

PBY1025
PBY1030
PBY1040

Progressive, Fully-modulating
Heavy 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>Burner model identification</i>	6
<i>Technical Specifications</i>	6
<i>Performance Curves</i>	7
<i>Overall dimensions</i>	8
INSTALLING THE BURNER	9
<i>Packing</i>	9
<i>Handling the burner</i>	9
<i>Fitting the burner to the boiler</i>	9
<i>Electrical connections</i>	10
<i>Fan motor and pump motor direction</i>	11
<i>Connecting the oil heating resistors</i>	11
<i>Recommendations to design heavy oil feeding plant</i>	11
<i>Pipe heating system</i>	12
<i>Inlet minimum pressure of the pump (both for supplying system and burner)</i>	12
<i>Pump operating maximum pressure (both for the supplying system and burner)</i>	12
<i>Adjusting the supplying oil ring</i>	12
<i>Burner adjustments</i>	12
HYDRAULIC DIAGRAMS	16
<i>Pilot gas train</i>	22
<i>Light oil pilot</i>	23
<i>Heavy oil pumps</i>	23
<i>Light oil pilot pump</i>	24
<i>About the use of fuel pumps</i>	24
<i>Connecting the oil flexible hoses to the burner</i>	25
<i>Connecting the compressed air hoses</i>	25
ADJUSTING AIR AND FUEL RATE	26
<i>Pneumatic noozles</i>	27
<i>Oil thermostat adjustment</i>	28
<i>Adjusting the pilot gas flow rate: gas valve Brahma EG12xR and pressure governor</i>	28
<i>Adjustments - brief description</i>	28
<i>Oil Flow Rate Settings</i>	29
<i>Calibration of air pressure switch</i>	31
<i>Fully-modulating burners</i>	31
<i>EVL air valve for gun cleaning</i>	32
PART II: OPERATION	33
OPERATION	33
<i>Control panel</i>	34
PART III: MAINTENANCE	35
<i>Maintenance of the gas governor with filter (pilot gas train)</i>	36
<i>Removing the combustion head</i>	36
<i>Removing the oil gun, replacing/adjusting the nozzle and the ignition electrode</i>	37
<i>Checking the detection current</i>	38
<i>Cleaning and replacing the detection photoresistor</i>	38
<i>Seasonal stop</i>	38
<i>Burner disposal</i>	38
TROUBLESHOOTING	39
BURNER EXPLODED VIEW	40
SPARE PARTS	42
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:

- Remove the power supply by disconnecting the power cord from the mains.
- 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:
 - set the burner fuel flow rate depending on the heat input of the appliance;
 - 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;
 - 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;
 - make sure that control and safety devices are operating properly;
 - make sure that exhaust ducts intended to discharge the products of combustion are operating properly;
 - on completion of setting and adjustment operations, make sure that all mechanical locking devices of controls have been duly tightened;
 - 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 electricians 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 2009/142/EC - Gas Appliances;
- Directive 2006/95/EC on low voltage;
- Directive 2004/108/EC on electromagnetic compatibility

Harmonised standards :

- UNI EN 676 (Gas Burners;-EN 55014-1Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus.
- 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.
- 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:

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

Harmonised standards :

- CEI EN 60335-1(Household and similar electrical appliances - Safety. Part 1: General requirements;
- UNI 267 Automatic forced draught burners for liquid fuels
- EN 55014-1Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus.
- 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/EC on electromagnetic compatibility

Harmonised standards :

- CEI EN 60335-1 Household and similar electrical appliances - SafetyPart 1: General requirements;
- EN 55014-1Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus.
- 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 2009/142/EC - Gas Appliances;
- Directive 2006/95/EC on low voltage;
- Directive 2004/108/EC on electromagnetic compatibility

Harmonised standards :

- UNI EN 676 Gas Burners
- EN 55014-1Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus.
- UNI 267 Automatic forced draught burners for liquid fuels
- 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 2009/142/EC - Gas Appliances;
- Directive 2006/95/EC on low voltage;
- Directive 2004/108/EC on electromagnetic compatibility

Harmonised standards :

-EN 55014-1 Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus.

-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

Industrial burners

European directives:

- Directive 2009/142/EC - Gas Appliances;

- Directive 2006/95/EC on low voltage;

- Directive 2004/108/EC on electromagnetic compatibility

Harmonised standards :

-EN 55014-1 Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus.

-EN 50165 Electrical equipment of non-electric appliances for household and similar purposes. Safety requirements.

-UNI EN 746-2: Industrial thermoprocessing equipment

PART I: INSTALLATION

GENERAL FEATURES

This particular burner series has been developed to use compressed air or alternatively steam, to atomize heavy oil. In this way we have achieved higher efficiency compared to mechanical atomization. These burners are equipped with a low pressure nozzle which permits to save fuel and, above all, to preserve the whole system. All burners are progressive type, complete with electrical panel; oil pump motor to be separately installed by the final user. They are provided with self cleaning nozzle system. A supplying system of compressed air and steam at 8 bar must be provided on the site. All burners are ignited by means of a pilot flame burning LPG or Natural gas. The standard version of the burner uses compressed air to atomize oil fuel. If compressed air is not available on site, it is possible to use steam to atomise oil fuel by using a special kit. In any case compressed air is essential: to ignite the burner when steam is not available, to control valves and for self cleaning nozzle.

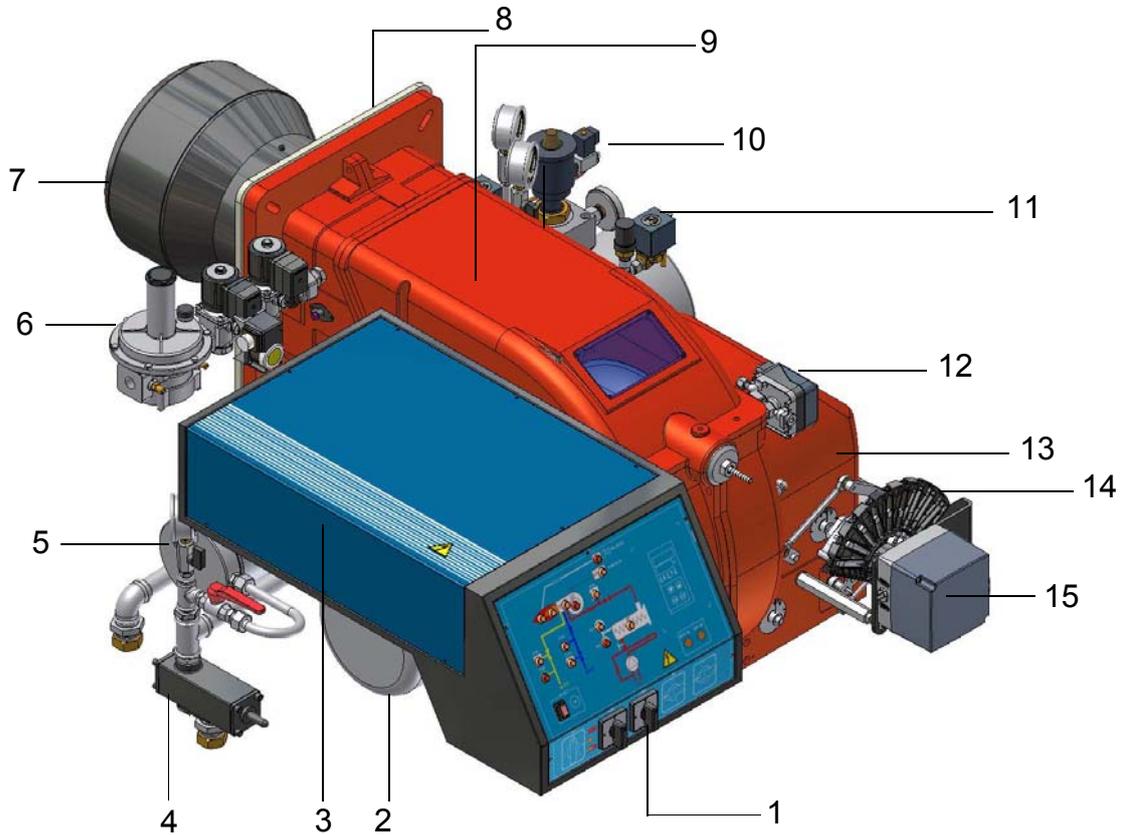


Fig. 1

- 1 Control panel
- 2 Fan motor
- 3 Electrical panel
- 4 Pressure governor
- 5 Oil pre-heater tank
- 6 Pilot gas train
- 7 Blast tube-combustion head
- 8 Burner flange
- 9 Burner cover
- 10 Oil train
- 11 Compressed air train
- 12 Air pressure switch
- 13 Air inlet
- 14 Adjusting cam
- 15 Actuator

Burner model identification

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

Type (1)	Model (2)	D- (3)	PR. (4)	S. (5)	*. (6)	A. (6)
(1) BURNER TYPE	PBY1025 - PBY1030 - PBY1040					
(2) FUEL	H - heavy oil, viscosity $\leq 4000\text{cSt}$ (530°E) @ 50°C					
(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

BURNER		PBY1025	PBY1030	PBY1040
Output	min - max kW	2550 - 8700	2550 - 10000	2550 - 13000
Fuel		Heavy oil		
Viscosity		See "Burner model identification" table		
Heavy oil rate	min. - max. kg/h	227 - 775	227 - 891	227 - 1160
Gas pressure	max. mbar	500		
Gas pressure after gas governor	mbar	100		
Compressed air pressure	min - max bar	4 - 10		
Power supply		400V 3N a.c. 50Hz		
Total power consumption	kW	44.1	59.6	79.6
Fan motor	kW	18.5	22	30
Pump motor	kW	1.1	1.1	1.1
Pre-heater resistors	kW	24	36	48
Protection		IP40		
Protection (if provided with light oil pilot)		IP21		
Operation		Progressive - Fully modulating		
Operating temperature	°C	(-10) / (+50)		
Storage Temperature	°C	(-20) / (+60)		
Working service*		Intermittent		

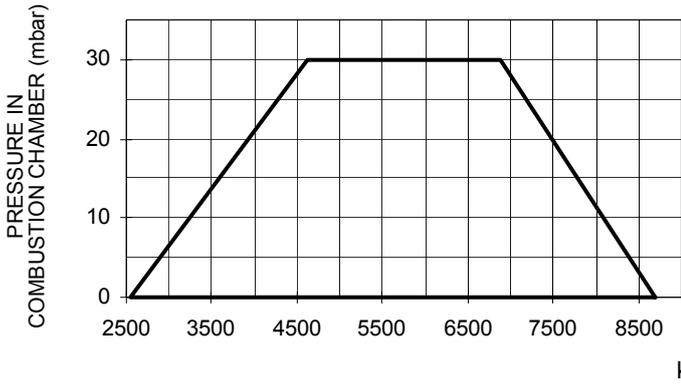
Heavy oil net calorific value (Hi): 9650 kcal/kg or 40395 kJ/kg (average value).

***NOTE ON THE BURNER WORKING SERVICE:** for safety reasons, one controlled shutdown must be performed after 24 hours of continuous operation.

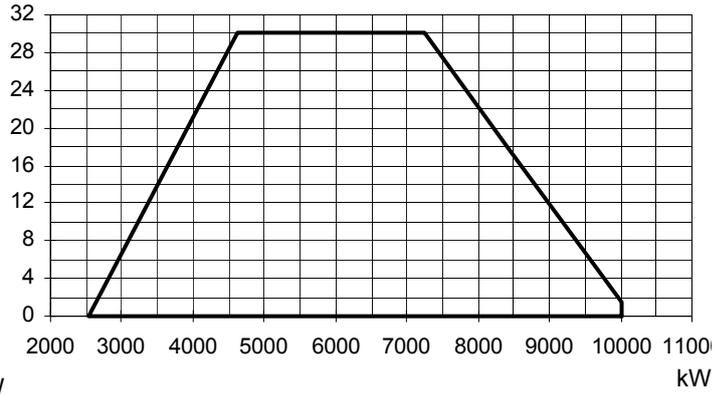
WARNING: the burners are supplied for 400V three phase supply; in case of three phase 230V supply, replace the thermal overload relays. Maximum output is referred to a null backpressure in the furnace.

Performance Curves

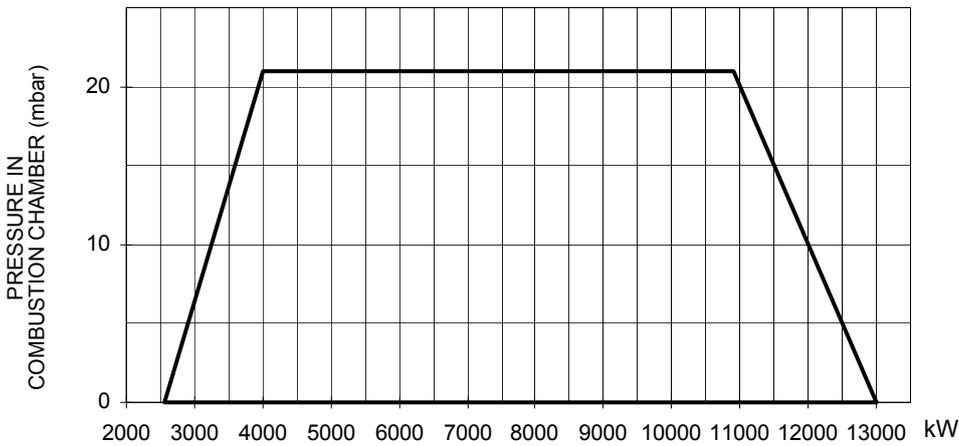
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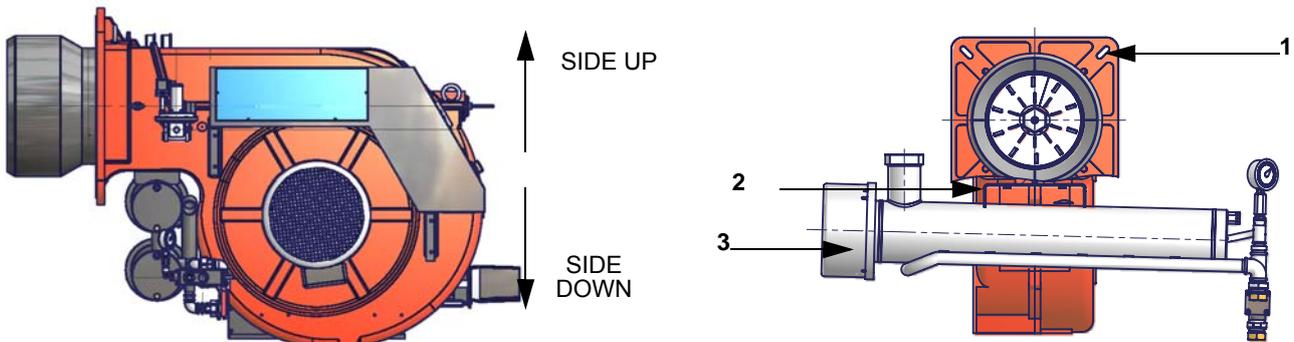


To get the input in kcal/h, multiply value in kW by 860.

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

NOTE: The performance curve is a diagram that represents the burner performance in the type approval phase or in the laboratory tests, but does not represent the regulation range of the machine. On this diagram the maximum output point is usually reached by adjusting the combustion head to its "MAX" position (see paragraph "Adjusting the combustion head"); the minimum output point is reached setting the combustion head to its "MIN" position. During the first ignition, the combustion head is set in order to find a compromise between the burner output and the generator specifications, that is why the minimum output may be different from the Performance curve minimum.

