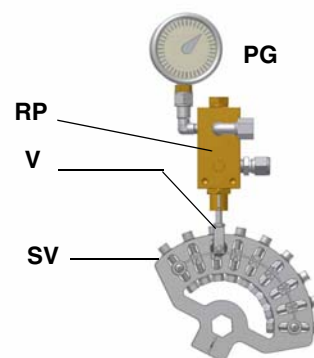
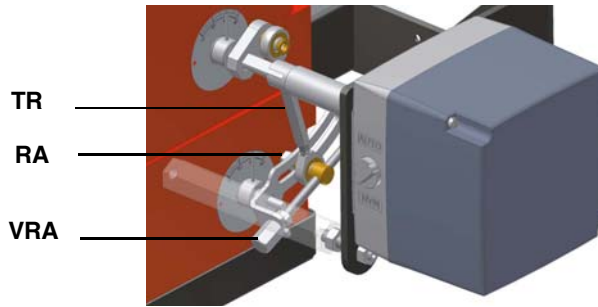


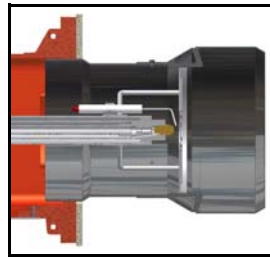
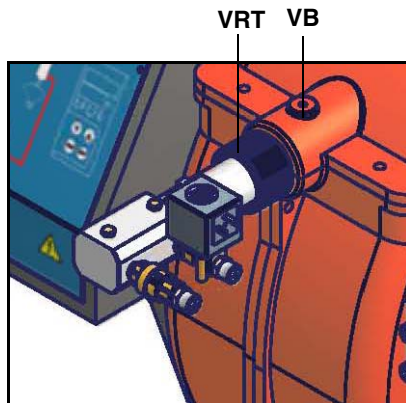
Fig. 19

- 10 in order to get the maximum oil flow rate, adjust the pressure (reading its value on the **PG** pressure gauge) without changing the air flow rate set during the gas operation adjustments (see previous paragraph): checking always the combustion parameters, the adjustment is to be performed by means of the **SV** adjusting cam screw (see picture) when the cam has reached the high flame position.
- 11 To adjust the **air flow rate in the high flame stage**, loose the **RA** nut and screw **VRA** as to get the desired air flow rate: moving the rod **TR** towards the air damper shaft, the air damper opens and consequently the air flow rate increases, moving it far from the shaft the air damper closes and the air flow rate decreases.

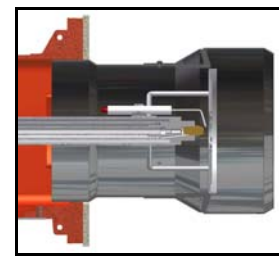
Note: once the procedure is performed, be sure that the blocking nut **RA** is fasten. Do not change the position of the air damper rods.



- 12 Only if necessary, change the combustion head position: to let the burner operate at a lower output, loose the **VB** screw and move progressively back the combustion head towards the MIN position, by turning clockwise the **VRT** ring nut. Fasten **VB** screw when the adjustment is accomplished.



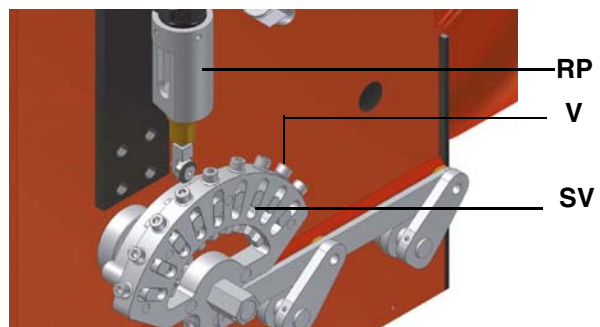
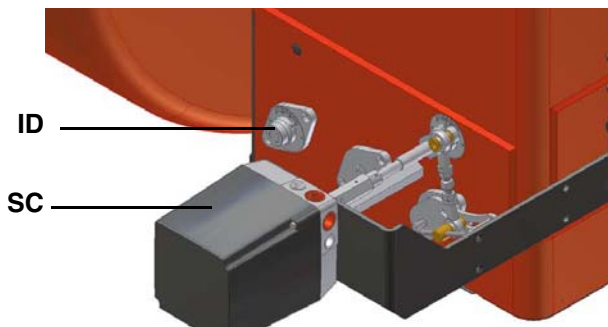
"MIN" position



"MAX" position)

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

- 13 the air and oil rate are now adjusted at the maximum power stage, go on with the point to point adjustment on the **SV** adjusting cam as to reach the minimum output point.

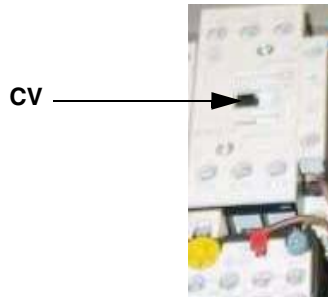


- 14 as for the point-to-point regulation in order to set the cam foil shape, move the low flame microswitch (cam III) a little lower than the maximum position (90°);
- 15 set the **TAB** thermostat to the minimum in order that the actuator moves progressively towards the low flame position;
- 16 move cam III (low flame) towards the minimum to move the actuator towards the low flame until the two bearings find the adjusting screw that refers to a lower position: screw **V** to increase the rate, unscrew to decrease, in order to get the pressure as showed on diagram in Fig. 28, according to the requested rate.
- 17 Move again cam III towards the minimum to meet the next screw on the adjusting cam and repeat the previous step; go on this way as to reach the desired low flame point.
- 18 The low flame position must never match the ignition position that is why cam III must be set 20°- 30° more than the ignition position.

Turn the burner off; then start it up again. If the adjustment is not correct, repeat the previous steps.

Adjustment by the Siemens SQL33.. actuator

- 1 Open the electrical panel to check the fan-pump motor rotation and act directly on the its contactor **CV** (see next picture): keep pressed for some seconds until the oil circuit is charged;



- 2 bleed the air from the **M** pressure gauge port (Fig. 20) by loosening the cap without removing it, then release the contactor.

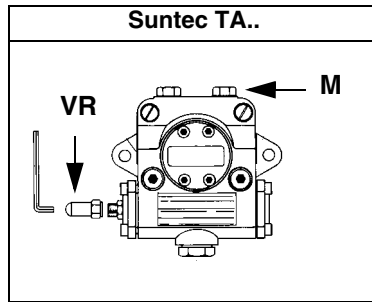
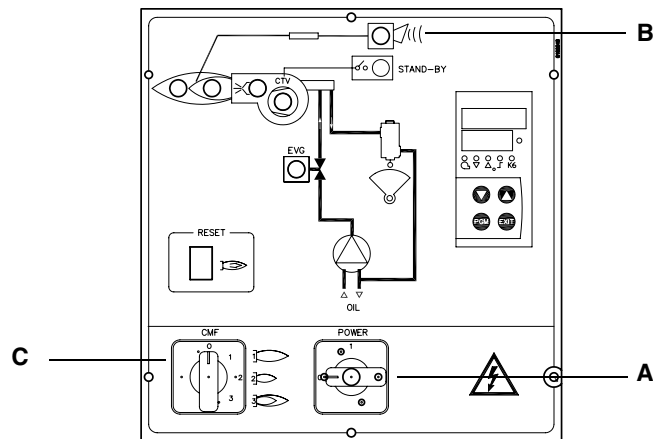
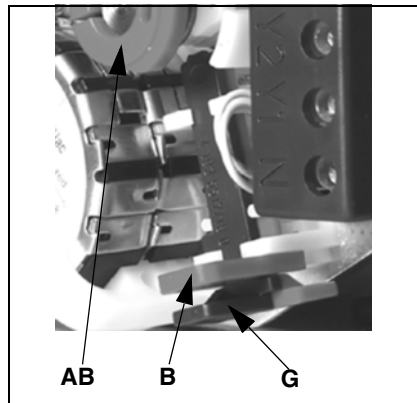
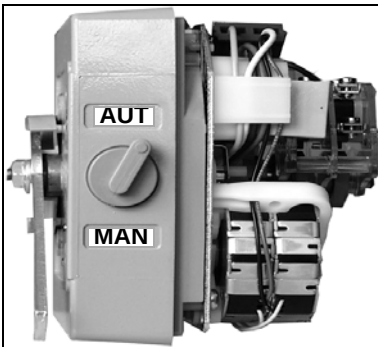


Fig. 20

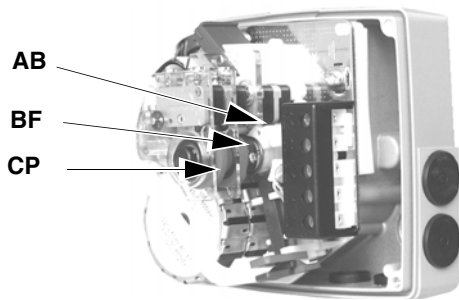
- 3 Turn the burner on by means of its main switch **A**: if the burner locks (LED **B** on in the control panel) press the RESET button (**C**) on the control panel (see next picture) - see chapter "OPERATION" on page 26.



- 4 be sure that the actuator cam for the "Startup enabling signal" (when used) is about 5° more than the ignition cam;

**SQL330.. actuator cams**

AB = High flame cam
 BF = Low flame cam
 B = plastic cam
 G = cam locking lever
 CP = Start signal cam



- 5 Start the burner up by means of the thermostat series and wait until the pre-purge phase comes to end;
- 6 the burner starts up with the actuator on the ignition position, set it to the **MAN** (manual mode), by the **MAN/AUTO** selector (ignition position= read on the air damper index **ID1** - see picture on pag.23);
- 7 disconnect the **TAB** thermostat removing the wire from the terminal no. 6 or by setting MAN on the RWF40 modulatore or by setting 0 by means of the **CMF** switch (only for fully-modulating burners);
- 8 set the actuator on the manual mode (MAN) by means of the MAN/AUTO switch (see next pictures).
- 9 manually drive the adjusting cam **SV** to the high flame position and set the actuator to the AUTO mode (by the related switch - see picture) to lock the adjusting cam.
- 10 the nozzle supply pressure is already factory-set and must not be changed. Only if necessary, adjust the supply pressure as follows (see related paragraph); insert a pressure gauge into the port showed on Fig. 21 and act on on the pump adjusting screw **VR** (see Fig. 20) as to get the nozzle pressure at 20bar or 25bar (according to the nozzle model: Bergonzo or Fluidics nozzles - see page 18).

