

**PBY90 - PBY91**  
**PBY92 - PBY93**  
**RBY510 - RBY515**  
**RBY520 - RBY525**

**Progressive, Fully-modulating  
Heavy oil Burners  
with pneumatic atomization  
(LMV2x/3x micro-processor control)**

**MANUAL OF INSTALLATION - USE - MAINTENANCE**

***CIB* UNIGAS**

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

## DANGERS, WARNINGS AND NOTES OF CAUTION

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

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

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

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

### 1) GENERAL INTRODUCTION

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

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

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

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

Contact qualified personnel only.

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

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

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

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

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

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

### 2) SPECIAL INSTRUCTIONS FOR BURNERS

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

was designed.

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

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

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

#### Special warnings

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

### 3) GENERAL INSTRUCTIONS DEPENDING ON FUEL USED

#### 3a) ELECTRICAL CONNECTION

- For safety reasons the unit must be efficiently earthed and installed as required by current safety regulations.
- It is vital that all safety requirements are met. In case of any doubt, ask for an accurate inspection of 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 :

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- 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

**Burner data plate**

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

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

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

**SYMBOLS USED**

 **WARNING!** Failure to observe the warning may result in irreparable damage to the unit or damage to the environment

 **DANGER!** Failure to observe the warning may result in serious injuries or death.

 **WARNING!** Failure to observe the warning may result in electric shock with lethal consequences

## PART I: SPECIFICATIONS

### 1.0 GENERAL FEATURES

This particular burner series has been studied 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, with self cleaning nozzle system and oil pump motor to be separately installed by the final user. 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 atomize 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.

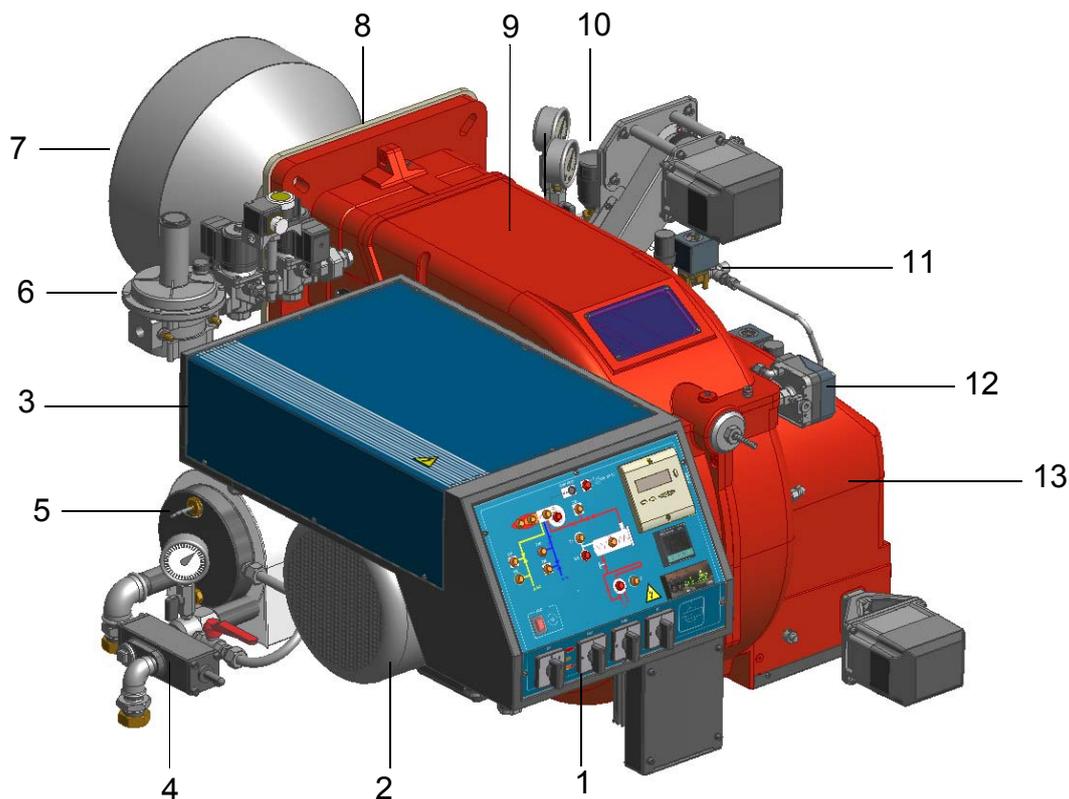


Fig. 1

Note: the figure is indicative only.

- 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



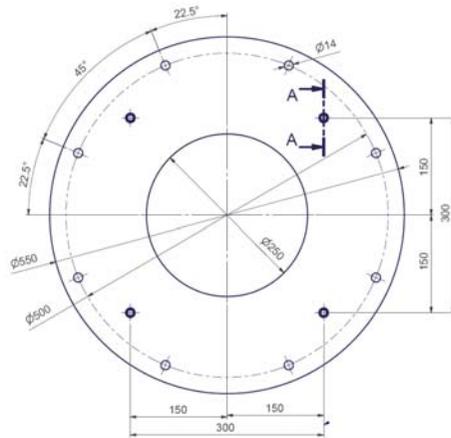
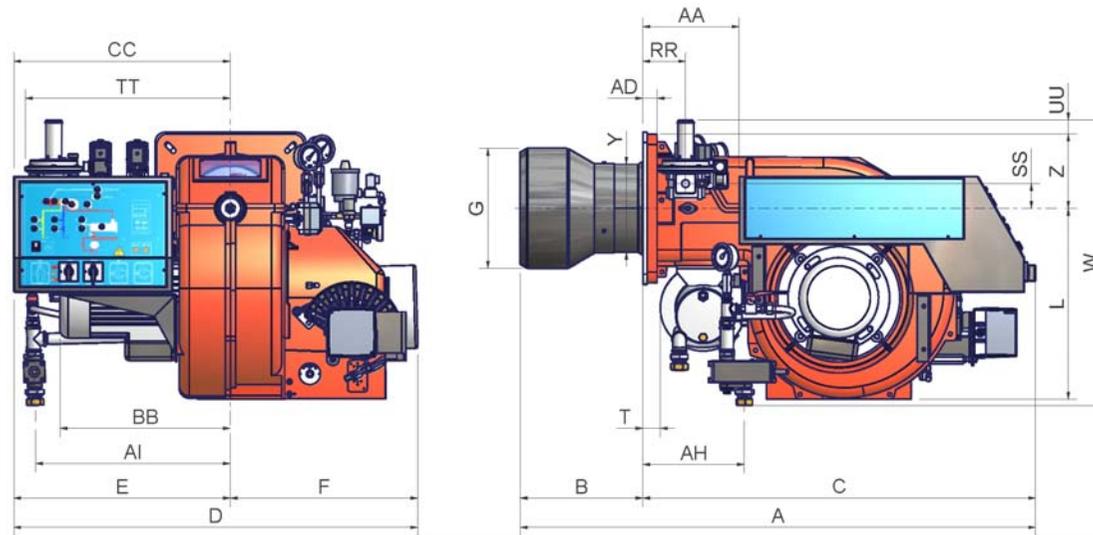
BURNER		RBY510	RBY515	RBY520	RBY525
Output	min ÷ max kW	1100 - 5000	1200 - 6000	1200 - 6500	1800 - 7300
Fuel		Heavy oil			
Oil viscosity		See "Burner model identification" table			
Heavy oil rate	min. ÷ max. kg/h	98 - 446	107 - 535	107 - 579	160 - 651
Gas pressure	max. mbar	500			
Gas pressure after gas governor	mbar	100			
Compressed air pressure	min. ÷ max. bar	4 - 10			
Power supply		400V 3N a.c. 50Hz			
Total power consumption (with Cucchi Pump)	kW	26.75	30.25	40.25	43.75
Total power consumption (with Kral Pump)	kW	26.55	30.05	40.05	43.55
Fan motor	kW	7.5	11	15	18.5
Pump motor (Cucchi)	kW	0.75	0.75	0.75	0.75
Pump motor (Kral)	kW	0.55	0.55	0.55	0.55
Pre-heater resistors	kW	18	18	24	24
Protection		IP40			
Approx. weight	kg	230	240	250	260
Operation		Progressive - Fully modulating			
Operating temperature	°C	-10 ÷ +50			
Storage Temperature	°C	-20 ÷ +60			
Working service*		Intermittent			

Heavy oil net calorific value (Hi): 40.43 MJ/kg (average value).

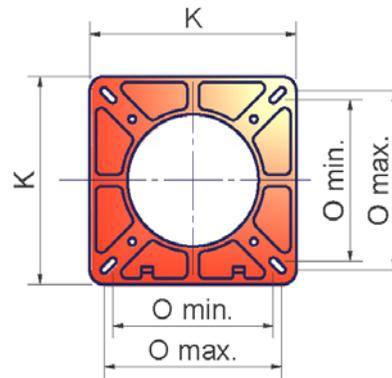
**\* NOTE ON THE WORKING SERVICE: the control box automatically stops after 24h of continuous working. The control box immediately starts up, automatically.**

**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.

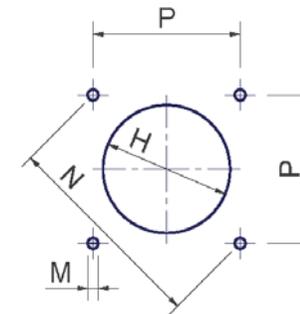
### 1.3 Overall dimensions (mm)



Reccomended counterflange



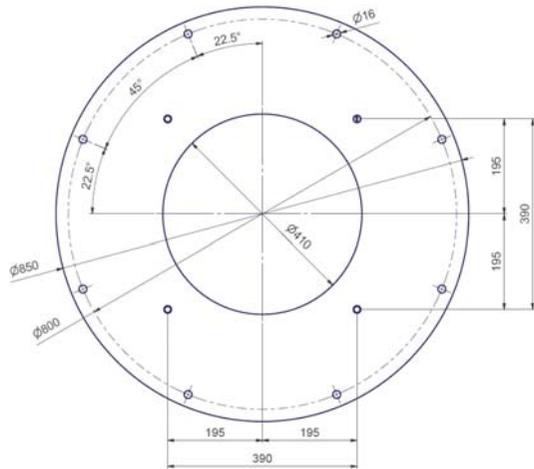
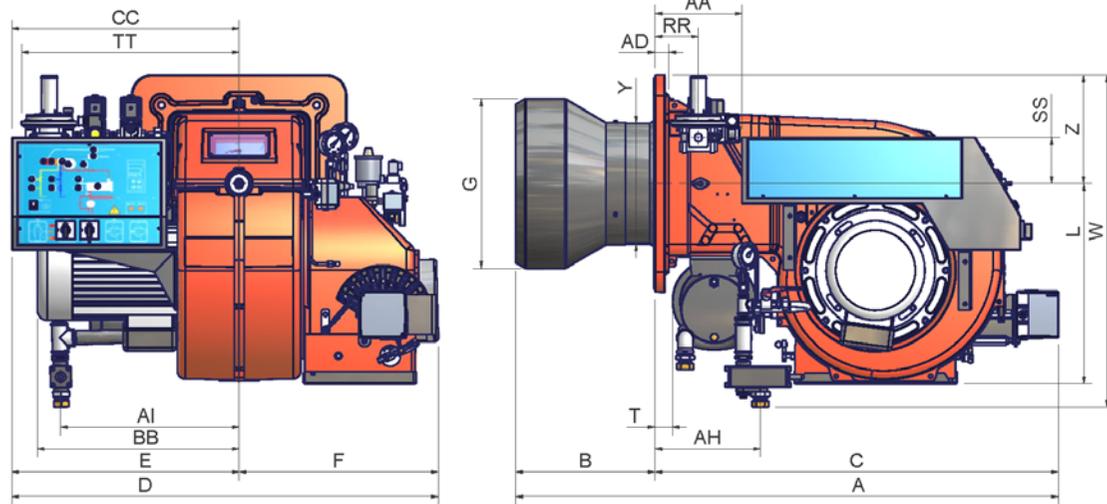
Burner flange



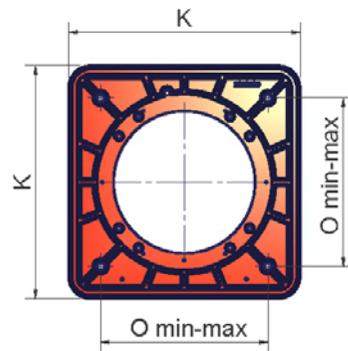
boiler recommended drilling tem-

**PBY90, PBY91, PBY92: A COUNTERFLANGE IS MANDATORY**

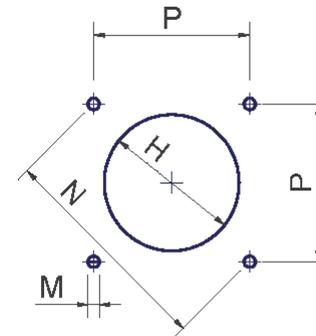
	A	AA	AD	AH	AI	B	BB	C	CC	D	E	F	G	H	K	L	M	N	O min	O max	P	RR	SS	T	TT	UU	W	Y	Z
<b>PBY90</b>	1282	237	35	250	479	318	419	964	532	992	532	460	306	346	360	464	M12	424	280	310	300	105	60	43	504	34	693	228	180
<b>PBY91</b>	1285	237	35	250	479	321	419	964	532	992	532	460	324	364	360	464	M12	424	280	310	300	105	60	43	504	34	693	228	180
<b>PBY92</b>	1291	237	35	250	479	327	419	964	532	992	532	460	365	405	360	464	M12	424	280	310	300	105	60	43	504	34	693	228	180



