

PN91 - PN92 - PN93

***LMV5..
Microprocessor-controlled
heavy oil burners***

MANUAL OF INSTALLATION - USE - MAINTENANCE

CIB UNIGAS

BURNERS - BRUCIATORI - BRULERS - BRENNER - QUEMADORES - ГОРЕЛКИ

WARNINGS

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

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

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

CAREFULLY KEEP THIS MANUAL FOR FUTURE REFERENCE.

1) GENERAL INTRODUCTION

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

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

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

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

Contact qualified personnel only.

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

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

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

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

The manufacturer shall not be held liable, by agreement or otherwise, for damages resulting from improper installation, use and failure to comply with the instructions supplied by the manufacturer.

2) SPECIAL INSTRUCTIONS FOR BURNERS

- The burner should be installed in a suitable room, with ventilation openings complying with the requirements of the regulations in force, and sufficient for good combustion.
- Only burners designed according to the regulations in force should be used.
- This burner should be employed exclusively for the use for which it was designed.
- Before connecting the burner, make sure that the unit rating is the same as delivery mains (electricity, gas oil, or other fuel).
- Observe caution with hot burner components. These are, usually, near to the flame and the fuel pre-heating system, they become hot during the unit operation and will remain hot for some time after the

burner has stopped.

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

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

Special warnings

- Make sure that the burner has, on installation, been firmly secured to the appliance, so that the flame is generated inside the appliance firebox.
- Before the burner is started and, thereafter, at least once a year, have qualified personnel perform the following operations:
 - a set the burner fuel flow rate depending on the heat input of the appliance;
 - b set the flow rate of the combustion-supporting air to obtain a combustion efficiency level at least equal to the lower level required by the regulations in force;
 - c check the unit operation for proper combustion, to avoid any harmful or polluting unburnt gases in excess of the limits permitted by the regulations in force;
 - d make sure that control and safety devices are operating properly;
 - e make sure that exhaust ducts intended to discharge the products of combustion are operating properly;
 - f on completion of setting and adjustment operations, make sure that all mechanical locking devices of controls have been duly tightened;
 - g make sure that a copy of the burner use and maintenance instructions is available in the boiler room.
- In case of 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

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-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

Burner model identification

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

Type (1)	PN91 (1)	Model (2)	N- (2)	PR. (3)	S. (4)	*. (5)	A. (6)	ES. (7)
(1) BURNER TYPE	PN91 - PN92 - PN93							
(2) FUEL	N - Heavy oil, viscosity $\leq 50\text{cSt}$ (7° E) @ 50° C E - Heavy oil, viscosity $\leq 110\text{cSt}$ (15°E) @ 50° C D - Heavy oil, viscosity $\leq 400\text{cSt}$ (50° E) @ 50° C P - Petroleum, viscosity 89cSt (12° 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							
MICRO-PROCESSOR CONTROL	ES - with no O2 trim control, with no VSD control							

Technical Specifications

BURNER		PN91	PN92	PN93
Output	min - max kW	698 - 2093	849 - 2558	550 - 4100
Fuel		Heavy oil		
Oil viscosity		See "Burner model identification" table		
Heavy oil rate	min. - max. kg/h	62 - 187	76- 228	49- 365
Power supply		230/400V 3N a.c. 50Hz		
Total power consumption (Heavy oil)	kW	22.5	24	32
Total power consumption (Petroleum)	kW	12.5	18	26
Fan motor	kW	4	5.5	7.5
Pre-heater resistors (heavy oil)	kW	18	18	24
Pre-heater resistors (Petroleum)	kW	8	12	18
Protection		IP40		
Approx. weight	kg	240	280	290
Operation		Progressive - Fully modulating		
Operating temperature	°C	-10 ÷ +50		
Storage Temperature	°C	-20 ÷ +60		
Working service*		Intermittent		

Heavy oil net calorific value (Hi): 40.4 MJ/kg (average value). Heavy oil net calorific value (Hi): 40.4 MJ/kg (average value).

Burners provided with Siemens LMV5x control box: the control box automatically stops after 24h of continuous working. The control box immediately starts up, automatically.

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 ($kW = kcal/h / 860$);
- backpressure (data are available on the boiler ID plate or in the user’s manual).

Example:

Furnace input: 600kW

Backpressure: 4mbar

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

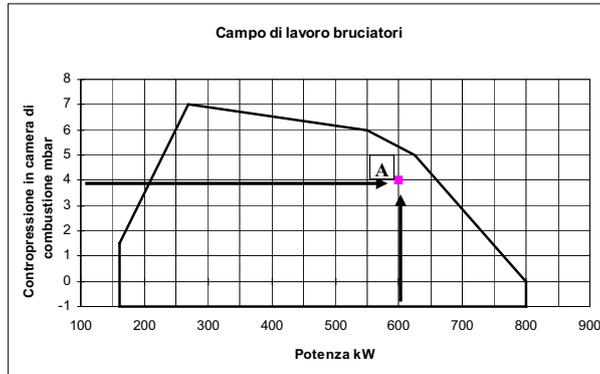
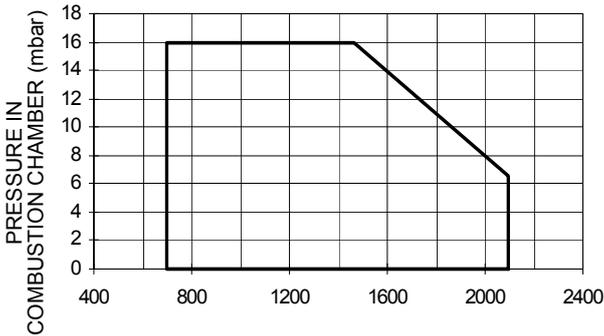


Fig. 1

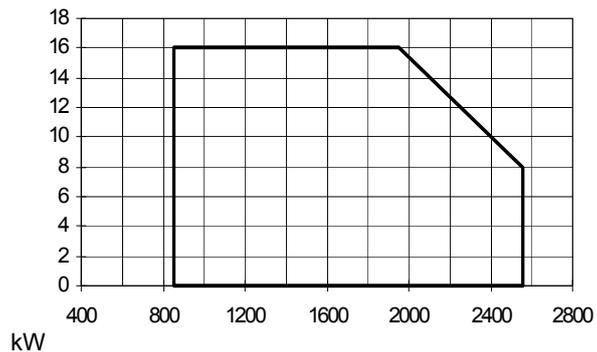
Data are referred to standard conditions: atmospheric pressure at 1013mbar, ambient temperature at 15°C.

Performance Curves

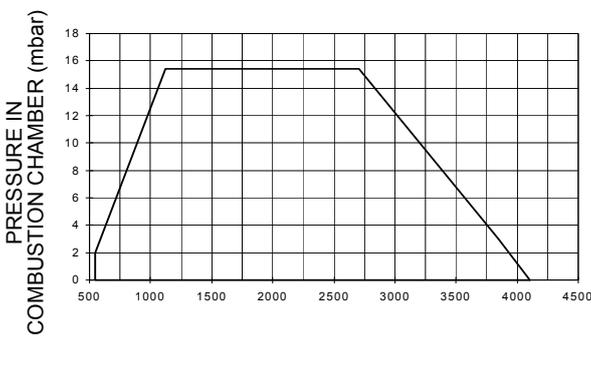
PN91



PN92



PN93

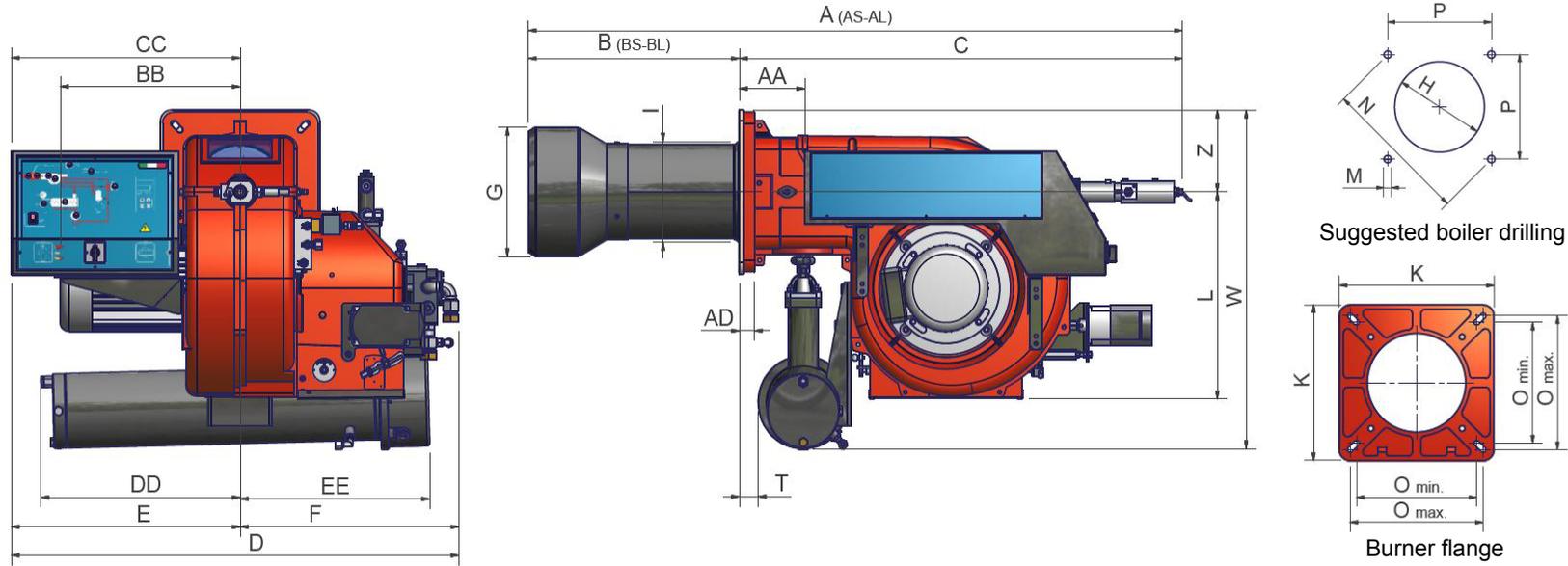


To get the input in kcal/h, multiply value in kW by 860.

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.

Overall dimensions (mm)



TIPO	A (AS)	A (AL)	AA	AB	AC	AD	AE	B (BS)	B (BL)	BB	C	CC	D	DD	E	EE	F	G	H	I	K	L	M	N	Omin	Omax	P	T	W	Y	Z
PN91	1329	1519	152	276	221	35	473	298	488	441	1031	533	1129	464	533	441	596	262	292	228	360	466	M12	424	280	310	300	44	765	240	185
PN92	1332	1522	152	276	221	35	473	301	491	441	1031	533	1129	464	533	441	596	292	322	228	360	466	M12	424	280	310	300	44	765	240	185
PN93	1315	1505	152	276	221	35	473	301	491	460	1014	533	1129	464	533	441	596	292	322	228	360	466	M12	424	280	310	300	44	765	248	185

BS = standard blast tube

BL = extended blast tube

HYDRAULIC DIAGRAMS

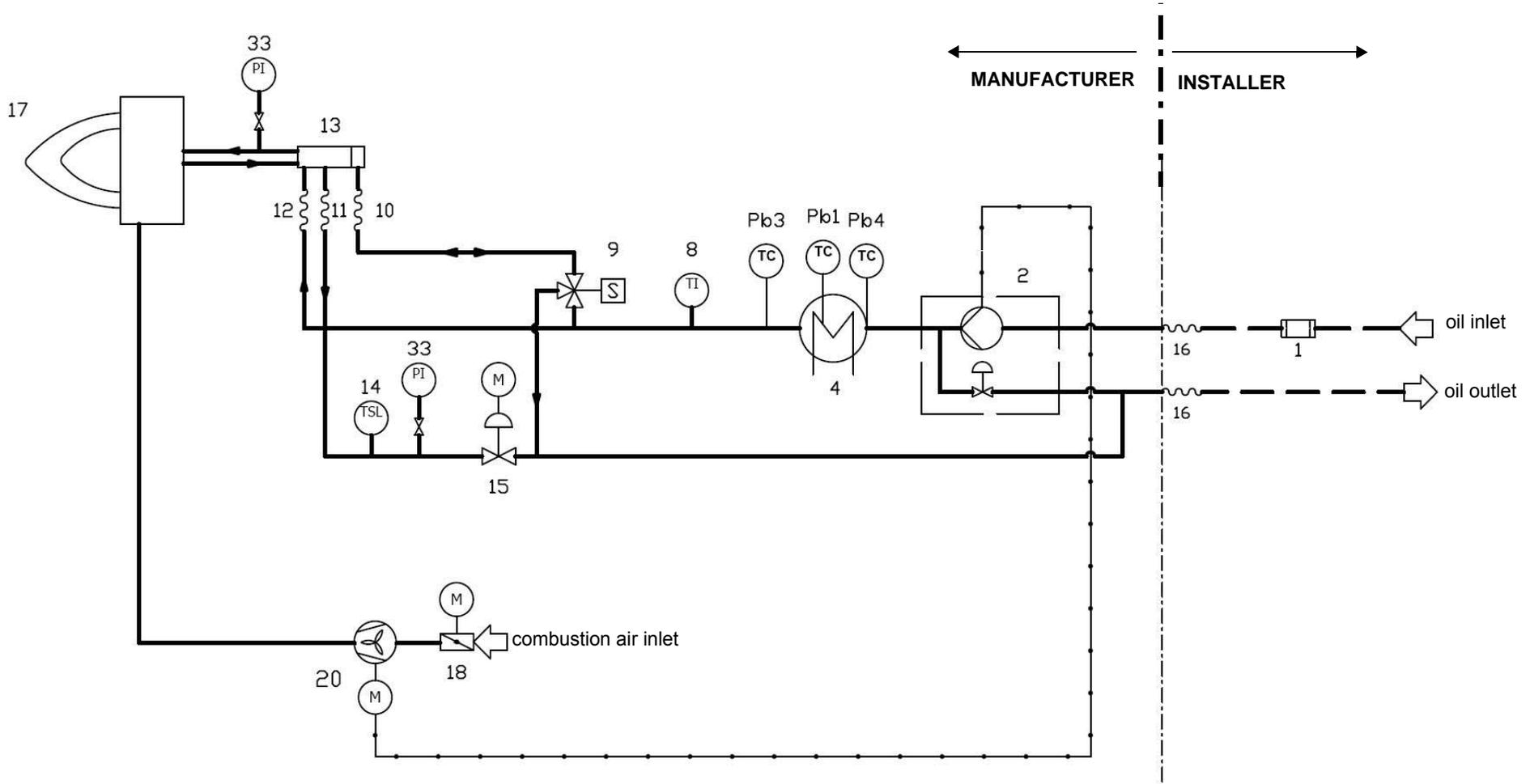


Fig. 2- (3I2D-25) Hydraulic diagram

3LMD-25	KEYS
	OIL TRAIN
1	Filter
2	Pump and pressure governor
4	Electrical preheater tank
Pb4	Temperature probe
Pb1	Temperature probe
Pb3	Temperature probe
8	Thermometer
9	3-way solenoid valve
10	Flexible hose
11	Flexible hose
12	Flexible hose
13	Oil distributor
33	Pressure gauge with manual valve (*optional)
14	Low thermostat - TCI
15	Pressure governor with actuator
16	Flexible hose
17	Burner
	COMBUSTION AIR TRAIN
18	Air damper with actuator
20	Draught fan with electromotor