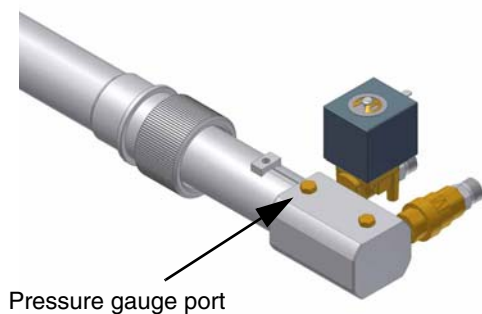


Fig. 21

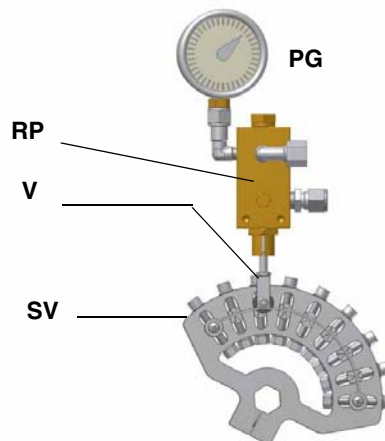
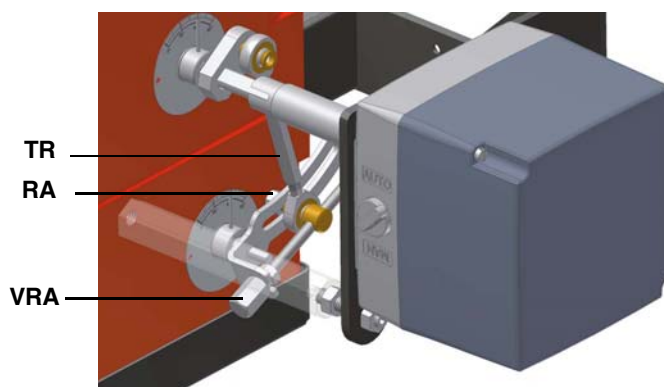


Fig. 22

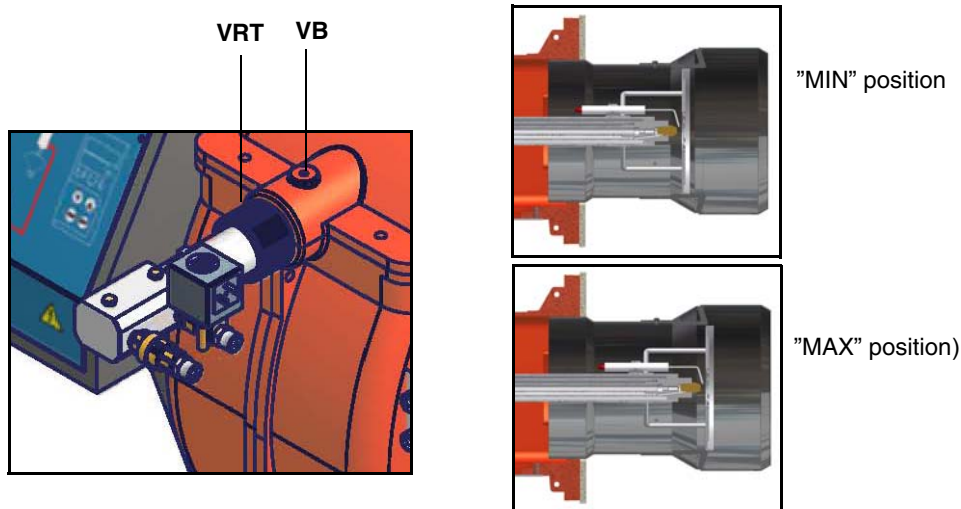
- 11 in order to get the maximum oil flow rate, adjust the pressure (reading its value on the **PG** pressure gauge) without changing the air flow rate set during the gas operation adjustments (see previous paragraph): checking always the combustion parameters, the adjustment is to be performed by means of the **SV** adjusting cam screw (see picture) when the cam has reached the high flame position.
- 12 To adjust the **air flow rate in the high flame stage**, loose the **RA** nut and screw **VRA** as to get the desired air flow rate: moving the rod **TR** towards the air damper shaft, the air damper opens and consequently the air flow rate increases, moving it far from the shaft the air damper closes and the air flow rate decreases.

Note: once the procedure is performed, be sure that the blocking nut **RA** is fastened. Do not change the position of the air damper rods.



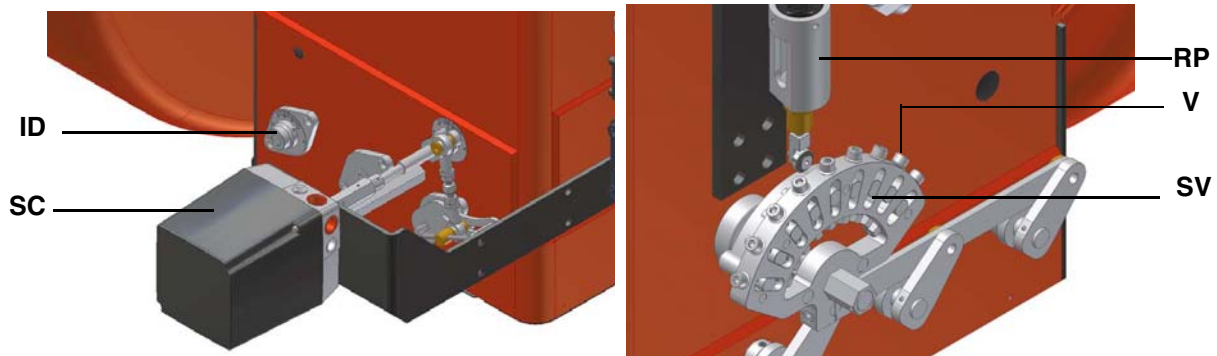
- 13 Only if necessary, change the combustion head position: to let the burner operate at a lower output, loose the **VB** screw and move

progressively back the combustion head towards the MIN position, by turning clockwise the **VRT** ring nut. Fasten **VB** screw when the adjustment is accomplished.



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

- 14 once the air and oil flow rate have been adjusted at the maximum output, go on with the point to point adjustment on the **SV** adjusting cam as to reach the minimum output point: gradually move the adjusting cam in order to adjust each of the **V** screws as to describe the cam foil shape.



- 15 to change the **SV** position set the actuator on the manual mode (MAN), turn the adjusting cam **SV** and set again the actuator to the AUTO mode to lock the adjusting cam;
- 16 act on the **V** screw that matches the bearings referring to the adjusting cam position;
- 17 to adjust the next screw, set again the actuator mode to **MAN**, turn the adjusting cam and set the actuator to **AUTO** mode to lock the adjusting cam on the next screw; adjust it and go on this way to adjust all the screws in order to set the cam foil shape, according to the combustion values read.
- 18 Once the cam foil shape is defined, reconnect the **TAB** thermostat reconnecting the wire to the terminal no.6 or setting the RWF40 burner modulator to AUTO or the CMF switch to 3 (only for fully-modulating burner).
- 19 Turn the burner off then start it up again.
- 20 Once the pre-purge time comes to end, drive the burner to the high flame stage by the **TAB** thermostat: check the combustion values;
- 21 drive the burner to low flame, if necessary adjust the low flame size (output) by inserting a screwdriver on the slot **F** to move the **BF** cam.



- 22 The low flame position must never match the ignition position that is why cam **BF** must be set 20°- 30° more than the ignition position.

NOTE: to change the low flame position, act exclusively on the actuator cam.

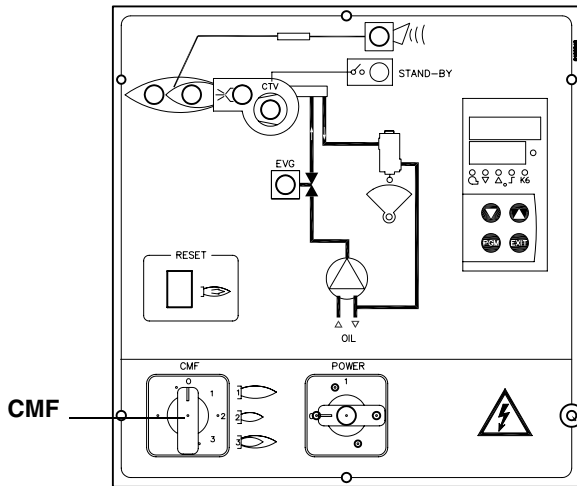
- 23 Now adjust the pressure switch (if provided -see page 24).

Fully modulating burners

To adjust the fully-modulating burners, use the **CMF** switch on the burner control panel (see next picture), instead of the **TAB** thermostat as described on the previous paragraphs about the progressive burners. Go on adjusting the burner as described before, paying attention to use the CMF switch instead of **TAB**.

The **CMF** position sets the operating stages: to drive the burner to the high-flame stage, set CMF=1; to drive it to the low-flame stage, set CMF=2.

To move the adjusting cam set CMF=1 or CMF=2 and then CMF=0.



CMF = 0 stop
 CMF = 1 high flame operation
 CMF = 2 high flame operation flame operation
 CMF = 3 automatic operation

Calibration of air pressure switch (when provided)

To calibrate the air pressure switch, proceed as follows:

- Remove the transparent plastic cap.
- Once air and gas 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 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.

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 THE EVENT OF REPEATED LOCKOUTS, DO NOT PERSIST WITH THE RESET BUTTON AND CONTACT QUALIFIED PERSONNEL WHO WILL PROCEED TO ELIMINATE THE MALFUNCTION.