Reccomended counterflange



Burner flange



boiler recommended drilling template

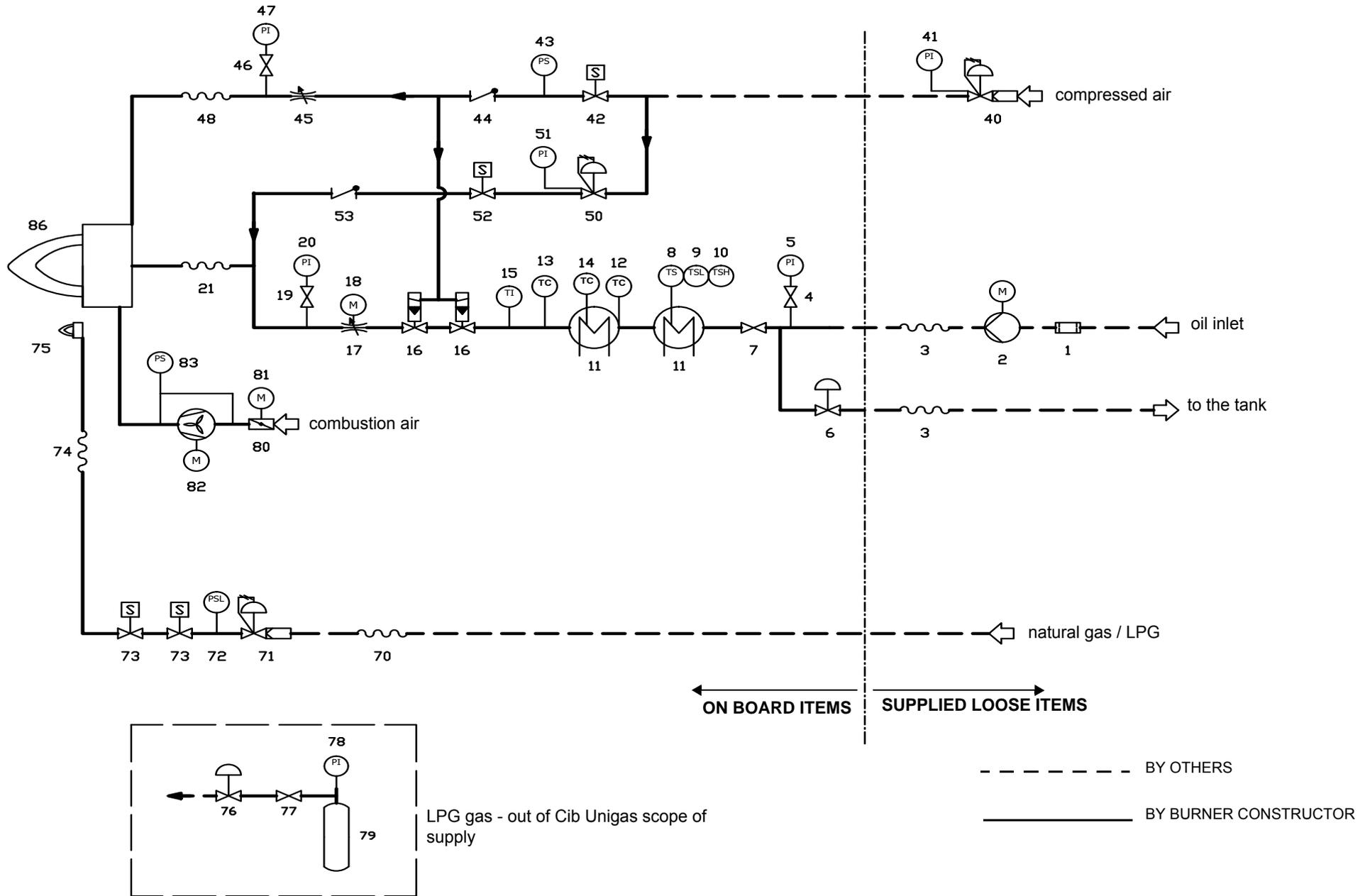
**RB510, RB520, RB525: A COUNTERFLANGE IS MANDATORY**

	A (AS)	A (AL)	AA	AD	AH	AI	B (BS)	B (BL)	BB	C	CC	D	E	F	G	H	K	L	M	N	O	P	RR	SS	T	TT	W	Y	Z
<b>RB510</b>	1432	-	219	35	265	448	374	-	468	1058	571	1072	571	501	387	427	540	498	M14	552	390	390	109	115	44	547	827	329	270
<b>RB515</b>	1436	-	219	35	265	448	378	-	508	1058	571	1072	571	501	474	524	540	498	M14	552	390	390	109	115	44	547	827	329	270
<b>RB520</b>	1436	1532	219	35	265	448	378	558	508	1058	571	1072	571	501	474	524	540	498	M14	552	390	390	109	115	44	547	827	329	270
<b>RB525</b>	1436	1532	219	35	265	448	378	558	642	1058	571	1142	642	501	474	524	540	498	M14	552	390	390	109	115	44	547	827	329	270

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

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

Fig. 2 - (3I2D-03 v4) Hydraulic diagram



3I2D-03 rev.4	LEGEND		
<b>POS</b>	<b>OIL TRAIN</b>		<b>COMPRESSED AIR TRAIN (PURGE)</b>
1	Filter	50	Pressure governor with filter
2	Pump with electromotor	51	Pressure gauge
3	Flexible hose	52	Solenoid valve
4	Maual valve	53	One-way valve
5	Pressure gauge		<b>PILOT GAS TRAIN</b>
6	Pressure governor	71	Pressure governor with filter
7	Maual valve	72	Pressure switch
8	Thermostat	73	Solenoid valve
9	Low thermostat	74	Flexible hose
10	High thermostat	75	Pilot burner
11	Electrical preheater tank	76	Pressure governor for L.P.G. tank
12	Temperature probe	77	Manual valve
13	Temperature probe	78	Pressure gauge
14	Temperature probe	79	L.P.G. tank
15	Temperature gauge		<b>COMBUSTION AIR TRAIN</b>
16	Pneumatic valve	80	Air damper
17	Metering valve with servomotor	81	Actuator
18	Actuator	82	Remote draught fan with electromotor
19	Maual valve	83	Pressure switch - PA
20	Pressure gauge	86	Burner
21	Flexible hose		
	<b>COMPRESSED AIR TRAIN (ATOMIZATION)</b>		
40	Pressure governor with filter		
41	Pressure gauge		
42	Solenoid valve		
43	Pressure switch		
44	One-way valve		
45	Metering valve		
46	Manual valve		
47	Pressure gauge		
48	Flexible hose		

**NOTE** The following items are out of CIB UNIGAS scope of supply  
77 - 78 - 79

## 1.4 How to interpret the burner "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. 3), 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.

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

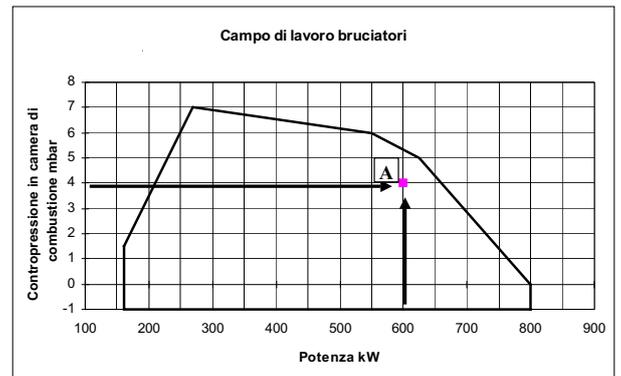
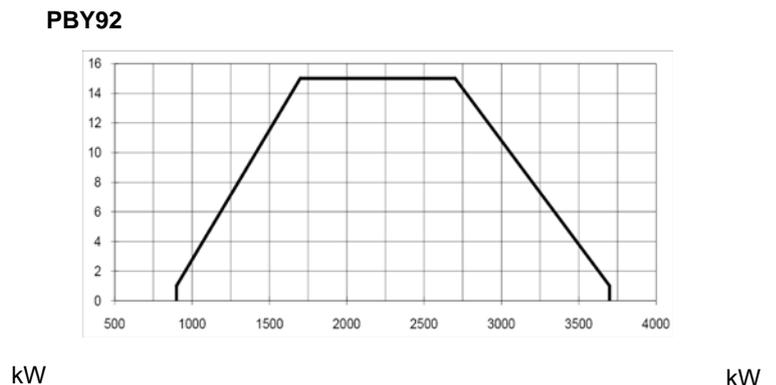
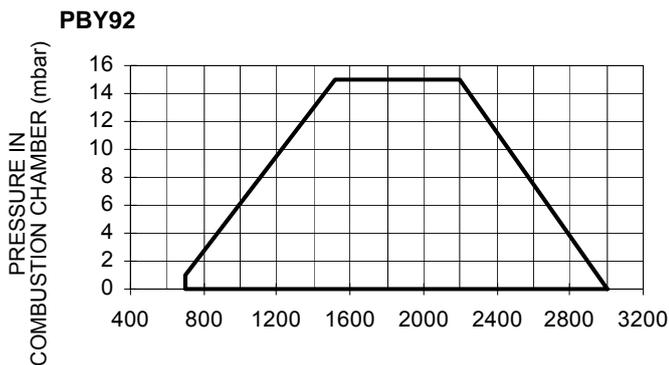
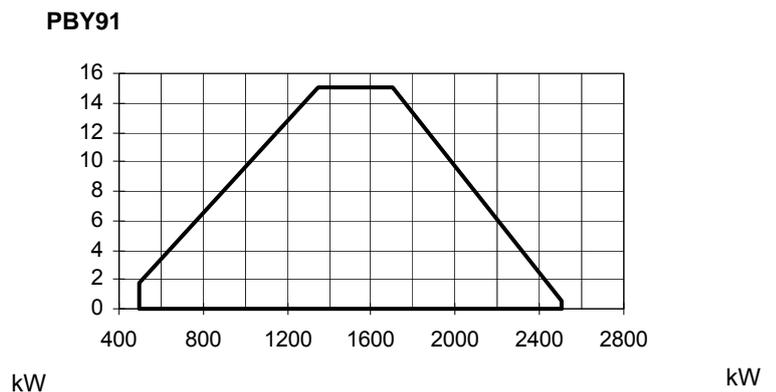
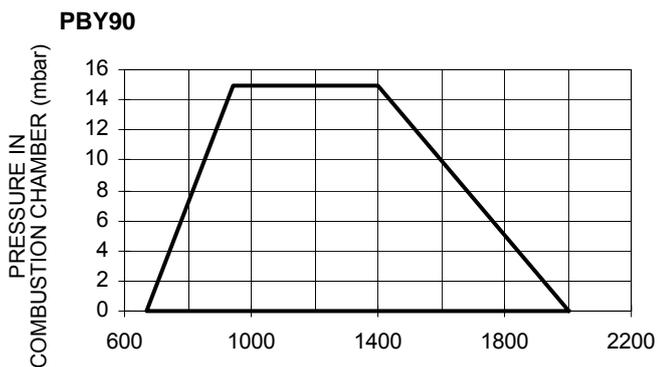


Fig. 3

## 1.5 Performance Curves

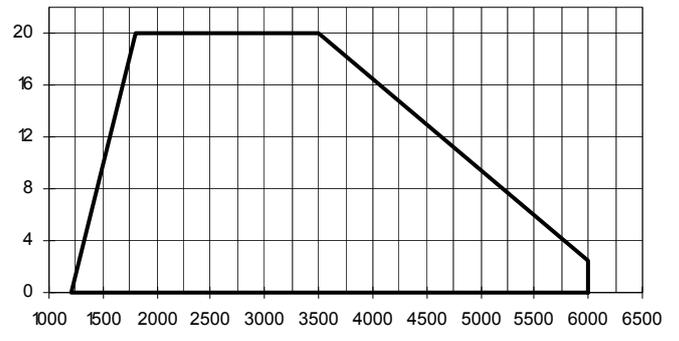
**NOTE:** The performance curve is a diagram that represents the burner performance in the type approval phase or in the laboratory tests, but does not represent the regulation range of the machine. On this diagram the maximum output point is usually reached by adjusting the combustion head to its "MAX" 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.