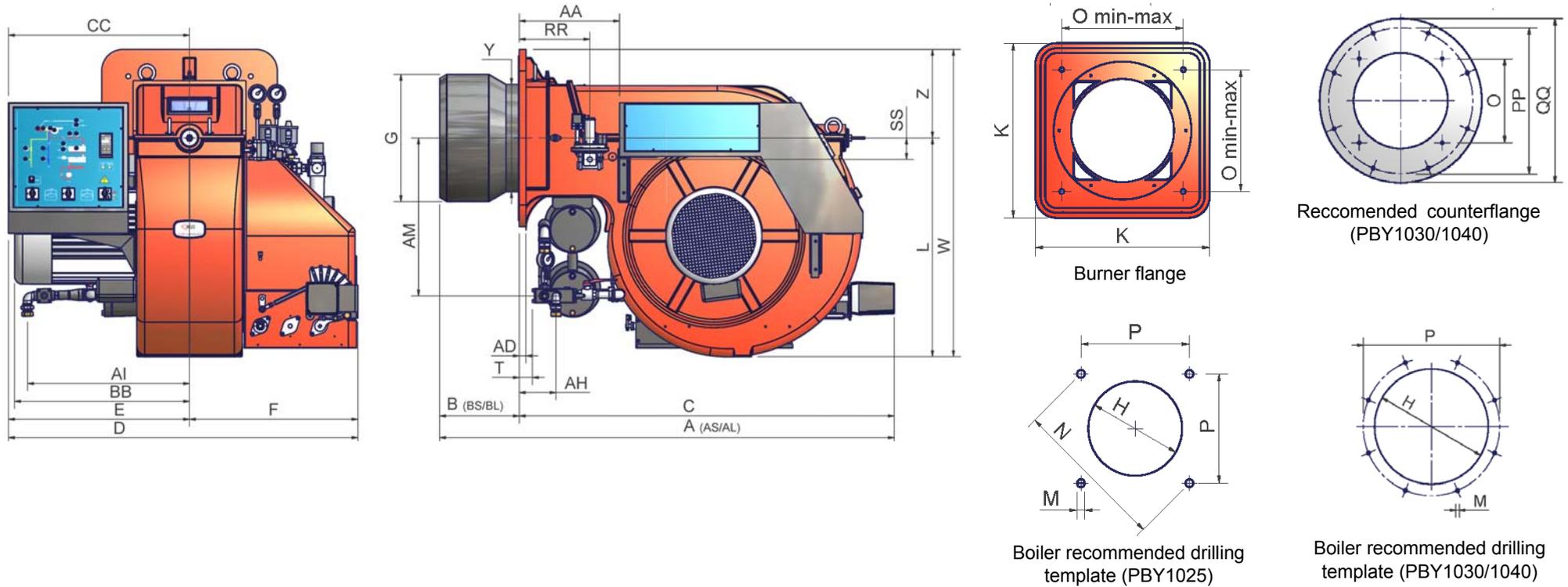
The burner is designed to work positioned according to the picture below. Set the upper side of the burner flange in a horizontal position, in order to find the correct inclination of the pre-heater tank. For different installations, please contact the Technical Department.



Key

- 1 Burner flange (upper side indicated)
- 2 Bracket
- 3 Pre-heater tank on the burner

Overall dimensions (mm)



8

	A(*S)	A(*L)	AA	AD	AH	AI	AM	B(*S)	B(*L)	BB	C	CC	D	E	F	G	H	K	L	M	N	O	P	PP	QQ	RR	SS	T	W	Y	Z
PBY1025	1784	1980	377	25	304	404	335	376	572	641	1408	680	1312	680	632	472	522	660	815	M16	651	460	460	x	x	265	80	49	1145	379	330
PBY1030	1761	2006	377	25	138	608	589	353	598	657	1408	680	1312	680	632	633	524	660	815	M16	x	460	460	800	900	265	80	49	1145	400	330
PBY1040	1769	1988	377	25	138	608	589	361	580	657	1408	680	1312	680	632	671	731	660	815	M16	x	460	800	800	900	265	80	49	1145	400	330

*S = measure referred to burner fitted with standard blast tube

*L = measure referred to burner fitted with extended blast tube

PBY1030/1040: It is necessary to place a counterflange between the burner and the boiler.

INSTALLING THE BURNER

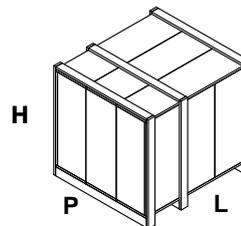
Packing

Burners are despatched in wooden crates whose dimensions are:

- 2280 mm x 1730 mm x 1360 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:

- burner;
- ceramic fibre plait to be inserted between the burner and the boiler;
- oil flexible hoses;
- oil filter;
- oil pump with motor;
- envelope containing this manual.

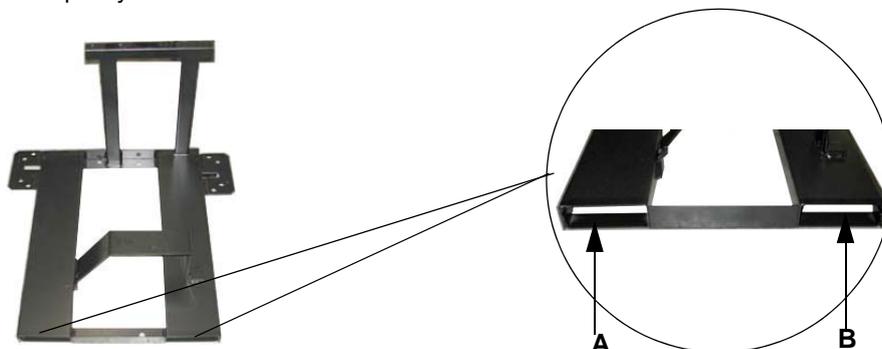


To get rid of the burner's packing, follow the procedures laid down by current laws on disposal of materials.

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.

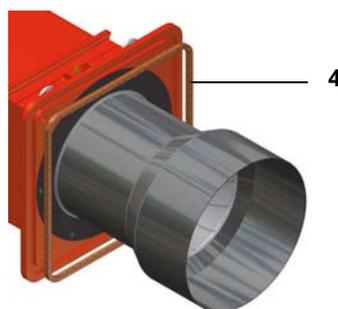
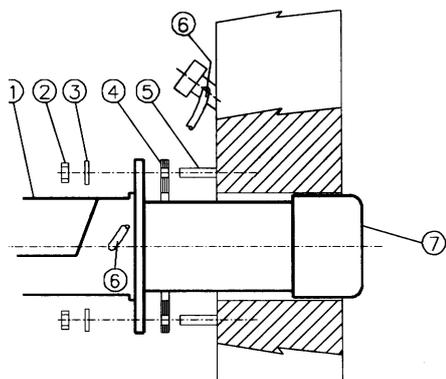
The burner is mounted on a stirrup provided for handling the burner by means of a fork lift truck: the forks must be inserted into the A and B ways. Remove the stirrup only once the burner is installed to the boiler.



Fitting the burner to the boiler

To perform the installation, proceed as follows:

- 1 drill the furnace plate as described in paragraph ("Overall dimensions");
- 2 place the burner towards the furnace plate: lift and move the burner by means of its eyebolts placed on the top side (see "Lifting and moving the burner");
- 3 screw the stud bolts (5) in the plate holes, according to the burner's drilling plate described on paragraph "Overall dimensions";
- 4 place the ceramic fibre plait on the burner flange;
- 5 install the burner into the boiler;
- 6 fix the burner to the stud bolts, by means of the fixing nuts, according to the picture below.
- 7 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 Ceramic fibre plait
- 5 Stud bolt
- 7 Blast tube

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.
	ATTENTION: 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.
	WARNING: 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.
	IMPORTANT: Connecting electrical supply wires to the burner terminal block MA, be sure that the ground wire is longer than phase and neutral ones.
	auxiliary contacts are provided (terminals no. 507 and no. 508 of the MA terminal block) to connect an intervention system (alarm/power supply cutoff) in case of fault of the oil resistor contactor (see Fig. 2-Fig. 3).

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 following diagrams,
- 3 check the direction of the fan-pump motor (see next paragraph)
- 4 refit the panel cover

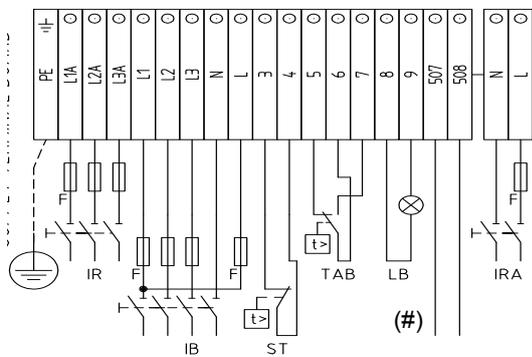


Fig. 2 - Progressive burners

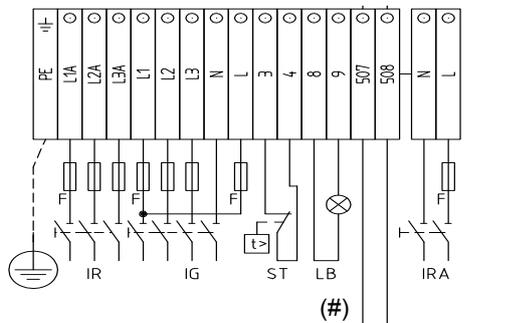


Fig. 3 - Fully modulating burners

(#) Free contact for "Faulty heater resistor contactor"

(**) Probes connection (see Fig. 4)

Probes connection

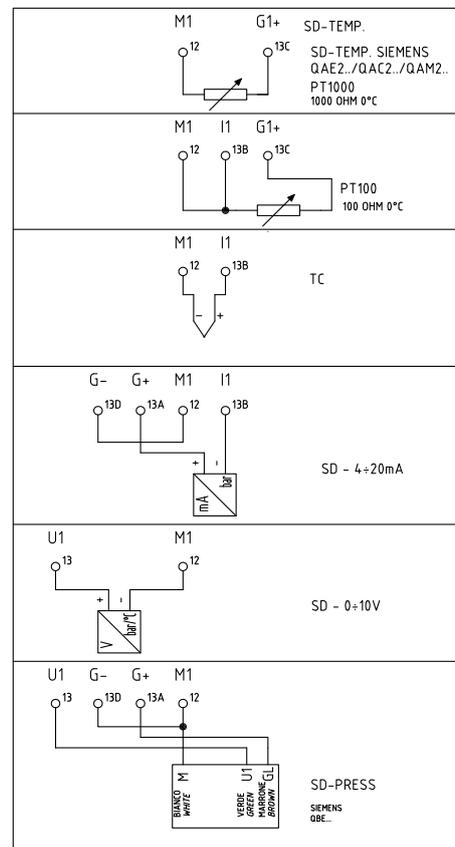


Fig. 4

Probes connection by means of the 7-pins plug (Fig. 5) - see Fig. 4 for connections.

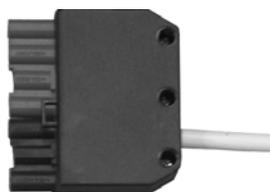
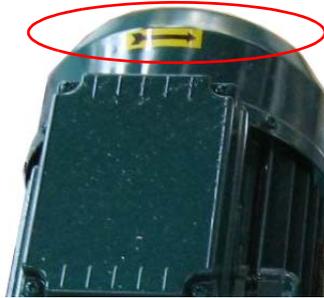


Fig. 5

Fan motor and pump motor direction

Once the electrical connection of the burner is performed, remember to check the rotation of the motor. The motor should rotate according to the arrow shown on the next picture. In the event of incorrect rotation reverse the three-phase supply and check again the rotation of the motor.

NOTE: burners are supplied 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.



Connecting the oil heating resistors

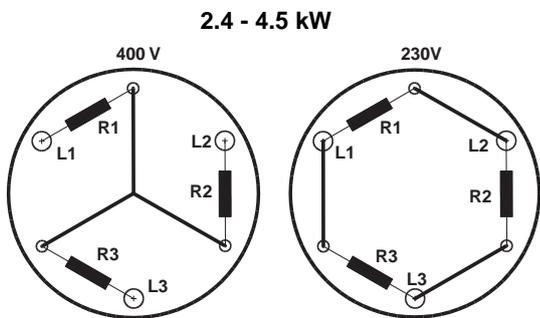


Fig. 6

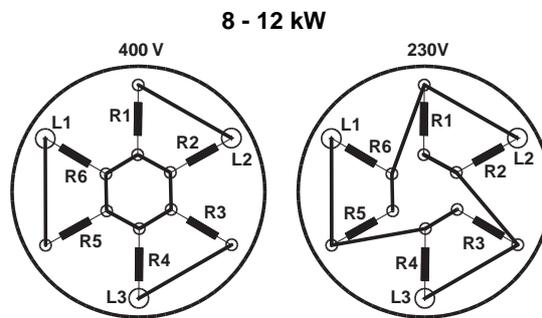


Fig. 7

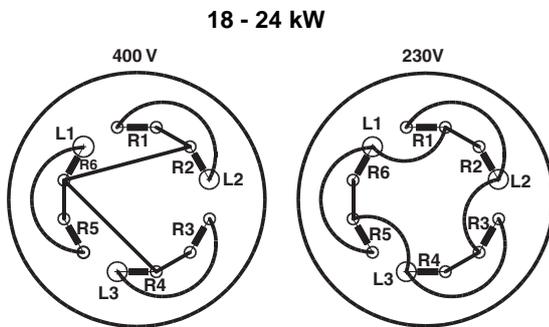


Fig. 8

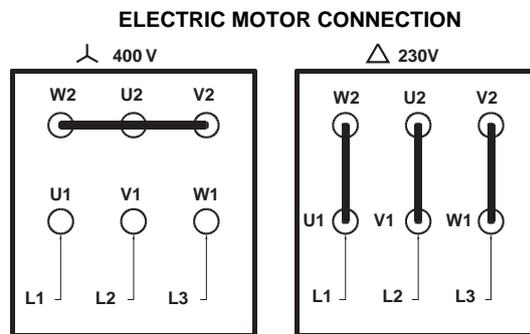


Fig. 9

Recommendations to design heavy oil feeding plant

This paragraph is intended to give some suggestions to make feeding plants for heavy oil burners. To get a regular burner operation, it is very important to design the supplying system properly. Here some suggestions will be mentioned to give a brief description.

The term "heavy oil" is generic and summarises several chemical-physical properties, above all viscosity. The excessive viscosity makes the oil impossible to be pumped, so it must be heated to let it flow in the pipeline; because of the low-boiling hydrocarbons and dissolved gases, the oil must be also pressurised. The pressurisation is also necessary to feed the burner pump avoiding its cavitation because of the high suction at the inlet. The supplying system scope is to pump and heat oil.

The oil viscosity is referred in various unit measures; the most common are: °E, cSt, Saybolt and Redwood scales. Table 3 shows the-various unit conversions (e.g.: 132 cSt viscosity corresponds to 17.5°E viscosity).

The diagram in shows how the heavy oil viscosity changes according to its temperature.

Example: an oil with 22°E viscosity at 50°C once heated to 100°C gets a 3 °E viscosity.

As far as the pumping capability, it depends on the type of the pump that pushes the oil even if on diagram in a generic limit is quoted at about 100 °E, so it is recommended to refer to the specifications of the pump provided.

Usually the oil minimum temperature at the oil pump inlet increases as viscosity does, in order to make the oil easy to pump. Referring to the diagram on Fig. 2, it is possible to realise that to pump an oil with 50°E viscosity at 50°C, it must be heated at about 80°C.

Pipe heating system

Pipe heating system must be provided, that is a system to heat pipes and plant components to maintain the viscosity in the pumping limits. Higher the oil viscosity and lower the ambient temperature, more necessary the pipe heating system.