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

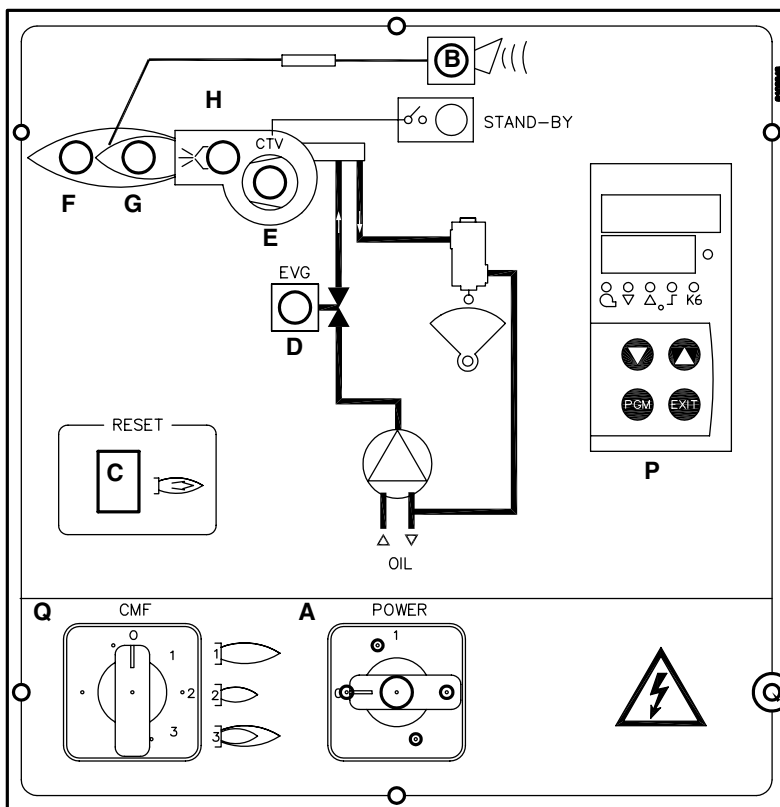


ATTENTION: before starting the burner up, be sure that the manual cutoff valves are open . Be sure that the mains switch is closed.

- 1 Set to the ON position the switch **A** on the control panel of the burner.
- 2 Check the control box is not in the lockout position (light **B** must be off); in such a case reset it by the reset pushbutton **C**.
- 3 Check the series of thermostats (or pressure switches) sends the burner the signal to operate.
- 4 The startup sequence begins: the control box ignites the fan/pump motor and energises the ignition transformer as well (signalled by the light **H** on the burner control panel).
- 5 At the end of the pre-purge stage, the light oil solenoid valve EVG is energised (signalled by the lamp **G** on the control panel) and the burner is on.
- 6 The ignition transformer is energized for few seconds after the ignition of the flame (post-ignition time) and at the end of this time is de-energised (light **H** off).
- 7 After the ignition the servocontrol moves to the high flame position for some seconds, then the operation begins and the burner switches to high flame or to low flame, according to the plant demand.
- 8 The high/low flame operation is showed by the **F** LED turning on/off.

Burner control panel

Keys



P

Fig. 23

- A ON-OFF main switch
- B Lockout signalling lamp
- C Conreol box release pushbutton
- D Signalling lamp for light oil solenoid valve opening
- E Thermal cutout intervention signalling lamp
- F High flame operation signalling lamp
- G Low flame operation signalling lamp
- H Ignition transformer operation signalling lamp
- P Siemens RWF40 modulator
- Q Manual operation mode switch

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 BEGINNIG 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 28); when reassembling, carefully observe the measures on page 29;
- check the ignition electrodes and their ceramic insulators, clean, adjust and replace if necessary (page 29);
- 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 (page 29), if necessary replace it and, if in doubt, check the detection current following the scheme in Fig. 25;
- clean and grease leverages and rotating parts.

Light oil filter maintenance

For correct and proper servicing, proceed as follows:

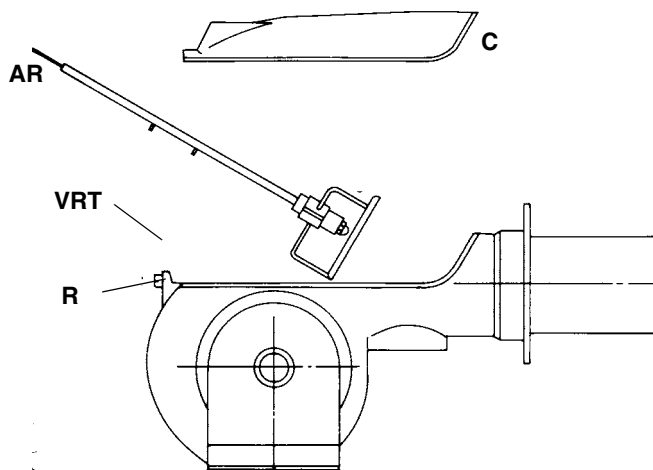
- 1 shut off fuel in the line section being serviced;
- 2 unscrew the tray;
- 3 remove the filter cartridge from its support and wash it with petrol or replace if necessary; check seal O-Ring, replace if necessary;
- 4 reassemble the tray and restore fuel flow.



Removing the combustion head

- 1 Remove the top cover **C**;
- 2 remove the photoresistor from its seat;
- 3 unscrew the revolving connectors (**E** in figure) on the fuel pipes (use 2 spanners to avoid loosening the connections attached to the distributor block);
- 4 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;
- 5 remove the whole assembly as shown in figure;
- 6 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.

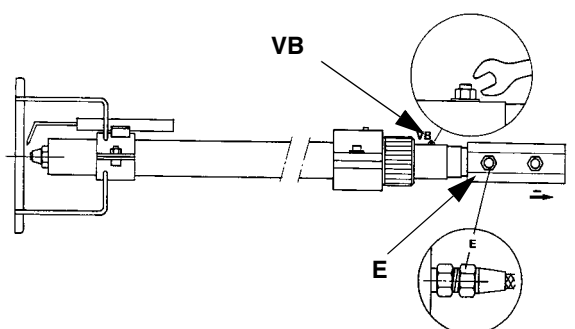


Removing the oil gun

Once the combustion head is removed, as described before, remove the oil gun as follows:

- 1 unscrew the connectors from the 2 oil pipes (**E** in figure) using 2 spanners to avoid loosening the connections attached to the distributor block);
- 2 loosen the screw **VB**
- 3 remove the gun with the light oil nozzle holder.
- 4 clean the oil gun by means of a vacuum cleaner; to scrape off the scale use a metallic brush
- 5 replace the oil gun, if necessary.

Note: To re-assemble, follow the procedure above in reversed order.



Correct position of electrodes and nozzle



ATTENTION: avoid the ignition electrodes to get in touch with metallic parts (blast tube, head, etc.), otherwise the boiler's operation would be compromised. Check the electrodes position after any intervention on the combustion head.

To guarantee a good ignition the measures showed on the next picture Fig. 24 must be observed.
Be sure to tighten the screw on the electrodes group before reassembling the combustion head.

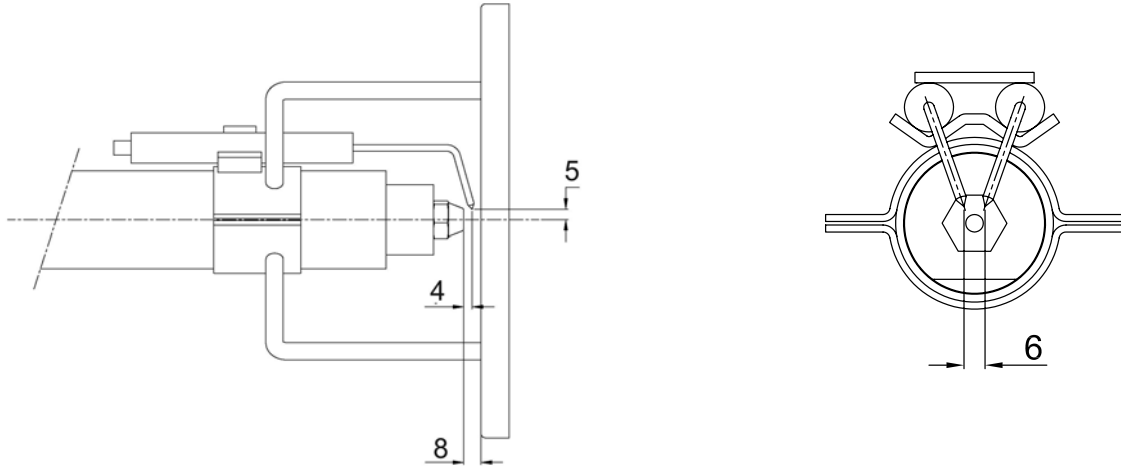


Fig. 24

Replacing the ignition electrodes



ATTENTION: avoid the ignition electrodes to get in touch with metallic parts (blast tube, head, etc.), otherwise the boiler's operation would be compromised. Check the electrodes position after any intervention on the combustion head.

To replace the ignition electrodes, proceed as follows:

- 1 remove the burner cover;
- 2 disconnect the electrodes cables;
- 3 remove the combustion head (see par. "Removing the combustion head");
- 4 loose screw (B) that fasten the ignition electrodes;
- 5 remove the electrodes and replace them, referring to the values quoted on Fig. 24.

Cleaning and replacing the detection photoresistor

When cleaning the photoresistive detector, always use a clean cloth. If necessary, remove it from its slot to replace it.

Checking the detection current

To measure the detection signal follow the diagram in Fig. 25.

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.

Minimum current intensity with flame: $45\mu\text{A}$

Maximum current intensity without flame: $5.5\mu\text{A}$

Maximum possible current intensity with flame: $100\mu\text{A}$

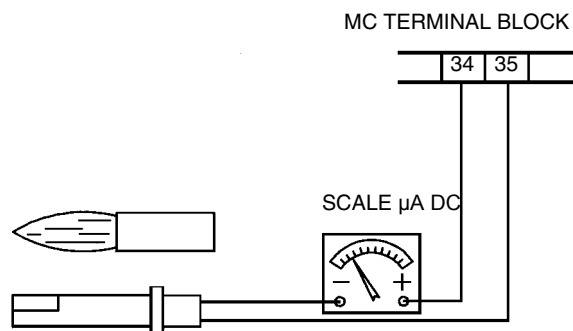


Fig. 25

Seasonal stop

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

- 1 turn the burner's main switch to 0 (Off position)
- 2 disconnect the power mains
- 3 close the fuel cock 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".