INSTALLING THE BURNER

Packing

Burners are despatched in wooden crates whose dimensions are:

PN91-92-93 1730mm x 1280mm x 1020mm (L x P x H)

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

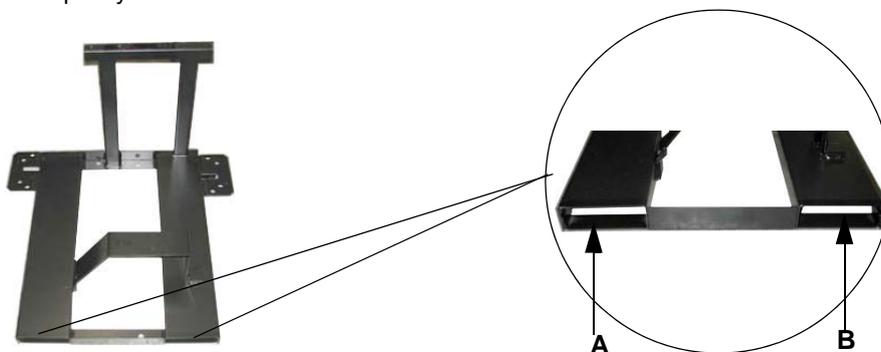
- burner;
- gasket to be inserted between the burner and the boiler;
- oil flexible hoses;
- oil filter;
- envelope containing this manual.

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

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.

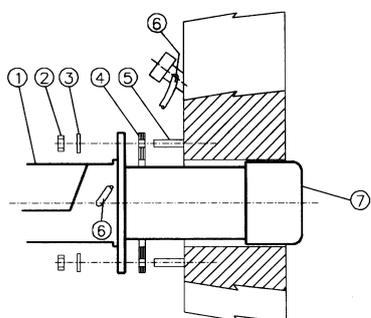
The burner is mounted on a stirrup provided for handling the burner by means of a fork lift truck: the forks must be inserted into the A and B ways. Remove the stirrup only once the burner is installed to the boiler.



Fitting the burner to the boiler

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

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



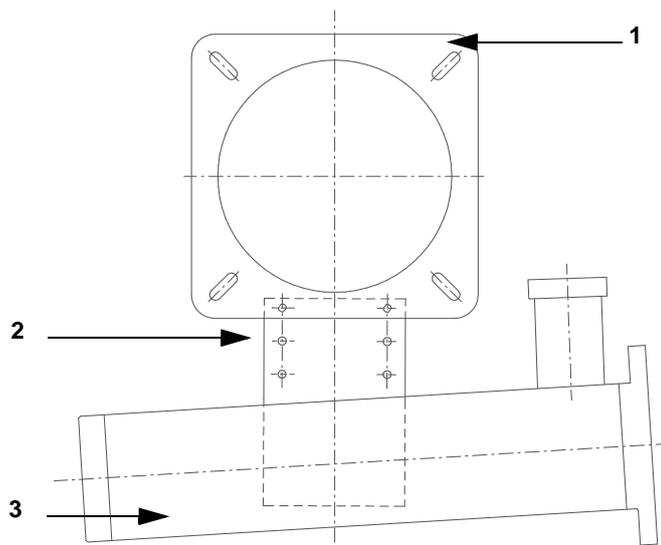
Keys

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

Set the upper side of the burner flange in a horizontal position, in order to obtain the correct inclination of the pre-heating tank

Key

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



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.

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.

Fan motor direction

Once the electrical connection of the burner is performed, remember to check the rotation of the motor. The motor should rotate in an counterclockwise direction looking at cooling fan. In the event of incorrect rotation reverse the three-phase supply and check again the rotation of the motor.

Connecting the oil heating resistors

2.4 - 4.5 kW

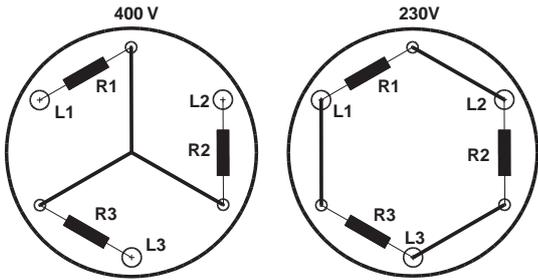


Fig. 3

8 - 12 kW

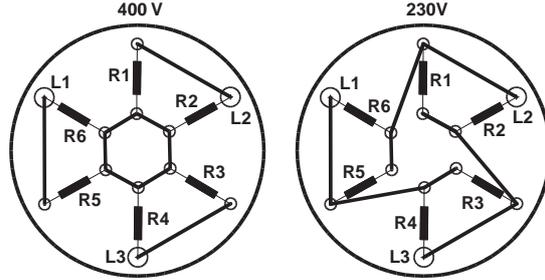


Fig. 4

18 - 24 kW

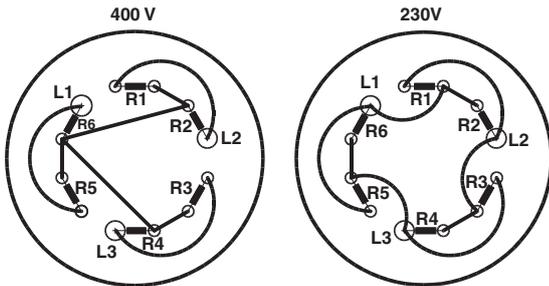


Fig. 5

ELECTRIC MOTOR CONNECTION

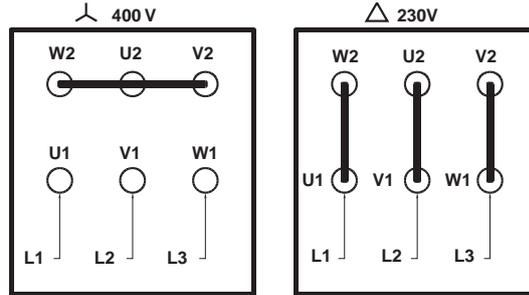


Fig. 6

Double-pipe and single-pipe system

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

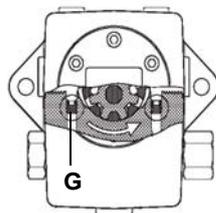
Single-pipe system: a single pipe drives the oil from the tank to the pump's inlet. Then, from the pump, the pressurised oil is driven to the nozzle: a part comes out from the nozzle while the other part goes back to the pump. In this system, the by-pass plug, if provided, must be removed and the optional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

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

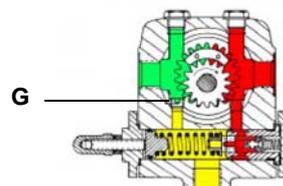
Burners come out from the factory provided for double-stage systems. They can be suited for single-pipe system (recommended in the case of gravity feed) as described before. To change from a 1-pipe system to a 2-pipe-system, insert the by-pass plug **G** (as for ccw-rotation- referring to the pump shaft).

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

Danfoss KSM..



Suntec TA



Bleed

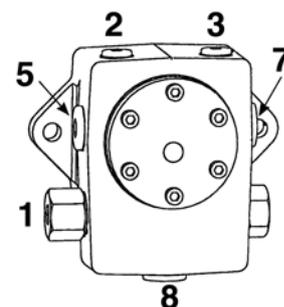
Bleeding in two-pipe operation is automatic: it is assured by a bleed flat on the piston. In one-pipe operation, the plug of a pressure gauge port must be loosened until the air is evacuated from the system.

Oil pumps

PN91: SUNTEC TA2 / DANFOSS KSM50

PN92/93/510: SUNTEC TA3 / DANFOSS KSM70

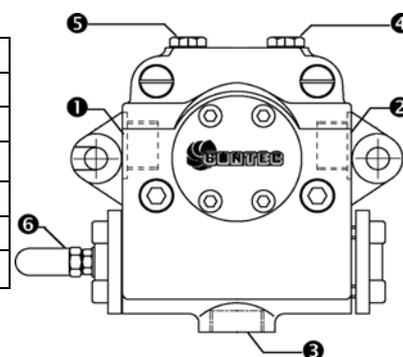
Danfoss KSM..	
Oil viscosity	2.5 ÷ 450 cSt
Oil temperature	-10 ÷ 160 °C
Max. suction pressure	4 bar
Min. suction pressure	-0.45 bar to avoid gasing
Max. return pressure	4 bar
Rotation speed	3450 rpm max



Keys

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

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



- 1 Inlet G1/2
- 2 To the nozzle G1/2
- 3 Return G1/2
- 4 Pressure gauge port G1/4
- 5 Vacuum gauge port G1/4
- 6 Pressure governor

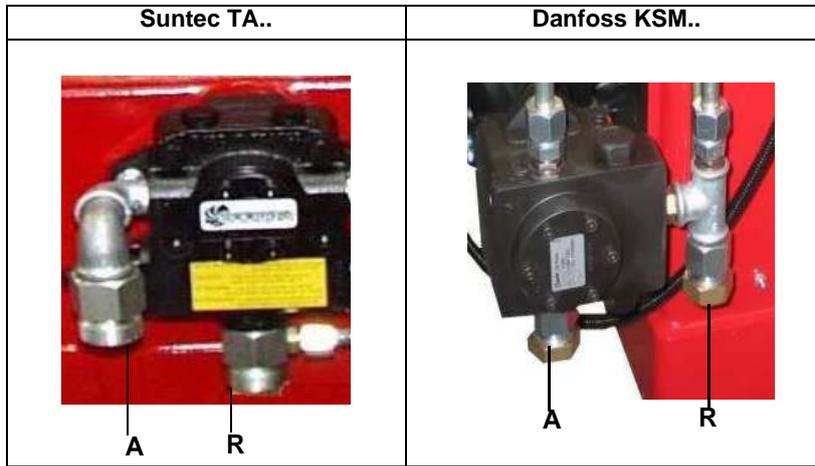
About the use of fuel pumps

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

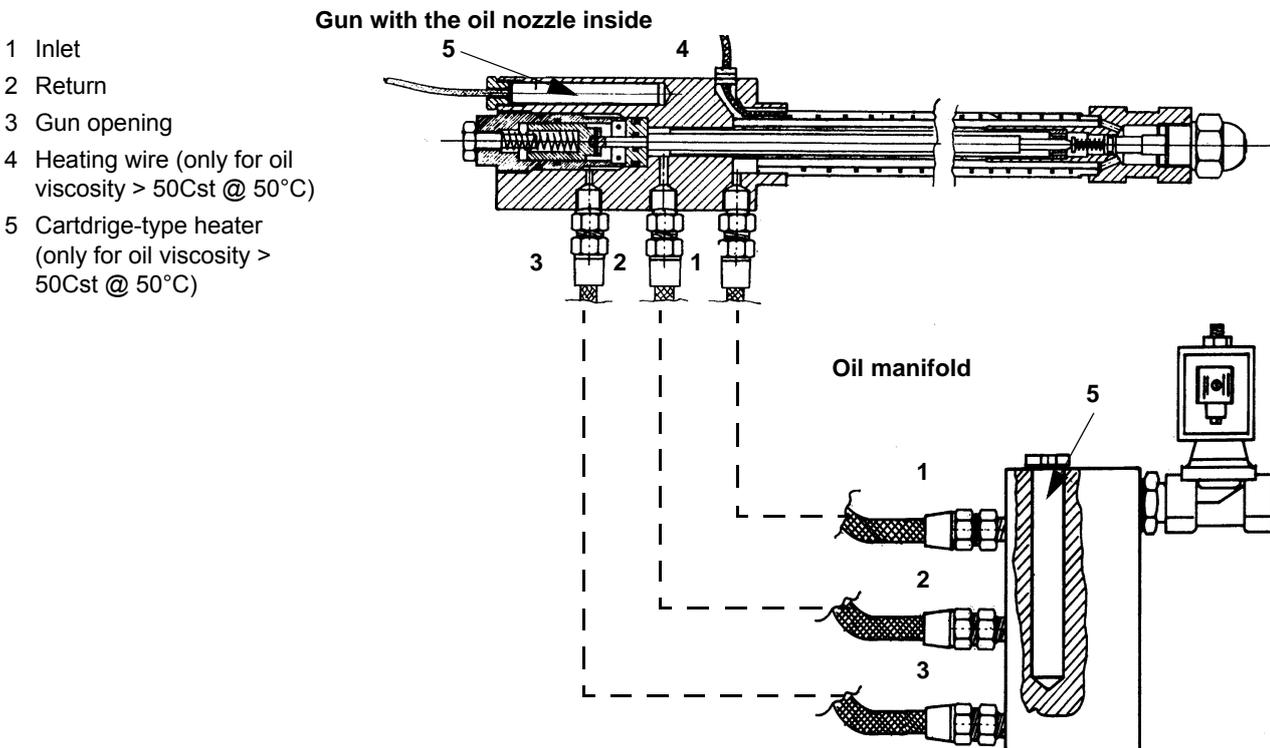
Connecting the oil flexible hoses

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

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



Connections to the oil gun



PART II: OPERATION

LIMITATIONS OF USE

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

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

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

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

NEVER OPEN OR DISMANTLE ANY COMPONENT OF THE MACHINE.