Inlet minimum pressure of the pump (both for supplying system and burner)

A very low pressure leads to cavitation (signalled by its peculiar noise): the pump manufacturer declares the minimum value. Therefore, check the pump technical sheets.

By increasing the oil temperature, also the minimum inlet pressure at the pump must increase, to avoid the gassification of the oil low-boiling products and the cavitation. The cavitation compromises the burner operation, it causes the pump to break too. The diagram on Fig. 3 roughly shows the inlet pump pressure according to the oil temperature.

Pump operating maximum pressure (both for the supplying system and burner)

Remember that pumps and all the system components through which the oil circulates, feature an upper limit. Always read the technical documentation for each component.

Schemes on - - are taken from UNI 9248 "liquid fuel feeding lines from tank to burner" standard and show how a feeding line should be designed. For other countries, see related laws in force.

The pipe dimensioning, the execution and the winding dimensioning and other constructive details must be provided by the installer.

Adjusting the supplying oil ring

According to the heavy oil viscosity used, in the table below indicative temperature and pressure values to be set are shown.

Note: the temperature and pressure range allowed by the supplying ring components must be checked in the specifications table of the components themselves.

HEAVY OIL VISCOSITY AT 50 °C		PIPELINE PRESSURE	PIPELINE TEMPERATURE
cSt (°E)		bar	°C
	< 50 (7)	1- 2	20
> 50 (7)	< 110 (15)	1- 2	50
> 110 (15)	< 400 (50)	1- 2	65
> 400 (50)	< 4000 (530)	1- 2	100

Tab. 1 - Supply pipeline hydraulic scheme 3ID0024, pump n.4

Burner adjustments

The table below shows indicative values of temperature and pressure to be set on the burner devices, according to the viscosity of the heavy oil used. The oil temperature should be set on TR resistor thermostat in order to get about 1.5°E viscosity at the nozzle.

VISCOSITY AT 50 °C	OIL PRESSURE AFTER BURNER PUMP (N. 2 in 3I2-D02/03)		OIL PRESSURE AFTER OIL METERING VALVE (N. 14 IN 3I2-D02/03)		TEMPERATURE OF THE PRE-HEATING RESISTORS THERMOSTAT TR		TEMPERATURE OF THE RESISTORS SAFETY THERMOSTAT TRS	TEMPERATURE OF THE PLANT ENABLING THERMOSTAT TCI	
	min	max	min	max	min	max			
°E	bar		bar		°C		°C	°C	
< 50 (7)	5	8	0.5	2 (PBY1025/1030) / 4 (PBY1040)	70	95	190	50	
> 50 (7)	< 110 (15)	5	8	0.5	2 (PBY1025/1030) / 4 (PBY1040)	75	105	190	60
> 110 (15)	< 400 (50)	5	8	0.5	2 (PBY1025/1030) / 4 (PBY1040)	100	140	190	70
> 400 (50)	<4000 (530)	5	8	0.5	2 (PBY1025/1030) / 4 (PBY1040)	140	160	190	70

Tab. 2 - Burner - hydraulic scheme 3I2-D02/03, pump n.2

	<p>ATTENTION: Atomizing air pressure is typically set at 0.1 ÷ 0.3 bar lower than oil pressure (PBY1023/1030).</p> <p>Atomizing air pressure is typically set at 0.5 ÷ 1 bar lower than oil pressure (PBY1040).</p>
---	---

Viscosity units conversion table

Cinematics viscosity Centistokes (cSt)	Engler Degrees (°E)	Saybolt Seconds Universal (SSU)	Saybolt Seconds Furol (SSF)	Redwood Seconds no.1 (Standard)	Redwood Seconds no..2 (Admiralty)
1	1	31	--	29	--
2.56	1.16	35	--	32.1	--
4.3	1.31	40	--	36.2	5.1
7.4	1.58	50	--	44.3	5.83
10.3	1.88	60	--	52.3	6.77
13.1	2.17	70	12.95	60.9	7.6
15.7	2.45	80	13.7	69.2	8.44
18.2	2.73	90	14.44	77.6	9.3
20.6	3.02	100	15.24	85.6	10.12
32.1	4.48	150	19.3	128	14.48
43.2	5.92	200	23.5	170	18.9
54	7.35	250	28	212	23.45
65	8.79	300	32.5	254	28
87.6	11.7	400	41.9	338	37.1
110	14.6	500	51.6	423	46.2
132	17.5	600	61.4	508	55.4
154	20.45	700	71.1	592	64.6
176	23.35	800	81	677	73.8
198	26.3	900	91	762	83
220	29.2	1000	100.7	896	92.1
330	43.8	1500	150	1270	138.2
440	58.4	2000	200	1690	184.2
550	73	2500	250	2120	230
660	87.6	3000	300	2540	276
880	117	4000	400	3380	368
1100	146	5000	500	4230	461
1320	175	6000	600	5080	553
1540	204.5	7000	700	5920	645
1760	233.5	8000	800	6770	737
1980	263	9000	900	7620	829
2200	292	10000	1000	8460	921
3300	438	15000	1500	13700	--
4400	584	20000	2000	18400	--

Tab. 3

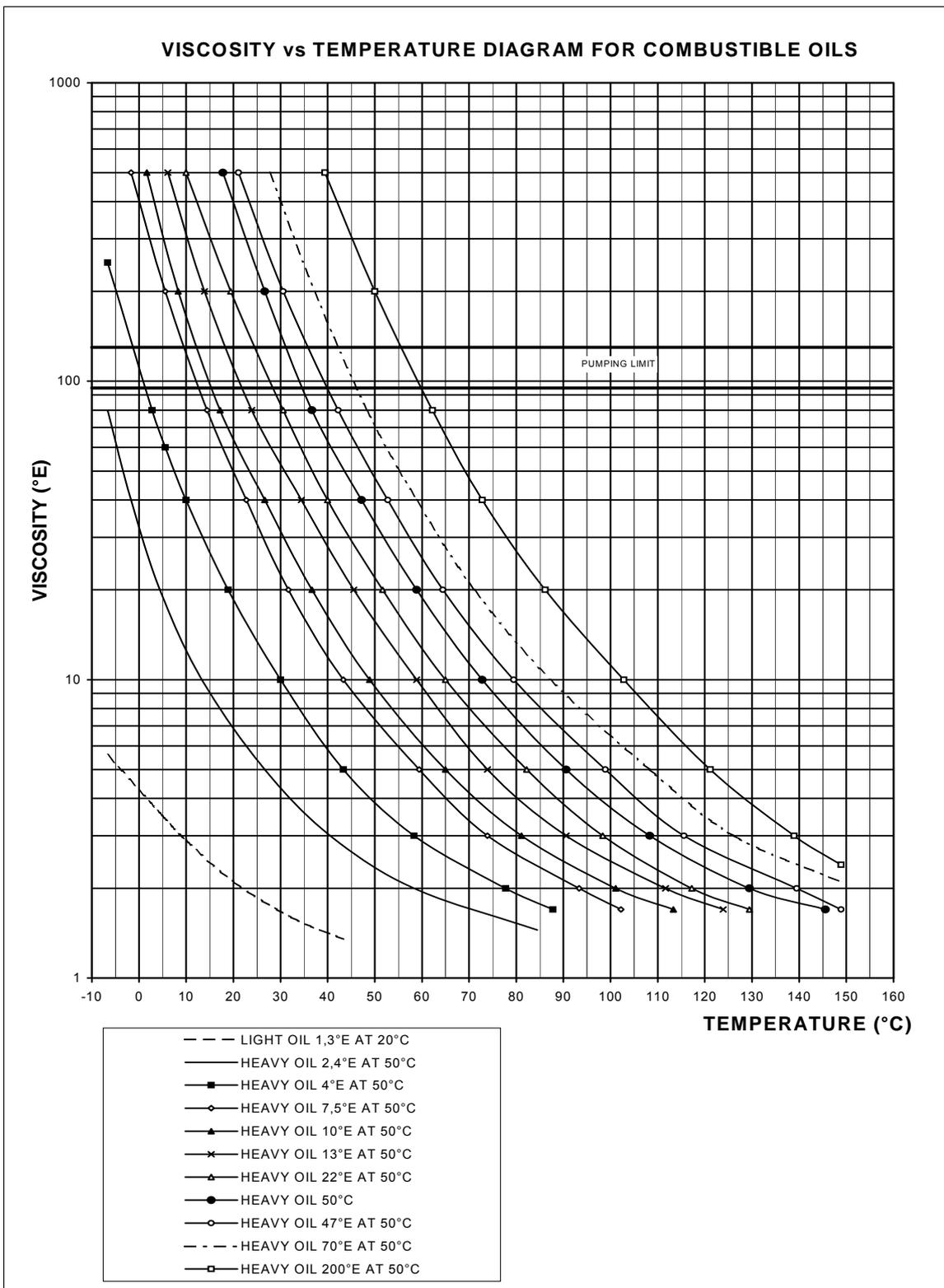


Fig. 10

Indicative diagram showing the oil temperature at burner pump inlet vs. oil viscosity

Example: if the oil has a 50°E @ 50°C viscosity, the oil temperature at the pump inlet should be 80°C (see diagram).

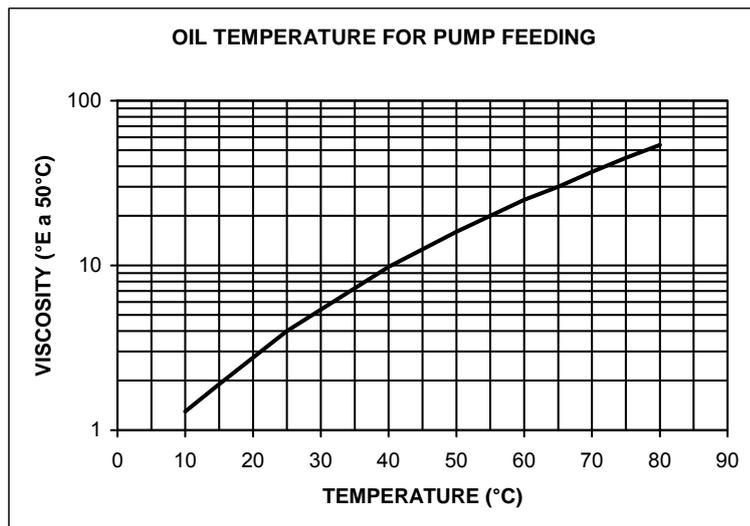


Fig. 11

Indicative diagram showing the oil pressure according to its temperature

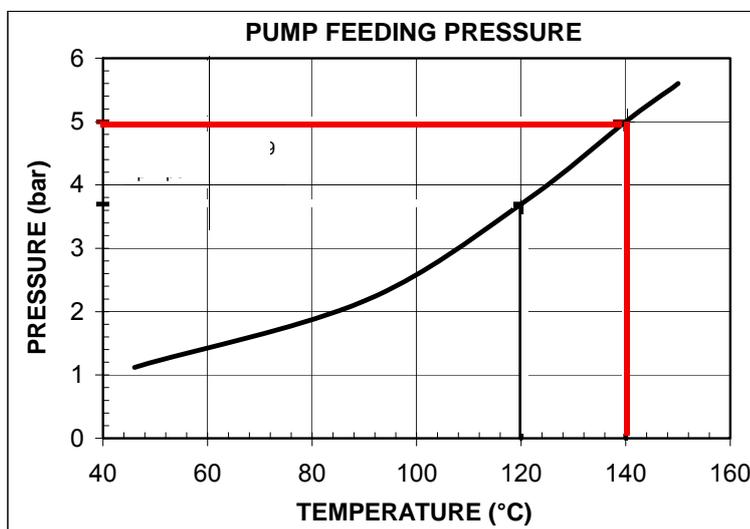
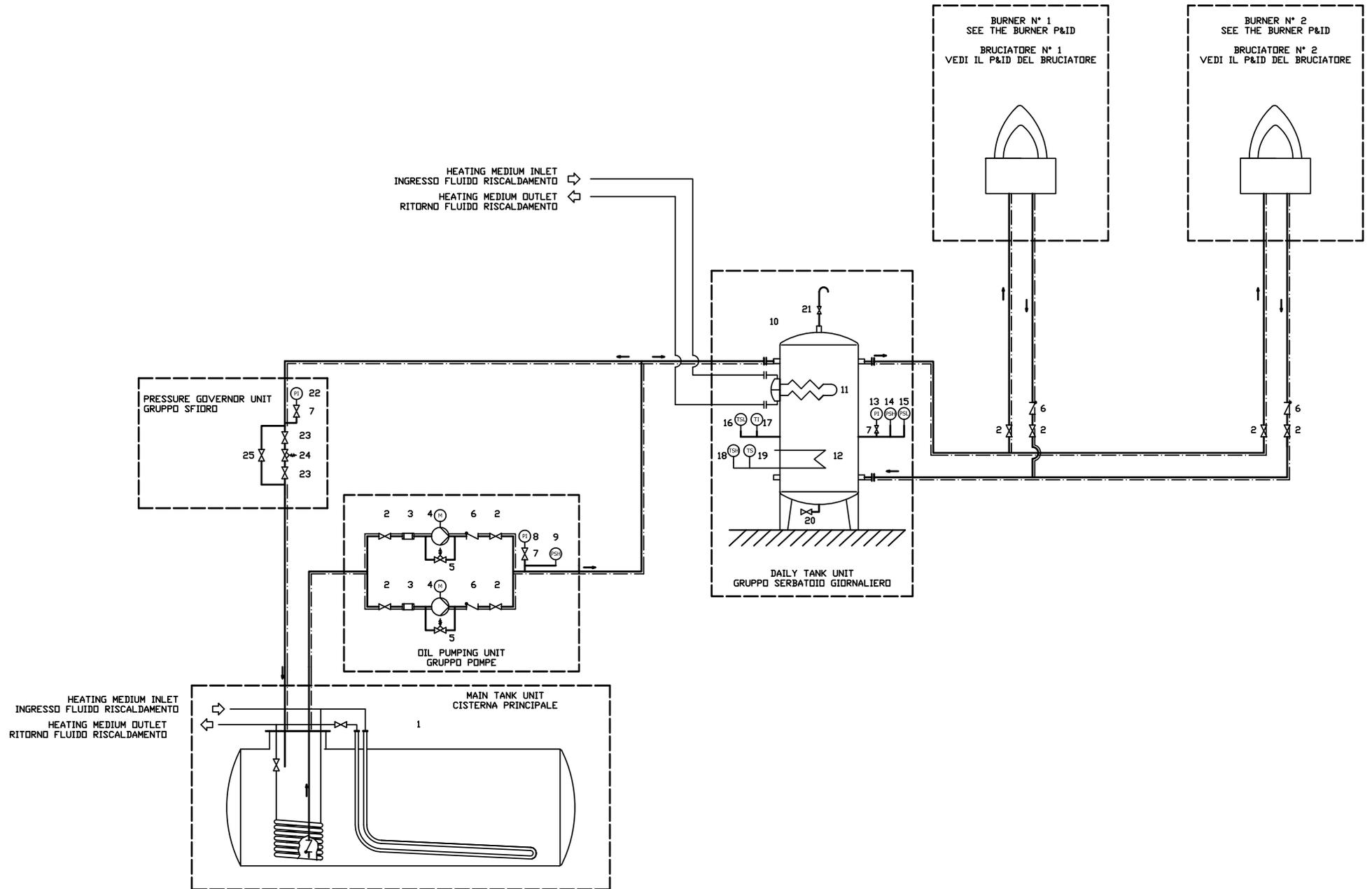


Fig. 12

Fig. 13 - Hydraulic diagram 3ID0024



3ID0024	KEYS
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POS	OIL TRAIN
------------	------------------