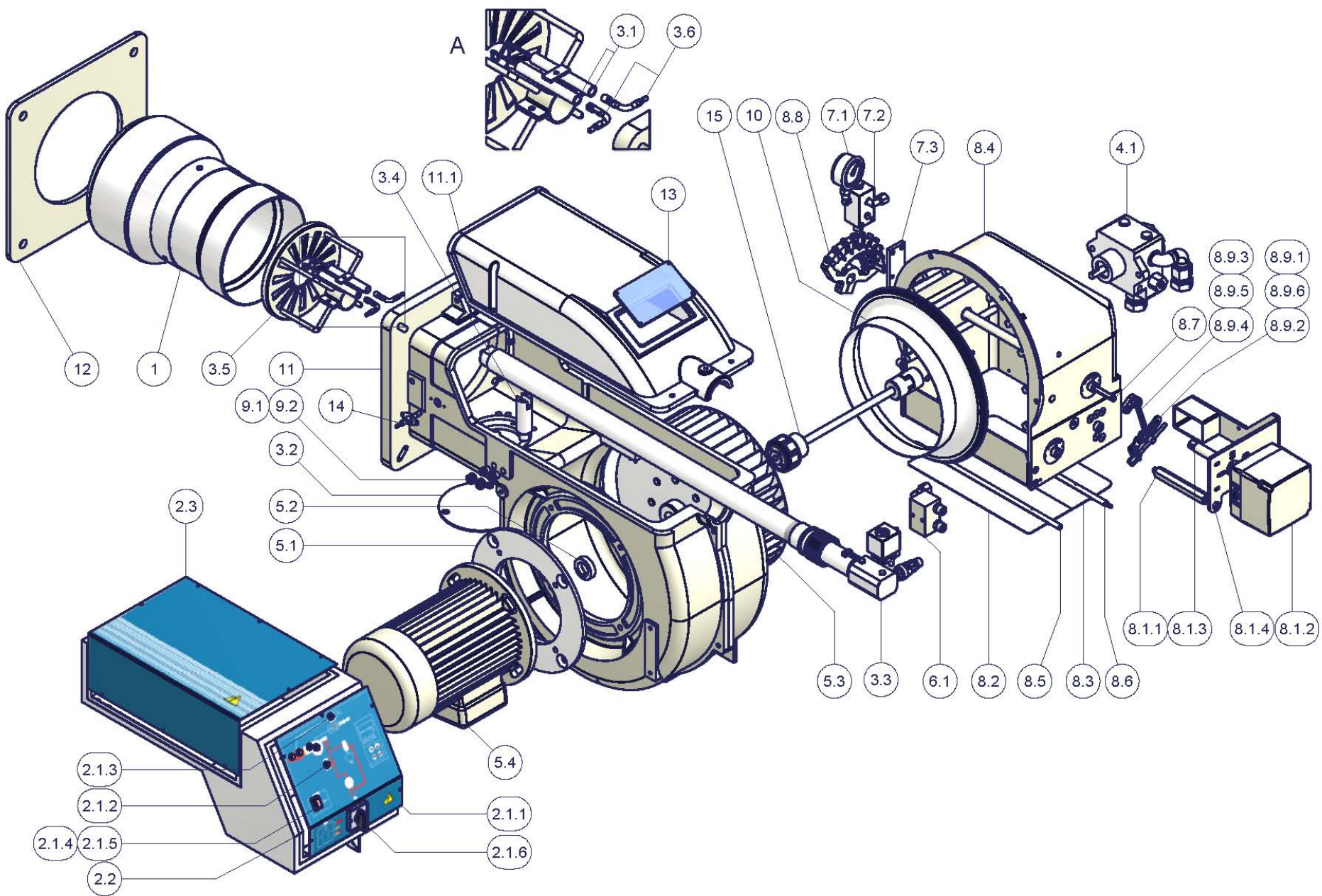
TROUBLESHOOTING

	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 REPEATS THE CYCLE DURING OPE- RATION
MAIN SWITCH OPEN	●							
LINE FUSE INTERVENTION	●							
MAX. PRESSURE SWITCH FAULT	●							●
FAN THERMAL CUTOUT INTERVENTION	●							
AUXILIARY RELAIS FUSES INTERVENTION	●							
CONTROL BOX FAULT	●	●		●	●		●	
ACTUATOR FAULT						●		
SMOKEY FLAME					●		●	
IGNITION TRANSFORMER FAULT				●				
IGNITION ELECTRODE DIRTY OR WRONG POSITIONED				●				
DIRTY NOZZLE				●			●	
FUEL SOLENOID VALVE DEFECTIVE				●			●	
PHOTORESISTOR DIRTY OR DEFECTIVE					●		●	
HI-LO FLAME THERMOSTAT DEFECTIVE						●		
WRONG POSITION OF ACTUATOR CAMS						●		
FUEL PRESSURE TOO LOW				●				
DIRTY FUEL FILTERS			●	●			●	

BURNER EXPLODED VIEW

ITEM	DESCRIPTION
1	STANDARD BLAST TUBE
2.1.1	FRONT CONTROL PANEL
2.1.2	LIGHT
2.1.3	LIGHT
2.1.4	LOCK-OUT RESET BUTTON
2.1.5	PROTECTION
2.1.6	SWITCH
2.2	BOARD
2.3	COVER
3.1	LONG IGNITION ELECTRODE
3.2	CLOSING PLATE
3.3	STANDARD COMPLETE OIL GUN
3.4	OIL GUN HOLDER
3.5	COMBUSTION HEAD
3.6	IGNITION CABLE
4.1	PUMP
5.1	MOTOR MOUNTING FLANGE
5.2	SPACER
5.3	FAN WHEEL
5.4	MOTOR
6.1	OIL MANIFOLD
7.1	PRESSURE GAUGE
7.2	PRESSURE GOVERNOR
7.3	BRACKET
8.1.1	SPACER

ITEM	DESCRIPTION
8.1.2	ACTUATOR
8.1.3	ACTUATOR SHAFT
8.1.4	BRACKET
8.2	AIR INTAKE DAMPER
8.3	AIR INTAKE DAMPER
8.4	AIR INTAKE
8.5	LOUVER SHAFT
8.6	LOUVER SHAFT
8.7	ADJUSTING CAM SHAFT
8.8	ADJUSTING CAM
8.9.1	SCREW
8.9.2	CAM
8.9.3	LEVERAGE
8.9.4	ROD
8.9.5	JOINT
8.9.6	JOINT
9.1	FAIRLEAD
9.2	FAIRLEAD
10	AIR INLET CONE
11	BURNER HOUSING
11.1	COVER
12	GENERATOR GASKET
13	INSPECTION GLASS
14	PHOTORESISTOR
15	COUPLING



SPARE PARTS

Description	Code		
	PG91	PG92	PG93
CONTROL BOX	2020455	2020455	2020455
IGNITION ELECTRODES	2080206	2080206	2080206
FUEL FILTER	2090018	2090018	2090018
GASKET	2110048	2110048	2110048
FAN WHEEL	2150031	2150033	2150032
IGNITION TRANSFORMER	2170302	2170302	2170302
ELECTRIC MOTOR	2180276	2180277	2180206
SOLENOID VALVE	2190403	2190403	2190403
FLEXIBLE HOSESL = 1500 1"MX	2340004	2340004	2340004
FLEXIBLE HOSES L = 335 3/8"	2340087	2340087	2340087
FLEXIBLE HOSES L = 385 3/8"	2340088	2340088	2340088
ADJUSTING CAM FOIL	2440013	2440013	2440013
SERVOCONTROL mod. SIEMENS SQL..	2480040	2480040	2480007
SERVOCONTROL mod. BERGER STM30..	2480090	2480090	2480090
PHOTORESISTOR mod. SIEMENS QRB..	2510003	2510003	2510003
COUPLING	2540121	2540121	2540134
PRESSURE GOVERNOR	2570054	2570054	2570077
BURNER MODULATOR	2570112	2570112	2570112
PUMP mod. SUNTEC	2590118	2590119	2590120
PUMP mod. DANFOSS	2590310	2590311	2590312
NOZZLE mod. BERGONZO A3	2610202	2610202	-
NOZZLE mod. FLUIDICS WR2 50°	-	-	2610203
OIL GUN (standard)	2700217	2700217	27002xx
OIL GUN (long)	2700223	2700223	27002xx
COMBUSTION HEAD	3060160	3060161	3060161
BLAST TUBE (standard)	30910C5	30910C6	30910C6
BLAST TUBE (long)	3091082	3091084	3091084
IGNITION CABLES	6050129	6050129	6050129

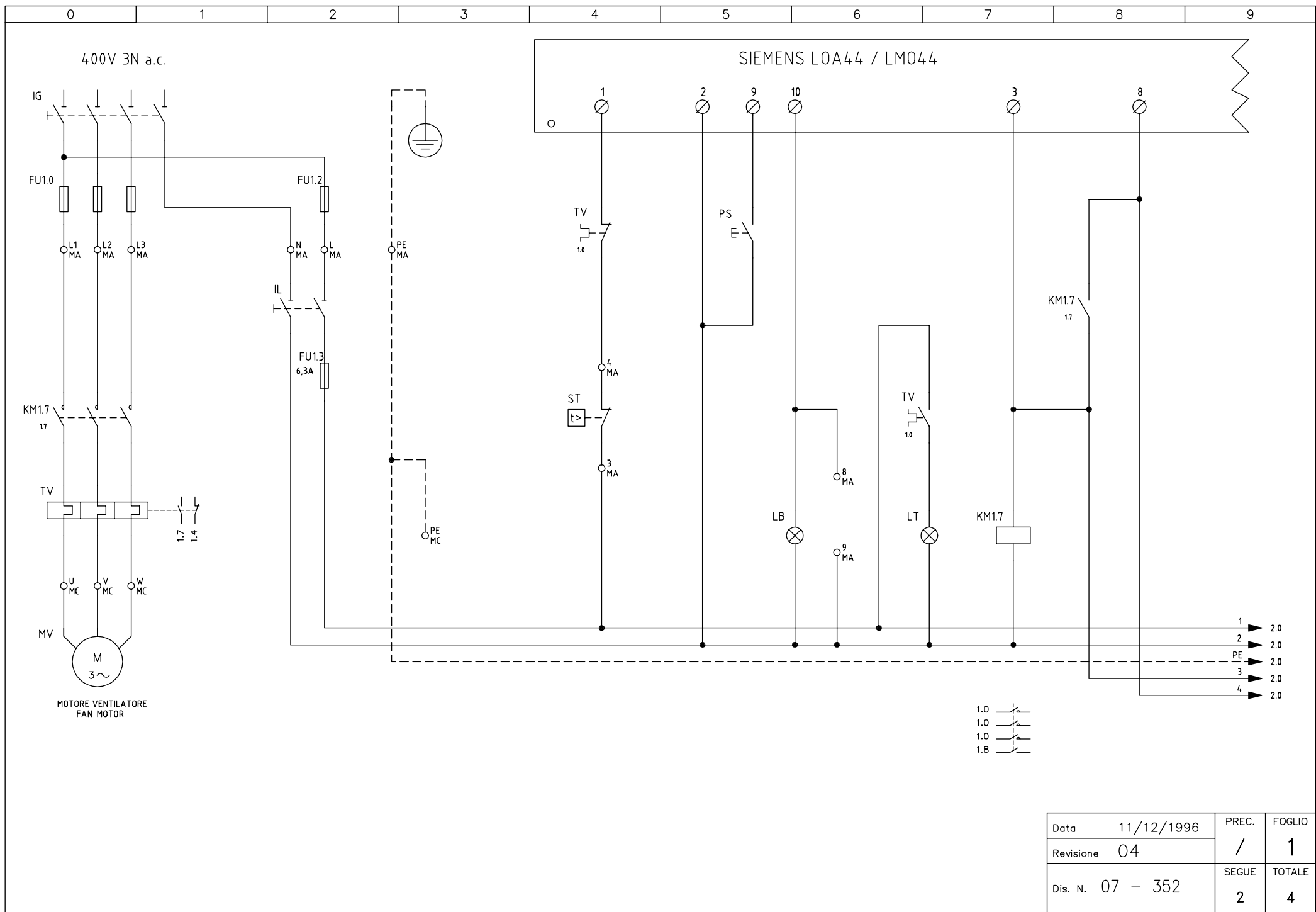
ELECTRIC WIRING DIAGRAMS

ATTENTION:

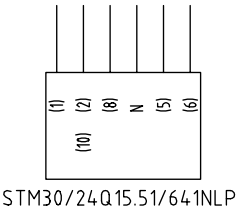
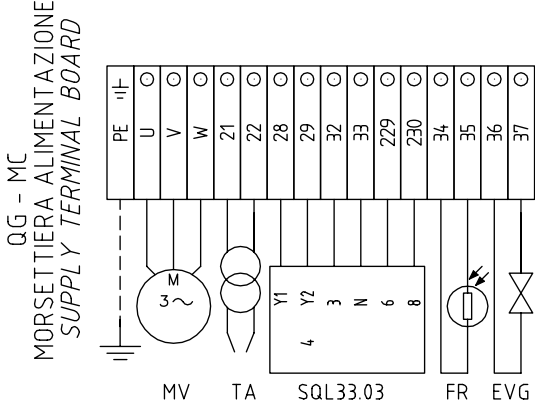
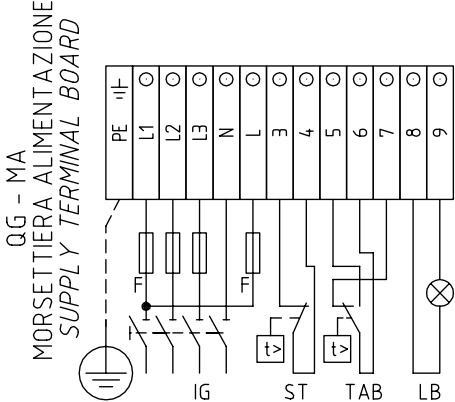
- 1 - Electric supply 230V/400V 50Hz 3N a.c.
- 2 - Don't reverse phase and neutral
- 3 - Make sure that the burner is properly hearted

Wiring diagram 07-352 Rev. 4 - Progressive Burners

Wiring diagram 07-401 Rev. 5 - Fully-modulating Burners



Data	11/12/1996	PREC.	FOGLIO
Revisione	04	/	1
Dis. N.	07 - 352	SEGUE	TOTALE
		2	4

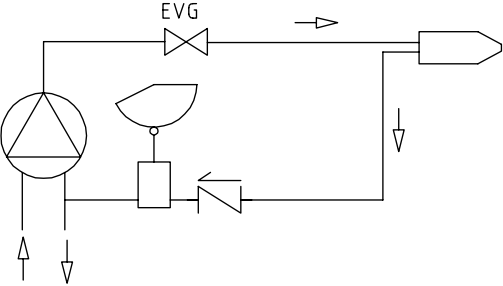


CAMME SERVOCOMANDO
SERVO CONTROL CAMS
SQL33.03

- Y1
- Y2
- 3
- 6
- ALTA FIAMMA
HIGH FLAME
- SOSTA E ACCENSIONE
STAND-BY AND IGNITION
- BASSA FIAMMA
LOW FLAME
- CONSENSO ALLA PARTENZA
INPUT TO START

SERVOCOMANDO SERRANDA ARIA (ALTERNATIVO)
AIR DAMPER SERVO CONTROL (ALTERNATIVE)
STM30/24Q15.51/641NLP

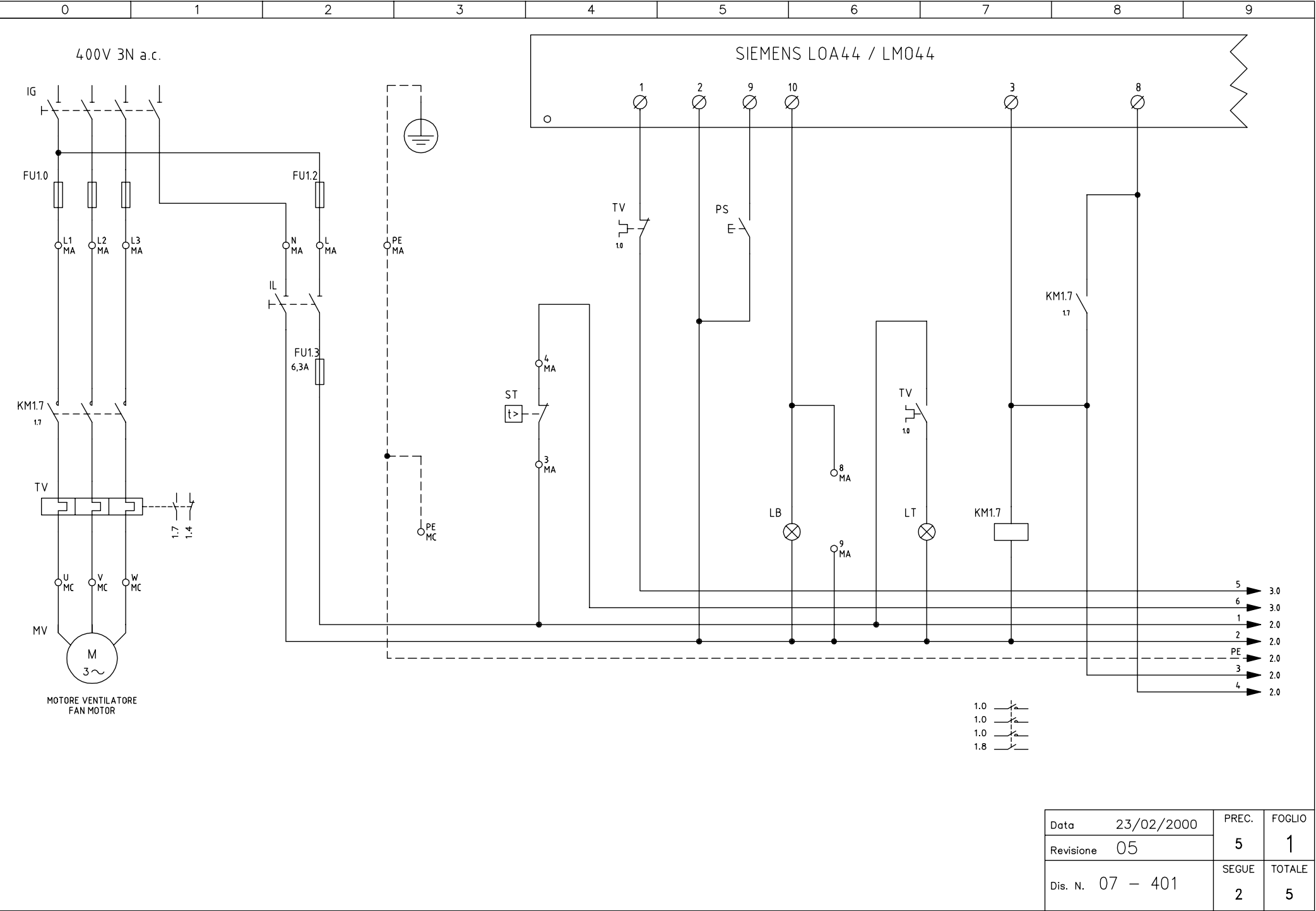
- I
- II
- III
- V
- ALTA FIAMMA
HIGH FLAME
- SOSTA E ACCENSIONE
STAND-BY AND IGNITION
- BASSA FIAMMA
LOW FLAME
- CONSENSO ALLA PARTENZA
INPUT TO START