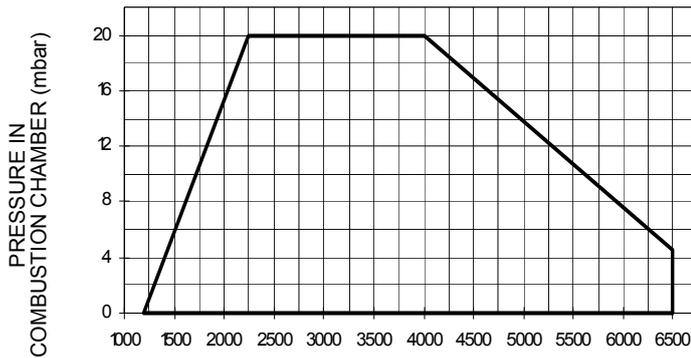
**RB510**



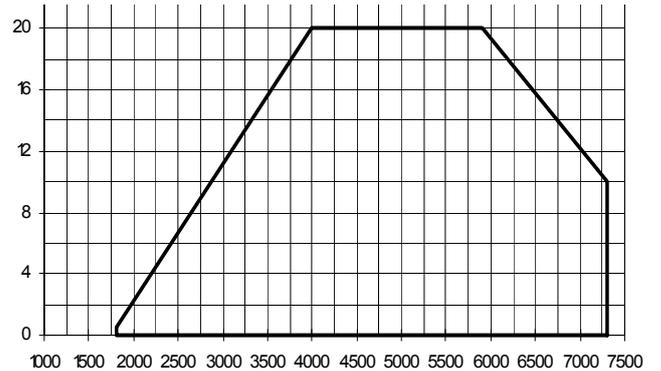
**RB515**



**RB520**



**RB525**



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.

## PART II: INSTALLATION

### 2.0 MOUNTING AND CONNECTING THE BURNER

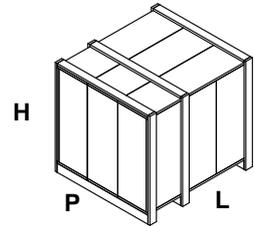
#### 2.1 Packing

Burners are despatched in wooden crates whose dimensions are:

- PBY90-91-92: 1730 mm x 1280 mm x 1020 mm(L x P x H)
- RBY510-515-520-525: 1730 mm x 1430 mm x 1130 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;
- gasket/ceramic fiber plait to be inserted between the burner and the boiler;
- oil flexible hoses;
- oil filter;
- envelope containing this manual.



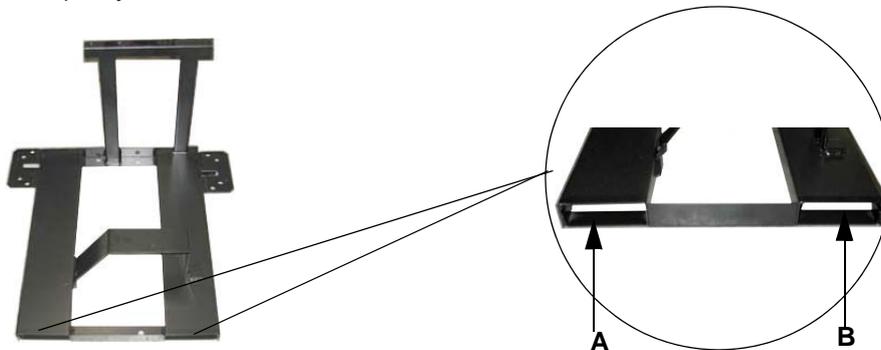
To get rid of the burner's packing, follow the procedures laid down by current laws on disposal of materials.

#### 2.2 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.

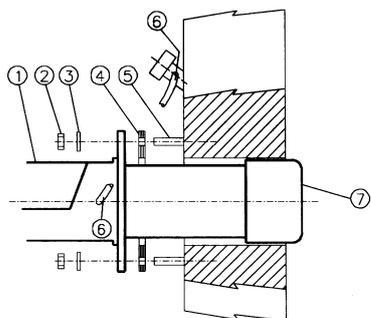
The burner is mounted on a stirrup provided for handling the burner by means of a fork lift truck: the forks must be inserted into the A and B ways. Remove the stirrup only once the burner is installed to the boiler.



## 2.3 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 boiler's door, according to the burner drilling template 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).



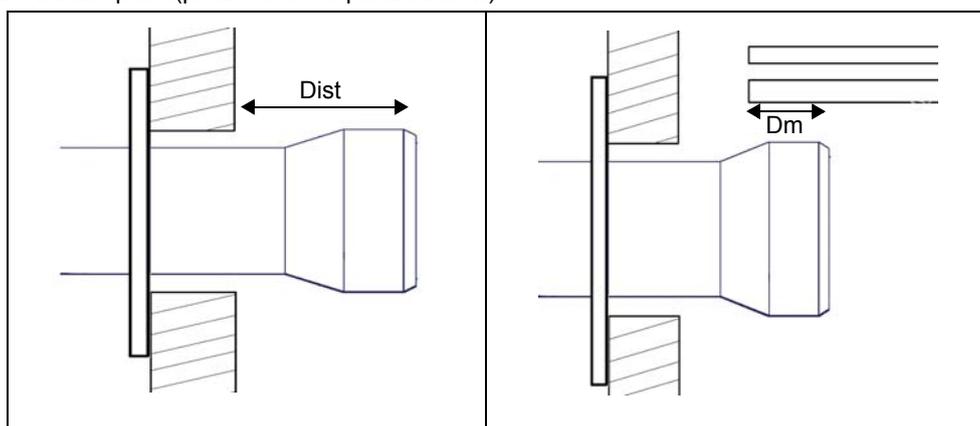
### Keys

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

## 2.4 Matching the burner to the boiler

The burners described in this manual have been tested with combustion chambers that comply with EN676 regulation and whose dimensions are described in the diagram. In case the burner must be coupled with boilers with a combustion chamber smaller in diameter or shorter than those described in the diagram, please contact the supplier, to verify that a correct matching is possible, with respect of the application involved. To correctly match the burner to the boiler verify the type of the blast tube. Verify the necessary input and the pressure in combustion chamber are included in the burner performance curve; otherwise the choice of the burner must be revised consulting the burner manufacturer. To choose the blast tube length follow the instructions of the boiler manufacturer. In absence of these consider the following:

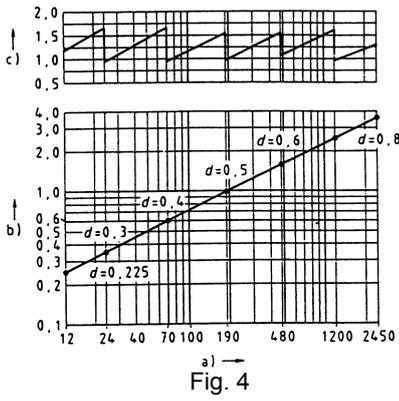
- Cast-iron boilers, three pass flue boilers (with the first pass in the rear part): the blast tube must protrude no more than **Dist** = 100 mm into the combustion chamber. (please see the picture below)
- Pressurised boilers with flame reversal: in this case the blast tube must penetrate **Dm** 50 ÷ 100 mm into combustion chamber in respect to the tube bundle plate. (please see the picture below)



The length of the blast tubes does not always allow this requirement to be met, and thus it may be necessary to use a suitably-sized

PART II: INSTALLATION

spacer to move the burner backwards or to design a blast tube that suits the utilisation (please, contact the manufacturer).

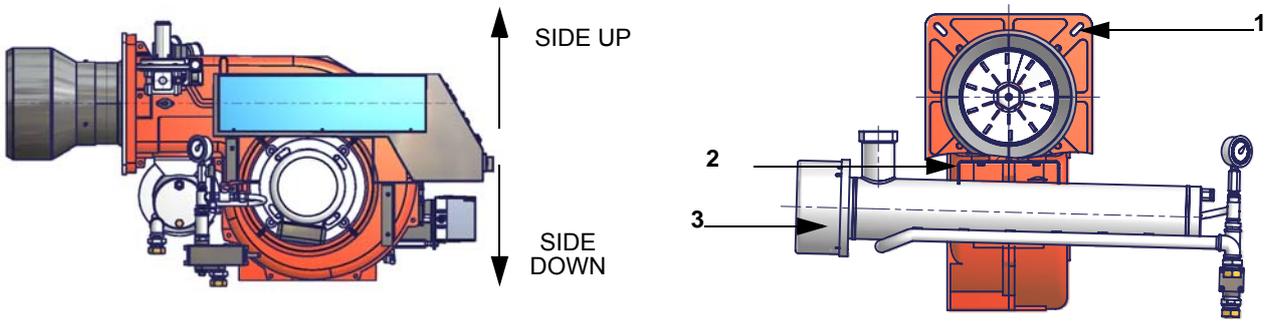


**Key**

- a) Heat output in kW
- b) Length of the flame tube in meters
- c) Flame tube firing intensity in MW/m<sup>3</sup>
- d) Combustion chamber diameter (m)

Fig. 4 - Firing intensity, diameter and length of the test flame tube as a function of the heat input in kW.

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-heating tank on the burner

## 3.0 OIL TRAIN CONNECTIONS

### 3.1 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 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 the fuel unit.

### 3.2 Connecting the pump

According to the pump provided, proceed as follows:

- 1 remove the closing nuts **A** (on the pump inlet) and **B** (from pump to the burner);
- 2 connect the pump **being careful to avoid exchanging the lines**: see the arrows marked on the pump.

For further information, refer to the technical documentation of the pump.

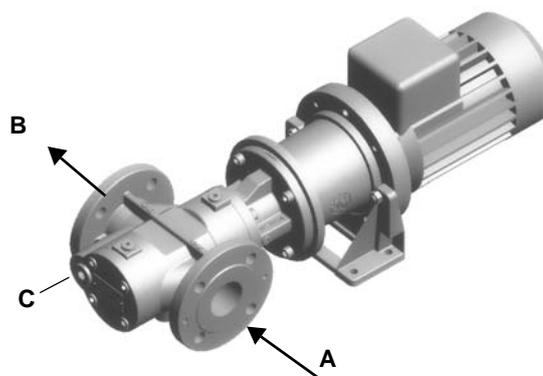


Fig. 5 - Kral

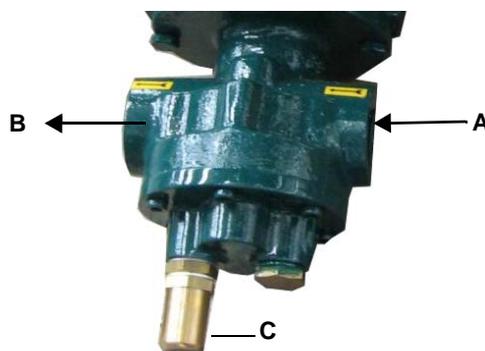


Fig. 6 - Cucchi

#### Legend

- A - Inlet
- B - Outlet
- C - Overflow pressure adjusting screw

### 3.3 Heavy oil pumps

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

Pumps	capacity [l/h]	power [kW]	speed [rpm]	connection	max outlet pressure [bar]	max inlet pressure (bar)
Kral KF 10 BCB	500	0,37	1500	DN25	10	2
Kral KF 15 BCB	800	0,55	1500	DN25	10	2
Kral KF 20 BCB	1100	0,55	1500	DN25	10	2
Cucchi FMG25	1400	0.75	1500	-	10	2

For further details see the manufacturer documentation.

### 3.4 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

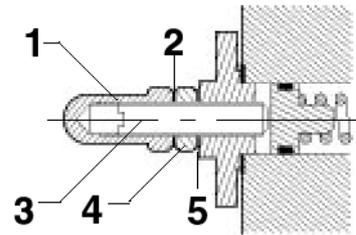


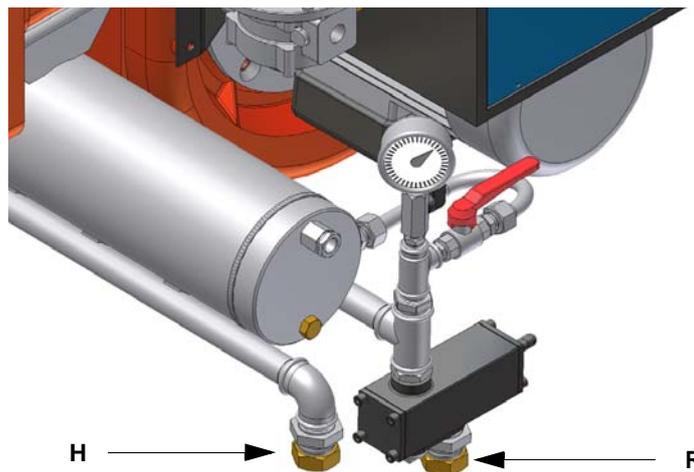
Fig. 7

3.5

### 3.6 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 **R** (on the oil pressure governor) of the inlet and return connections;
- 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.



### 3.7 Connecting the compressed air hoses

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



### 3.8 Pilot gas train

The connection to the pilot gas train must be done according to the following scheme, valid for LPG. In case of natural gas, connect the pressure governor (pos. 3) to the natural gas line (maximum input pressure = 1 bar).