1	Main tank
---	-----------

OIL PUMPING UNIT

2	Manual valve
3	Filter
4	Pump coupled to electrical motor
5	Safety valve
6	One-way valve
7	Manual valve
8	Pressure gauge
9	High pressure switch - PO MAX

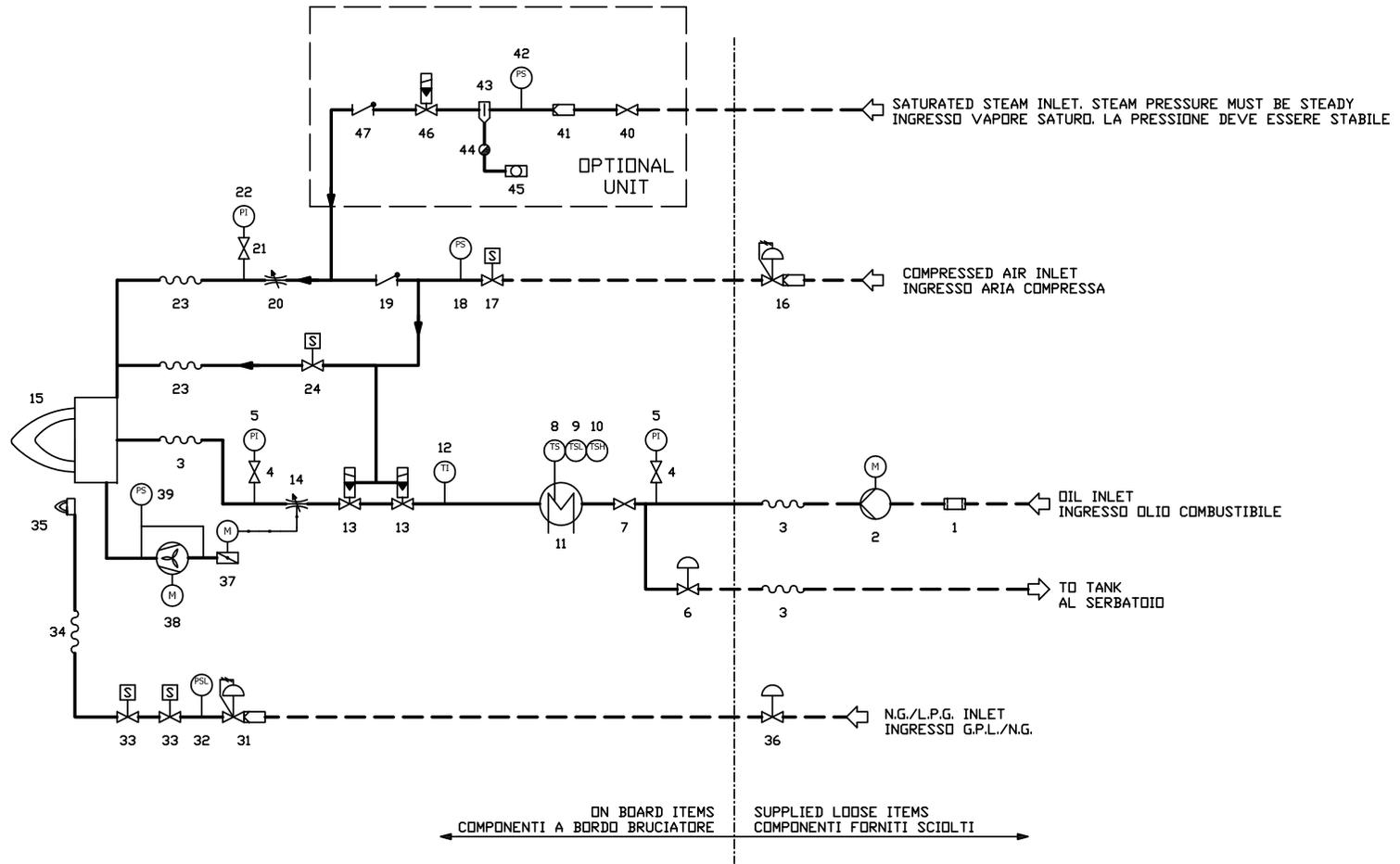
DAILY TANK

10	Daily tank
11	Heating device
12	Electrical resistor
13	Pressure gauge
14	High pressure switch - PO MAX
15	Low pressure switch - PO MIN
16	Low thermostat - TCN
17	Thermometer
18	High thermostat - TRS
19	Thermostat - TR
20	Manual valve
21	Manual valve

PRESSURE GOVERNOR UNIT

22	Pressure gauge
23	Manual valve
24	Pressure governor
25	Needle valve

Fig. 14 - Hydraulic diagram 3I2D-02 (PBY1025)



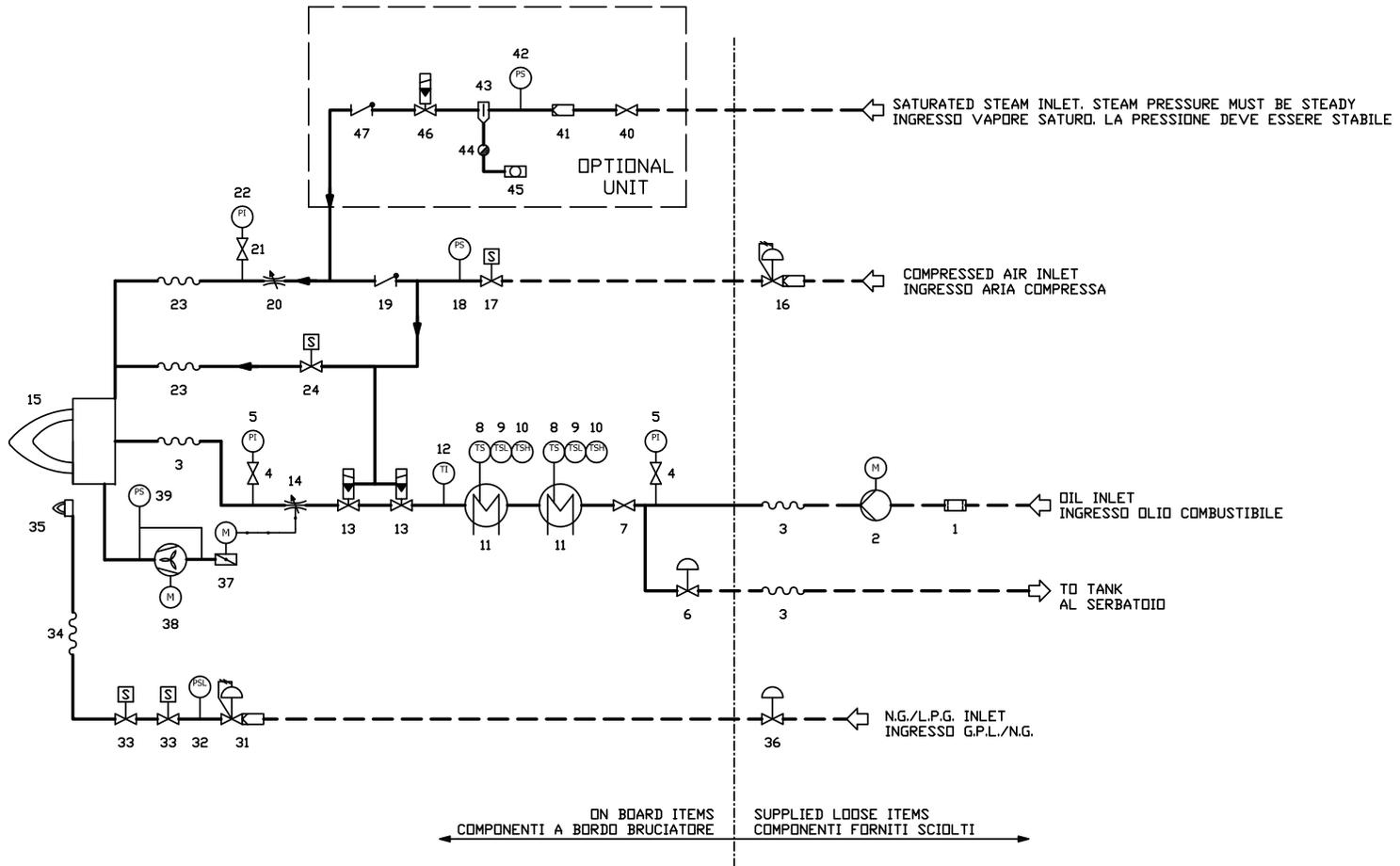
— BY CIB UNIGAS
 — FORNITURA CIB UNIGAS
 - - BY OTHERS
 - - NON DI FORNITURA CIB UNIGAS

3I2D-02	KEYS
POS	OIL TRAIN
1	Filter
2	Pump coupled to an electrical motor
3	Flexible hose
4	Manual valve
5	Pressure gauge
6	Pressure governor
7	Manual valve
8	Thermostat - TR
9	Low thermostat - TCI
10	High thermostat - TRS
11	Electrical preheater tank
12	Thermometer
13	Pneumatic valve
14	Metering valve
15	Main burner
	COMPRESSED AIR TRAIN
16	Pressure governor with filter
17	Solenoid valve
18	Pressure switch - PAC
19	One-way valve
20	Metering valve
21	Manual valve
22	Pressure gauge
23	Flexible hose
24	Solenoid valve

3I2D-02	KEYS
POS	PILOT GAS TRAIN
31	Pressure governor with filter
32	Pressure switch - PGP
33	Solenoid valve
34	Flexible hose
35	Pilot burner
36	Pressure governor for L.P.G. tank
	COMBUSTION AIR TRAIN
37	Air damper with actuator
38	Draught fan with electromotor
39	Pressure switch - PA
	STEAM TRAIN (OPTIONAL)
40	Manual valve
41	Filter
42	Pressure switch
43	Water separator
44	Water discharger
45	Flow indicator
46	Pneumatic valve
47	One-way valve

NOTE POS 36 is optional
 Steam train is optional

Fig. 15 - Hydraulic diagram 312-D03 (PBY1030/PBY1040)



3I2D-03	KEYS
POS	OIL TRAIN
1	Filter
2	Pump coupled to an electrical motor
3	Flexible hose
4	Manual valve
5	Pressure gauge
6	Pressure governor
7	Manual valve
8	Thermostat - TR
9	Low thermostat - TCI
10	High thermostat - TRS
11	Electrical preheater tank
12	Thermometer
13	Pneumatic valve
14	Metering valve
15	Main burner
COMPRESSED AIR TRAIN	
16	Pressure governor with filter
17	Solenoid valve
18	Pressure switch - PAC
19	One-way valve
20	Metering valve
21	Manual valve
22	Pressure gauge
23	Flexible hose
24	Solenoid valve

3I2D-03	KEYS
POS	PILOT GAS TRAIN
31	Pressure governor with filter
32	Pressure switch - PGP
33	Solenoid valve
34	Flexible hose
35	Pilot burner
36	Pressure governor for L.P.G. tank
COMBUSTION AIR TRAIN	
37	Air damper with actuator
38	Draught fan with electromotor
39	Pressure switch - PA
STEAM TRAIN (OPTIONAL)	
40	Manual valve
41	Filter
42	Pressure switch
43	Water separator
44	Water discharger
45	Flow indicator
46	Pneumatic valve
47	One-way valve

NOTE POS 36 is optional
 Steam train is optional

Pilot gas train

The connection to the pilot gas train must be done according to the following scheme

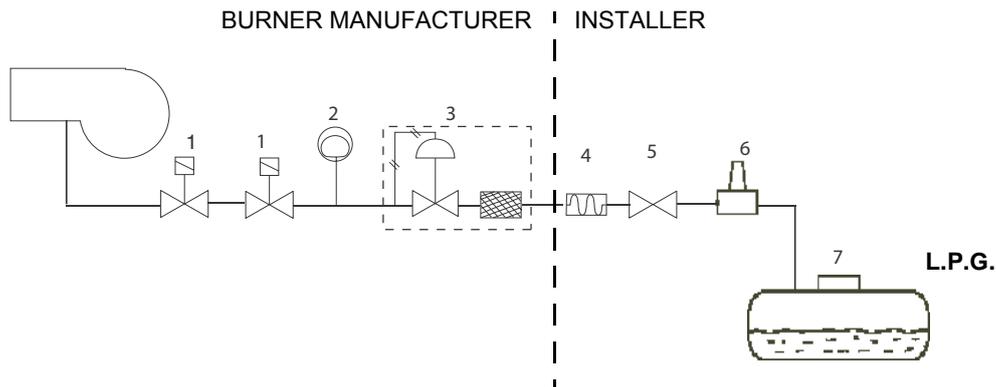


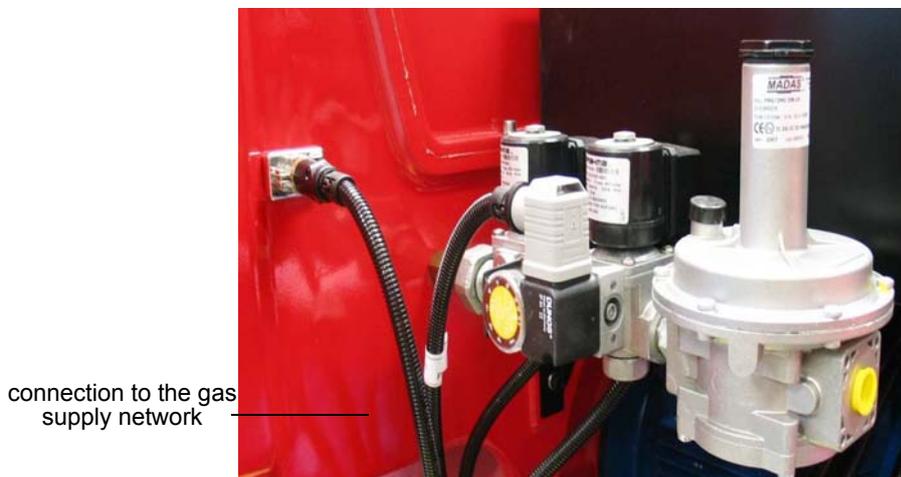
Fig. 16

Key

- 1 Gas valves
- 2 Gas pressure switch
- 3 Gas governor with filter
- 4 Bellows unit
- 5 Manual cutoff valve
- 6 Pressure governor
- 7 Tank

Gas supply: LPG

The pilot gas train is already installed into the burner, the connection from the governor with filter to the gas supply network must be carried out.



Once the gas train is installed, perform the electrical connections for all its items (gas valves group, pressure switch).



ATTENTION: once the gas train is mounted according to the diagram on Fig. 16, the gas proving test must be performed, according to the procedure set by the laws in force.

Light oil pilot

The burner can be provided with light oil pilot, instead of gas pilot.



light oil pilot nozzle

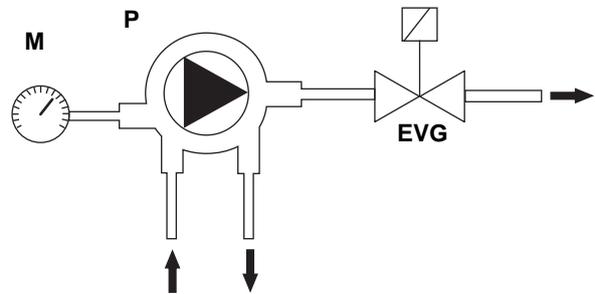


light oil pilot pump

Key

- EVG Light oil solenoid valve
- M Manometer
- P Pump

Fig. 17



Heavy oil pumps

The pump provided with the burner must be installed according to the hydraulic diagram.

Cucchi FMG40 pumps

- Capacity: 2500l/h
 - Power consumption: 1.1 kW
 - Speed: 1400 rpm
 - Max outlet pressure: 10bar
 - Max inlet pressure: 2bar
 - Min inlet pressure: -0.4bar
- For further details see the manufacturer documentation.