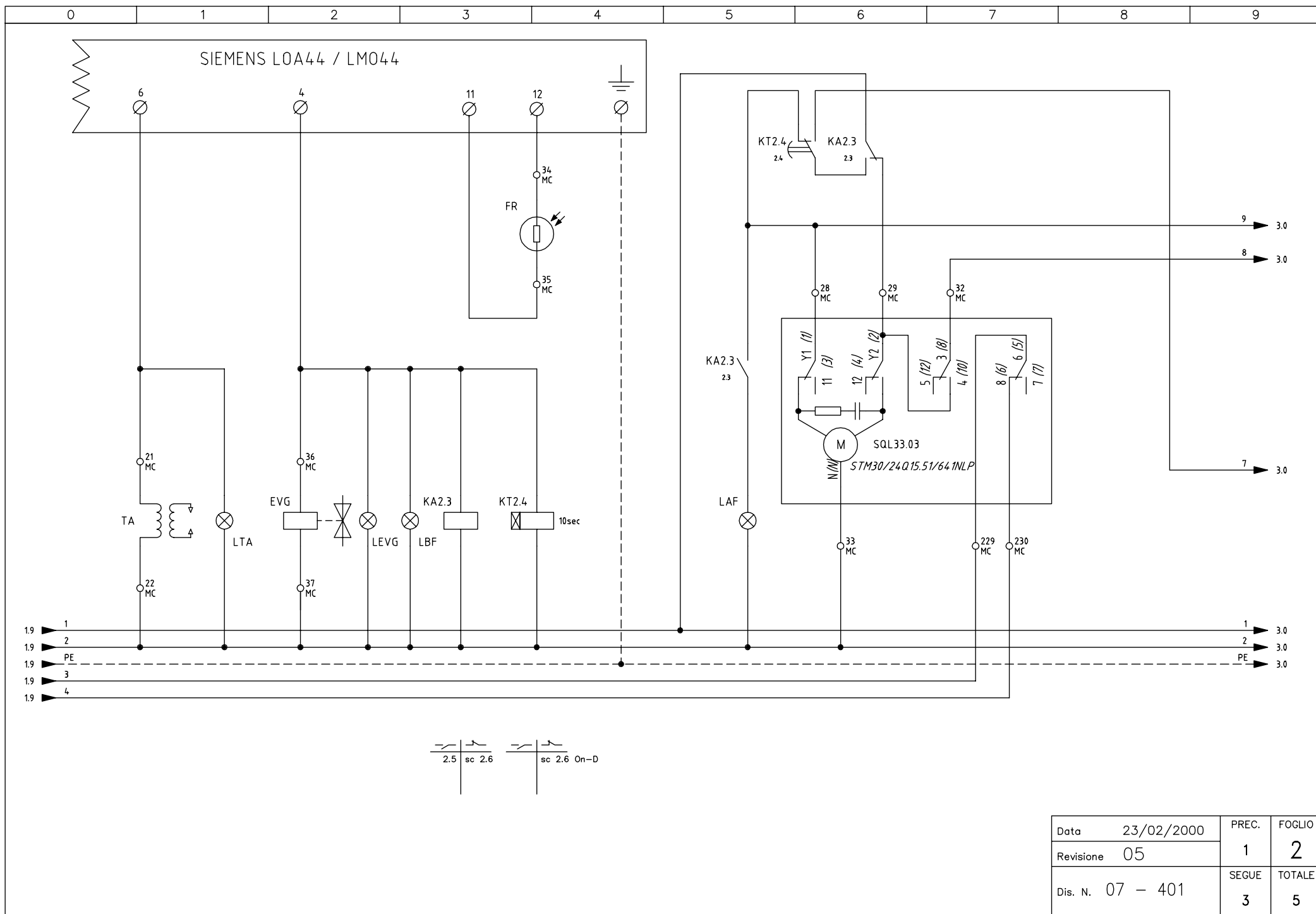


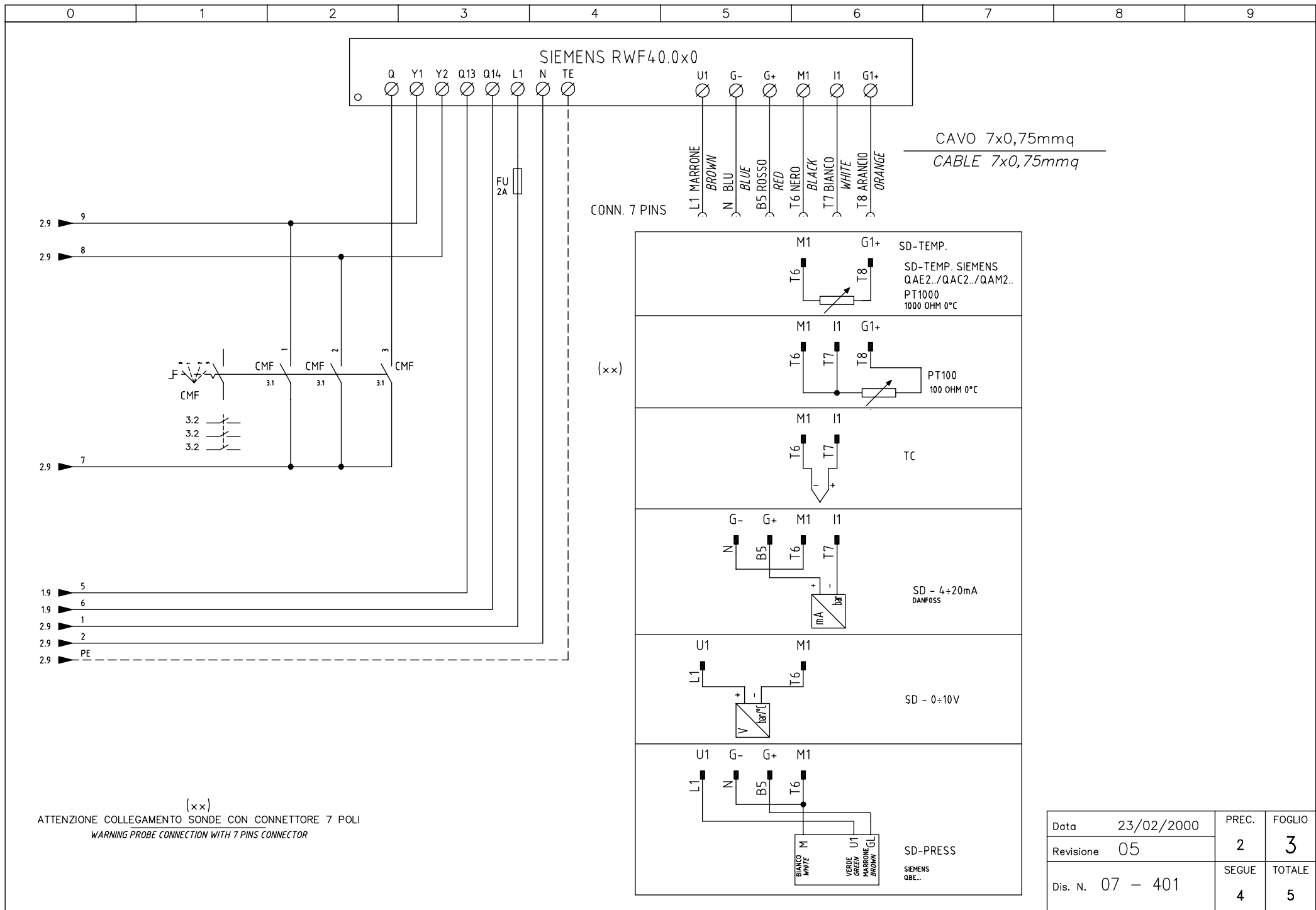
Data	11/12/1996	PREC.	FOGLIO
Revisione	04	2	3
Dis. N.	07 - 352	SEGUE	TOTALE
		4	4

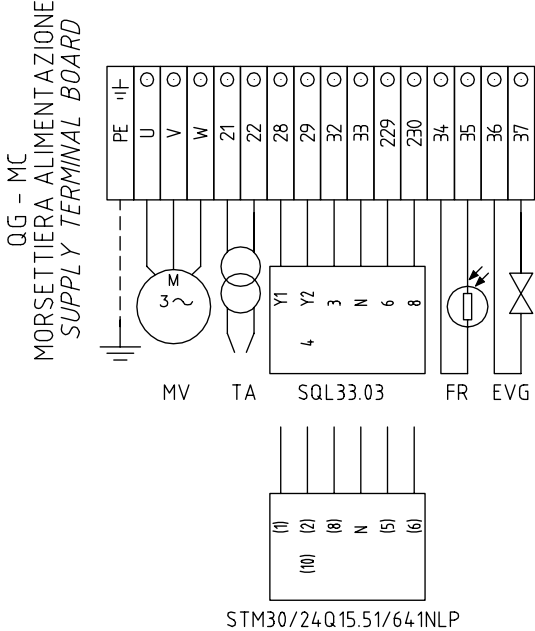
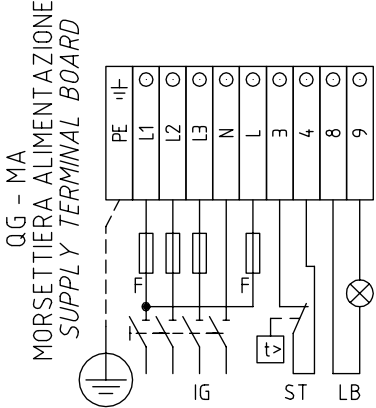
0	1	2	3	4	5	6	7	8	9
SIGLA/ITEM	FOGLIO/SHEET	FUNZIONE	FUNCTION						
EVG	2	ELETTROVALVOLA GASOLIO	LIGHT OIL ELECTRO-VALVE						
FR	2	FOTORESISTENZA RILEVAZIONE FIAMMA	PHOTORESISTOR FLAME DETECTOR						
FU1.0	1	FUSIBILI DI LINEA	LINE FUSES						
FU1.2	1	FUSIBILE DI LINEA	LINE FUSE						
FU1.3	1	FUSIBILE LINEA AUSILIARI	AUXILIARY LINE FUSE						
IG	1	INTERRUTTORE GENERALE	MAIN DISCONNECTOR						
IL	1	INTERRUTTORE LINEA AUSILIARI	AUXILIARY LINE SWITCH						
KA2.3	2	RELE' AUSILIARIO	AUXILIARY RELAY						
KM1.7	1	CONTATTORE MOTORE VENTILATORE	FAN MOTOR CONTACTOR						
KT2.4	2	RELE' TEMPORIZZATORE	DELAYED RELAY						
LAF	2	LAMPADA SEGNALAZIONE ALTA FIAMMA BRUCIATORE	BURNER IN HIGH FLAME INDICATOR LIGHT						
LB	1	LAMPADA SEGNALAZIONE BLOCCO FIAMMA	BURNER LOCK-OUT INDICATOR LIGHT						
LBF	2	LAMPADA SEGNALAZIONE BASSA FIAMMA BRUCIATORE	BURNER IN LOW FLAME INDICATOR LIGHT						
LEVG	2	LAMPADA SEGNALAZIONE APERTURA EVG	INDICATOR LIGHT FOR OPENING OF ELECTRO-VALVE EVG						
LT	1	LAMPADA SEGNALAZIONE BLOCCO TERMICO MOTORE VENTILATORE	INDICATOR LIGHT FOR FAN OVERLOAD TRIPPED						
LTA	2	LAMPADA SEGNALAZIONE TRASFORMATORE DI ACCENSIONE	IGNITION TRANSFORMER INDICATOR LIGHT						
MV	1	MOTORE VENTILATORE	FAN MOTOR						
PS	1	PULSANTE SBLOCCO FIAMMA	LOCK-OUT RESET BUTTON						
SIEMENS LOA44 / LM044	1	APPARECCHIATURA CONTROLLO FIAMMA	FLAME MONITOR DEVICE						
SQL33.03	2	SERVOCOMANDO SERRANDA ARIA	AIR DAMPER SERVO CONTROL						
ST	1	SERIE TERMOSTATI/PRESSOSTATI	SERIES OF THERMOSTATS OR PRESSURE SWITCHES						
STM30/24Q15.51/641NLP	2	SERVOCOMANDO SERRANDA ARIA (ALTERNATIVO)	AIR DAMPER SERVO CONTROL (ALTERNATIVE)						
TA	2	TRASFORMATORE DI ACCENSIONE	IGNITION TRANSFORMER						
TAB	2	TERMOSTATO/PRESSOSTATO ALTA-BASSA FIAMMA	HIGH-LOW THERMOSTAT/PRESSURE SWITCHES						
TV	1	TERMICO MOTORE VENTILATORE	FAN MOTOR THERMAL						