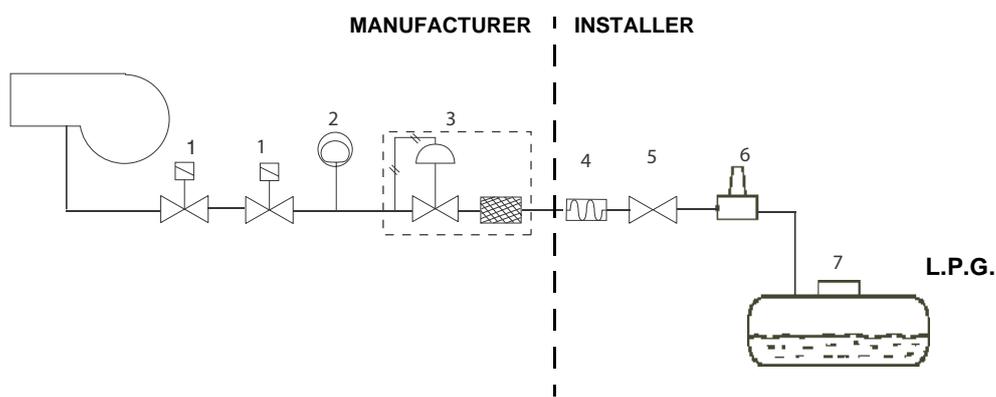


Fig. 8

#### Key

- 1 Burner
- 2 Gas valves
- 3 Minimum gas pressure switch
- 4 Gas pressure governor with filter
- 5 Bellow joint
- 6 Manual cutoff valve

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



connection to the gas supply network

Once the gas train is installed, execute 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. 8, the gas proving test must be performed, according to the procedure set by the laws in force.

## 4.0 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.

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



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

To execute the electrical connections, proceed as follows:

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

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

### 4.1 Note on electrical supply

If the power supply to the burner is 230V three-phase or 230V phase-phase (without a neutral), with the Siemens control box, between the terminal 2 (terminal X3-04-4 in case of LMV2x, LMV3x, LMV5x, LME7x) on the board and the earth terminal, an RC Siemens RC466890660 filter must be inserted.

#### Key

C - Capacitor (22nF/250V)

LME / LMV - Siemens control box

R - Resistor (1Mohm)

M - Resistor (1Mohm)

M - Terminal 2 (LGB,LMC,LME), terminal X3-04-4 ( LMV2x, LMV3x, LMV5, LME7x)

RC466890660 - RC Siemens filter

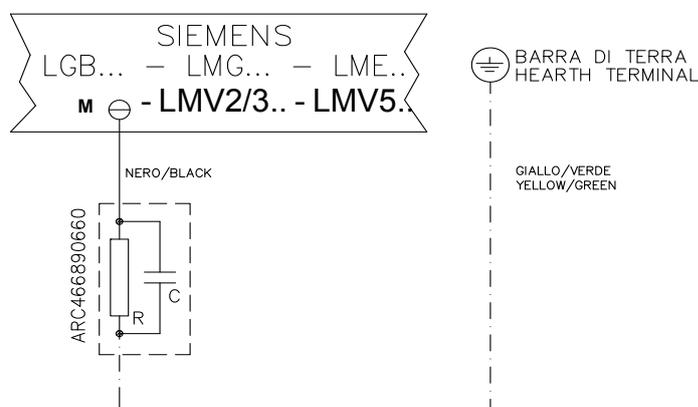


Fig. 9

### 4.2 Rotation of electric motor

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

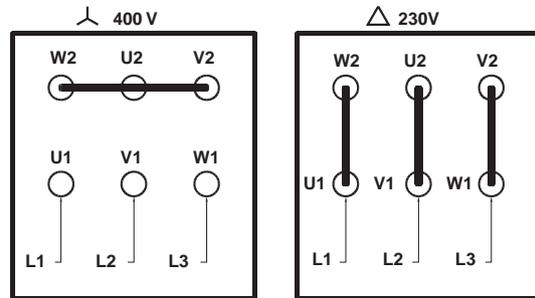


**CAUTION:** check the motor thermal cut-out adjustment

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



#### ELECTRIC MOTOR CONNECTION



### 4.3 Connecting the oil heating resistors

#### 2.4 - 4.5 kW

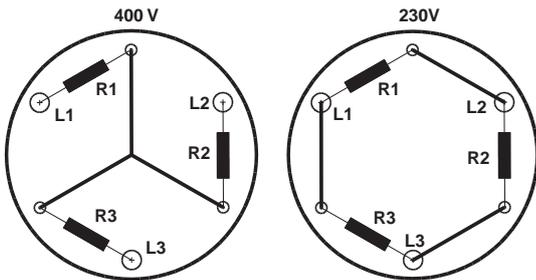


Fig. 10

#### 8 - 12 kW

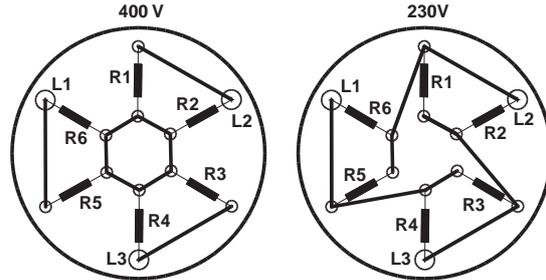


Fig. 11

#### 18 - 24 kW

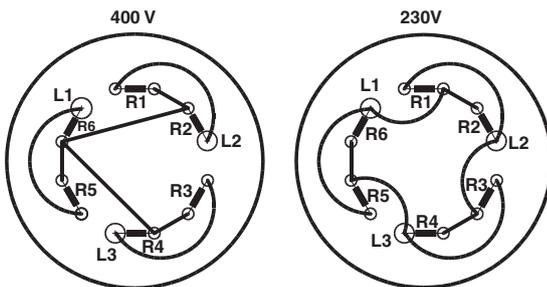


Fig. 12

## 5.0 Recommendations to design heavy oil feeding plants

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 Fig. 13 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 Fig. 13 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. 14, 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.

### 5.1 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.

### 5.2 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. 15 roughly shows the inlet pump pressure according to the oil temperature.

### 5.3 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 Fig. 16 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.