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

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

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

OPERATION



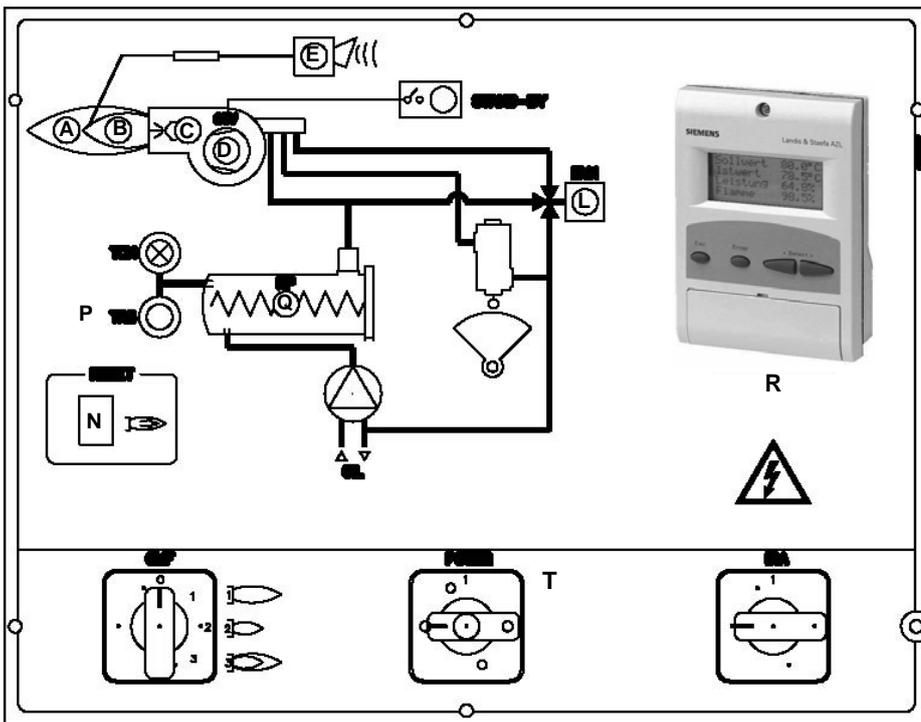
ATTENTION: before starting the burner up, be sure that the manual cutoff valves are open and check that the pressure upstream the gas train complies the value quoted on paragraph "Technical specifications".

Light oil operation

- The fan motor starts and the pre-purge phase as well. Since the pre-purge phase must be carried out at the maximum air rate, the control box drives the actuator opening and when the maximum opening position is reached, the pre-purge time counting starts.
- At the end of the pre-purge time, the actuator is in the light oil ignition position: the ignition transformer is energised (lamp **L** on); the ignitor gas valves and the light oil valves open. Few seconds after the valves opening, the transformer is de-energised and lamp **L** turns off.
- The burner is now operating, meanwhile the actuator goes to the high flame position; after some seconds, the two-stage operation begins; the burner is driven automatically to high flame or low flame, according to the plant requirements. Operation in high or low flame is signalled by LED **N** on the burner control panel.

Control panel

PN91 - PN92 - PN93



- A High flame lamp
- B Low flame lamp
- C Ignition transformer operation
- CMF Manual operation switch
 - 0= Off 1= High flame
 - 2= Low flame 3= Automatic
- D Fan motor thermal cutout intervention
- E Burner lockout
- IRA Auxiliary resistors wswitch
- L Heavy oil solenoid lamp operation
- N Control box reset pushbutton
- P Heating resistors safety thermostat
- Q Pre-heating tank
- R Modulator
- T Main switch

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 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 and 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

Tab. 1

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. 2

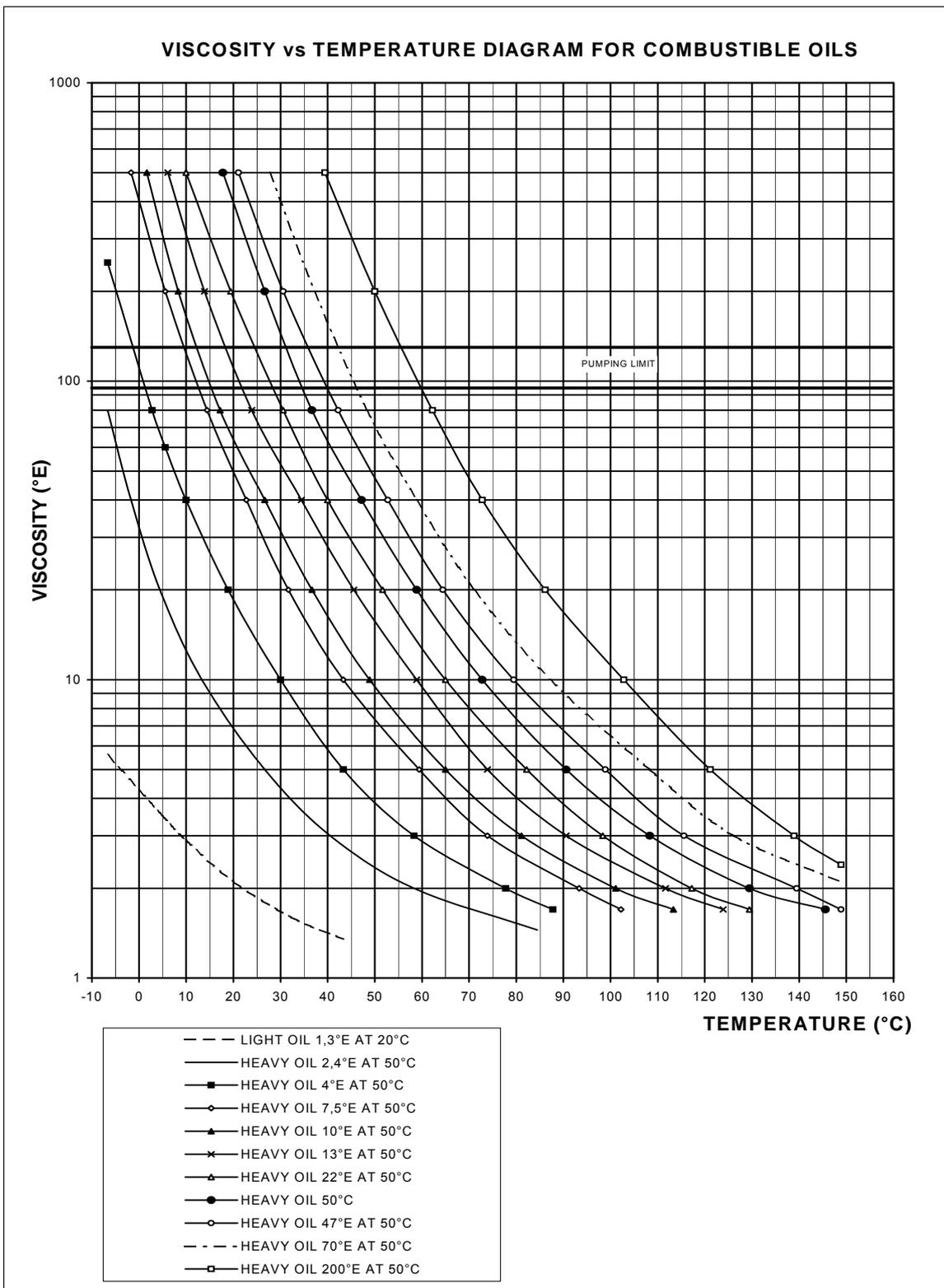


Fig. 7

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).

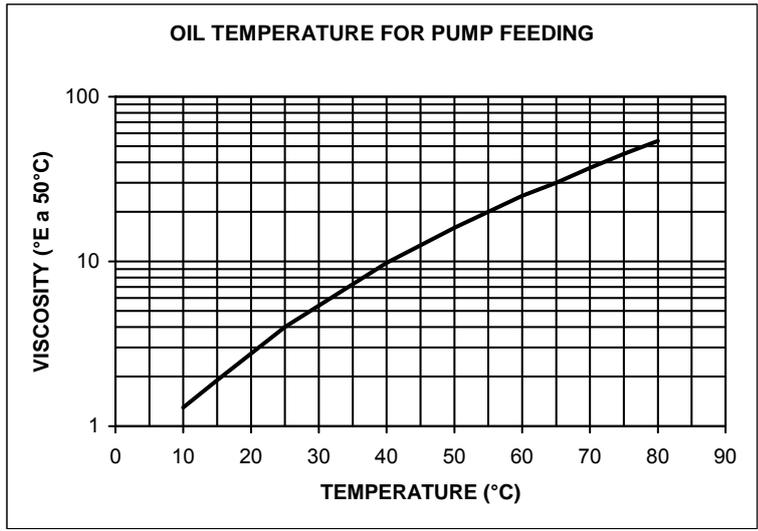


Fig. 8

Indicative diagram showing the oil pressure according to its temperature

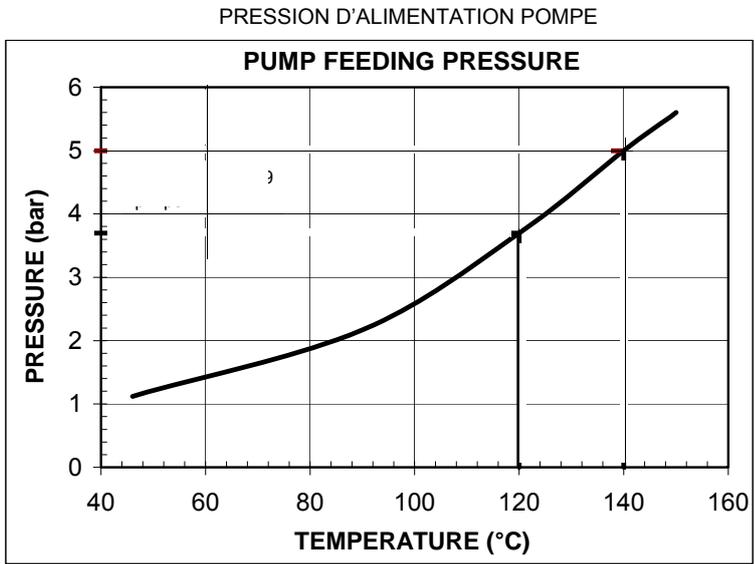


Fig. 9

Indicative diagram showing the oil atomising temperature according to its viscosity

Example: if the oil has a 50°E @ 50°C viscosity, the oil atomising temperature should be between 145°C and 160°C (see diagram).