Suntec TV Pressure governor

Pressure adjustment

Remove cap-nut 1 and the gasket 2, unscrew the lock nut 4. To increase pressure, twist adjusting screw 3 clockwise. To decrease the pressure, twist screw counterclockwise. Tight the lock nut 4, refit the gasket 2 and the cap nut 1.

Key

- 1 Cap nut
- 2 Gasket
- 3 Adjusting screw
- 4 Lock nut
- 5 Gasket

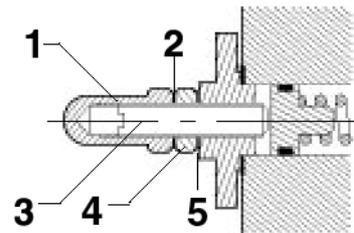


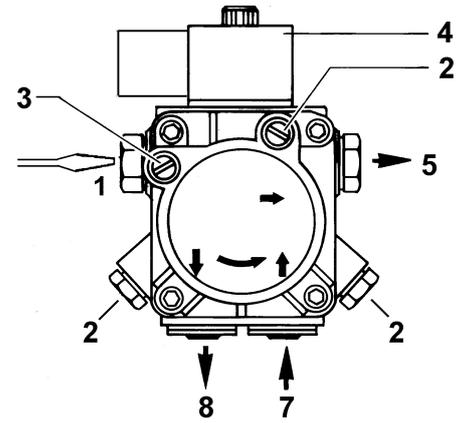
Fig. 18

Light oil pilot pump**Suntec AS47-57-67 B**

Oil viscosity	2 - 12 cSt
Oil temperature	0 - 60 °C
Max. suction pressure	2 bar max.
Max. return pressure	2 bar max.
Min. suction pressure	- 0.45 bar to avoid gasing
Rotation speed	3600 rpm max.

Key

- 1 Pressure governor
- 2 Manometer
- 3 Vacuum gauge
- 4 Solenoid valve
- 5 Nozzle
- 7 Suction
- 8 Return

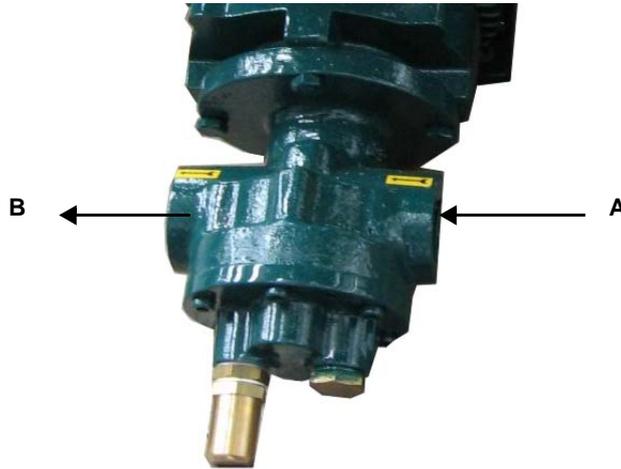
**About the use of fuel pumps**

- 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 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 the fuel unit.

Connecting the oil flexible hoses to the pump

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

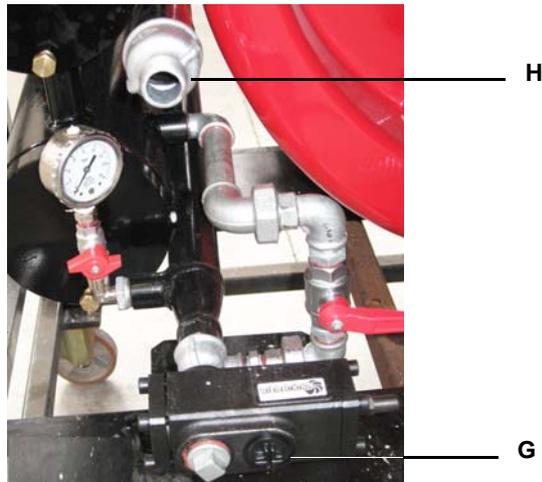
- 1 remove the closing nuts **A** (on the pump inlet) and **B** (from pump to the burner);
- 2 screw the rotating nut of the two flexible hoses on the pump **being careful to avoid exchanging the lines**: see the arrows marked on the pump.



Connecting the oil flexible hoses to the burner

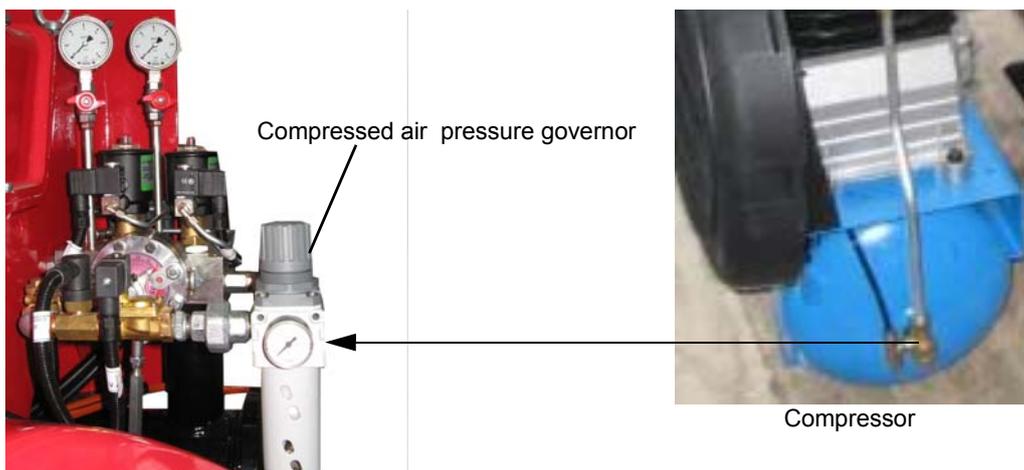
To connect the flexible oil hoses to the pump, proceed as follows, according to the pump provided:

- 1 remove the closing nuts **H** (on the heater) and **G** (on the oil pressure governor);
- 2 screw the rotating nut of the two flexible hoses on the burner **being careful to avoid exchanging the inlet and return lines**: see the arrows marked that show the inlet and the return.



Connecting the compressed air hoses

To connect the compressed air supply, refer to the following pictures



Hydraulic connections

Key

- G Gas
- A Compressed Air
- O Oil
- CA Nozzle cleaning air

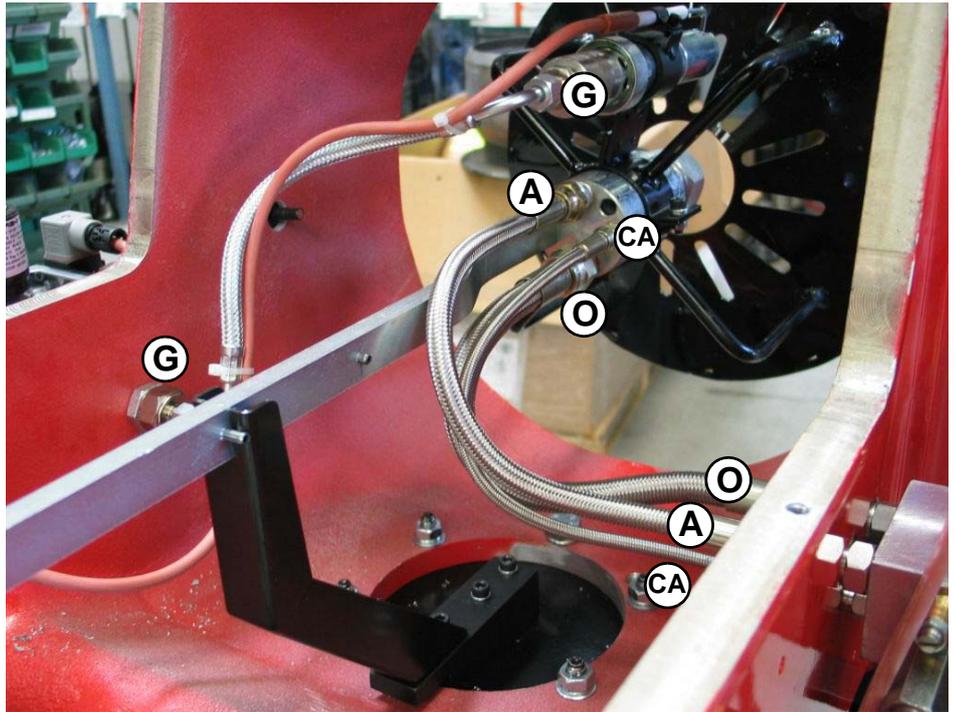


Fig. 19

ADJUSTING AIR AND FUEL RATE

 **ATTENTION:** before starting the burner up, be sure that the manual cutoff valves are open. 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 fuel decrease slowly until the normal combustion values are achieved.

 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.

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

Recommended combustion parameters		
Fuel	Recommended (%) CO ₂	Recommended (%) O ₂
Heavy oil	11 ÷ 12.5	4.7 ÷ 6.7

The heavy oil flow rate can be adjusted choosing a nozzle that suits the boiler/utilisation output and setting properly the delivery pressure values.

Nozzles selection table

Nozzle	Maximum oil rate		Item code
	kg/h	GPH	
AA.750.9	750 kg/h	200 GPH	2610335
AA.950.0	950 kg/h	250 GPH	2610340

Fluidics noozles

The oil flow rate can be adjusted choosing nozzles that suit the boiler/utilisation output and setting the delivery and return pressure values according to the ones quoted in the diagram below (as far as reading the pressure values, see next paragraphs).
 Nozzle 32-Y - A° - 8-7 (**Note:** the nozzle mounted on PBY1040 is without "reverse disc")

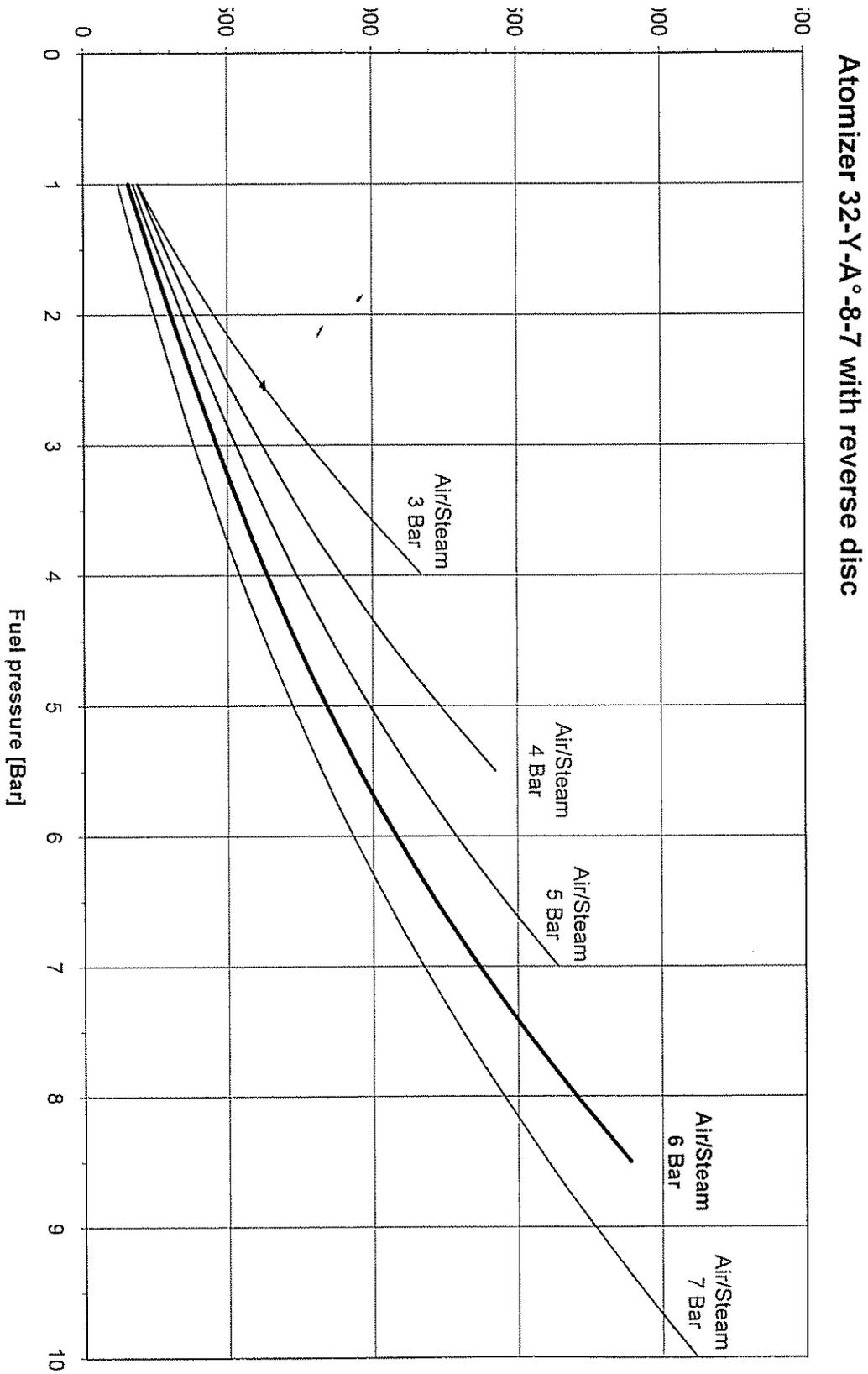


Fig. 20

Oil thermostat adjustment

All thermostats are located inside the control panel. To set the temperature use a small screwdriver.

Such temperature must be set during burner operation, checking temperature in the thermometer mounted on the pre-heating tank. We suggest a thermometer with scale up to 200° C.

Safety resistors thermostat TRS: it is factory preset and sealed. Don not modify it!

When the set temperature is exceeded, check the reason and reset it by means of the push button PR

Resistor thermostat TR: check the best atomising oil temperature on paragraph on page 11 and set it on TR.

Thermostat TCI (it gives the enabling signal to the oil N.C. valve): set TCI at about 20° less than TR.

Note: if the burner is provided with two pre-heating tanks, there will be two TCI thermostats.

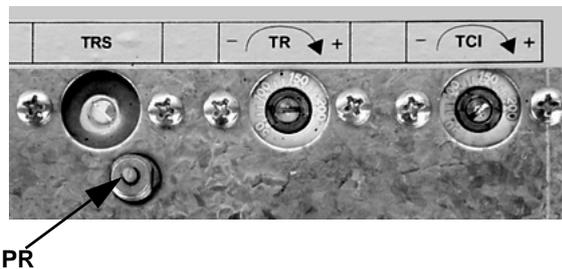


Fig. 21

Adjusting the pilot gas flow rate: gas valve Brahma EG12xR and pressure governor

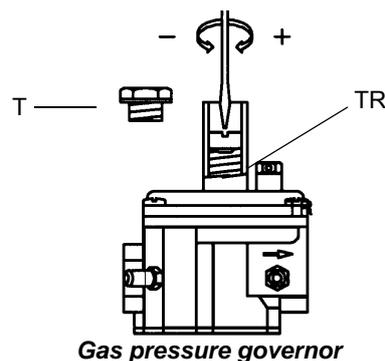
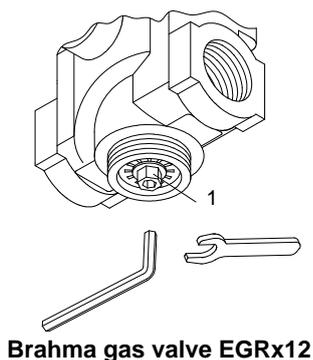
To change the pilot gas valve flow rate, proceed as follows:

- 1 remove the protection on the bottom of the valve, moving it counterclockwise (see next picture);
- 2 rotate clockwise the nut 1 as shown in to close the valve or counterclockwise to open.