### 5.4 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



**ATTENTION:** Atomizing air pressure is typically set at 1 bar lower than oil pressure.

## 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. 6

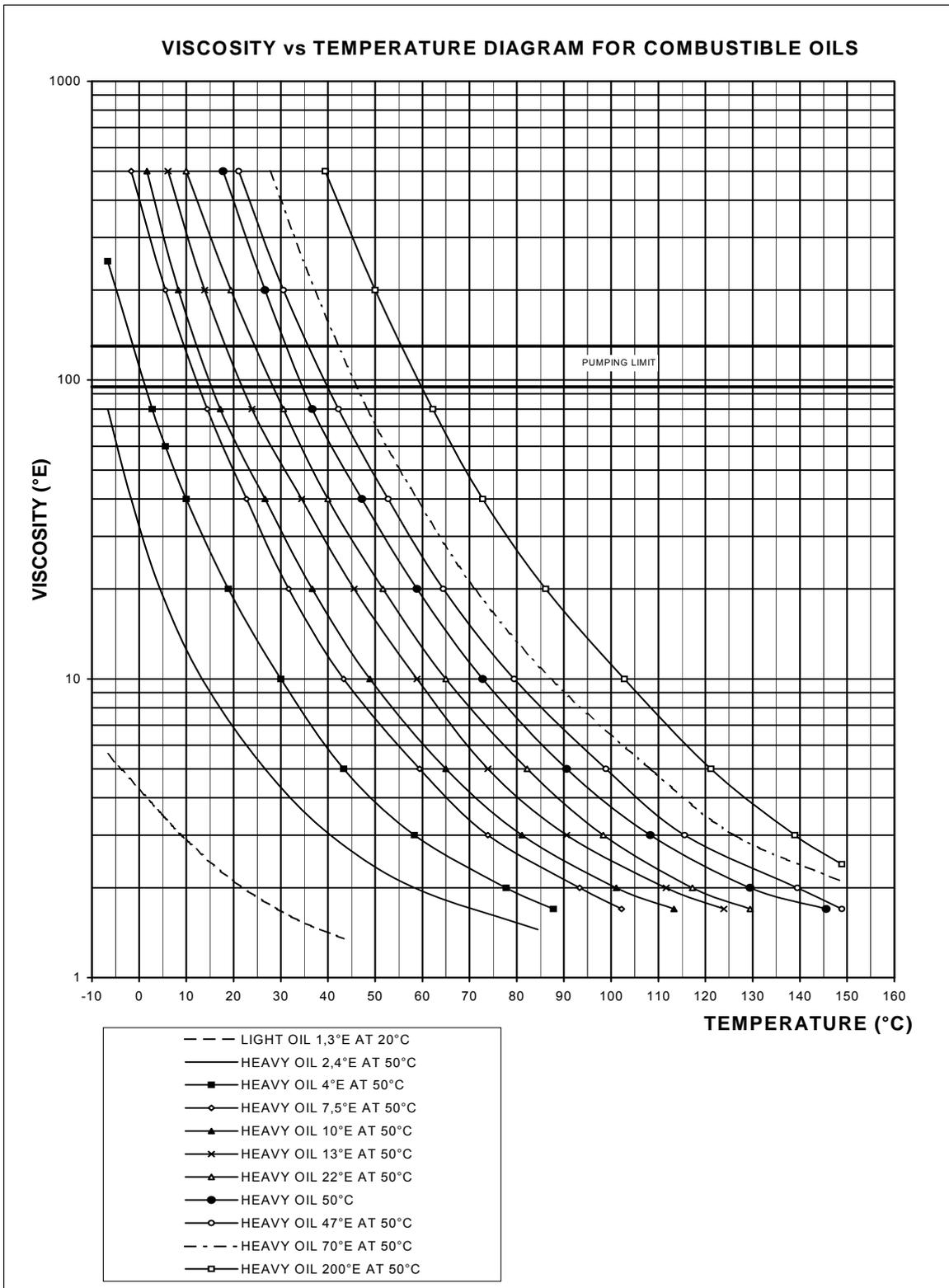


Fig. 13

**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).

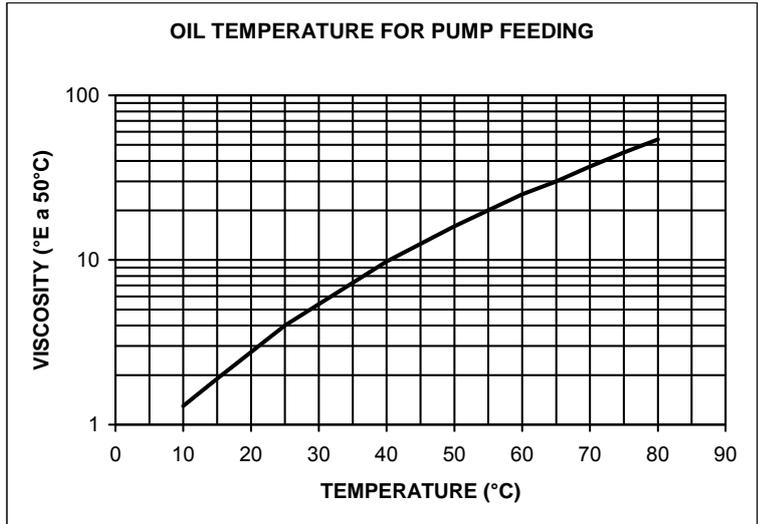


Fig. 14

**Indicative diagram showing the oil pressure according to its temperature**

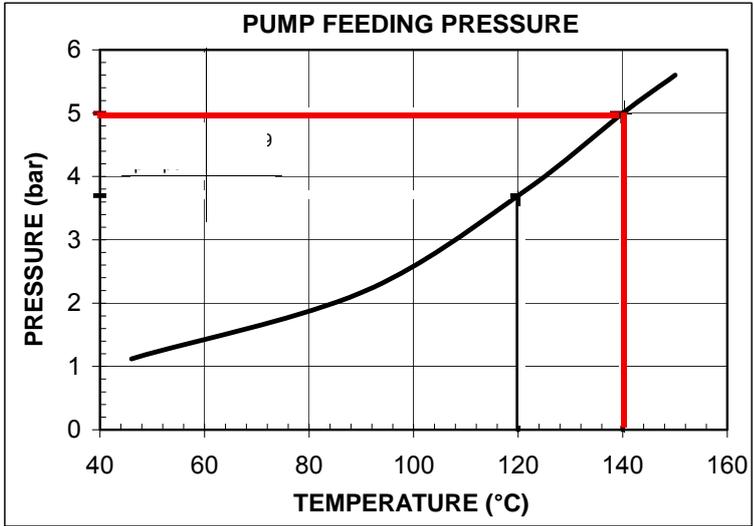
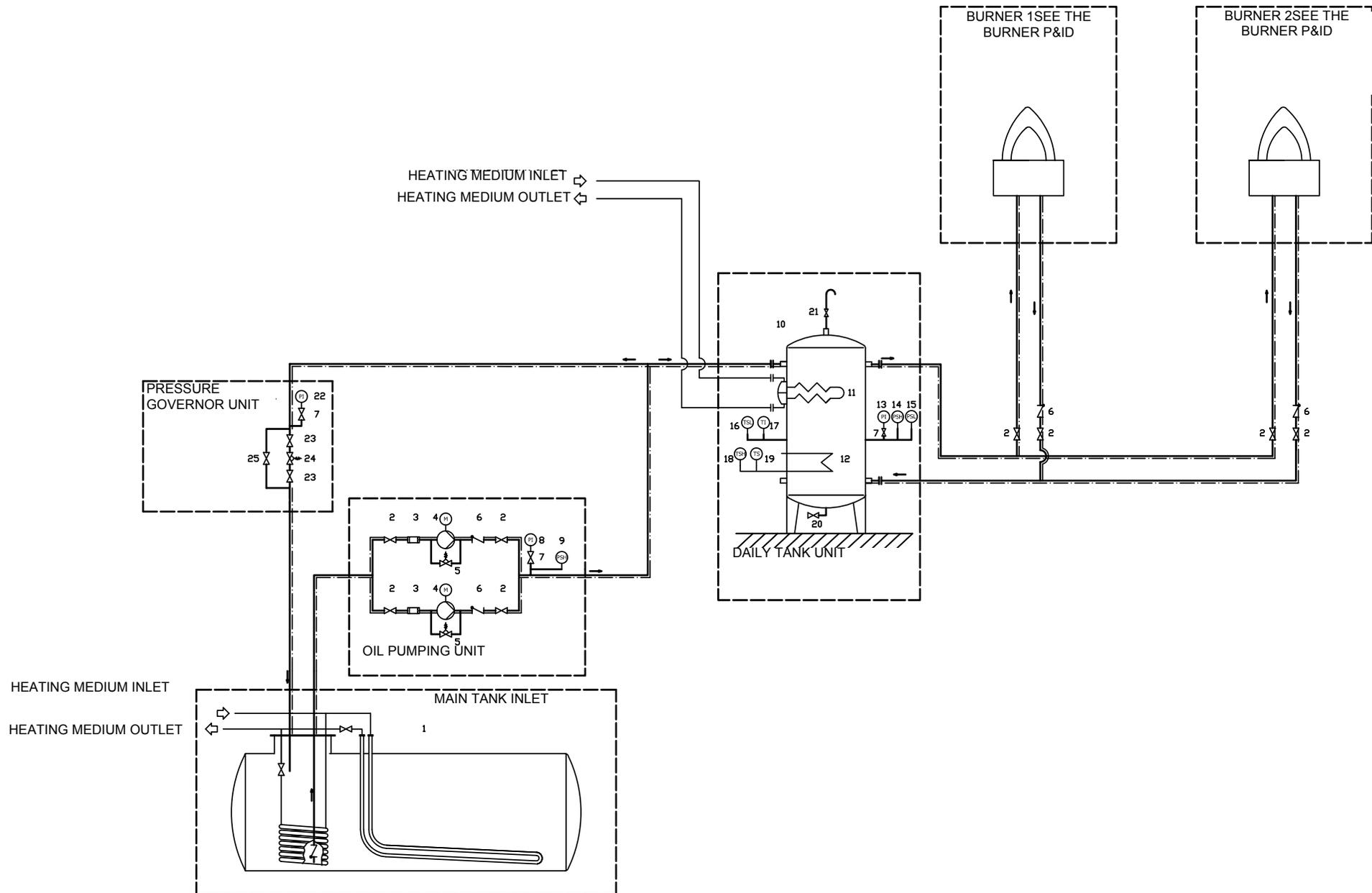


Fig. 15

# 6.1 HYDRAULIC DIAGRAMS

Fig. 16 - Hydraulic diagram 3ID0024



<b>3ID0024</b>	<b>KEYS</b>
----------------	-------------

<b>POS</b>	<b>OIL TRAIN</b>
------------	------------------

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
----	--------------

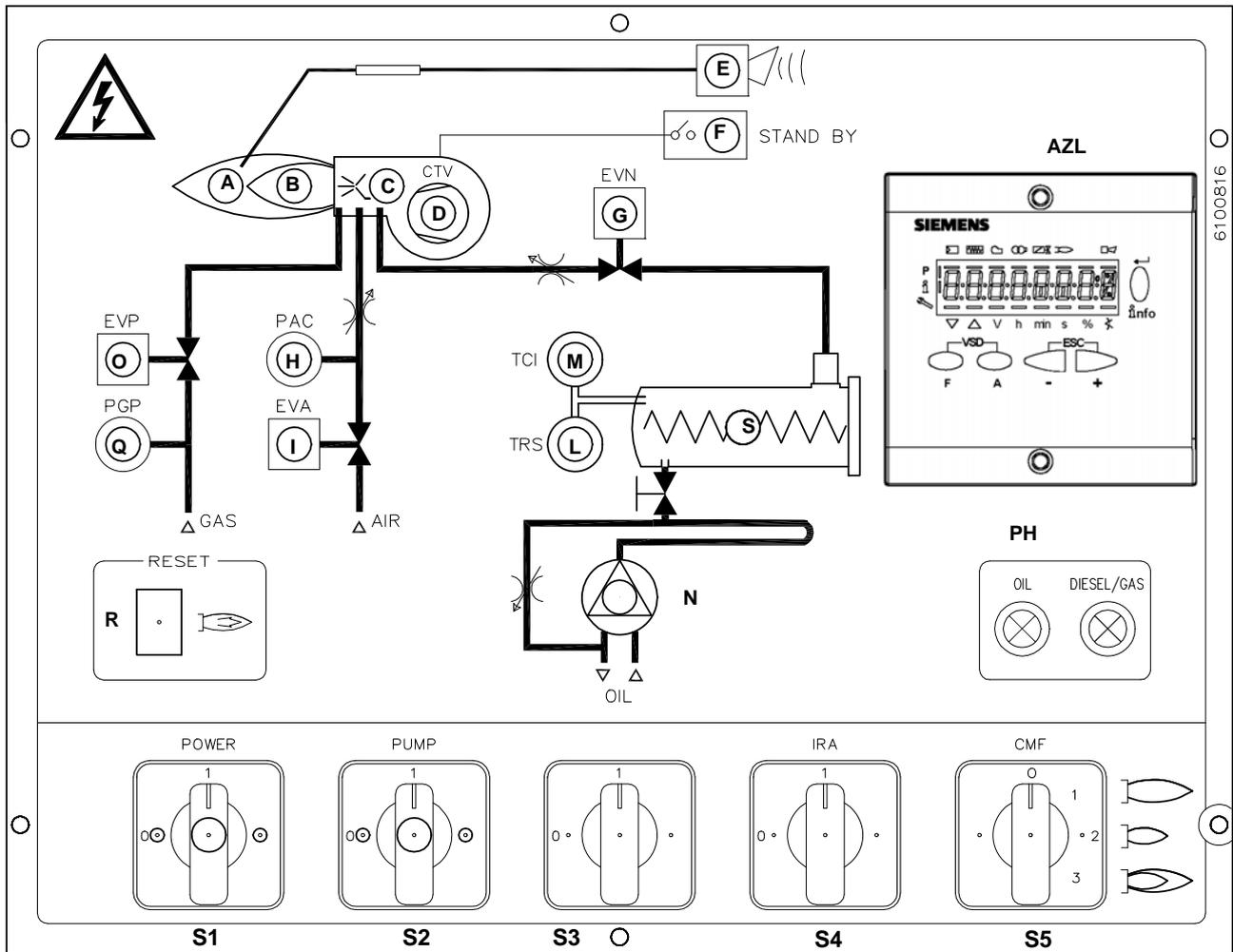
24	Pressure governor
----	-------------------

25	Needle valve
----	--------------

## PART III: OPERATION

**LIMITATIONS OF USE: PLEASE REFER TO THE CHAPTER “WARNINGS” AT THE BEGINNING OF THIS MANUAL.**

6.2 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 Compressed air pressure switch lamp
- I Compressed air solenoid valve lamp
- L Heating resistors safety thermostat lamp
- M Plant enabling thermostat lamp
- AZL Siemens output controller
- N Oil pump in operation
- O Pilot solenoid valve lamp
- PH Heavy oil operation lamp
- Q Pilot gas pressure switch
- R Reset pushbutton for control box
- S Pre-heater in operation lamp
- S1 Main switch
- S2 Pump operation selector "MAN-AUTO"
- S3 Fuel operation selector
- S4 Auxiliary resistors switch
- S5 Operation mode manual selector

## 7.0 ADJUSTMENT FOR OIL OPERATIONS

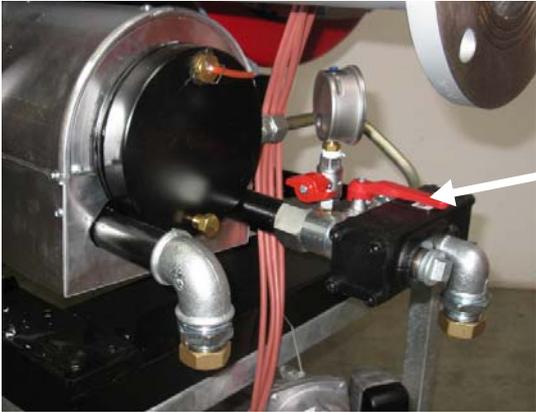


Before starting up the burner, make sure that the return pipe to the tank is not obstructed. Any obstruction would cause the pump seal to break.



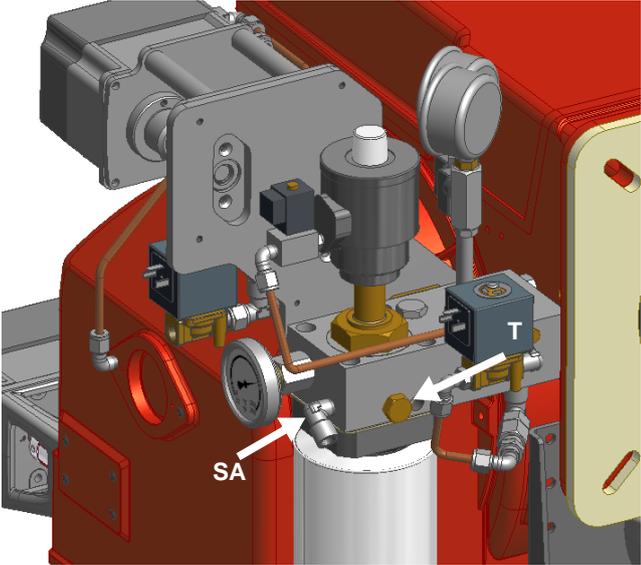
**ATTENTION:** before starting the burner up, be sure that the manual cutoff valves are open. Be sure that the mains switch is closed.

The figure below shows nozzle flow valve. Before turn on the burner, open the manual valve.



### 7.1 Air vent

Before to give tension to the eletrical resistance, release the air inside the heaters through the SA connection acting on the T cap.



## 7.2 Oil Flow Rate Settings

The light oil flow rate can be adjusted choosing a pneumatic nozzle that suits the boiler/utilisation output and setting the delivery and return pressure values according to the ones quoted on the following table.

VISCOSITY AT 50 °C		OIL PRESSURE AFTER BURNER PUMP		OIL PRESSURE AFTER OIL METERING VALVE	
		min	max	min	max
°cSt (°E)		bar		°C	
	< 50 (7)	6	10	1	2
> 50 (7)	< 110 (15)	6	10	1	2
> 110 (15)	< 400 (50)	6	10	1	2
> 400 (50)	<4000 (530)	6	10	1	2

Tab. 2

The pressure values shown in the table are intended as working range. In order to obtain a more accurate indication, please refer to the nozzle pressure-flow diagrams.

## 7.3 Compressed air adjustment



**ATTENTION:** set the pressure value about 1 bar, at the pressure gauge 47 (see Fig. 18). check it before open valve 16!

To start the burner set the oil and atomisation medium pressure at about 1 bar, as first trial. then, regulate the burner checking the combustion values at the chimney, according to the paragraph "operation", and adjust the starting point according to the regulation.

40



Fig. 17

47

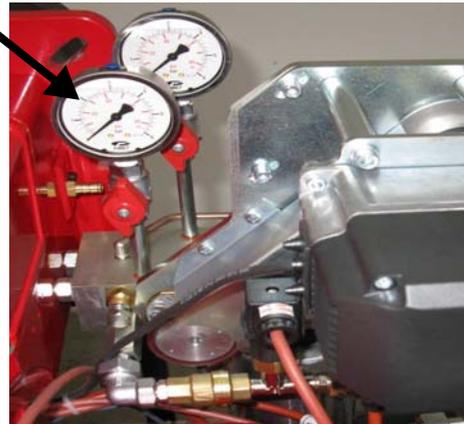


Fig. 18



**ATTENTION:** set the pressure value about 5-10 bar, at the pressure gauge on the governor 40 (see hydraulic diagram and Fig. 23)

## 7.4 Air valve for gun cleaning

As the flame is off, the purge valve 52 opens automatically the compressed air to clean the gun. With this operation, the oil between the valves and the nozzle is drained. The air pressure value for the gun cleaning must be setted to the pressure value of the atomization

medium, regulated in low flame (generally 1 bar), and should be adjusted through the item 50. (see hydraulic diagram of the burner)

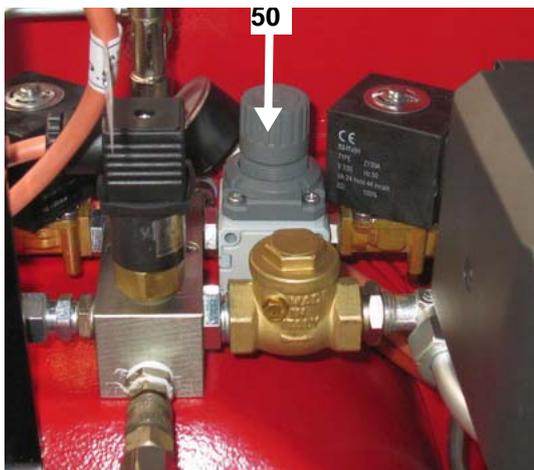
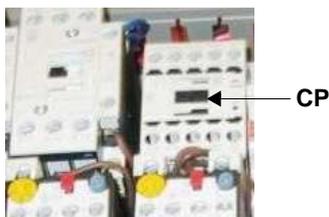