Data	11/12/1996	PREC.	FOGLIO
Revisione	04	3	4
Dis. N.	07 - 352	SEGUE	TOTALE
		1	4









CAMME SERVOCOMANDO

ACTUATOR CAMS

SQL33.03

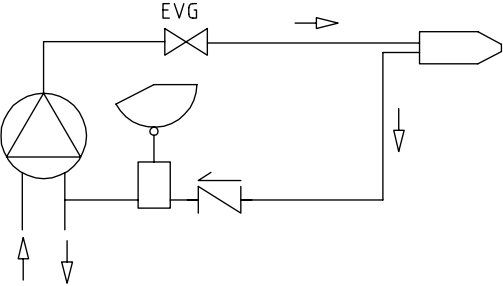
- Y1
- Y2
- 3
- 6
- ALTA FIAMMA
HIGH FLAME
- SOSTA E ACCENSIONE
STAND-BY AND IGNITION
- BASSA FIAMMA
LOW FLAME
- CONSENSO ALLA PARTENZA
INPUT TO START

SERVOCOMANDO SERRANDA ARIA (ALTERNATIVO)

AIR DAMPER ACTUATOR (ALTERNATIVE)

STM30/24Q15.51/641NLP

- I
- II
- III
- V
- ALTA FIAMMA
HIGH FLAME
- SOSTA E ACCENSIONE
STAND-BY AND IGNITION
- BASSA FIAMMA
LOW FLAME
- CONSENSO ALLA PARTENZA
INPUT TO START



Data	23/02/2000	PREC.	FOGLIO
Revisione	05	3	4
Dis. N.	07 - 401	SEGUE	TOTALE
		5	5

0	1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---	---

SIGLA/ITEM	FOGLIO/SHEET	FUNZIONE	FUNCTION
CMF	3	COMMUT. MANUALE FUNZ. 0)FERMO 1)ALTA FIAMMA 2)BASSA FIAMMA 3)AUTOMATICO	MANUAL SWITCH 0)OFF 1)HIGH FLAME 2)LOW FLAME 3)AUTOMATIC
EVG	2	ELETTROVALVOLA GASOLIO	LIGHT OIL SOLENOID VALVE
FR	2	FOTORESISTENZA RILEVAZIONE FIAMMA	PHOTORESISTOR FLAME DETECTOR
FU	3	FUSIBILE	FUSE
FU1.0	1	FUSIBILI DI LINEA	LINE FUSES
FU1.2	1	FUSIBILE DI LINEA	LINE FUSE
FU1.3	1	FUSIBILE LINEA AUSILIARI	AUXILIARY LINE FUSE
IG	1	INTERRUTTORE GENERALE	MAINS SWITCH
IL	1	INTERRUTTORE LINEA AUSILIARI	AUXILIARY LINE SWITCH
KA2.3	2	RELE' AUSILIARIO	AUXILIARY RELAY
KM1.7	1	CONTATTORE MOTORE VENTILATORE	FAN MOTOR CONTACTOR
KT2.4	2	RELE' TEMPORIZZATORE	DELAYED RELAY
LAF	2	LAMPADA SEGNALE ALTA FIAMMA BRUCIATORE	BURNER IN HIGH FLAME INDICATOR LIGHT
LB	1	LAMPADA SEGNALE BLOCCO FIAMMA	BURNER LOCK-OUT INDICATOR LIGHT
LBF	2	LAMPADA SEGNALE BASSA FIAMMA BRUCIATORE	BURNER IN LOW FLAME INDICATOR LIGHT
LEVG	2	LAMPADA SEGNALE APERTURA EVG	INDICATOR LIGHT FOR OPENING OF ELECTRO-VALVE EVG
LT	1	LAMPADA SEGNALE BLOCCO TERMICO MOTORE VENTILATORE	INDICATOR LIGHT FOR FAN OVERLOAD TRIPPED
LTA	2	LAMPADA SEGNALE TRASFORMATORE DI ACCENSIONE	IGNITION TRANSFORMER INDICATOR LIGHT
MV	1	MOTORE VENTILATORE	FAN MOTOR
PS	1	PULSANTE SBLOCCO FIAMMA	LOCK-OUT RESET BUTTON
PT100	3	SONDA DI TEMPERATURA	TEMPERATURE PROBE
SD-PRESS	3	SONDA DI PRESSIONE	PRESSURE PROBE
SD-TEMP.	3	SONDA DI TEMPERATURA	TEMPERATURE PROBE
SD - 0÷10V	3	TRASDUTTORE USCITA IN TENSIONE	TRANSDUCER VOLTAGE OUTPUT
SD - 4÷20mA	3	TRASDUTTORE USCITA IN CORRENTE	TRANSDUCER CURRENT OUTPUT
SIEMENS LOA44 / LM044	1	APPARECCHIATURA CONTROLLO FIAMMA	CONTROL BOX
SIEMENS RWF40.0x0	3	REGOLATORE MODULANTE	BURNER MODULATOR
SQL33.03	2	SERVOCOMANDO SERRANDA ARIA	AIR DAMPER ACTUATOR
ST	1	SERIE TERMOSTATI/PRESSOSTATI	SERIES OF THERMOSTATS OR PRESSURE SWITCHES
STM30/24Q15.51/641NLP	2	SERVOCOMANDO SERRANDA ARIA (ALTERNATIVO)	AIR DAMPER ACTUATOR (ALTERNATIVE)
TA	2	TRASFORMATORE DI ACCENSIONE	IGNITION TRANSFORMER
TC	3	TERMOCOPPIA	THERMOCOUPLE
TV	1	TERMICO MOTORE VENTILATORE	FAN MOTOR THERMAL

Data	23/02/2000	PREC.	FOGLIO
Revisione	05	4	5
Dis. N.	07 - 401	SEGUE /	TOTALE 5

APPENDICE

APPARECCHIATURA DI COMANDO E CONTROLLO FIAMMA SIE-MENS LMO14 - LMO24 - LMO44

Le apparecchiature di controllo fiamma LMO... sono progettate per l'avviamento e il controllo di bruciatori a gasolio mono o bistadio con tiraggio forzato, a funzionamento intermittente. Le fiamme gialle vengono controllate dai rivelatori a fotoresistenza QRB..., le fiamme blu dai rivelatori QRC...

In termini di ingombro, collegamenti elettrici e rivelatori di fiamma, la serie LMO... è identica agli apparecchi di controllo fiamma LOA...

Condizioni indispensabili per l'avviamento

- Apparecchio di controllo fiamma sbloccato
- Tutti i consensi della linea di alimentazione sono chiusi
- Non ci sono abbassamenti di tensione
- Il rivelatore di fiamma è al buio, nessuna luce estranea

Sicurezza alle basse tensioni

- Nel normale funzionamento, se la tensione scende al di sotto di 165V ca., l'apparecchio esegue un arresto di sicurezza
- Quando la tensione supera 175V ca., l'apparecchio si riavvia automaticamente

Controllo del tempo di intervento del preriscaldatore di gasolio

Se il contatto di consenso del preriscaldatore di gasolio non si chiude entro 10 minuti, l'apparecchio di controllo fiamma andrà in blocco.

Funzionamento intermittente

Dopo non più di 24 ore di funzionamento continuo, l'apparecchio effettua un arresto di sicurezza automatico e quindi si riavvia.

Sequenza dei comandi in caso di anomalia

In caso di blocco vengono disattivate immediatamente le uscite delle valvole del combustibile e l'accensione (<1 secondo).

Causa	Azione
Dopo una interruzione di tensione	Riavviamento
Dopo che la tensione è scesa sotto la soglia minima consentita	Riavviamento
Nel caso di presenza prematura del segnale di fiamma o di segnale difettoso durante "t1" (tempo di preventilazione)	Arresto di blocco al termine di «t1»
Nel caso di presenza prematura del segnale di fiamma o di segnale difettoso durante "tw" (tempo di preriscaldamento)	Viene impedito l'avviamento, arresto di blocco dopo non più di 40 secondi
Se il bruciatore non si accende durante il tempo "TSA"	In blocco al termine di "TSA"
In caso di mancanza fiamma in funzionamento	Max. 3 ripetizioni del ciclo di avviamento, seguite da blocco fiamma.
Il contatto di consenso del preriscaldatore di gasolio non si chiude entro 10 minuti.	Arresto di blocco

Arresto di blocco

In caso di blocco, l'apparecchio LMO rimane in blocco (il blocco non può essere modificato), e si accende la lampada-spia rossa. Anche nel caso di mancanza di tensione l'apparecchio reagisce allo stesso modo.

Sblocco del bruciatore

In caso di blocco, è possibile sbloccare immediatamente l'apparecchio di controllo fiamma. E' sufficiente tenere premuto il pulsante di sblocco per circa 1 secondo (<3 secondi).

Programma di accensione con LMO24.113A2

In caso di mancanza fiamma durante il tempo "TSA", il bruciatore viene riacceso, ma non dopo il termine di "TSAmass". Pertanto durante il tempo di TSA è possibile effettuare diversi tentativi di accensione (vedi "Sequenza del ciclo").

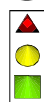
Limite di ripetizioni

Se si verifica una mancanza di fiamma durante il funzionamento, l'apparecchio ripete il ciclo di avviamento per un massimo di tre volte. Se durante il funzionamento la fiamma viene a mancare per la quarta volta, il bruciatore andrà in blocco. Il conteggio delle ripetizioni riparte ogni volta che interviene l'accensione comandata tramite "R-W-SB".

Funzionamento



Il pulsante di sblocco "EK..." è l'elemento chiave per lo sblocco dell'apparecchio di controllo fiamma e per l'attivazione/disattivazione delle funzioni di diagnostica.



Il LED a tre colori è l'elemento chiave per l'indicazione della diagnosi visiva e della diagnosi dell'interfaccia.