To perform a finest adjustment, act directly on the pressure governor as follows (see next picture):

- 3 remove the cap T: to increase the gas pressure at the outlet use a screwdriver on the screw TR as shown in the next picture. Screw to increase the pressure, unscrew to decrease; once the regulation is performed, replace cap T.

4



Set pilot gas pressure switch at 50 mbar.



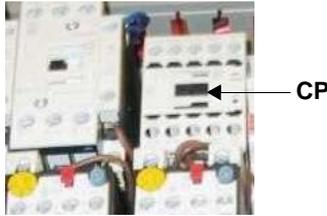
Fig. 22

Adjustments - brief description

- Adjust the air and oil 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.
- 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.
- Now set the low flame output, acting on the low flame microswitch of the actuator (cam III) in order to avoid the low flame output increasing too much or the flues temperature getting too low to cause condensation in the chimney.

Oil Flow Rate Settings

- 1 With the electrical panel open, prime the oil pump acting directly on the related contactor **CP** (see next picture): check the pump motor rotation (see “Fan motor and pump motor direction” on page 11) and keep pressing for some seconds until the oil circuit is charged;

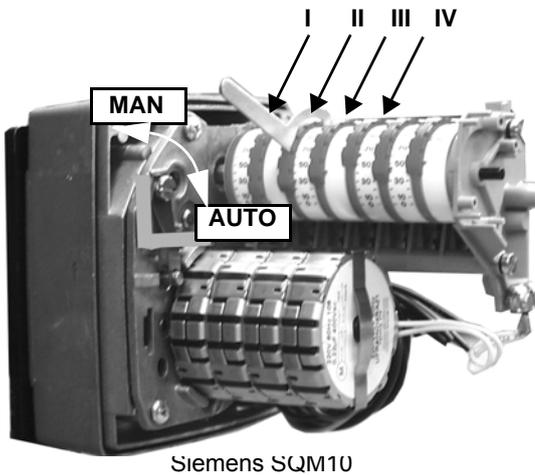


- 2 bleed the air from the **SA** port by loosening the cap **T** without removing it, then release the contactor and fasten cap **T**.



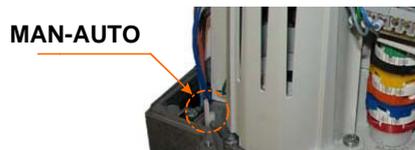
- 3 Before starting the burner up, drive the high flame actuator microswitch matching the low flame one (in order to let the burner operates at the lowest output) to safely achieve the high flame stage.
- 4 Turn the burner on by means of its main switch **A** (see next picture): if the burner locks (LED **B** on in the control panel) press the RESET button (**C**) on the control panel - see chapter “OPERATION”.
- 5 Start the burner up by means of the thermostat series (terminals 3 and 4 - see wiring diagrams) and wait until the pre-purge phase comes to end and that burner starts up;
- 6 drive the burner to high flame stage, by means of the thermostat **TAB** (high/low flame thermostat - see Wiring diagrams), as far as fully-modulating burners, see related paragraph.

Then move progressively the microswitch to higher values until it reaches the high flame position; always check the combustion values (see next steps).



Actuator cams

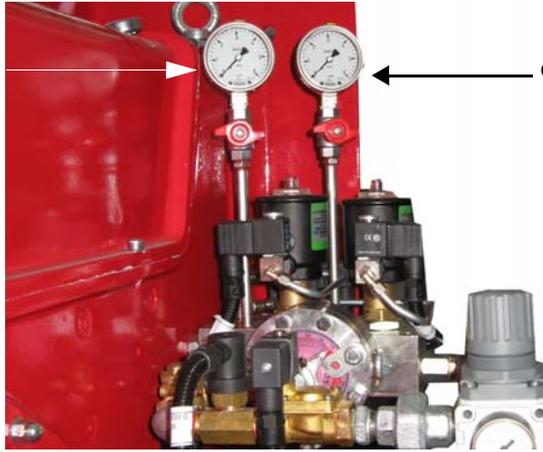
- I High flame
- II Stand-by and Ignition
- III Low flame
- IV Stroke limitation



Siemens SQM40

- 7 During high fire operation, oil pressure is about 2 bar (read on oil pressure gauge - see picture below).

compressed air pressure gauge



oil pressure gauge

Fig. 23

- 8 Set the atomising air pressure switch **PA** (Fig. 24) at 0.5 bar
- 9 Set the pilot gas pressure switch **PG** (Fig. 25) at 50 mbar.

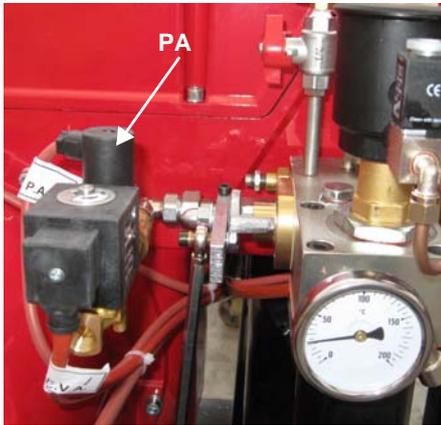


Fig. 24 - Atomising air pressure switch



Fig. 25 - Gas pressure switch

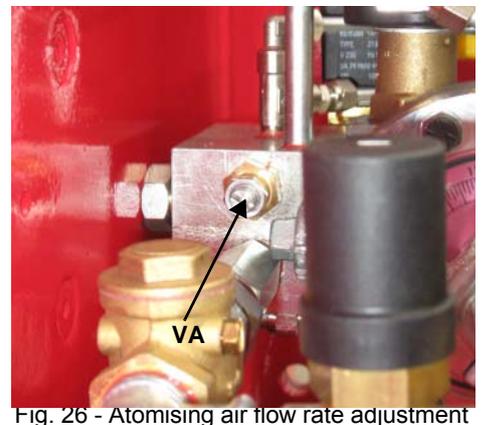


Fig. 26 - Atomising air flow rate adjustment

- 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); read the pressure on the oil pressure gauge on Fig. 23 and act on on the pump-governor adjusting screw **VR** (see Fig. 27 and description on page 23) as to get the nozzle pressure at 2bar (see step 8). If the required flow rate is not reached, increase the feeding pressure by means of the Suntec TV governor (see picture below)

compressed air pressure gauge



VR

Fig. 27 - Suntec TV governor

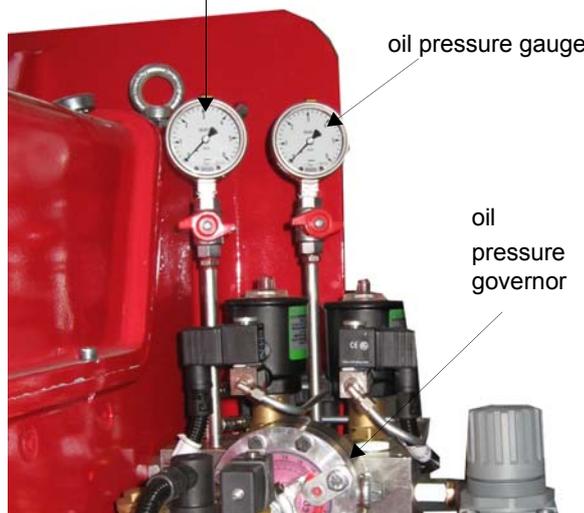
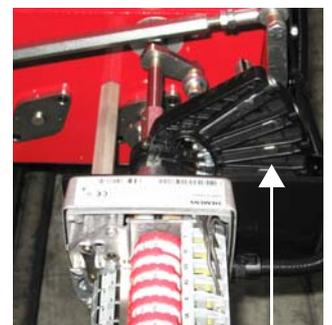


Fig. 29 - Oil pressure governor



SV

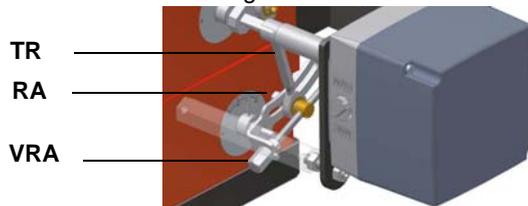
Fig. 31

- 11 in order to get the maximum oil flow rate, adjust the pressure (reading its value on the oil pressure gauge (Fig. 29): checking always the

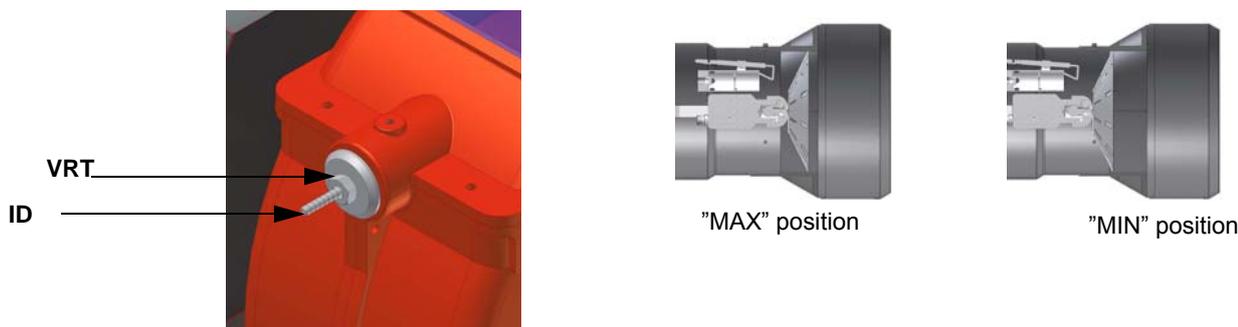
combustion parameters, the adjustment is to be performed by means of the **SV** adjusting cam screw **V** (Fig. 31) when the cam has reached the high flame position.

- 12 The atomising air flow rate and pressure can be adjusted with the **VA** screw (Fig. 26). Too low a pressure produces poor atomising with smoke in the flue. Too high a pressure produces instability and the flame can be cut off.
- 13 To adjust the **comburent 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.



- 14 If necessary, change the combustion head position: to let the burner operate at a lower output, move progressively back the combustion head towards the MIN position, by turning clockwise the **VRT** ring nut. The graduated index **ID** shows the combustion head shifting (each mark refers to 5mm).



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

- 15 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°);
- 16 set the **TAB** thermostat to the minimum in order that the actuator moves progressively towards the low flame position;
- 17 move cam III towards the minimum to make the actuator move 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 on , according to the requested rate.
- 18 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.
- 19 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.

Calibration of air pressure switch

To calibrate the air pressure switch, proceed as follows:

- Remove the transparent plastic cap.
- Once air and heavy oil setting have been accomplished, startup the burner.
- During the pre-purge phase o 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.

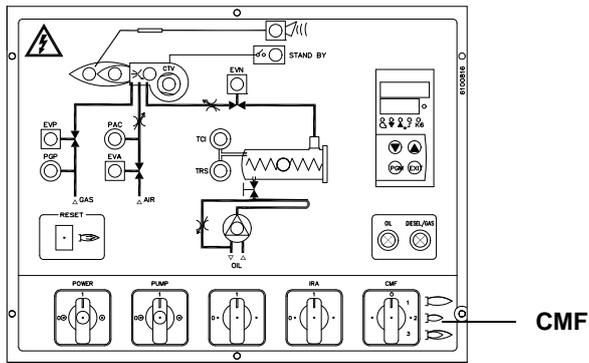


Fully-modulating burners

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 oprating 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 **2** and then **CMF=0**.



- CMF = 0 stop at the current position
- CMF = 1 high flame operation
- CMF = 2 low flame operation
- CMF = 3 automatic operation

EVL air valve for gun cleaning

After the flame is off, an automatic system provides the compressed air to clean the gun.



Fig. 32

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

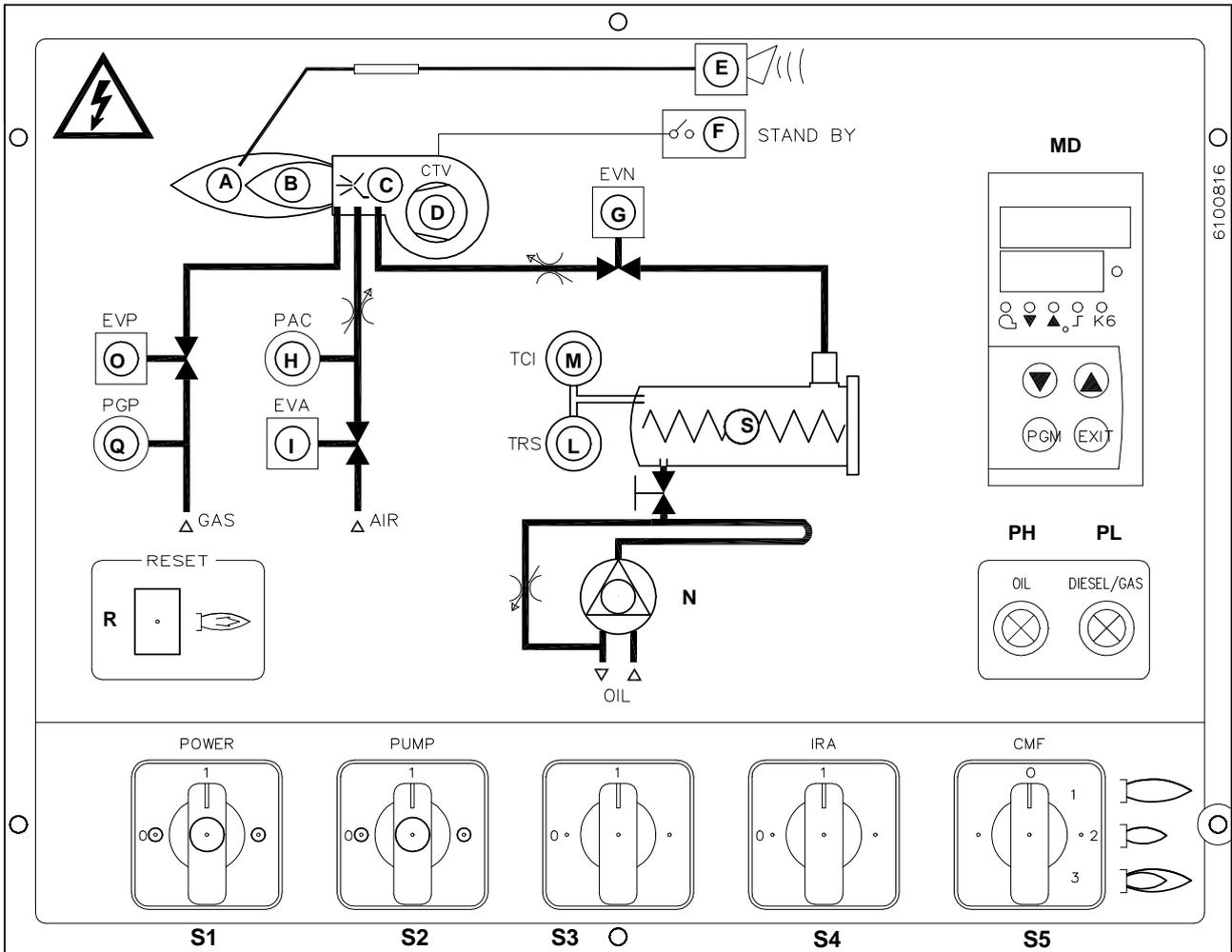


ATTENTION: before starting the burner up, be sure that the manual cutoff valves are open. Be sure that the mains switch is closed.