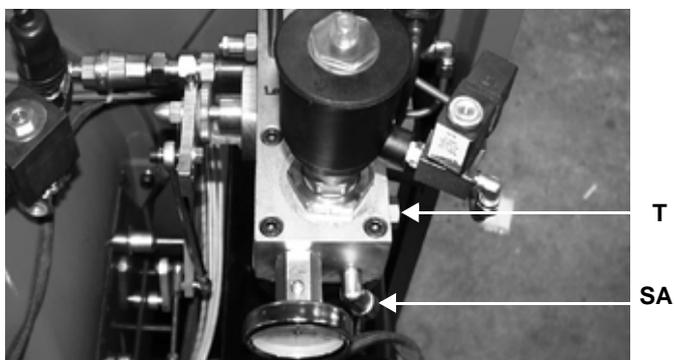
Fig. 19

### 7.5 Oil Flow Rate Settings actuator

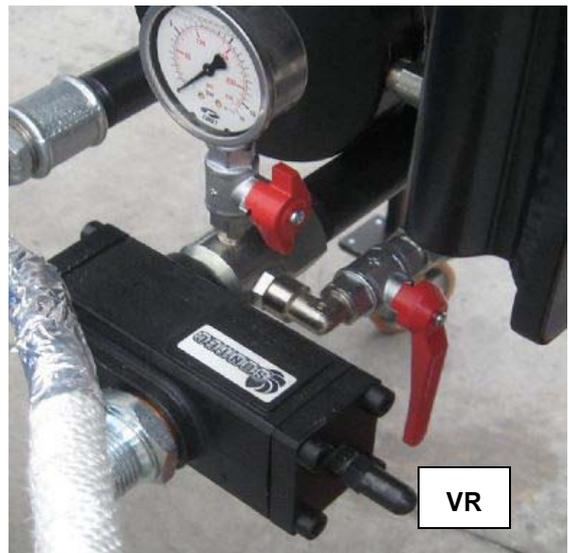
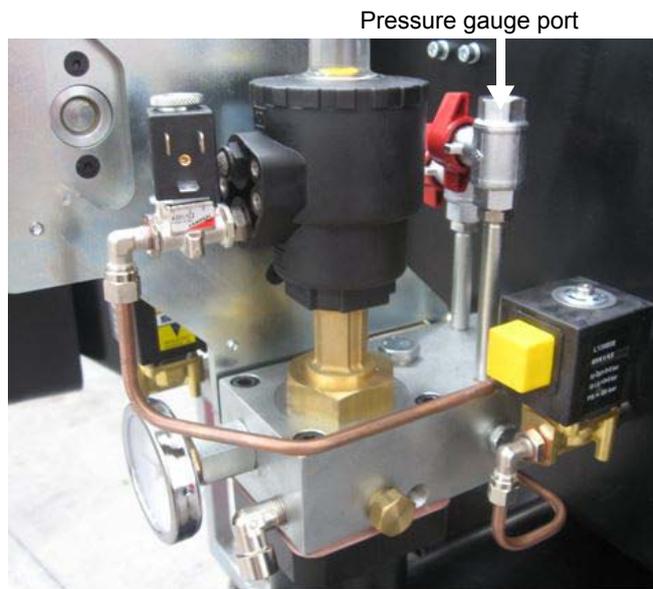
- 1 Turn the burner on by means of the main switch on the burner control panel (see chapter “Operation”);
- 2 with the electrical panel open, prime the oil pump acting directly on the related contactor **CP** (see next picture): check the pump motor rotation and keep pressing for some seconds until the oil circuit is charged;



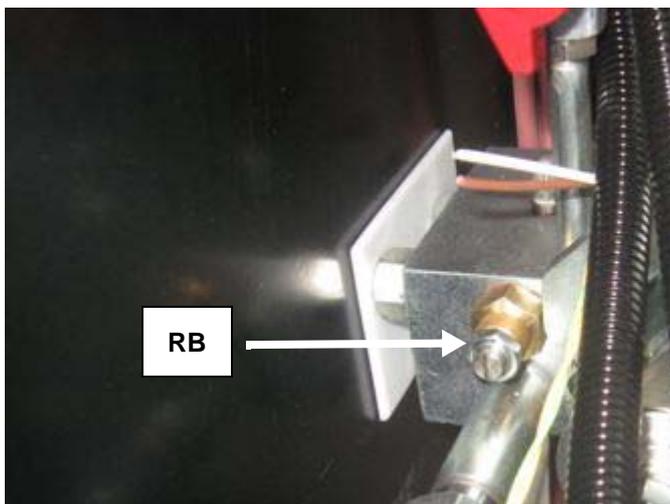
- 3 bleed the air from the **SA** port by loosening the cap **T** without removing it, then release the contactor and fasten cap **T**.



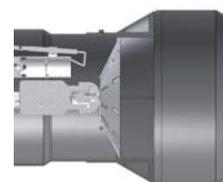
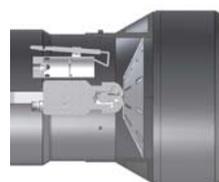
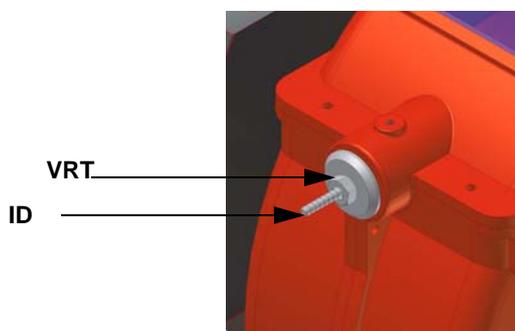
- 4 As for setting the fuel/air ratio curve, see the LMV2x/3x related manual.
- 5 The nozzle supply pressure is already factory-set and must not be changed. Only if necessary, adjust the supply pressure as follows (see related paragraph); read the pressure on the oil pressure gauge on picture below and act on the Suntec TV governor adjusting screw VR (see picture below and description on page 20) 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); if it is too high, reduce it.



6 Set the atomisation air according to the data in the nozzle diagram attached, by means of the RB knob (see picture).



7 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).



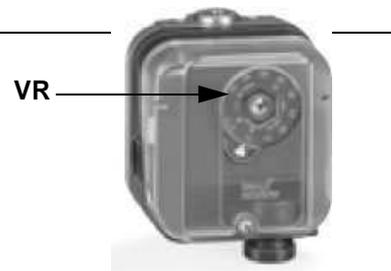
**Attention!** if it is necessary to change the head position, repeat the air and gas adjustments described above.

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

## 7.6 Calibration of air pressure switch

To calibrate the air pressure switch, proceed as follows:

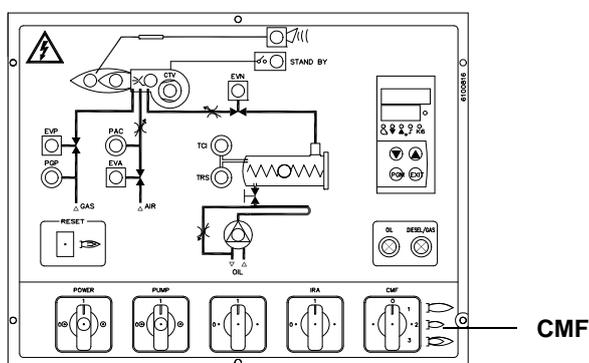
- Remove the transparent plastic cap.
- Once air and heavy oil setting have been accomplished, startup the burner.
- During the pre-purge phase of the operation, turn slowly the adjusting ring nut **VR** in the clockwise direction until the burner lockout, then read the value on the pressure switch scale 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.



## 7.7 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.



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

## 7.8 Oil thermostat adjustment

Progressive and fully modulating oil burners are equipped with electronic multi-thermostat Danfoss MCX, whose operation is controlled by thyristor. (for details refer to the attached technical documentation)



Fig. 20 - Danfoss MCX

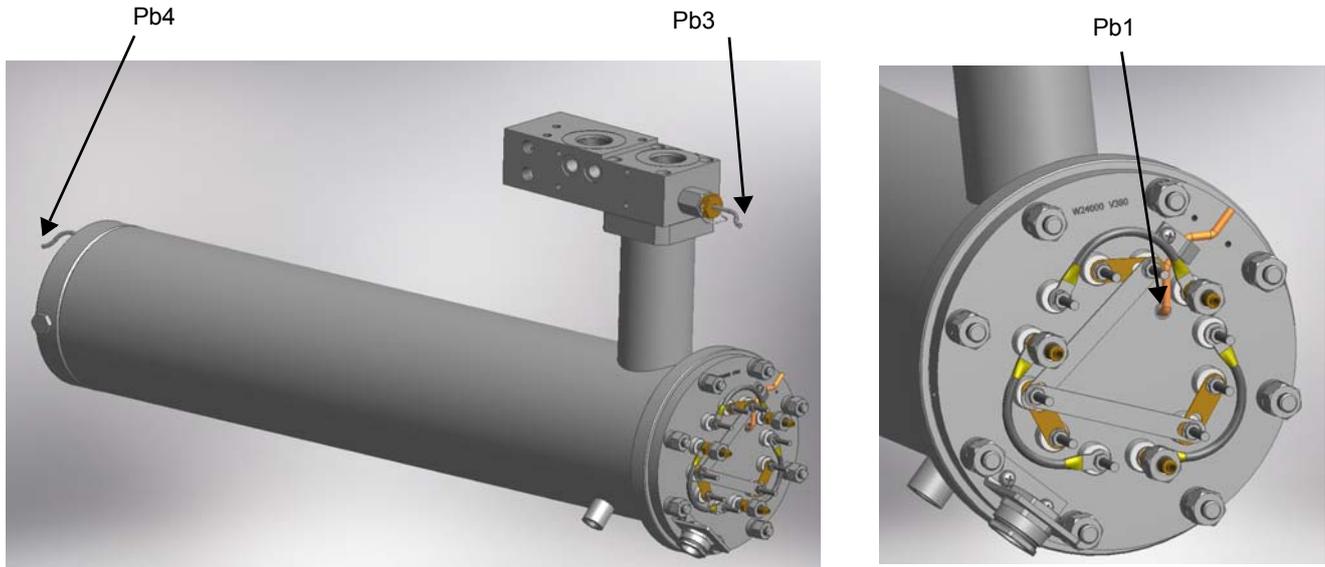


Fig. 21 - Probe connections (Danfoss MCX)

Menu path			Oil viscosity at 50 °C according to the letter shown in the burner model				
			P	N	E	D	H
			89 cSt	< 50 cSt	> 50 cSt < 110 cSt	> 110 cSt < 400 cSt	> 400 cSt < 4000 cSt
			12 °E	< 7°E	> 7 °E < 15 °E	> 15 °E < 50 °E	> 50 °E < 530 °E
Par							
rEG	Pb1	tr	Oil heater temperature probe				
	Pb2	tCl	Plant consent temperature probe (when installed)				
			20 °C	70 °C	70 °C	70 °C	---
	Pb3	Oil	oil heater output temperature probe (PID regulation);				
		SP0	Set-point oil heater with oil pump stopped (stand-by)				
			45 °C	120 °C	130 °C	140 °C	150 °C
	Pb4	tcn	Oil heater consent temperature probe				
			40 °C	100 °C	100 °C	110 °C	120 °C
		trS	Safety temperature tank resistors (manual reset)				
			120 °C	190-200 °C	190-200 °C	190-200 °C	190-200 °C

The above temperature values are suggested and refer to a plant designed according to the prescriptions in the burner user manual. The suggested values can change in reference to the fuel oil specifications.

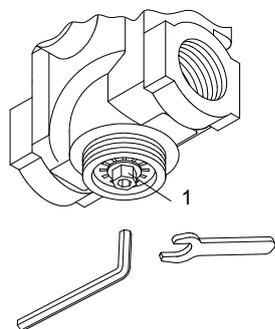
### Adjusting the pilot gas flow rate: gas valve Brahma EG12xR and pressure governor

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

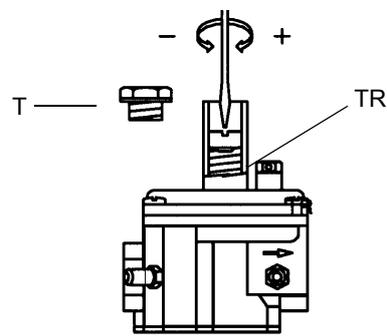
- 1 remove the protection on the bottom of the valve, moving it counterclockwise (see next picture);
- 2 rotate clockwise the nut 1 as shown in to close the valve or counterclockwise to open.

To perform gas pressure adjustment, act 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**.



**Brahma gas valve EGRx12**



**Gas pressure governor**

Set pilot gas pressure switch at 50 mbar.



Fig. 22

## 8.0 ADJUSTING AIR AND FUEL RATE

### 8.1 Adjustments - brief description

The air and fuel rates adjustments must be performed at the maximum output first (“high flame”): see the LMV related manual..

- Check that the combustion parameters are in the suggested limits.
- Check the flow rate measuring it on the counter or, if it was not possible, verifying the combustion head pressure by means of a differential pressure gauge, as described on par. “Measuring the gas pressure in the combustion head”.
- Then, adjust the combustion values by setting the “gas/air” ratio” curvepoints (see the LMV related manual).
- Set, now, the low flame output (according to the procedure described on the “Siemens LMV manual”) 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.