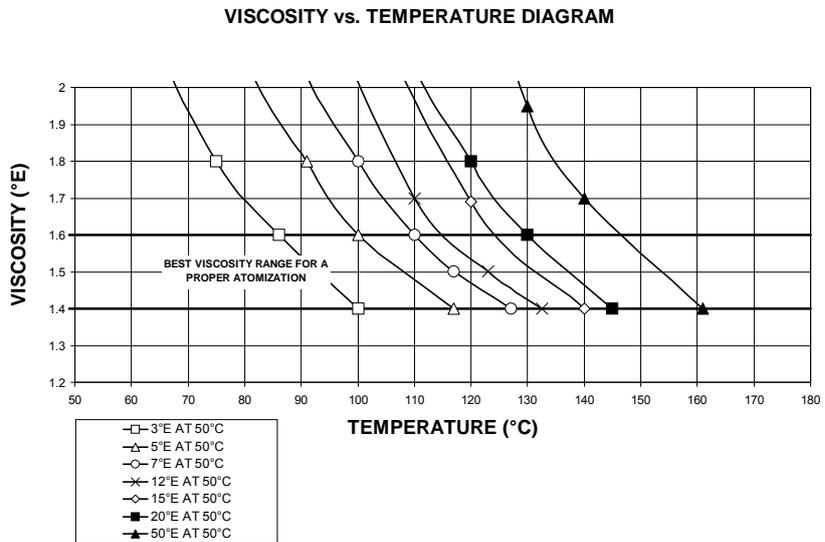


Fig. 10

HYDRAULIC DIAGRAMS

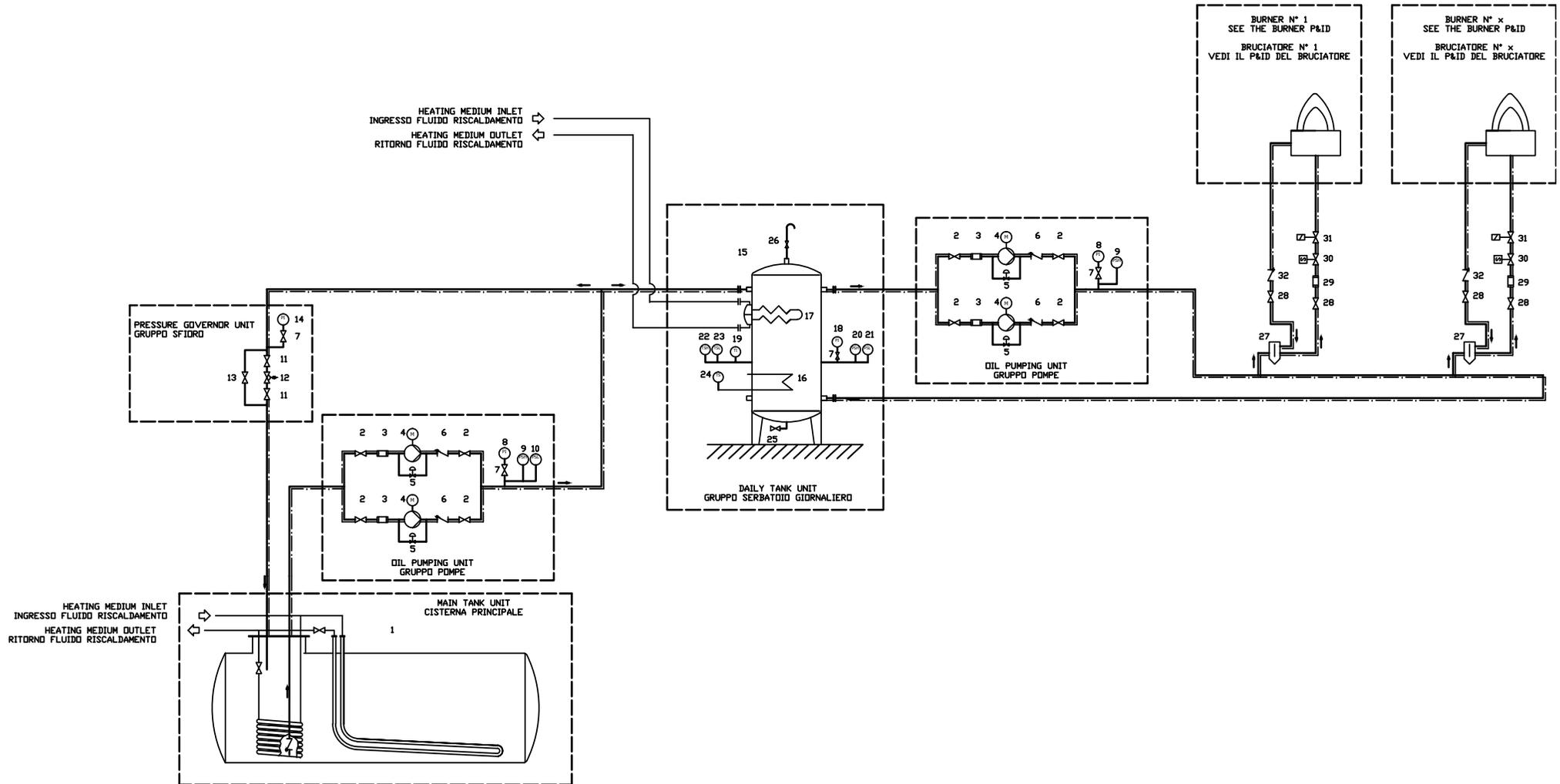


Fig. 11 - 3ID00014 v2 Hydraulic diagram - Two or more burners configuration

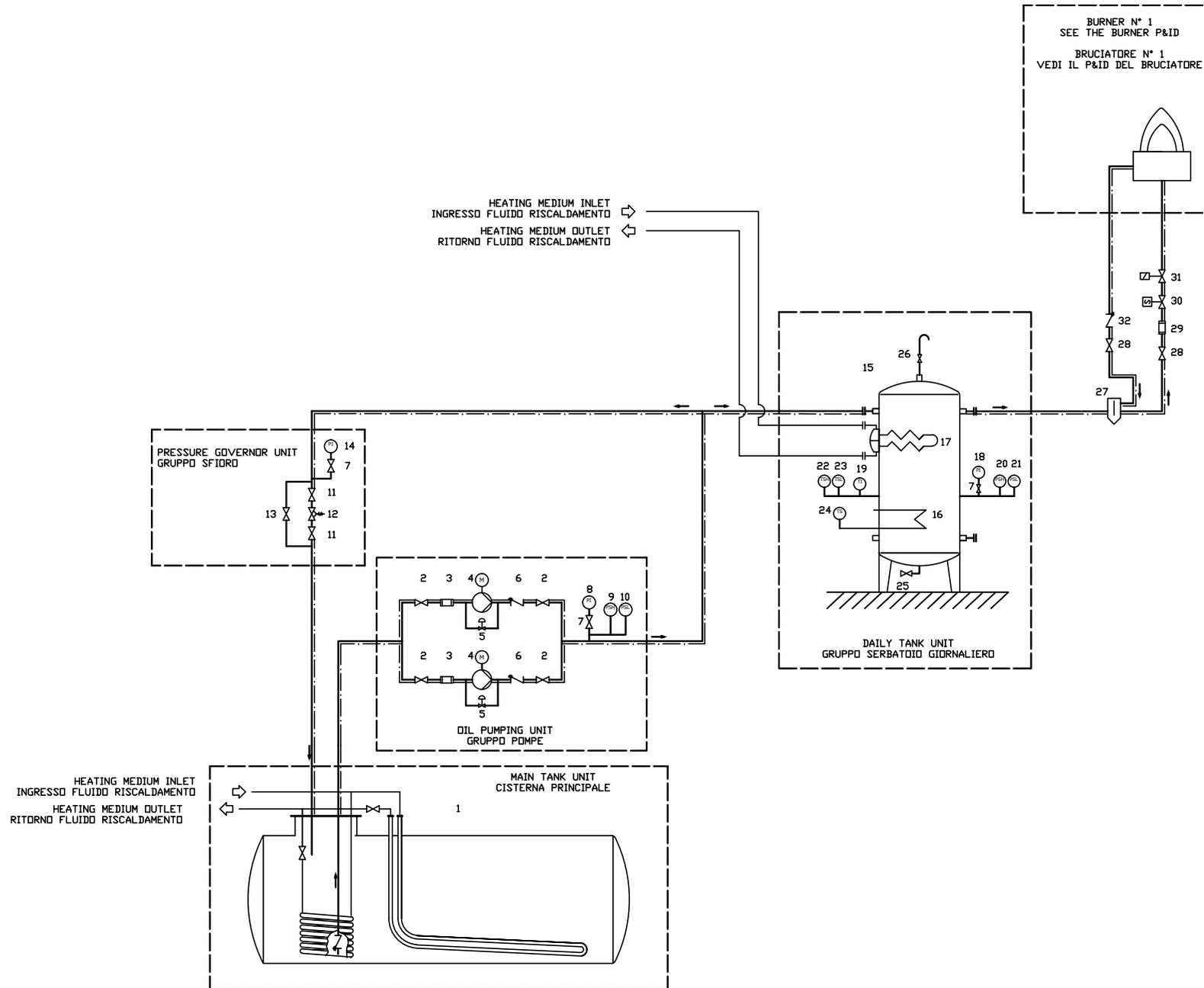


Fig. 12 - 3ID0023 v2 - Hydraulic diagram - Single burner configuration

3ID0023	LEGEND
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	Maximum pressure switch
10	Minimum pressure switch
PRESSURE GOVERNOR UNIT	
11	Manual valve
12	Pressure governor
13	Needle valve
14	Pressure gauge
DAILY TANK	
15	Daily tank
16	Electrical resistor
17	Heating device
18	Pressure gauge
19	Thermometer
20	High pressure switch
21	Low pressure switch
22	Thermostat (high)
23	Thermostat (low)
24	Thermostat
25	Manual valve
26	Manual valve
TO THE BURNER	
27	Degassing bottle
28	Manual valve
29	Filter (supplied loose with the burner)
30	Solenoid valve
31	Safety valve
31	One-way valve

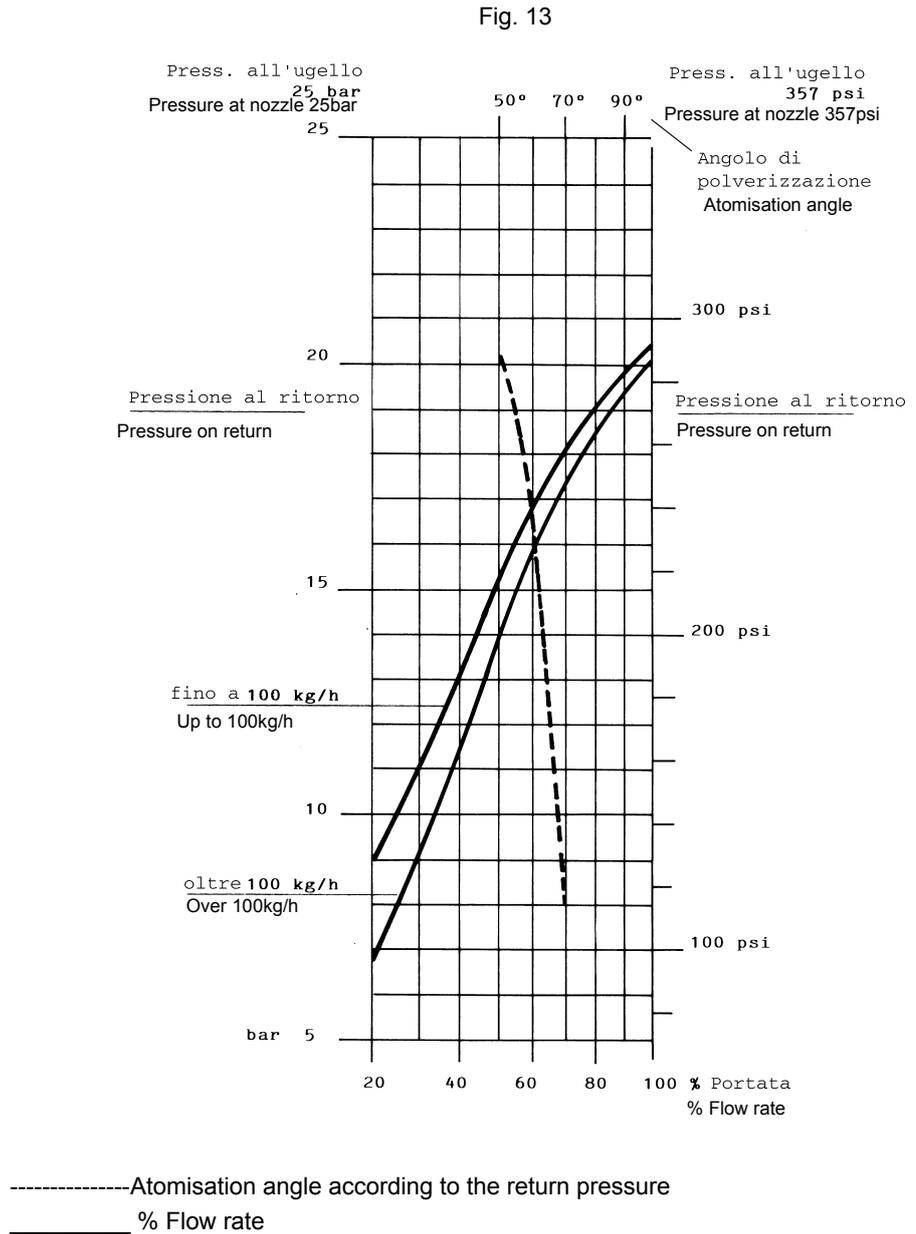
Adjusting oil flow rate

The oil flow rate can be adjusted choosing a by-pass nozzle that suits the boiler/utilisation output and setting the delivery and return pressure values according to the ones quoted on the chart below and the diagram on Fig. 13 (as far as reading the pressure values, see next paragraphs).

NOZZLE	DELIVERY PRESSURE bar	RETURN PRESSURE MAX. bar	RETURN PRESSURE MIN. bar
FLUIDICS WR2	25	19-20	7 - 9 (recommended)

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

Tab. 3



Example: as for over 100kg/h nozzles, the 80% of the nozzle flow rate can be obtained with a return pressure at about 18bar (see Fig. 13Fig. 13).

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. 14 - Danfoss MCX

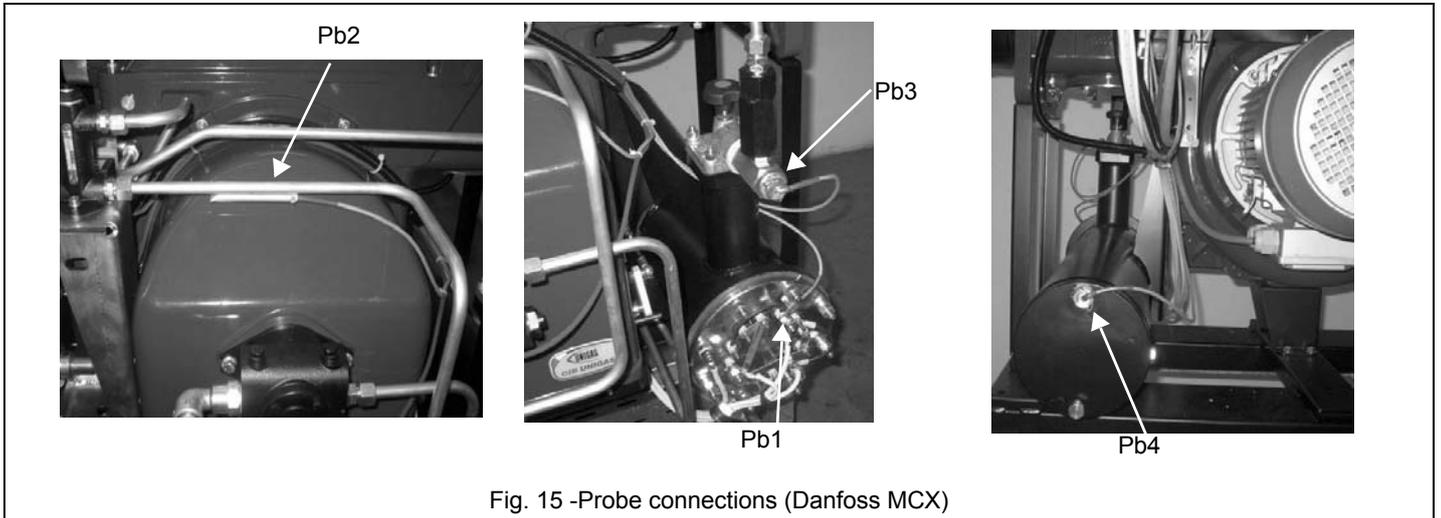


Fig. 15 -Probe connections (Danfoss MCX)

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

Adjustments - brief description

The air and fuel rates adjustments must be performed at the maximum output first ("high flame"): see the LMV5.. 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 LMV5.. related manual).
- Set, now, the low flame output, 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.

Start-up procedure

- 1 Turn the burner on.
- 2 the LMV control box starts the system test cycle: the AZL display shows the **System Test** message; at the end of the test, it shows the main page and the system stops (the safety chain is open) waiting for the startup enabling signal (standby - Program phase no. 12)

Setpoint	80°C
Act.value	78°C
Fuel	GAS
Standby	12

Main page

- 3 check the fan motor rotation (see related paragraph).
- 4 make the safety chain enabling the system to start up
- 5 the combustion cycle starts: the system will show the operating stages
 - **Prepurging** (program phase no.30)
 - **Driving to ignition position** (program phase no.36)
 - **Ignition position** (program phase no.38)
 - **Fuel** (the fuel solenoid valves open)
 - **Flame** (the flame lights up)
 - **Driving to low flame** (the actuator drives to low flame).

NOTE: the **C** and **A**, on the .

Once the ignition cycle ends, the main page is shown:

Setpoint	80°C
Act.value	78°C
Load	24%
Flame	60%

Main page

Set point: temperature set-point

Act value: actual temperature value

Load: load percentage (burner output)

Flame: percentage of flame detection current.

By pressing the ENTER key the display shows the second page:

Fuel	0.0	Air	1.8
Ax1		VSD	0.0
Ax2		O2	
Ax3		Ld.	0.0

Second page

Fuel: it shows (in degrees) the fuel actuator position.

Air: it shows (in degrees) the air actuator position.

Ax1..3: auxiliaries.

VSD: % value on the inverter maximum frequency

O2: oxygen percentage

Ld: load percentage (burner output).

Press the ENTER key to go back to the main page.

To access the **main menu**, from the main page, press the ESC key twice:

OperationalStat
Operation
ManualOperation
Params & Display.

Main menu

By pressing the ESC key once, the **Operational Status** (first item in the main menu) menu is directly shown:

Normal operation
Status/Reset
Fault History
Lockout History

the **Operational Status** menu provides the following items:

Normal operation: by selecting this item and pressing the ENTER key, the main page is showed; press ESC to go back to the main menu.