- Turn the burner on by means of its main switch **S1** (see next pictures).
- Check that the burner is not locked (LED **E** lights up); if so, reset it by pressing the reset button **R**.
- Check that the series of thermostats/pressure switches (terminals 3 and 4 - see Wiring diagrams), the TCI thermostat and the pilot gas pressure switch enable the burner to start up.
- At the beginning of the start-up cycle, the fan motor starts up and the compressed air valve (EVA) opens. (If the oil atomising pressure is not enough, the PAC pressure switch closes the oil valve causing the burner to lock out). The pre-purge phase begins (the air damper is closed).
- After the post-ignition time, the transformer is de-energised and the pilot turns off some seconds later.
- When the oil valve opens, the burner is working: the actuator starts opening. The burner drives to high flame (A signalling lamp on) or to low flame (B signalling lamp on) according to the plant requirements.
- When the burner turns off, even in case of lock out, the EVL valve performs the oil gun cleaning (page 37).

As far as fully-modulating burners, see the Siemens RWF40 burner modulator manual.

Control panel



- A High flame lamp
- B Low flame lamp
- C Ignition transformer lamp
- D Fan motor thermal cutout lamp
- E Burner lockout lamp
- F Burner stand-by lamp
- G Solenoid valve lamp
- H Atomisation air pressure switch lamp
- I Compressed air solenoid valve lamp
- L Heating resistors safety thermostat lamp
- M Plant enabling thermostat lamp
- MD Siemens modulator (on fully modulating versions only)
- N Oil pump in operation
- O Pilot solenoid valve lamp
- PL Light oil operation lamp
- PH Heavy oil operation lamp
- Q Pilot gas pressure switch
- R Reset pushbutton for control box
- S Pre-heating in operation lamp
- S1 Burner main switch
- S2 Pump operation selector MAN-AUTO
- S3 Heavy oil/light oil operation switch
- S4 Auxiliary resistors switch
- S5 Operation mode manual switch /0-Off, 1-

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

- Clean and examine the gas filter and replace it if necessary (next paragraph).
- Clean and examine the oil filter cartridge and replace it if necessary.
- Examine the flexible hoses and check for possible leaks.
- Check and clean if necessary the oil heaters and the tank, according to the fuel type and its use; remove the heaters flange fixing nuts and remove the heaters from the tank: clean by using steam or solvents and not metallic things.
- Remove and clean the combustion head (page 36).
- Examine and clean the ignition electrode, adjust and replace if necessary (see page 37).
- Examine and clean the detection probe, adjust and replace if necessary (see page 38).
- Examine the detection current (see page 38).
- Remove and clean (page 38) the heavy oil nozzle (**Important: use solvents for cleaning, not metallic tools**) and at the end of the maintenance procedures, after replacing the burner, turn it on and check the shape of the flame; if in doubt replace the nozzle. Where the burner is used intensively it is recommended to replace the nozzle as a preventive measure, at the begin of the operating season.
- Clean and grease joints and rotating parts.

IMPORTANT: Remove the combustion head before checking the ignition electrode.

- Remove and clean the compressed air governor **A** in Fig. 33
- Remove and clean the oil governor **B** in Fig. 33



CAUTION: avoid the contact of steam, solvent and other liquids with the electric terminals of the resistor. On flanged heaters, replace the seal gasket before refitting it. Periodic inspections must be carried out to determine the frequency of cleaning.

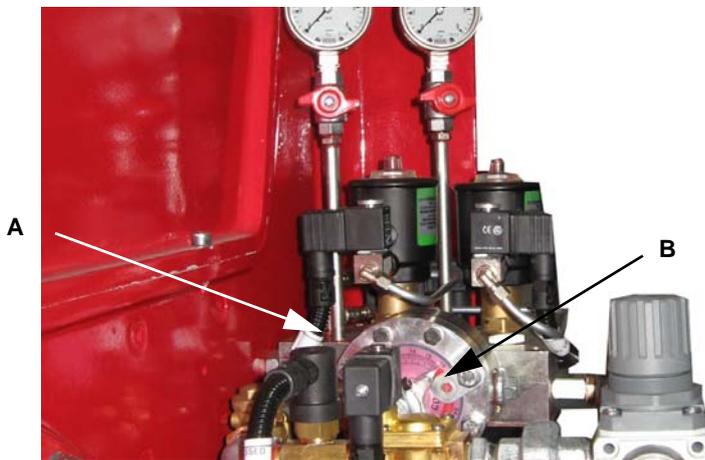


Fig. 33

Maintenance of the gas governor with filter (pilot gas train)

Before disassembling the device, be sure that there is no pressurised gas inside it.

To check the filtering part (1) on threaded bodies (see Fig. 34):

- remove the bottom cover, unscrewing the fixing screws;
- remove the filtering part (1), clean it with water and soap, blow it with compressed air or replace it if necessary;
- reassemble the filtering part in its initial position checking that it is placed in its own slots (see Fig. 35);
- reassemble the bottom cover (3), being sure that the main bolt is centered in the bottom cover slot.

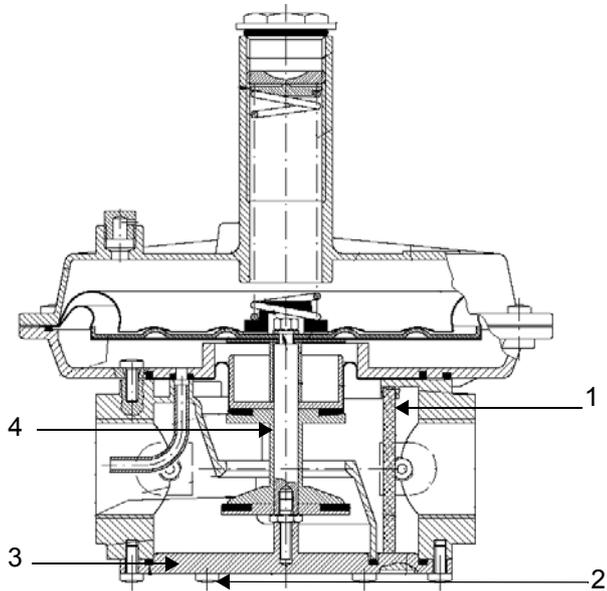


Fig. 34 - threaded body

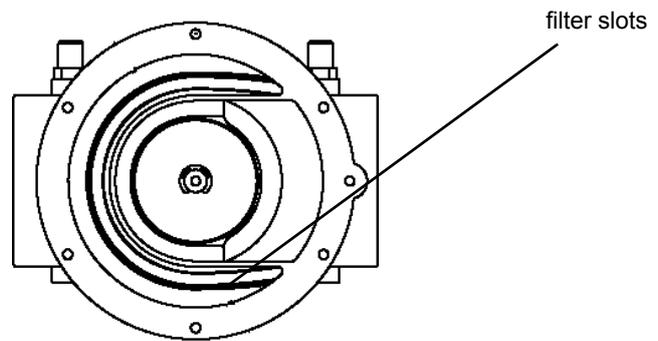


Fig. 35 - threaded body without bottom cover

Removing the combustion head

- Remove the cover H.
- Slide the photoresistor out of its housing.
- Unscrew the flexible hoses from the gun (burner side) and remove the whole assembly as shown on Fig. 36.

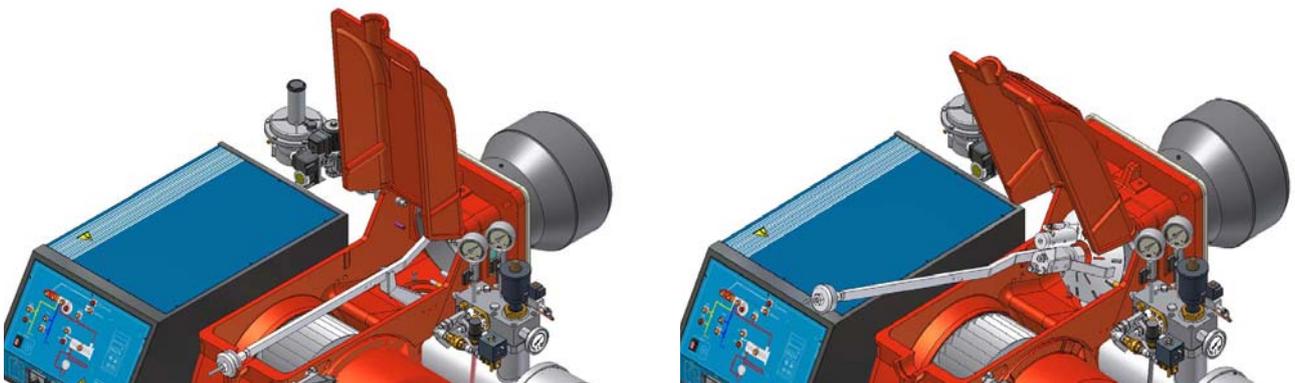


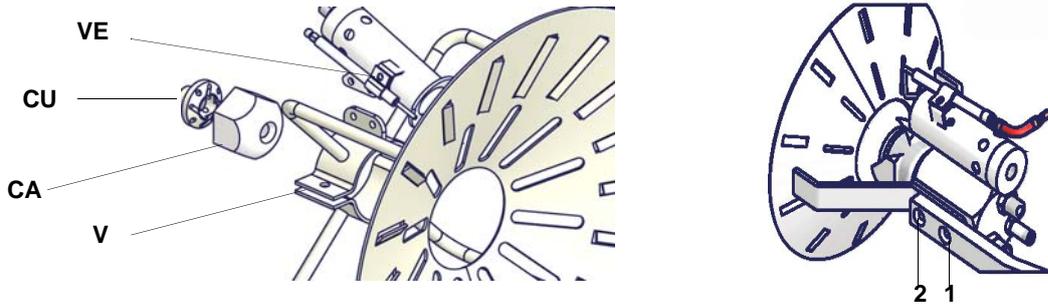
Fig. 36

Removing the oil gun, replacing/adjusting the nozzle and the ignition electrode

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

To remove the oil gun, proceed as follows:

- 1 remove the combustion head as described on the previous paragraph;
- 2 after removing the oil gun, to clean the nozzle remove it from its place after uncrewing **V**;
- 3 unscrew cap **CA** and clean the nozzle body **CU**; replace the nozzle if necessary;
- 4 in order to replace the electrode, unscrew the fixing screw and remove it: place the new electrode being careful to observe the measures (in mm) shown on next pictures and reassemble following the reversed procedure.
- 5 To adjust the nozzle position, unscrew the fixing screw, move the nozzle backwards or forwards, then fix the screw on the new position. In the example from "1" to "2" - see picture below.



C = 0 mm (factory set to change the nozzle position, please contact the Technical Dpt.)
B = 1.6 mm

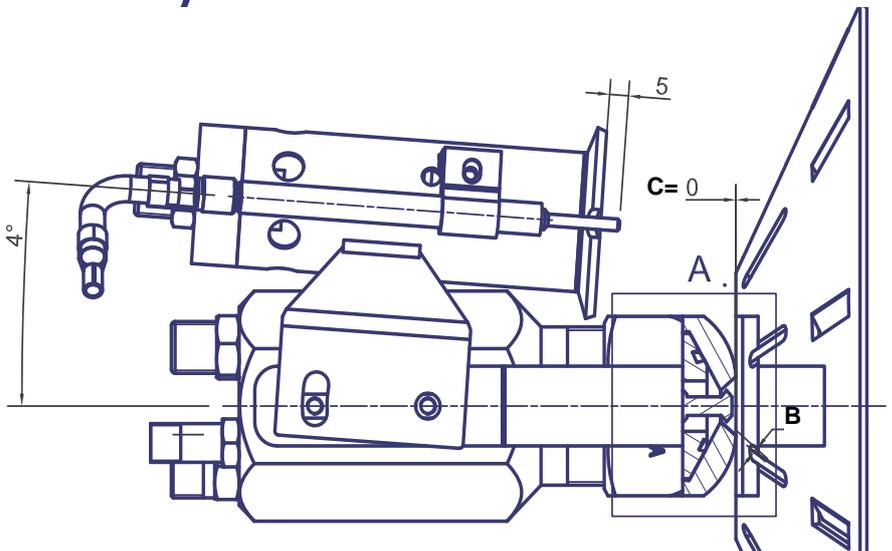
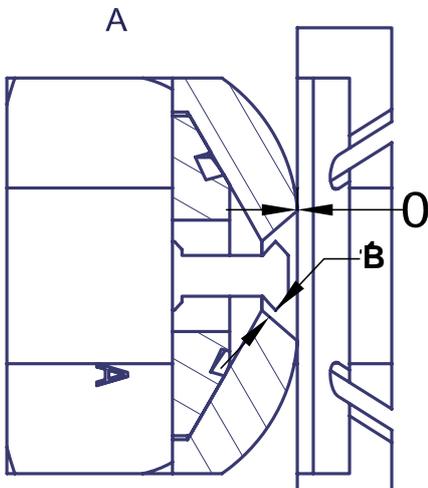
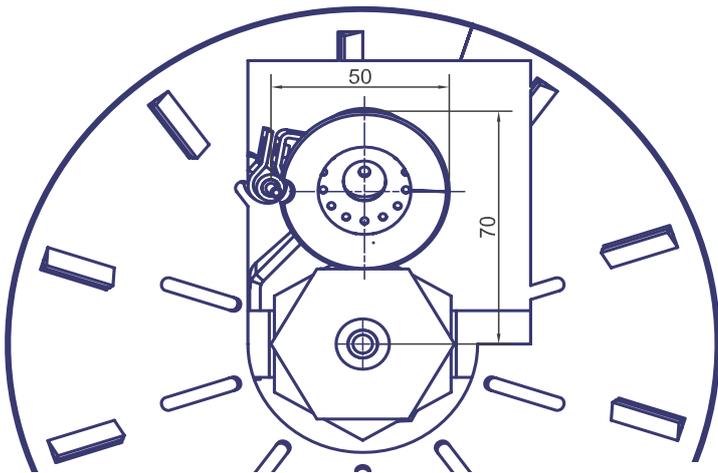


Fig. 37

Checking the detection current

To measure the detection signal follow the diagram in Fig. 38.

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

Minimum current intensity with flame: $8\mu\text{A}$

Maximum possible current intensity with flame: $35\mu\text{A}$

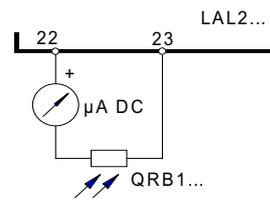


Fig. 38

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.