**.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.



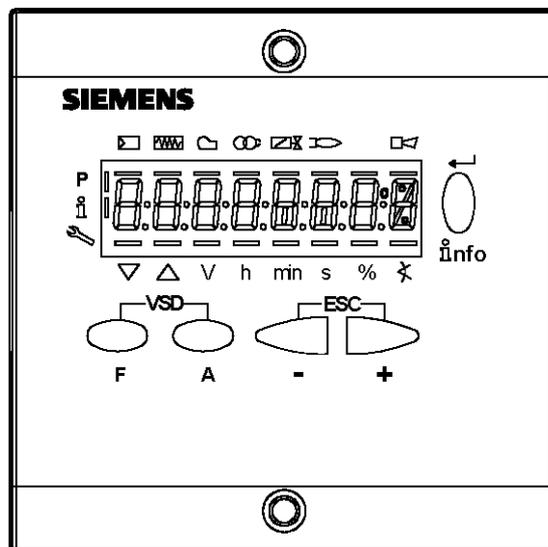
**IMPORTANT!** the combustion air excess must be adjusted according to the values in the following chart.

Recommended combustion parameters		
Fuel	Recommended (%) CO <sub>2</sub>	Recommended (%) O <sub>2</sub>
Heavy oil	11 ÷ 12	4.2 ÷ 6.2

### 8.2 User interface

The AZL2x.. display is shown below:

The keys functions are the following:



**Key F**

Used to adjust the “fuel” actuator position (Fuel): :

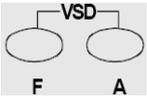
While pressing the **F** key, the “fuel” actuator position can be changed by means of the **+** and **-** keys.



**Key A**

Used to adjust the “air” actuator position (Air):

While pressing the **A** key, the “air” actuator position can be changed by means of the **+** and **-** keys.



**Key F + A**

While pressing the two keys contemporarily, the **code** message will appear: by entering the proper password it is possible to access the **Service** mode.

**Info and Enter keys**



Used for **Info** and **Service** menus  
 Used as **Enter** key in the setting modes  
 Used as **Reset** key in the burner operation mode  
 Used to enter a lower level menu



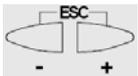
**-Key -**  
 Used to decrease a a value  
 Used to enter Info and Service during the curve adjustments



**+Key +**  
 Used to increase a a value  
 Used to enter Info and Service during the curve adjustments

**Keys (+ & -) = ESC**

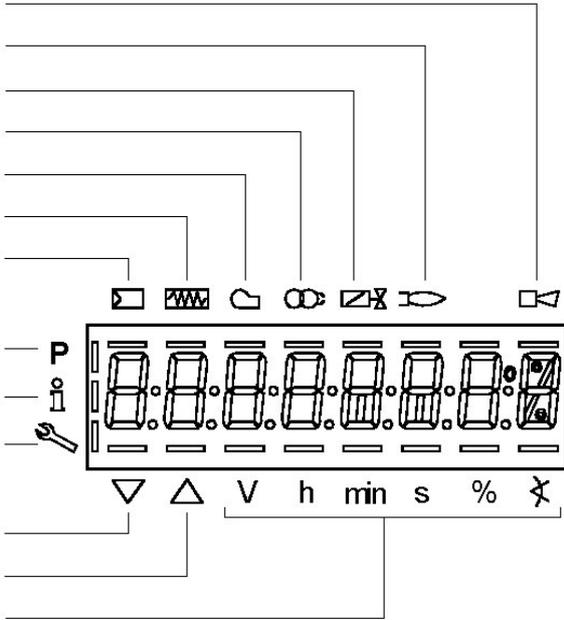
By pressing + and - at the same time, the ESCAPE function is performed:



to enter a lower level menu

The display will show these data:

- Lock+unlock codes
- Flame
- Open valves
- Ignition transformers energised
- Fan motor energised
- Oil pre-heater energised
- Plant heat request
- Parametere setting mode
- Info mode
- Service mode
- Closing actuator
- Opening actuator
- Unit measurel



The display will show these data:

**8.3 Setting menu**

The setting menu is divided into different blocks:

Bloc.	Descrizione	Description	Password
100	Informazioni generali	General	OEM / Service / Info
200	Controllo bruciatore	Burner control	OEM / Service
400	Curve rapporto	Ratio curves	OEM / Service
500	Controllo rapporto	Ratio control	OEM / Service
600	Servocomandi	Actuators	OEM / Service
700	Storico errori	Error history	OEM / Service / Info
900	Dati di processo	Process data	OEM / Service / Info

The accesses to the various blocks are allowed by passwords. Passwords are divided into three levels:

- User level (info): no password needed
- Service level (Service)
- Manufacturer level (OEM)

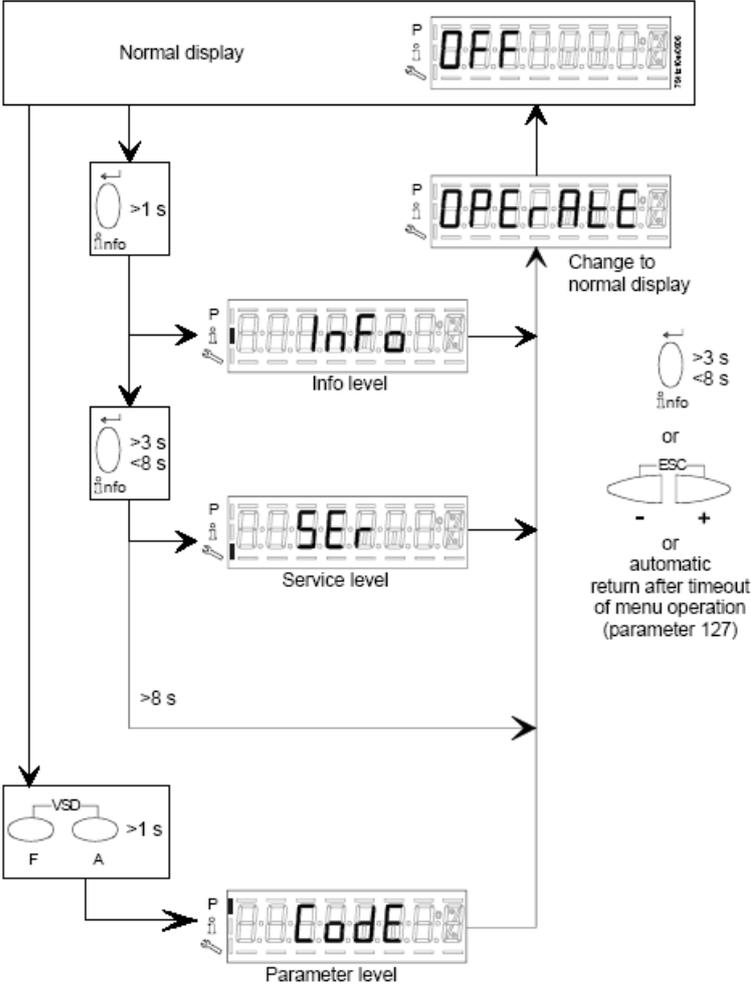
## 8.4 PHASES LIST

During operation, the following program phases are shown. The meaning for each phase is quoted in the table below

Fase /Phase	Funzione	Function
Ph00	Fase blocco	Lockout phase
Ph01	Fase di sicurezza	Safety phase
Ph10	t10 = tempo raggiungimento posizione riposo	t10 = home run
Ph12	Pausa	Standby (stationary)
Ph22	t22 = tempo di salita ventilatore (motore ventilatore = ON, valvola intercettazione di sicurezza = ON)	t22 = fan ramp up time (fan motor = ON, safety shutoff valve = ON)
Ph24	Verso posizione preventilazione	Traveling to the prepurge position
Ph30	t1 = tempo preventilazione	t1 = prepurge time
Ph36	Verso posizione accensione	Traveling to the ignition position
Ph38	t3 = tempo preaccensione	t3 = preignition time
Ph40	TSA1 = primo tempo sicurezza (trasformatore accensione ON)	TSA1= 1st safety time (ignition transformer ON)
Ph42	TSA1 = primo tempo sicurezza (trasformatore accensione OFF)	TSA1 = 1st safety time (ignition transformer OFF) t42 = preignition time OFF
Ph44	t44 = intervallo 1	t44 = interval 1
Ph50	TSA2 = secondo tempo sicurezza	TSA2 = 2nd safety time
Ph52	t52 = intervallo 2	t52 = interval 2
Ph60	Funzionamento 1 (stazionario)	Operation 1 (stationary)
Ph62	t62 = massimo tempo bassa fiamma (funzionamento 2, in preparazione per spegnimento, verso bassa fiamma)	t62 = max. time low-fire (operation 2, preparing for shutdown, traveling to low-fire)
Ph70	t13 = tempo postcombustione	t13 = afterburn time
Ph72	Verso posizione postcombustione	Traveling to the postpurge position
Ph74	t8 = tempo postventilazione	t8 = postpurge time
Ph80	t80 = tempo evacuazione controllo tenuta valvole	t80 = valve proving test evacuation time
Ph81	t81 = tempo perdita pressione atmosferica, prova atmosferica	t81 = leakage time test time atmospheric pressure, atmospheric test
Ph82	t82 = test perdita, test riempimento	t82 = leakage test filling test, filling
Ph83	t83 = tempo perdita pressione gas, test pressione	t83 = leakage test time gas pressure, pressure test
Ph90	Tempo attesa "mancanza gas"	Gas shortage waiting time

## 8.5 Entering the Parameter levels

By means of a proper use of the keys, it is possible to enter the various level parameters, as shown in the following flow chart:

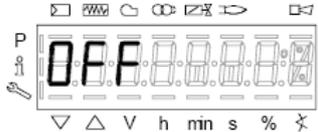


The burner and consequently the LMV2x.. are factory set; the air and fuel curves as set as well.

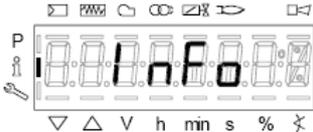
**8.6 Info level**

To enter the **Info** level, proceed as follows:

- 1 in any menu position, press keys + and - at the same time, then the program will start again: the display will show **OFF**.



- 2 until the display will show **InFo**, Press the **enter (InFo)** key

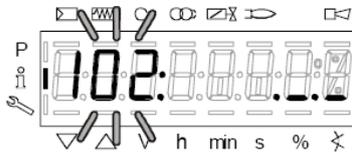


- 3 then it will show the first code (167) flashing, on the right side it will show the data entered. By pressing + or - it is possible to scroll (up or down) the parameter list.
- 4 If a dot-line is shown on the right, there is no enough room for complete visualisation: press **enter** again the data will be completely shown for 1 to 3 seconds. By pressing **enter** or + and- at the same time, the system will exit the parameter visualisation and go back to the flashing number.

The **Info** level shows some basic parameters as:

Parameter	Description
167	Cubic meters of fule (resettable)
162	Operating hours (resettable)
163	Device operating hours
164	Burners start-ups (resettable)
166	Total number of start-ups
113	Burner number (i.e. serial number)
107	Software version
102	Software date
103	Device serial number
104	Customer code
105	Version
143	Free

5 Example: choose parameter 102 to show the date



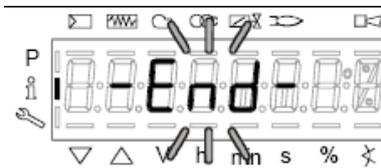
the display shows parameter **102** flashing on the left and characters **. \_ . \_** on the right.

6 press **InFo** for 1-3 seconds: the date will appear

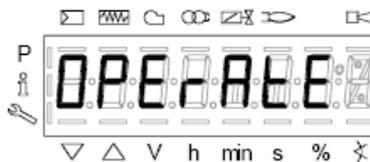
7 press **InFo** to go back to parameter "102"

8 by pressing **+ / -**, it is possible to scroll up/down the parameter list (see table above), or, by pressing **ESC** or **InFo** for more seconds, the display will show

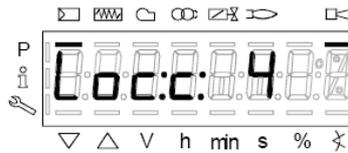
9 Once the last parameter is accessed (143) by pressing **+**, the **End** message will flash.



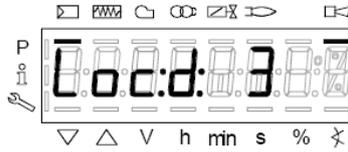
10 Press **InFo**  for more than three seconds or  for more than three seconds orto return to the normal display.



If a message like the one below is shown during operation,



it means that the burner is locked out and the Error code is shown (in the example “error code:4”); this message is alternating with another message

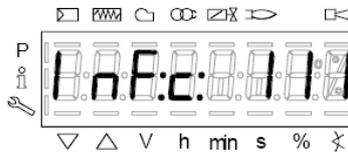


Diagnostic code (in the example “diagnostic code:3”). Record the codes and find out the fault in the Error table. To perform the reset, press InFo for one second:



The unit displays an event which does not lead to shutdown.