- s Rosso
l Giallo
o Verde

Tabella dei codici di colore

Stato	Codice colore	Colore
Il preriscaldatore di gasolio è in funzione, tempo di attesa "tw"	llllllllll	Giallo
Fase di accensione, accensione controllata	lmlmlmlml	Giallo - spento
Funzionamento, fiamma regolare	oooooooooooo	Verde
Funzionamento, fiamma non regolare	omomomomo	Verde - spento
Abbassamento di tensione	lslslsls	Giallo - Rosso
Anomalia - allarme	ssssssssss	Rosso
Codice di anomalia (vedi Tabella dei codici di anomalia)	smsmsmsmsm	Rosso - spento
Luce estranea prima dell'avviamento del bruciatore	osososososo	Verde - Rosso
Diagnosi dell'interfaccia	ssssssssssssss	Rosso - intermittenza veloce

Legenda

- m Spento
l Giallo
o Verde
s Rosso

Diagnosi della causa di anomalia

In questa condizione, è possibile attivare il sistema di diagnostica che indica la causa dell'anomalia, interpretabile in base alla tabella dei codici di errore; è sufficiente tenere premuto il pulsante di sblocco per più di tre secondi.

Tabella dei codici di errore

Numero lampeggi	Possibile causa
2 lampeggi **	● Mancanza di fiamma al termine del tempo TSA ● Valvole combustibile difettose o sporche ● Rivelatore di fiamma difettoso o sporco ● Regolazione imprecisa del bruciatore, mancanza di combustibile ● Accensione difettosa
3 lampeggi ***	Posizione libera
4 lampeggi ****	Luce estranea all'avviamento del bruciatore
5 lampeggi *****	Posizione libera
6 lampeggi ****	Posizione libera
7 lampeggi *****	● Numero eccessivo di mancanze di fiamma durante il funzionamento (limitazione del numero di ripetizioni del ciclo di avviamento) ● Valvole del combustibile difettose o sporche ● Rivelatore di fiamma difettoso o sporco ● Regolazione imprecisa del bruciatore
8 lampeggi *****	Controllo del tempo di intervento del preriscaldatore di gasolio
9 lampeggi *****	Posizione libera
10 lampeggi *****	Errore di cablaggio o errore interno, contatti in uscita

Mentre è in corso la diagnosi della causa dell'anomalia, le uscite dei comandi sono disattivate.

- Il bruciatore rimane spento

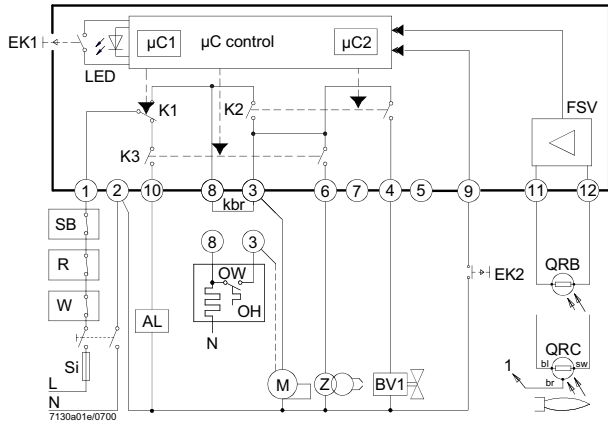
Sbloccando l'apparecchio di controllo fiamma si interrompe la diagnosi della causa dell'anomalia e il bruciatore si accende nuovamente.

- Si attiva il segnale di anomalia "AL" al morsetto 10

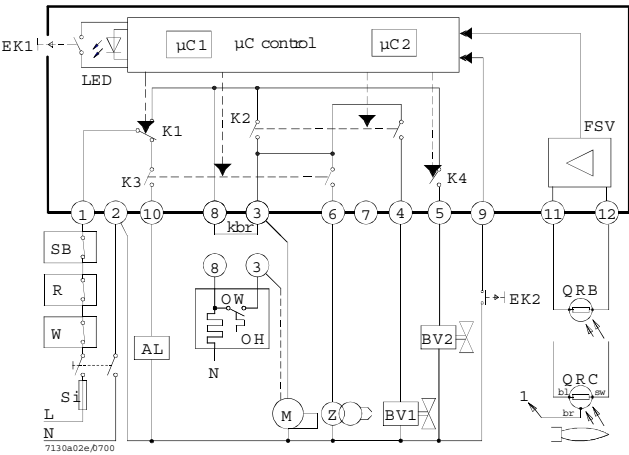
Tenere premuto il pulsante di sblocco per circa 1 secondo (< 3 secondi).

Schema elettrico e schema interno

LMO14

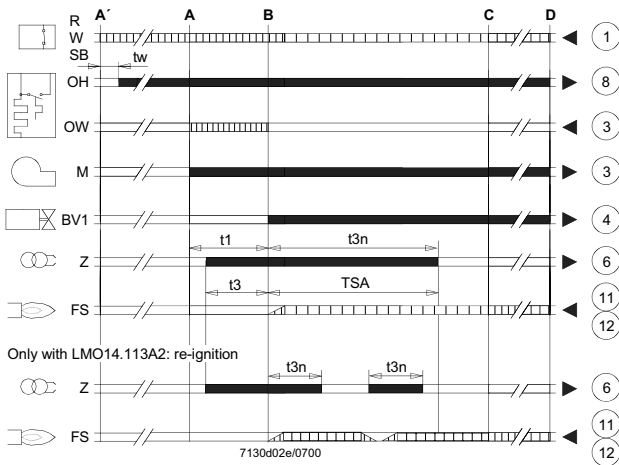


LMO24 - LMO44

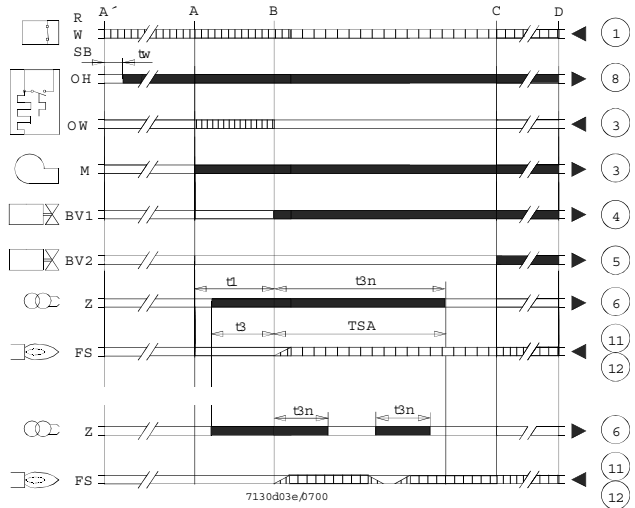


Sequenza dei comandi

LMO14



LMO24 - LMO44



Legenda

- AL Dispositivo di allarme
- Kbr... collegamento per cavo (necessario solo per bruciatori senza preriscaldatore di gasolio)
- BV... Valvola del combustibile
- EK1 Pulsante di sblocco
- EK2 Pulsante di sblocco a distanza
- FS Segnale di presenza fiamma
- FSV Amplificatore del segnale di fiamma
- K... Contatti del relè di comando
- LED Luci-spia a tre colori
- M Motore del bruciatore
- OW Contatto di consenso del preriscaldatore
- t1 Tempo di preventilazione
- t3 Tempo di preaccensione
- t3n Tempo di post-accensione
- A' Inizio della sequenza di avviamento per bruciatori con pre-riscaldatore di gasolio
- A Inizio della sequenza di avviamento per bruciatori senza pre-riscaldatore di gasolio
- Segnali di uscita dell'apparecchio
- Segnali necessari in ingresso

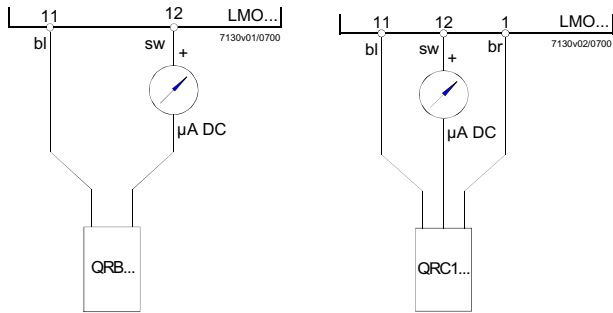
Legenda

- OH Preriscaldatore di gasolio
- QRB Rivelatore a fotoresistenza
- QRC Rivelatore di fiamma blu
- bl = blu
- br = marrone
- sw = nero
- R Termostato o pressostato di regolazione
- SB Termostato di sicurezza
- Si Fusibile esterno
- W Termostato o pressostato di sicurezza
- Z Trasformatore di accensione
- t4 Intervallo tra il segnale di fiamma e il consenso a "BV2"
- TSA Tempo di sicurezza all'accensione
- tw Tempo di attesa per il preriscaldamento del gasolio
- B Tempo per la presenza di fiamma
- C Posizione di funzionamento
- D Arresto di regolazione tramite "R"
- μC1 Microprocessore 1
- μC2 Microprocessore 2

Caratteristiche tecniche

Tensione	AC 230 V +10 % / -15 %	
	AC 110 V +10 % / -15 %	
Frequenza	50...60 Hz ±6 %	
Fusibile esterno	(Si) 5 A (fusione lenta)	
Potenza assorbita	12 VA	
Posizione di montaggio	qualsiasi	
Peso	200 g circa	
Protezione	IP 40	
Lunghezza massima consentita dei cavi, max. 3 m		
capacità di linea	100 pF/m	
Lunghezza del cavo del rivelatore 20 m, posa separata		
Sblocco a distanza	20m	
Corrente massima ammessa a $\cos\varphi \geq 0.6$		
	LMO14	LMO24-LMO44
Morsetto 1	5A	5 A
Morsetti 3 e 8	3A	5 A
Morsetti 4, 5, 6 e 10	1A	1 A
Supervisione della fiamma con	QRB e QRC	
	QRB	QRC
Min. intensità di corrente di rivelazione necessaria (con fiamma)		
	45 µA	70 µA
Min. intensità di corrente di rivelazione necessaria (senza fiamma)		
	5.5 µA	5.5 µA
Massima intensità di corrente possibile)		
	100 µA	100 µA

Circuito per la misurazione della corrente di rilevazione



Legenda

- µA Microamperometro DC con resistenza interna da 5k W max.
- bl Blu
- sw Nero
- br Marrone



C.I.B. UNIGAS S.p.A.
Via L.Galvani, 9 - 35011 Campodarsego (PD) - ITALY
Tel. +39 049 9200944 - Fax +39 049 9200945/9201269
web site: www.cibunigas.it - e-mail: cibunigas@cibunigas.it

Note: Specifications and data subject to change. Errors and omissions excepted.