Status/Reset: it shows system errors or faults occurring / it represents the lockout reset function.

Fault History: by selecting this item and pressing the ENTER key, the Lockout History will be showed about the last 21 faults occurred.

Lockout History: by selecting this item and pressing the ENTER key, the Lockout History will be showed about the last 9 lockouts occurred, and the related date and hour.

Alarm act/deact: enable/disable the horn in case of alarm.

Fault History

To visualise the **Fault History**, select it and press the ENTER key. The message will be as:

1 Class:		05Gas
code	BF	Phase: 10
Diag.:	00	Lod: 0.0
Start No.		88

alternating by an error message as:

O2 control and
limiter automat
deactivated

To see the other Fault History pages, press the arrow keys.

To exit the Fault History pages, press ESC.

Lockout History

To visualise the **Lockout History**, choose the related item and press ENTER. The message will be:

1	10.08.07	13.47
C:71	D:00	F: 12
Start No.		88
Load	0.0	Gas

alternating by an error message as:k

No flame at end
of safety time

To see the other Lockout History pages, press the arrow keys.

To exit the Lockout History pages, press ESC.

Setting the temperature set-point value

To set the temperature set-point value, that is the generator operating temperature; proceed as follows.

From the main page, enter the main menu by pressing the ESC key twice:

OperationalStat
Operation
ManualOperation
Params & Display.

by means of the arrow keys, select "Params&Display", press ENTER: the system will ask you to enter the proper password

Access w-out PW
Access Serv
Access OEM
Access LS

by means of the arrow keys, select "Access w-out pass" (access without password - user level), confirm by pressing ENTER.

The other levels require password reserved to the Technical Service, to the Manufacturer, etc.

The menu shown accessing without password is the following:

BurnerControl
RatioControl
O2Contr./Guard.
LoadController

Choose "LoadController" and press ENTER: the following menu is shown:

```

ControllerParam
Configuration
Adaption
SW Version
    
```

Choose "ControllerParam" and press ENTER: the following menu is shown:

```

ContrlParamList
MinActuatorStep
SW_FilterTmeCon
SetPointW1
    
```

Choose "SetPointW1" and press ENTER:

```

SetpointW1
Curr:                90°
New:                 90°
    
```

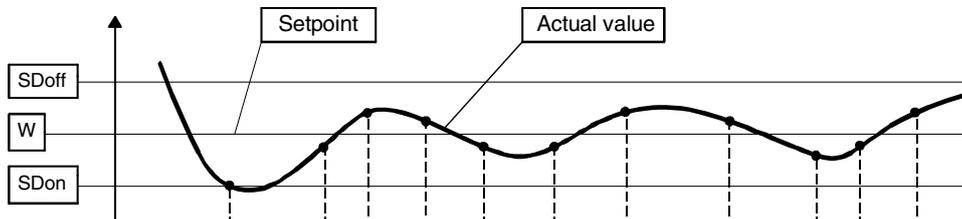
Curr: it shows the current set-point; use the arrows keys to change.

NOTE: the available range for this parameter depends on the probe provided; the unit measure of the detected value and its limits are bound up with parameters set at the "Service" level.

Once the new set-point is set, confirm by pressing ENTER, otherwise exit without changing by pressing ESC.

Press ESC to exit the set-point programming mode.

Once the temperature set-point W1 is imposed, set the Switch-on (SDon) and the Switch-off (SDoff) point of the 2-position controller:



To set these values, select the item SD_ModOn (SDOn), by scrolling down the "Load controller" menu with the arrow keys and press ENTER:

```

SetpointW1
SetpointW2
SD_ModOn
SD_ModOff
    
```

the display will show:

```

SD_ModOn
Curr::                1.0%
New:                 1.0%
    
```

The default value for this parameter is 1% that is, the burner will light again at a temperature 1% lower than the set-point. Change value, if needed, by means of the arrow keys; press ENTER to confirm and the press ESC to exit. Press only ESC to exit without changing.

Now choose SD_ModOff always scrolling down the Load Controller menu, by means of the arrow keys, and press ENTER.

```

SetpointW1
SetpointW2
SD_ModOn
SD_ModOff
    
```

the display will show:

SD_ModOff	
Curr::	10.0%
New:	10.0%

The default value for this parameter is 10% that is, the burner will turn off at a temperature 1% higher than the set-point. Change value, if needed, by means of the arrow keys; press ENTER to confirm and the press ESC to exit. Press only ESC to exit without changing. Press the ESC key until the following menu is shown:

BurnerControl
RatioControl
O2Contr./Guard.
LoadController

scroll this menu down until the item "AZL" is reached

LoadController
AZL
Actuators
VSD Module

confirm by pressing ENTER:

Times
Languages
DateFormat
PhysicalUnits

Times: it sets the "Summer (SUM) Time / Winter (WIN) Time" operation and the continent (EU - Europe; US - United States)

Sum/Winter Time
Time EU/US

choose the Summertime/Wintertime mode desired and confirm by pressing ENTER; press ESC to exit. Set the time zone (Time EU/US) in the same way.

Languages: it allows setting the current language

Language	
Curr::	Italiano
New:	English

choose the desired language and confirm by pressing ENTER; press ESC to exit.

DateFormat: it allows setting the date format as DD-MM-YY (day-month-year) or MM-DD-YY (month-day-year)

DateFormat	
Curr::	DD-MM-YY
New:	MM-DD-YY

choose the desired format and confirm by pressing ENTER; press ESC to exit.

PhysicalUnits: it allows setting the measuring units for temperature and pressure

UnitTemperature
UnitPressure

Settable temperature units: °C or °F

Settable pressure units: bar or psi.

- choose the desired unit and confirm by pressing ENTER; press ESC to exit.
- choose the temperature and pressure unit and confirm by pressing ENTER; press ESC to exit.

System lockout

If the system locks out, the following message will appear:

1	10.08.07	13.47
C:71	D:00	F: 12
Start No.		88
Load	0.0	Gas

call the Technical Service and tell the message data.

Cold start thermal shock (CSTP)

If the generator cannot suffer thermal shocks, the CSTP (Cold Start Thermal Schock) function can be enabled. This function is already set by the Technical service (access by reserved password).

if this function is enabled, when the burner starts up the “Thermal shock protection activated” message will be showed.

If this function is not enabled, after startup, the burner will rapidly increase the load according to the requested value and, if necessary, to the maximum output.

Manual mode

To by-pass the thermal protection or not to let the burner operate in high flame stage (maximum output) after ignition, the manual mode is provided.

To choose the manual mode (Manual Operation), use the SELECT arrow keys

OperationalStat
Operation
ManualOperation
Params & Display.

Items to be set are the following:

SetLoad
Autom/Manual/Off

SetLoad: to set the required load percentage

SetLoad	
Curr::	0.0%
New:	20.0%

set the required percentage and confirm by pressing ENTER; press ESC to exit.
choose "Autom/Manual/Off":

SetLoad	
Autom/Manual/Off	

Autom/Manual/Off	
Curr::	Automatic
New:	Burner On

three modes are provided:
Automatic: automatic operation
Burner on: manual operation
Burner off: burner in stand-by

If the BurnerOn mode is chosen, the burner does not follow the modulator and probe settings, but operates at the set load.

	Caution: if BurnerOff mode is selected, the burner stays in stand-by.
	Caution: in the BurnerOn mode, the safety thresholds are set by the Technical Service.

For further details, see the LMV5x annexed manuals.

Oil circuit

The fuel is pushed into the pump 1 to the nozzle 3 at the delivery pressure set by the pressure governor. The solenoid valve 2 stops the fuel immission into the combustion chamber. The fuel flow rate that is not burnt goes back to the tank through the return circuit. The spill-back nozzle is feeded at constant pressure, while the return line pressure is adjusted by means of the pressure governor controlled by an actuator coupled to an adjusting cam. The fuel amount to be burnt is adjusted by means of the burner actuator according to the adjustments set (see prevoius paragrah).

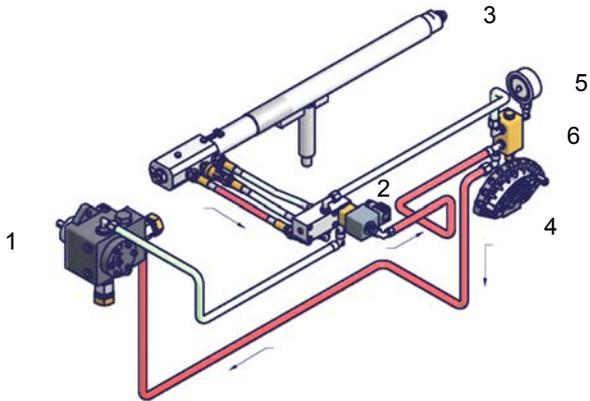


Fig. 16 - Stand-by

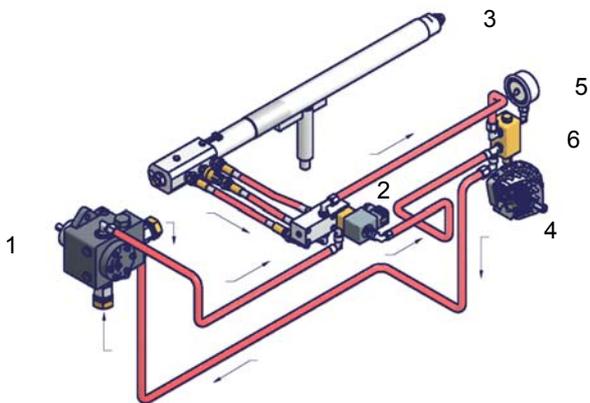


Fig. 17 - Pre-purge

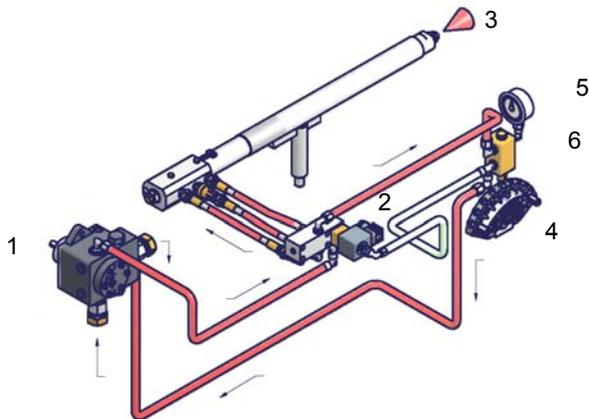


Fig. 18 - Low flame

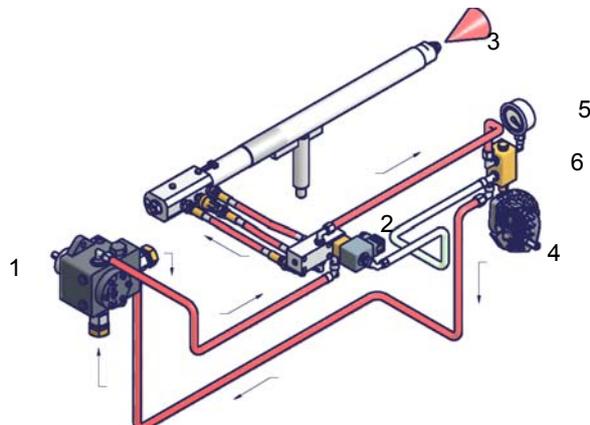


Fig. 19 - High flame

Key

- 1 Oil pump
- 2 Oil solenoid valve
- 3 Nozzle
- 4 Adjusting cam
- 5 Pressure gauge
- 6 Pressure governor

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 oil filter cartridge and replace it if necessary.
- Examine the condition of the oil flexible tubing 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.
- Clean and examine the filter inside the oil pump. Filter must be thoroughly cleaned at least once in a season to ensure correct working of the fuel unit. To remove the filter, unscrew the four screws on the cover. When reassemble, make sure that the filter is mounted with the feet toward the pump body. If the gasket between cover and pump housing should be damaged, it must be replaced. An external filter should always be installed in the suction line upstream of the fuel unit.
- Remove and clean the combustion head (page 37).
- Examine and clean the ignition electrodes, adjust and replace if necessary (see page 37).
- Examine and clean the detection probe, adjust and replace if necessary (see page 39).
- Examine the detection current.
- 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.

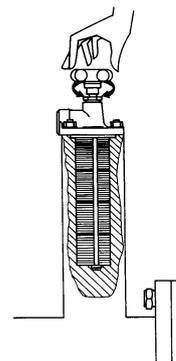
IMPORTANT: Remove the combustion head before checking the ignition electrodes.



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.

Self-cleaning filter

Fitted only for oil viscosity >110 cSt @ 50 °C. Periodically turn the knob to clean the filter.

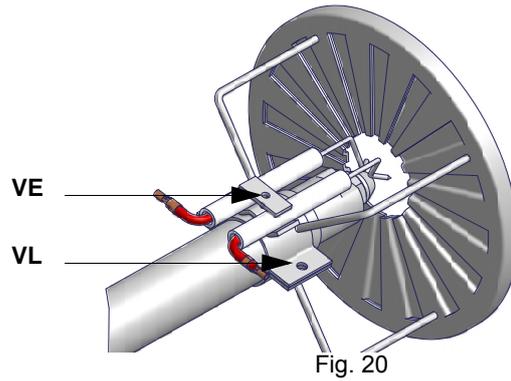
**Removing the oil gun, replacing the nozzle and the electrodes**

ATTENTION: avoid the electrodes to get in touch with metallic parts (blast tube, head, etc.), otherwise the boiler operation would be compromised. Check the electrodes 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 loosen the **VL** screw and remove the oil gun and the electrodes: check the oil gun, replace it if necessary;
- 3 after removing the oil gun, unscrew the nozzle and replace it if necessary;

- 4 in order to replace the electrodes, unscrew the **VE** fixing screws and remove them: place the new electrodes being careful to observe the measures showed on pag.: reassemblbe following the reversed procedure.



Removing the combustion head

- Remove the cover H.
- Slide the UV photoelectric cell out of its housing.
- Unscrew the oil connections E (Fig. 21) connecting the flexible pipes to the lance L and remove the whole assembly as shown in Fig. 21-Fig. 22.
- clean the combustion head by means of a vacuum cleaner; to scrape off the scale use a metallic brush.