The display shows current error code **c**: alternating with diagnostic code **d**:



Press **InFo** to return to the display of phases.

Example: Error code **111** / diagnostic code **0**



To reset, press InFo for a second. Record the codes and check the Error List to find the type of faults.

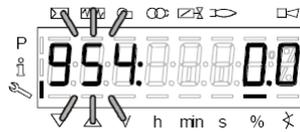
### 8.7 Service level

To enter the Service mode, press InFo until the display will show:

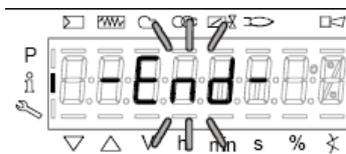


The service level shows all the information about flame intensity, actuators position, number and lock codes:

Parameter	Description
954	Flame intensity
121	% output, if set = automatic operation
922	Actuators position, 00=combustibile; 01= aria
161	Lock-outs number
701..725	Lock-outs History (see chapter 23 in the LMV2x manual)



- 1 the first parameter will be "954": the percentage of flame is shown on the right. By pressing + or - it is possible to scroll up/down the parameter list.
- 2 Once the last parameter is accessed (143) by pressing + , the **End** message will blink.



- 3 Press **InFo**  for more than three seconds or for more than three seconds orto return to the normal display.



For further nformation, see tha LMV2 related manual.

## PART IV: 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.
- 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 46).
- Examine and clean the ignition electrode, adjust and replace if necessary (see page 46).
- Examine and clean the detection probe, adjust and replace if necessary.
- Examine the detection current.
- Remove and clean 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 regulator **A** in Fig. 23.
- Remove and clean the oil regulator **B** in Fig. 23.



**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.**

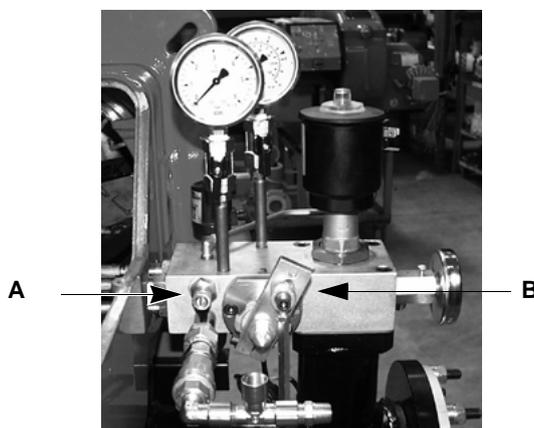


Fig. 23

### 8.8 Maintenance of the pressure governor with filter (for ignitor 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 picture Fig. 24):

- 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 picture Fig. 24);
- reassemble the bottom cover (3), being sure that the main bolt is centered in the bottom cover slot.

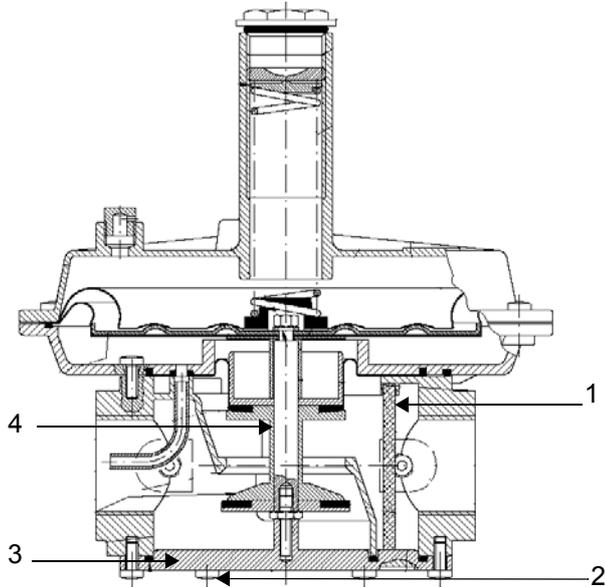


Fig. 24 - threaded body

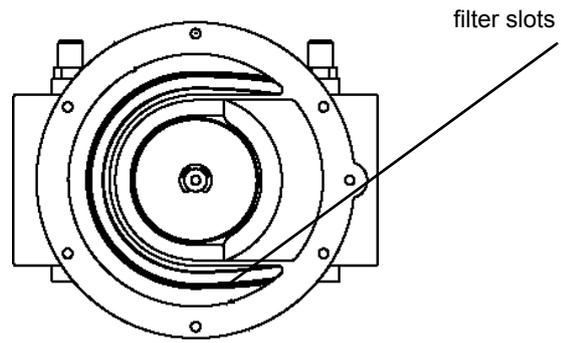


Fig. 25 - threaded body without bottom cover

### 8.9 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. 26.

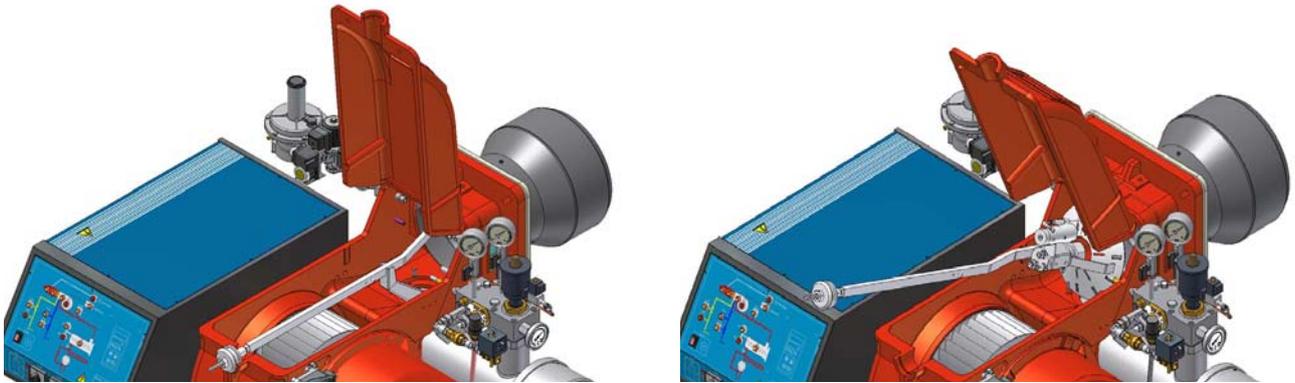


Fig. 26

### 8.10 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 uncsrewing **V**;
- 3 unscrew cap **C** 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.

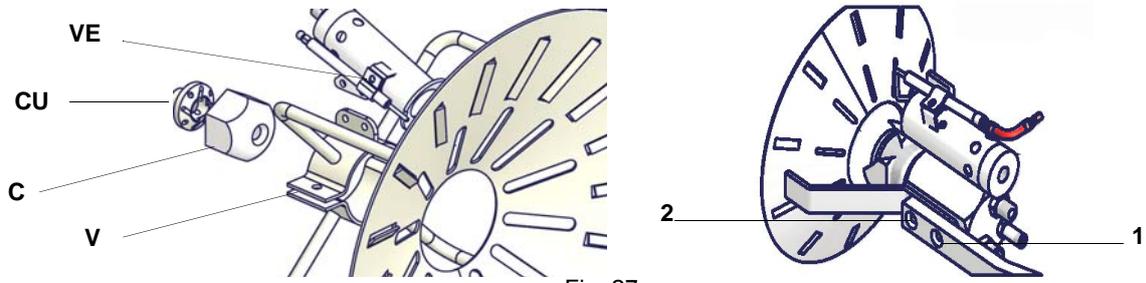
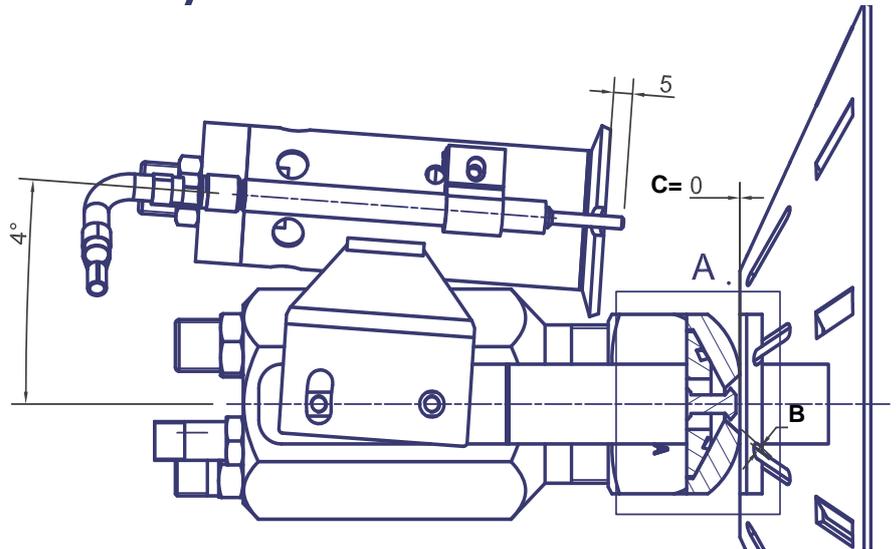
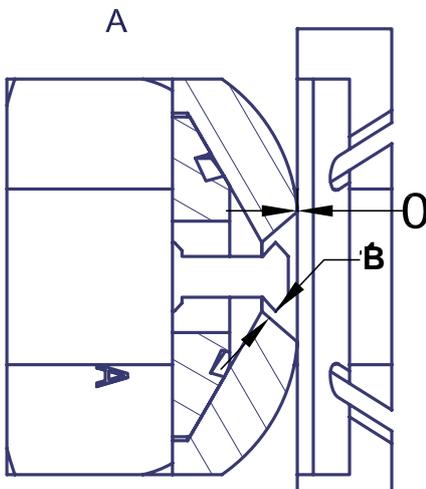
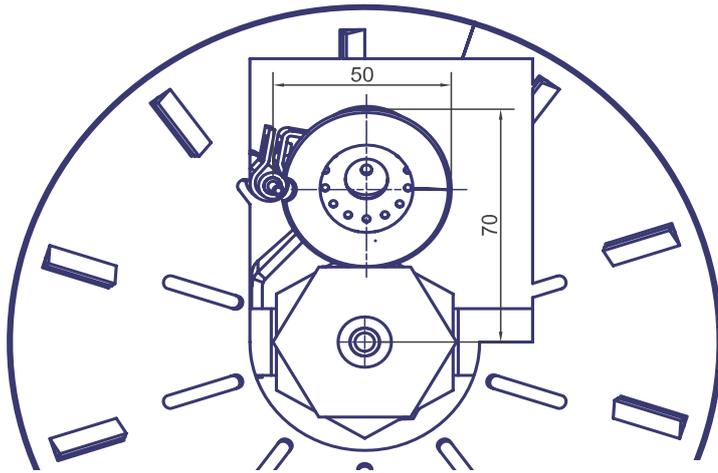


Fig. 27

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

PBY90-91-92,93 B = 1 mm

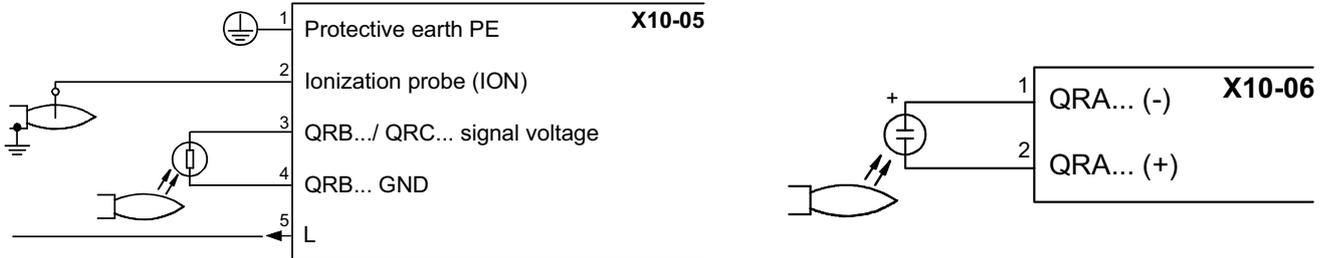
RBY510-515-520-525, B =1.6 mm



### 8.11 Checking the detection current

To check the detection signal follow the scheme in the picture below. If the signal is less than the value indicated, check the position of the detection electrode or detector, the electrical contacts and, if necessary, replace the electrode or the detector.

Device	Flame detector	Minimum detection signal
Siemens LMV2x/3x	QRA	70 $\mu$ A (intensity of flame >24%)
	Ionization probe	4 $\mu$ A (values on display: 30%)
	QRB	<230 k $\Omega$ (intensity of flame >16%)



### 8.12 Extraneous light

Extraneous light during standby (phase 12) leads to start prevention, followed by a restart.

Extraneous light during the prepurge phase leads to immediate lockout.

If extraneous light occurs during the shutdown phase, the system switches to the safety phase.

One repetition is permitted. This means that if the error occurs again the next time the system is shut down, the unit initiates lockout.

### 8.13 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

### 8.14 Burner disposal

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

## 9.0 WIRING DIAGRAMS

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Refer to the attached wiring diagrams.

### **WARNING**

- 1 - Electrical supply 230V 50Hz 1 a.c./400V 50Hz 3N a.c.
- 2 - Do not reverse phase with neutral
- 3 - Ensure burner is properly earthed







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