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

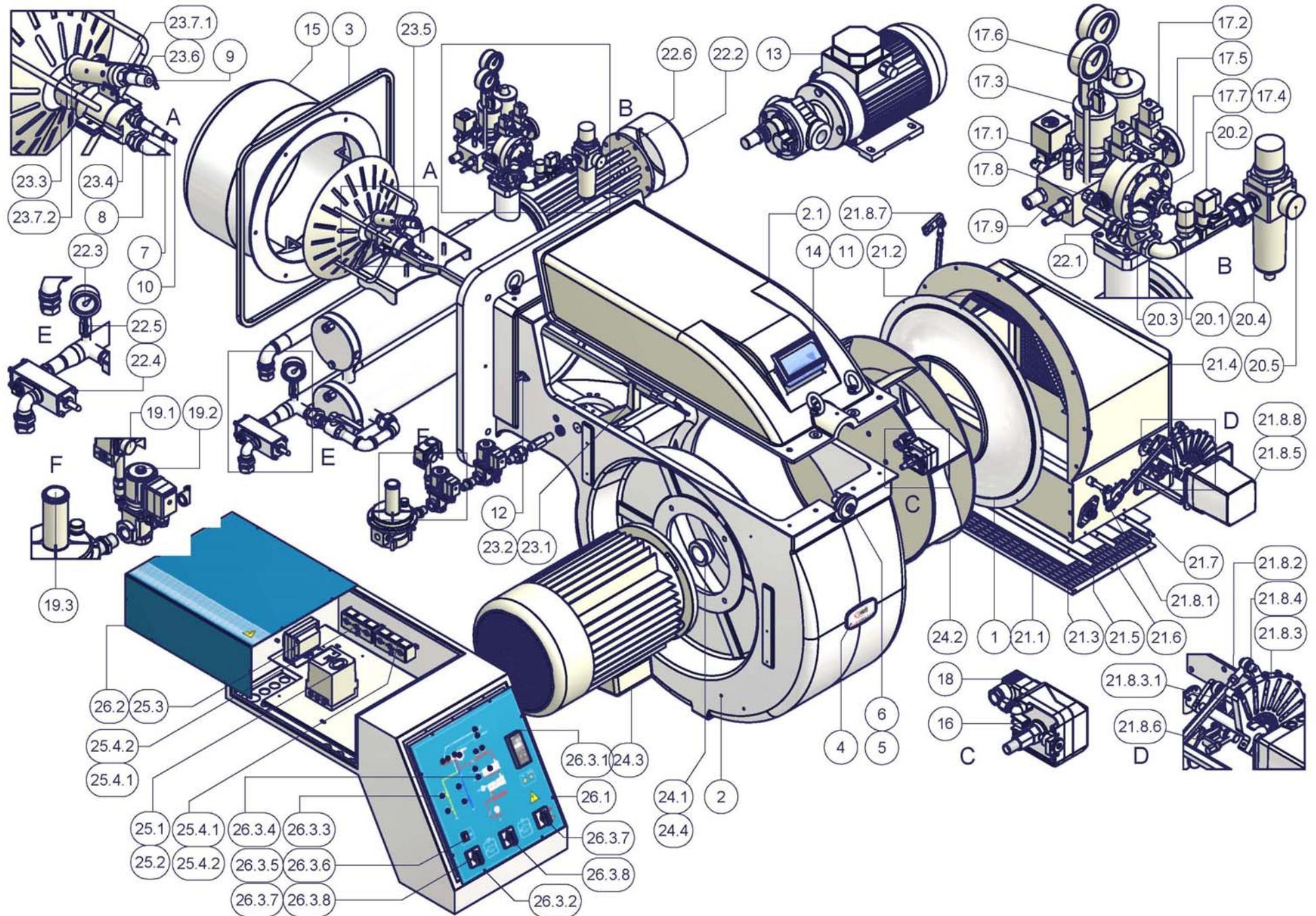
CAUSES/TROUBLES	DOES NOT START UP	CONTINUES PRE-PURGE	IBURNER STARTS UP WITH COLD OIL	DOES NOT IGNITE AND GOES TO SHUT DOWN	DOES NOT DRIVE TO HIGH FLAME	GOES TO SHUT DOWN DURING OPERATION	GOES OFF AND REPEATS THE CYCLE DURING OPERATION
MAIN SWITCH OFF	●						
LINE FUSES BLOWN	●						
MAXIMUM THERMOSTAT MALFUNCTION	●						
FAN THERMAL CUTOUT TRIPPED	●						
AUXILIARY FUSE BLOWN	●						
OIL RESISTOR FAULTY	●		●				
OIL ENABLING THERMOSTAT TRIPPED	●		●				
FAULTY CONTROL BOX	●	●		●	●	●	●
AIR ACTUATOR MALFUNCTION					●		
CIRCUIT ENABLING THERMOSTAT		●			●		
SMOKY FLAME						●	●
FAULTY IGNITION TRANSFORMER				●			
IGNITION ELECTRODE WRONGLY POSITIONED				●			
DIRTY NOZZLE				●		●	
FAULTY OIL VALVE				●			●
FAULTY OR DIRTY PHOTORESISTOR							●
FAULTY RESISTOR THERMOSTAT	●						
FAULTY HIGH-LOW FLAME THERMOSTAT					●		
ACTUATOR CAM NOT CALIBRATED					●		
LOW OIL PRESSURE				●		●	●
DIRTY OIL FILTER				●		●	●
DIRTY IGNITION ELECTRODE				●			

BURNER EXPLODED VIEW

ITEM	DESCRIPTION
1	AIR INLET CONE
2	BURNER HOUSING
2.1	COVER
3	CERAMIC FIBRE PLAIT
4	NAME PLATE
5	PLUG
6	NIPPLE
7	FLEXIBLE HOSE
8	FLEXIBLE HOSE
9	GAS FLEXIBLE HOSE
10	FLEXIBLE HOSE
11	INSPECTION GLASS
12	PHOTORESISTOR
13	PUMP
14	BRACKET
15	STANDARD BLAST TUBE
16	AIR PRESSURE SWITCH
17.1	OIL SOLENOID VALVE
17.2	COMPRESSED AIR SOLENOID VALVE
17.3	PNEUMATIC OIL VALVE
17.4	INTERLOCK
17.5	THERMOMETER
17.6	PRESSURE GAUGE
17.7	OIL PRESSURE GOVERNOR
17.8	COMPRESSED AIR PRESS. GOVERNOR
17.9	OIL MANIFOLD
18	CONNECTOR
19.1	GAS PRESSURE
19.2	GAS SOLENOID VALVE
19.3	GAS GOVERNOR WITH FILTER

ITEM	DESCRIPTION
20.1	AIR PRESSURE SWITCH
20.2	COMPRESSED AIR SOLENOID VALVE
20.3	ONE-WAY VALVE
20.4	COMPRESSED ARI GOVERNOR WITH FILTER
20.5	PRESSURE GAUGE
21.1	NET
21.2	NET
21.3	AIR INTAKE DAMPER
21.4	AIR INTAKE
21.5	LOUVER SHAFT
21.6	LOUVER SHAFT
21.7	LOUVER SHAFT
21.8.1	THROTTLE SHAFT
21.8.2	BRACKET
21.8.3	ADJUSTING CAM
21.8.3.1	ADJUSTING CAM FOIL
21.8.4	LEVERAGE
21.8.5	ACTUATOR
21.8.6	CAM
21.8.7	LEVERAGE
21.8.8	ACTUATOR SHAFT
22.1	GASKET
22.2	COVER
22.3	PRESSURE GAUGE
22.4	OIL PRESSURE GOVERNOR
22.5	MANUAL VALVE
22.6	RESISTOR
23.1	BRACKET
23.2	NOZZLE HOLDER ROD
23.3	NOZZLE

ITEM	DESCRIPTION
23.4	NOZZLE HOLDER
23.5	COMBUSTION HEAD
23.6	IGNITION CABLE
23.7.1	IGNITION ELECTRODE
23.7.2	PILOT
24.1	SPACER
24.2	FAN WHEEL
24.3	MOTOR
24.4	CLAMPING PLATE
25.1	CONTROL BOX
25.2	CONTROL BOX SOCKET
25.3	IGNITION TRANSFORMER
25.4.1	THERMOSTAT
25.4.2	THERMOSTAT
26.1	BOARD
26.2	COVER
26.3.1	POWER CONTROLLER
26.3.2	FRONT CONTROL PANEL
26.3.3	LIGHT
26.3.4	LIGHT
26.3.5	LOCK-OUT RESET BUTTON
26.3.6	PROTECTION
26.3.7	SWITCH
26.3.8	SWITCH



SPARE PARTS

DESCRIPTION	PBY1025	PBY1030	PBY1040
CONTROL BOX	2020420	2020420	2020420
IGNITION ELECTRODE	2080257	2080257	2080257
OIL FILTER	2090209	2090209	2090209
LIGHT OIL PILOT FILTER	2090001	2090001	2090001
FAN WHEEL	2150063	2150058	2150058
AIR PRESSURE SWITCH	2160097	2160065	2160065
COMPRESSED AIR PRESSURE SWITCH - PMM10A 2-10 bar	2160083	2160083	2160083
GAS PRESSURE SWITCH - DUNGS GW150 A6	2160086	2160086	2160086
IGNITION TRANSFORMER	2170301	2170301	2170302
MOTOR	21802A2	2180294	2180292
LIGHT OIL PILOT PUMP MOTOR	2180705	2180705	2180705
SOLENOID VALVE L180	2190408	2190408	2190408
SOLENOID VALVE L139	2190451	2190451	2190451
LIGHT OIL PILOT SOLENOID VALVE	2190638	2190638	2190638
GAS SOLENOID VALVE	2190502	2190502	2190502
FLEXIBLE HOSE	2340004	2340004	2340004
FLEXIBLE HOSE L=335	2340087	2340087	2340087
FLEXIBLE HOSE L=365	234FX13	234FX13	234FX13
FLEXIBLE HOSE L=300	234FX03	234FX03	234FX03
FLEXIBLE HOSE L=800	234FX07	234FX07	234FX07
ADJUSTING CAM FOIL	2440052	2440052	2440052
ACTUATOR	2480004	2480004	2480004
PHOTORESISTOR	2510003	2510003	2510003
RESISTOR THERMOSTATTR-TCI	2560026	2560026	2560026
THERMOSTAT TRS	2560028	2560028	2560028
PRESSURE GOVERNOR - SUNTEC TV	2570068	2570068	2570068
OIL PRESSURE GOVERNOR	25700C1	25700C2	25700C2
BURNER MODULATOR (only for fully-modulating burners)	2570112	2570112	2570112
PUMP - CUCCHI FMG40	2590219	2590219	2590219
LIGHT OIL PILOT PUMP - SUNTEC AS47	2590130	2590130	2590130
NOZZLE	2610335	2610340	2610229
LIGHT OIL PILOT NOZZLE	2610003	2610003	2610004
L.P.G. PILOT	2640053	2640053	2640053
LIGHT OIL PILOT	2640053	2640053	2640053
GAS GOVERNOR WITH FILTER	2800085	2800085	2800085
AIR PRESSURE GOVERNOR WITH FILTER	2800116	2800130	2800130
L.P.G. REDUCER	2800125	2800125	2800125
COMBUSTION HEAD	30601A2	30601D6	30601E2
STANDARD BLAST TUBE	30910T6	309BSF5	-
EXTENDED BLAST TUBE	30910K4	30910H7	309BSY7
AIR PRESSURE SWITCH ASS.Y	3500108	3500108	3500108
IGNITION CABLE	6050143	6050143	6050143
MIMIC PANEL	6100826	6100826	6100826

NOTE: it is recommended to mention the burner ID number on the spare parts request form.

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 terminal 8.
- 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

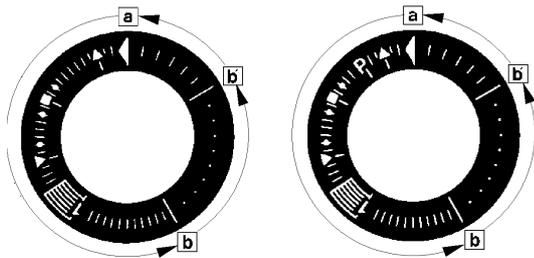
B-C Burner operation: during burner operation, «LR» drives the air damper to the nominal load or low-fire position, depending on heat demand; the release of the nominal load takes place via auxiliary switch «v» in the actuator and in the event of loss of flame during operation, the LAL... will initiate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

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».

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

Lockout indication

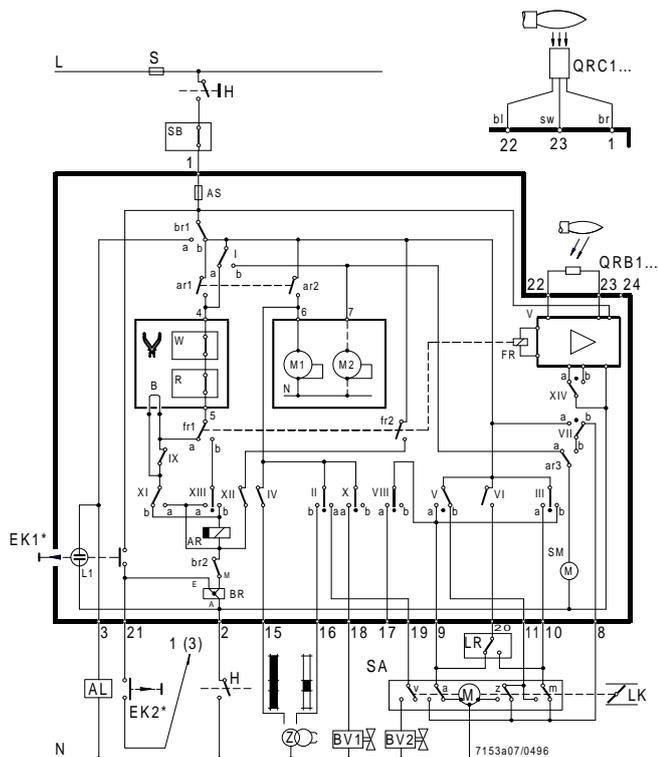


- a-b Startup sequence
- b-b' Idle step (with no contact confirmation)
- b(b')-a Postpurge program

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

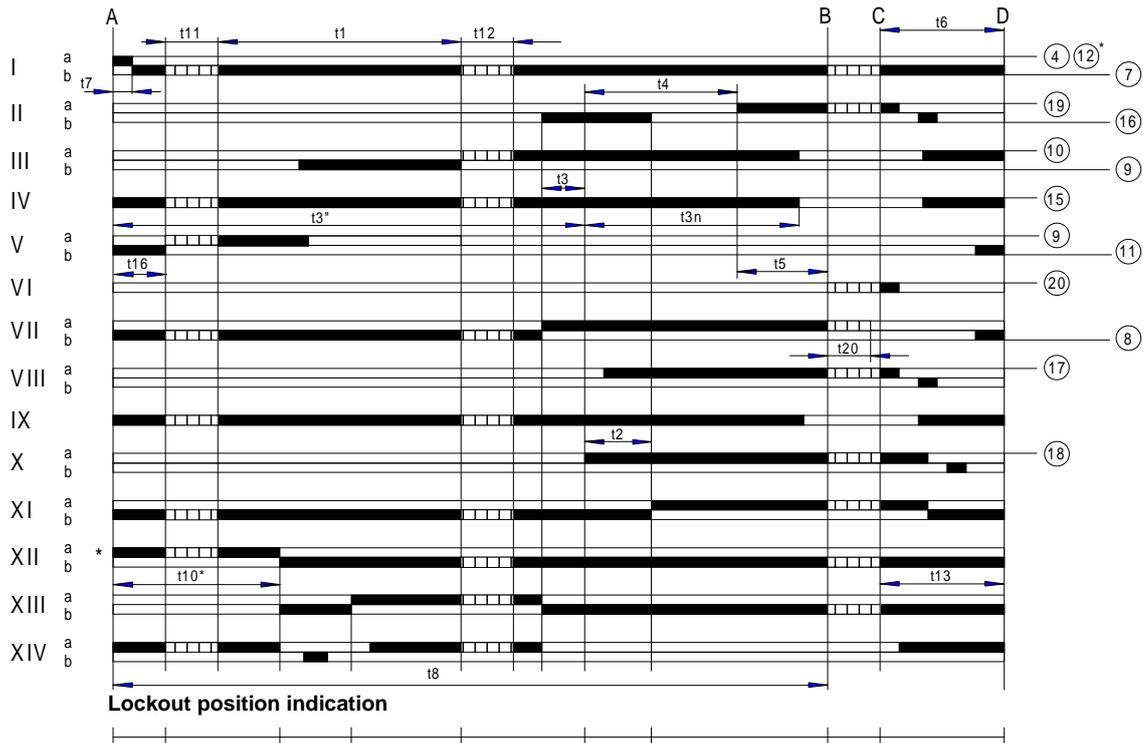
Specifications

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	optional
Protection	IP 40
Perm. input current at terminal 1	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
External fuse	max. 10 A
Weight	Device 1000 g 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 without notice. Errors and omissions excepted.