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

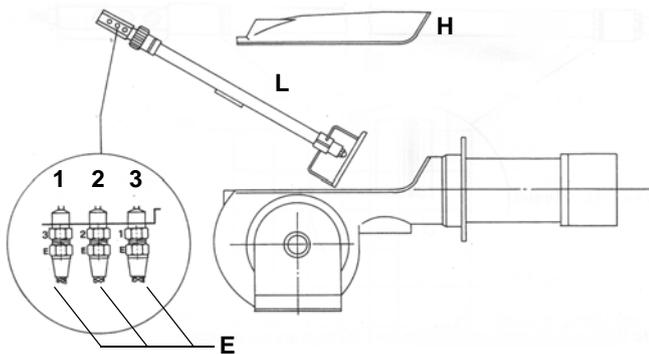


Fig. 21

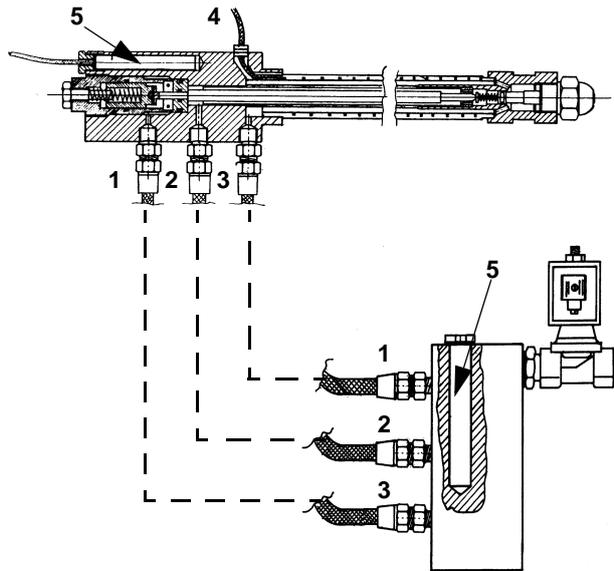


Fig. 22

Key

- 1 Inlet
- 2 Return
- 3 Lance opening
- 4 Heating wire (only for oil viscosity > 110 cSt @ 50 °C)
- 5 Cartdrige-type heater
- H Cover
- L Oil lance
- E Oil piping connections

Removing the oil gun, replacing the nozzle and the electrodes

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

To remove the oil gun, proceed as follows:

- 1 remove the combustion head as described on the previous paragraph;
- 2 loosen the **VU** screw and remove the oil gun: check the oil gun, replace it fi necessary;
- 3 after removing the oil gun, unscrew the nozzle and replace it if necessary;
- 4 in order to replace the electrodes, unscrew the **VB** fixing screws and remove them: place the new electrodes being careful to observe the measures shown on next paragraph: reassemblbe following the reversed procedure.

Caution: adjust the nozzle position, by means of the **VU** screw.

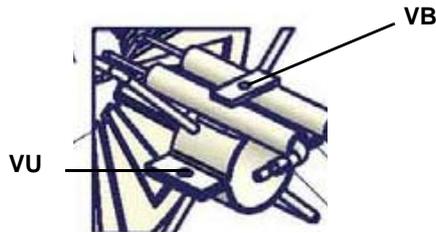


Fig. 23

Setting the combustion head position

If necessary, change the combustion head position: to let the burner operate at a lower output, loose the **VB** screw and move progressively back the combustion head towards the **MIN.** position, by turning clockwise the **VRT** ring nut. Fasten **VB** screw when the adjustment is accomplished (Fig. 24).

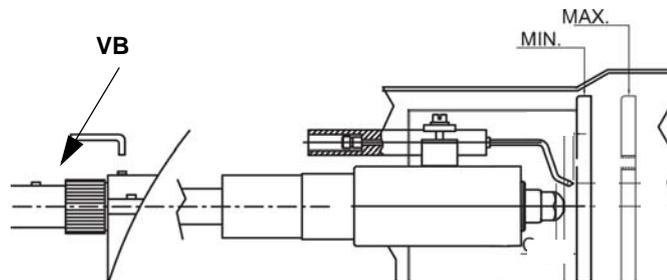


Fig. 24

Nozzle and electrodes correct position

Place the nozzle according to the combustion head; unscrew **VB** and move the combustion head. Check the ignition electrodes at the end of the procedure. Quotes are referred in mm.

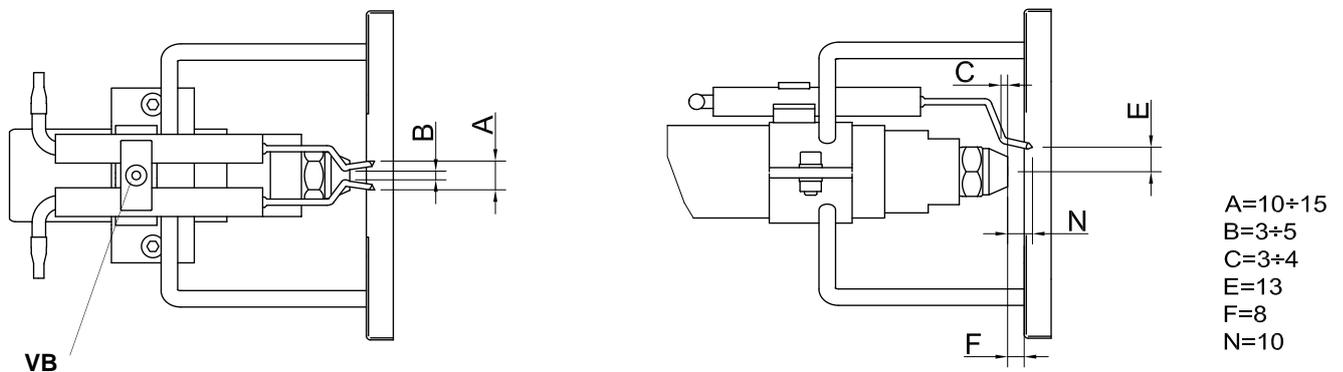


Fig. 25

Checking the detection current

To check the detection current follow the diagram on Fig. 26. 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. Minimum detection signal: 3.5Vdc

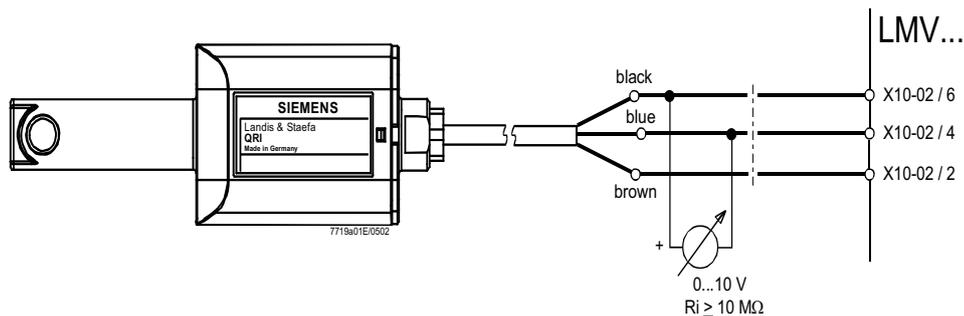


Fig. 26Detection with detector QRI...

Рис. 27

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

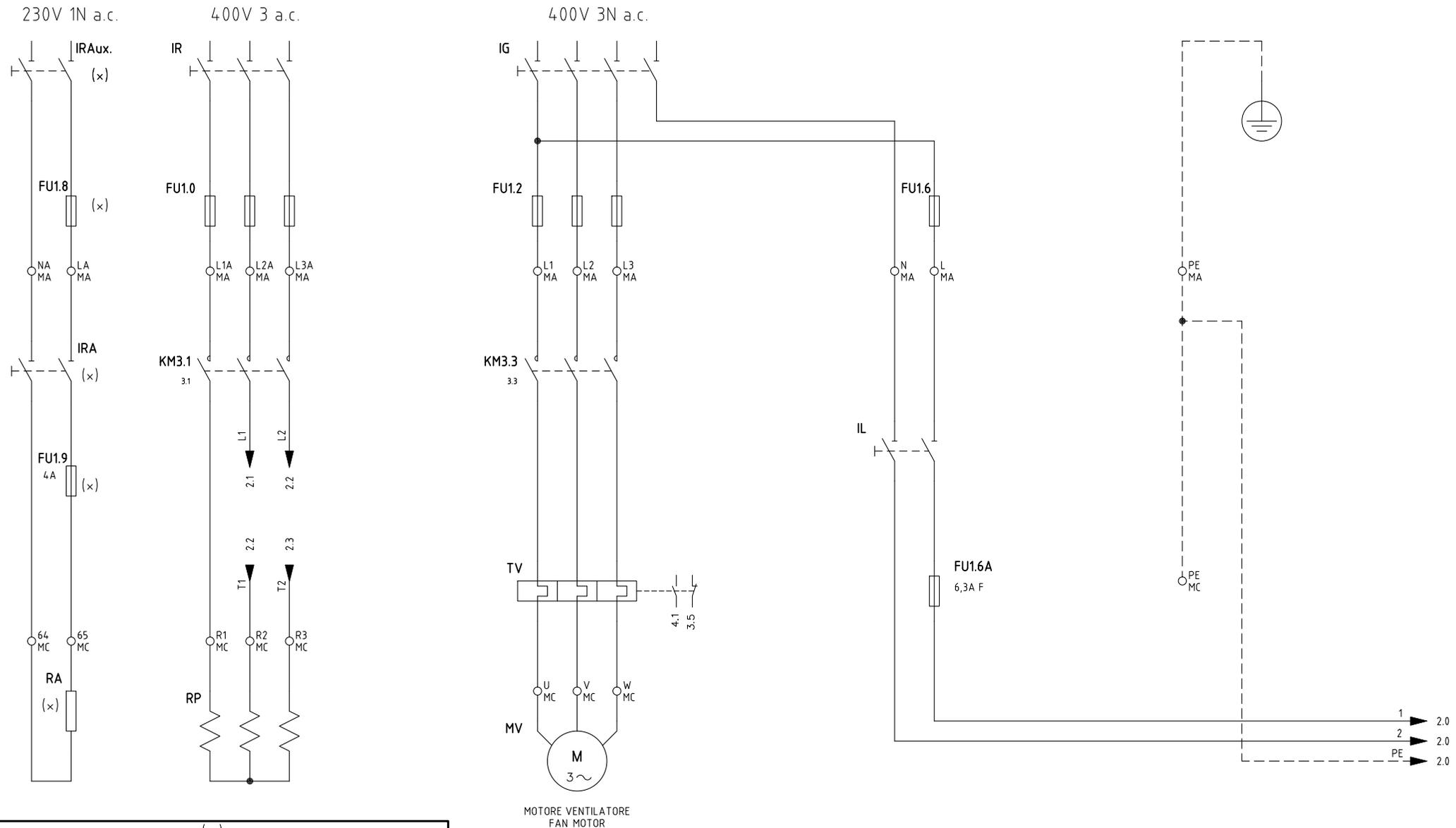
In case of disposal, follow the instructions according to the laws in force in your country about the "Disposal of materials".

WIRING DIAGRAMS

Refer to the attached wiring diagrams.

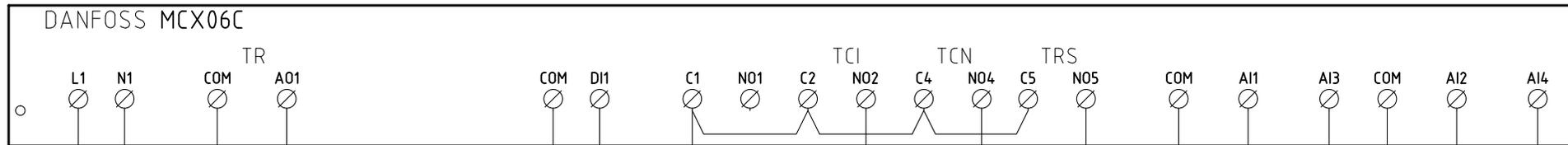
WARNING

- 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
- 4 - Refer to the attached document "RECOMMENDATIONS FOR LMV5x CONNECTIONS"



(x)
 UTILIZZATO SOLO PER VERSIONI "NAFTA 110 cSt a 50 °C" E "NAFTA 400 cSt a 50 °C"
 USED FOR "OIL 110 cSt a 50 °C" AND "OIL 400 cSt a 50 °C" VERSIONS ONLY

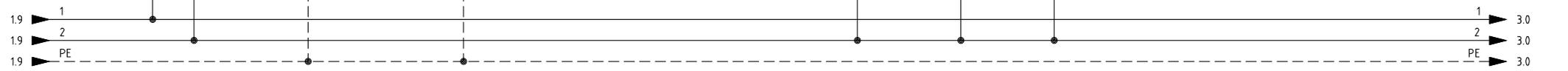
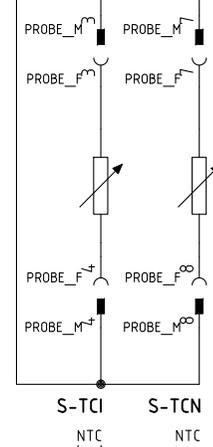
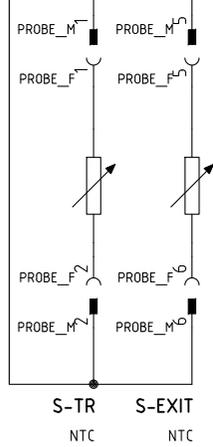
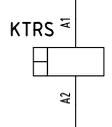
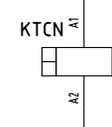
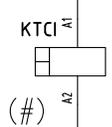
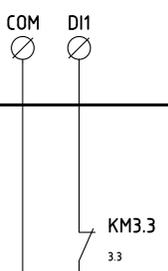
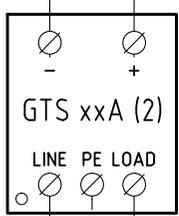
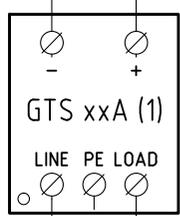
	Impianto	Ordine	Data	10/02/2014	PREC.	FOGLIO
	TIPI/TYPES PN60/70/81/91/92/93/RN510 MODELLO/MODEL x-.MD.S.xx.A..ES	Commissa	Data Controllato	10/02/2014	/	1
	Descrizione	Esecutore	Controllato	Dis. N.	09 - 0409	SEQUE
	CON LMV51.100 + QRI + MCX06C WITH LMV51.100 + QRI + MCX06C	U. PINTON	E. CAVALLI		2	9



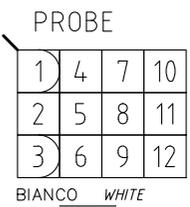
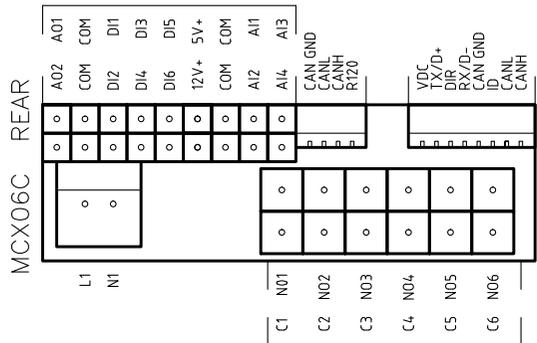
FU3.0
1A F

TRAFO
230V AC
24V AC
10VA

FU3.1
1A F

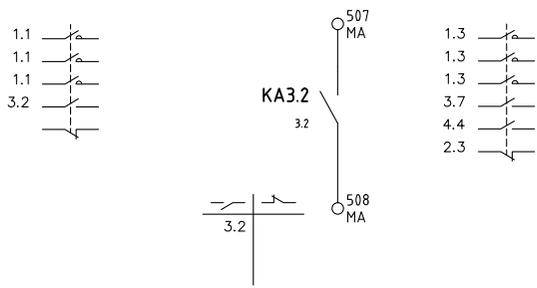
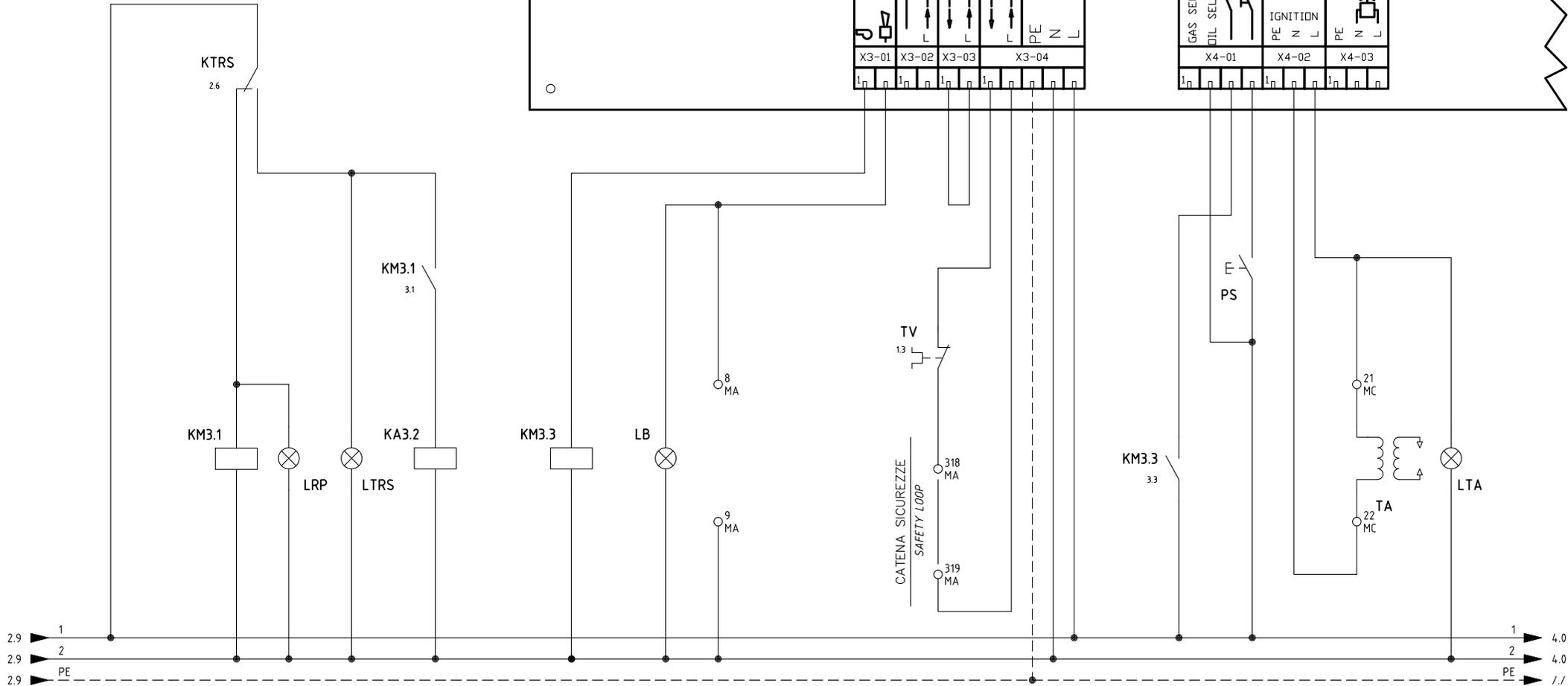
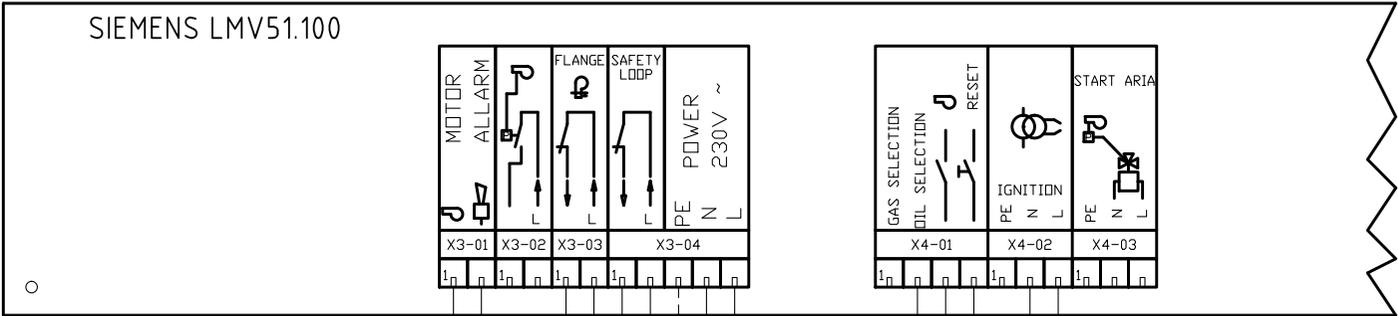


(#)
UTILIZZATO SOLO PER VERSIONI "NAFTA 400 cSt a 50 °C"
USED FOR "OIL 400 cSt a 50 °C" VERSIONS ONLY

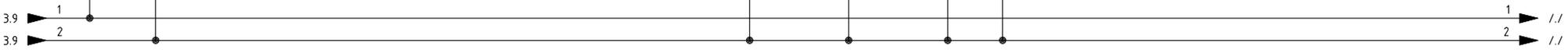
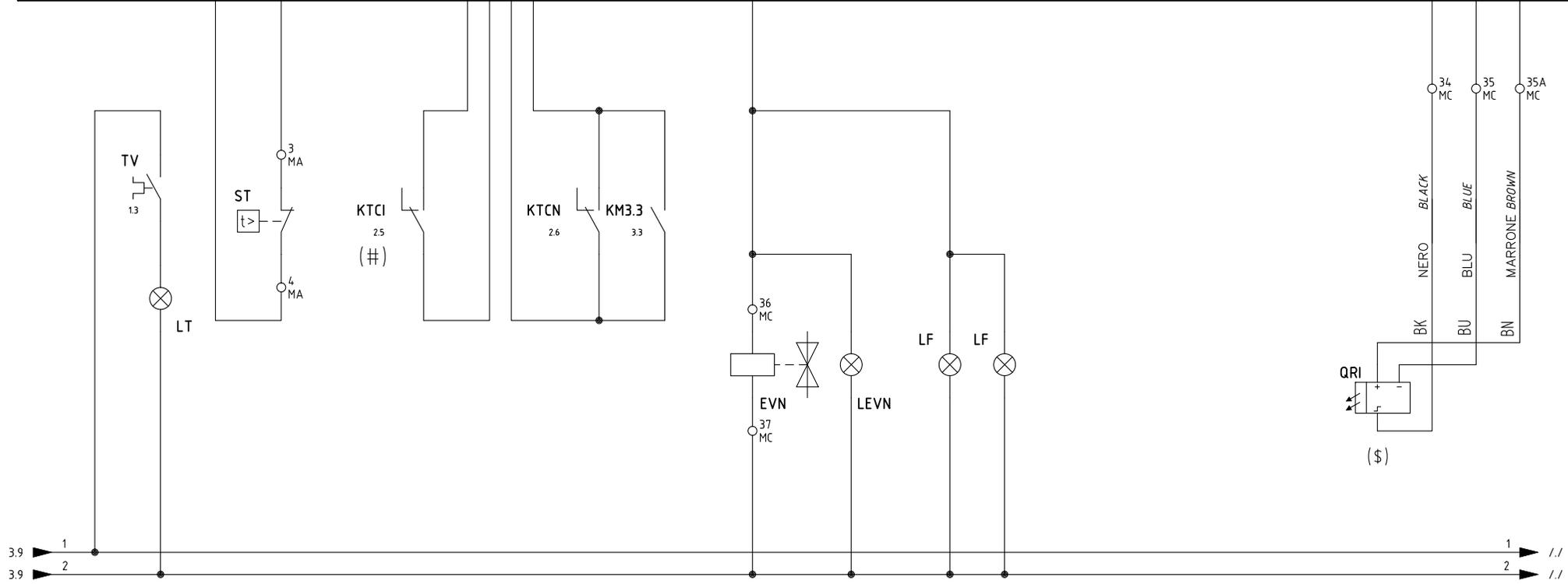
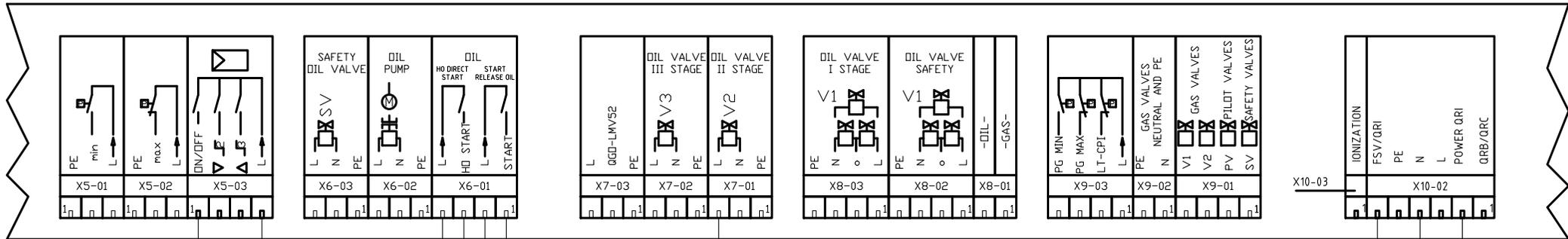


VISTA LATO COMPONENTI (SONDE)
COMPONENTS SIDE VIEW (PROBE)

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Revisione	00	1	2
Dis. N.	09 - 0409	SEGUE	TOTALE
		3	9

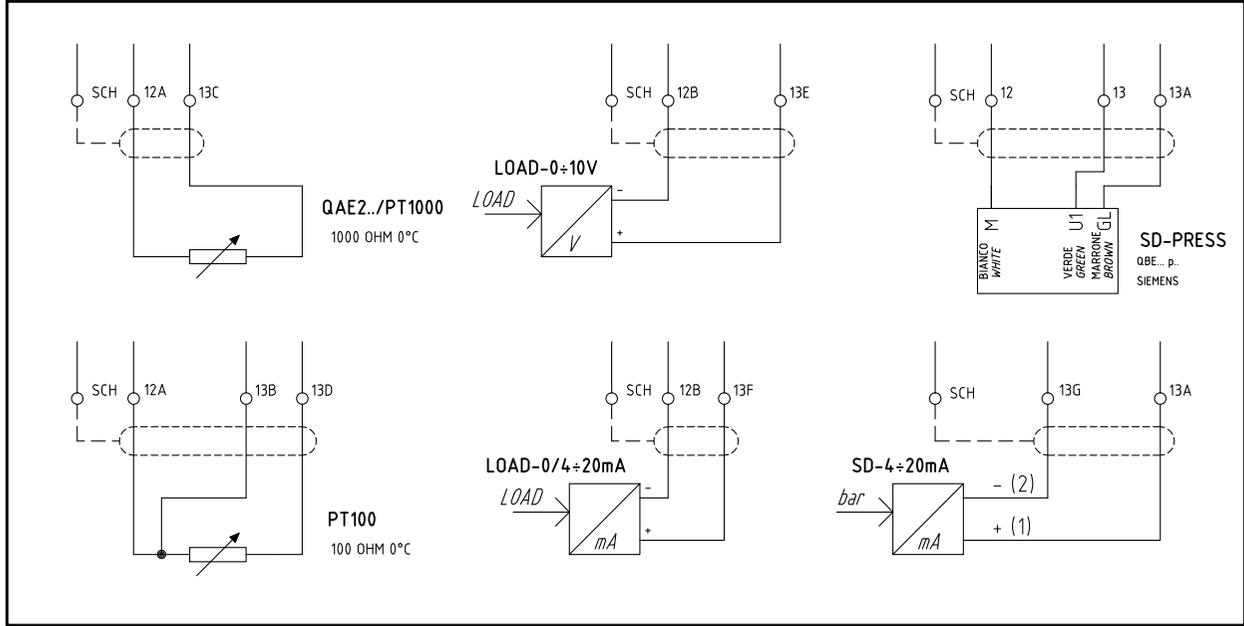
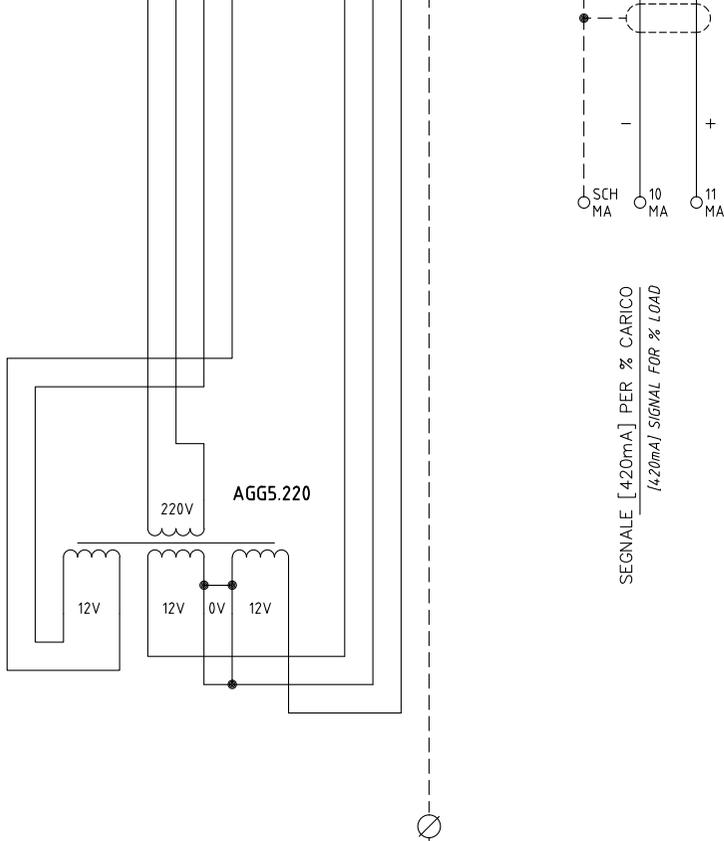
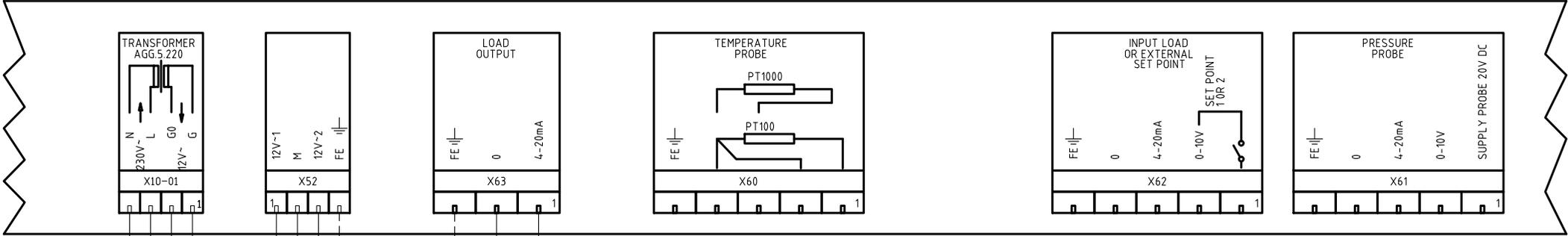


Data	10/02/2014	PREC.	FOGLIO
Revisione	00	2	3
Dis. N.	09 - 0409	SEGUE	TOTALE
		4	9



(#)
 UTILIZZATO SOLO PER VERSIONI "NAFTA 400 cSt a 50 °C"
 USED FOR "OIL 400 cSt a 50 °C" VERSIONS ONLY

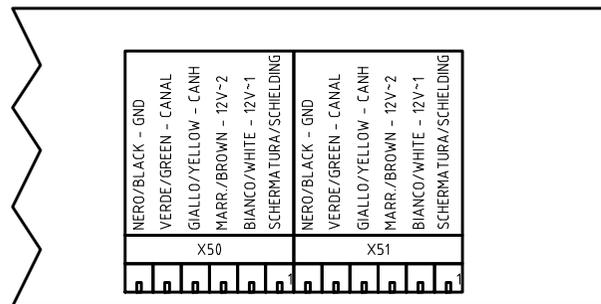
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Revisione	00	3	4
Dis. N.	09 - 0409	SEQUE	TOTALE
		5	9



(xx)
ATTENZIONE COLLEGAMENTO SONDE
WARNING PROBE CONNECTION

COLLEGAMENTO ELETTRICO PIU' CORTO POSSIBILE (~10cm)
DIRETTAMENTE SU PIASTRA QUADRO ELETTRICO
ELECTRICAL CONNECTION AS SHORT AS POSSIBLE (~ 10cm)
DIRECTLY ELECTRIC BOX PLATE

Data	10/02/2014	PREC.	FOGLIO
Revisione	00	4	5
Dis. N.	09 - 0409	SEGUE	TOTALE
		6	9

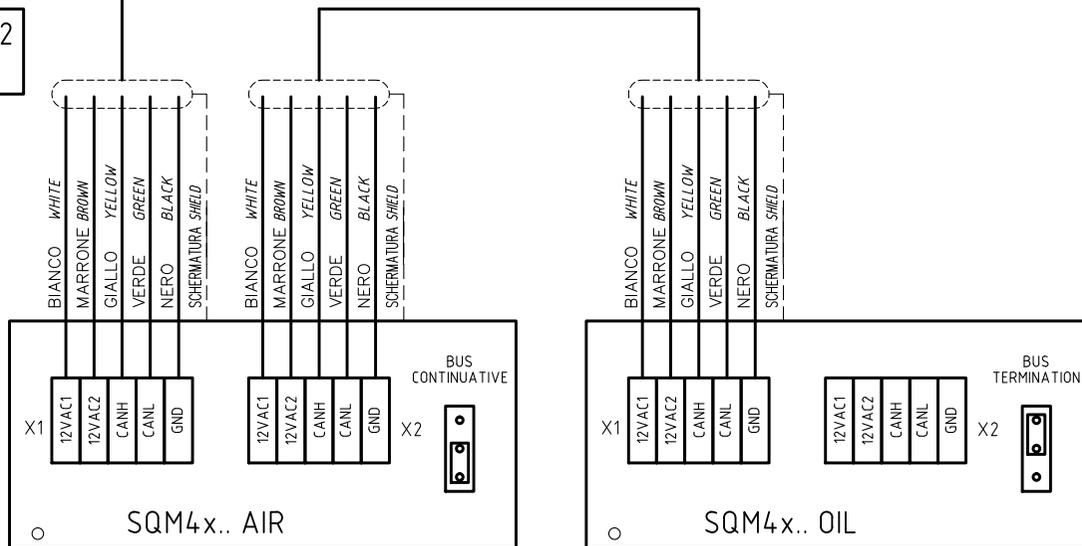


ESECUZIONE DELLA CONNESSIONE TRA LMV5x E SERVOCOMANDI < 20 METRI
 CONNECTIONS BETWEEN LMV5x AN ACTUATOR < 20 METERS

AGG5.635

CAVO DI SEGNALE E ALIMENTAZIONE ELETTRICA
 SIGNAL AND ELECTRIC SUPPLY CABLE

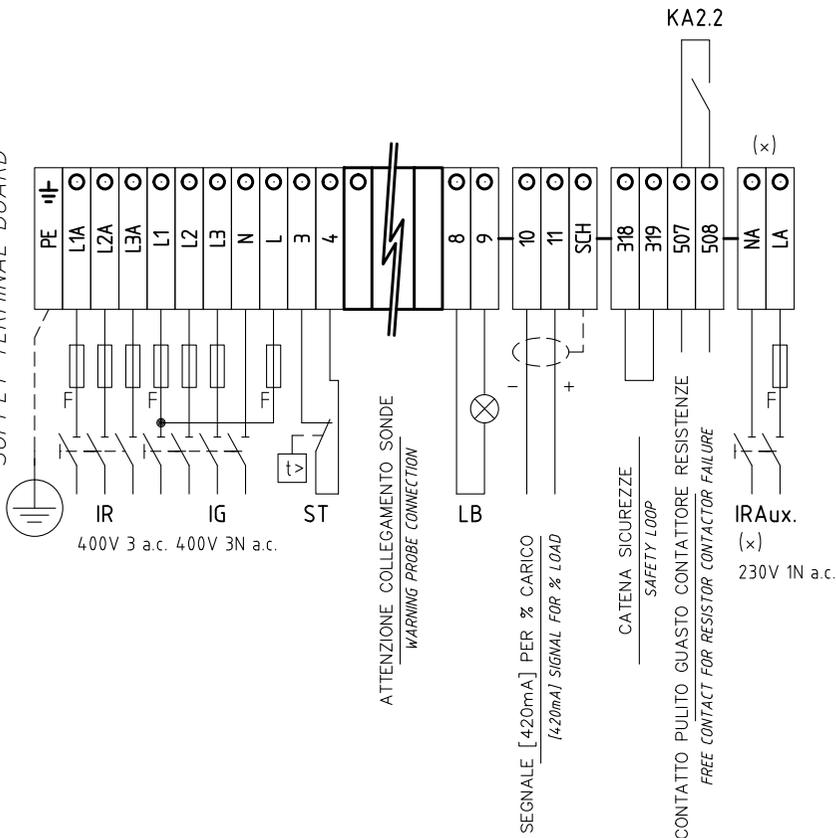
AZL 52



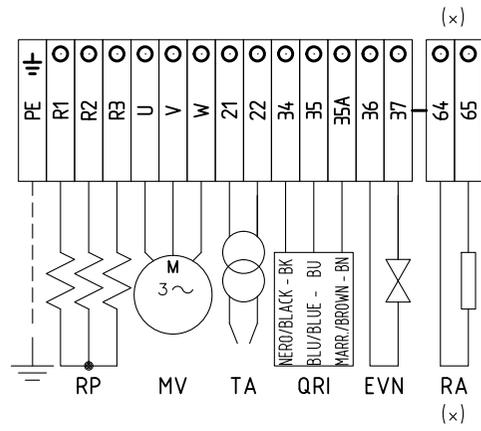
LA SEQUENZA DEI SERVOCOMANDI PUO' ESSERE DIVERSA;
 E' IMPORTANTE PERO' CHE L'ULTIMO SIA CON IL PONTE "BUS TERMINATION"
 THE CONNECTIONS OF ACTUATORS TO LMV CAN BE DIFFERENT;
 PLEASE NOTE THAT THE LAST ACTUATOR MUST HAVE THE BRIDGE "BUS TERMINATION"

Data	10/02/2014	PREC.	FOGLIO
Revisione	00	5	6
Dis. N.	09 - 0409	SEGUE	TOTALE
		7	9

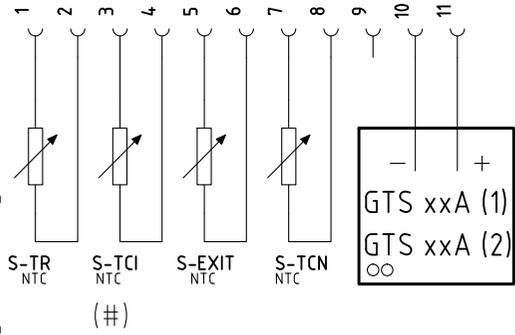
QG - MA1
MORSETTIERA ALIMENTAZIONE
SUPPLY TERMINAL BOARD



QG - MC
MORSETTIERA COMPONENTI BRUCIATORE
BURNER COMPONENT TERMINAL BOARD



QG - PROBE_F
CONNETTORE SONDE [MCX06C]
[MCX06C] РАЗЪЕМ ДАТЧИКОВ



(#)
UTILIZZATO SOLO PER VERSIONI "NAFTA 400 cSt a 50 °C"
USED FOR "OIL 400 cSt a 50 °C" VERSIONS ONLY

(x)
UTILIZZATO SOLO PER VERSIONI "NAFTA 110 cSt a 50 °C" E "NAFTA 400 cSt a 50 °C"
USED FOR "OIL 110 cSt a 50 °C" AND "OIL 400 cSt a 50 °C" VERSIONS ONLY

Data	10/02/2014	PREC.	FOGLIO
Revisione	00	6	7
Dis. N.	09 - 0409	SEGUE	TOTALE
		8	9

Sigla/Item	Foglio/Sheet	Funzione	Function
AGG5.220	5	TRASFORMATORE AUSILIARIO	AUXILIARY TRANSFORMER
AZL 52	6	INTERFACCIA UTENTE	USER INTERFACE
EVN	4	ELETTROVALVOLA NAFTA	OIL SOLENOID VALVE
FU1.0	1	FUSIBILI LINEA PRERISCALDATORE [RP]	LINE PRE-HEATING [RP] FUSES
FU1.2	1	FUSIBILI LINEA BRUCIATORE	BURNER LINE FUSES
FU1.6	1	FUSIBILE LINEA AUSILIARI	AUXILIARY LINE FUSE
FU1.6A	1	FUSIBILE LINEA AUSILIARI	AUXILIARY LINE FUSE
(x) FU1.8	1	FUSIBILE LINEA RESISTENZE AUSILIARIE	LINE AUXILIARY HEATERS FUSE
(x) FU1.9	1	FUSIBILE RESISTENZE AUSILIARIE	AUXILIARY HEATERS FUSE
FU3.0	2	FUSIBILE AUSILIARIO	AUXILIARY FUSE
FU3.1	2	FUSIBILE AUSILIARIO	AUXILIARY FUSE
GTS xxA (1)	2	TIRISTORE	THYRISTOR
GTS xxA (2)	2	TIRISTORE	THYRISTOR
IG	1	INTERRUTTORE LINEA BRUCIATORE	BURNER LINE SWITCH
IL	1	INTERRUTTORE LINEA AUSILIARI	AUXILIARY LINE SWITCH
IR	1	INTERRUTTORE LINEA RESISTENZE PRERISCALDATORE [RP]	PRE-HEATING RESISTOR [RP] LINE SWITCH
(x) IRA	1	INTERRUTTORE RESISTENZE AUSILIARIE	AUXILIARY HEATERS SWITCH
(x) IRAux.	1	INTERRUTTORE RESISTENZE AUSILIARIE	AUXILIARY HEATERS SWITCH
KA3.2	3	RELE' AUSILIARIO SEGNALAZIONE GUASTO CONTATTORE RESISTENZE	AUXILIARY RELAY FOR RESISTOR CONTACTOR FAILURE
KM3.1	3	CONTATTORE RESISTENZE PRERISCALDATORE [RP]	PRE-HEATING RESISTOR [RP] CONTACTOR
KM3.3	3	CONTATTORE MOTORE VENTILATORE	FAN MOTOR CONTACTOR
KTCI	2	RELE' AUSILIARIO	AUXILIARY RELAY
KTCN	2	RELE' AUSILIARIO	AUXILIARY RELAY
KTRS	2	RELE' AUSILIARIO	AUXILIARY RELAY
LB	3	LAMPADA SEGNALAZIONE BLOCCO BRUCIATORE	INDICATOR LIGHT FOR BURNER LOCK-OUT
LEVN	4	LAMPADA SEGNALAZIONE APERTURA [EVN]	INDICATOR LIGHT FOR OPENING OF ELECTRO-VALVE [EVN]
LF	4	LAMPADA SEGNALAZIONE FUNZIONAMENTO BRUCIATORE	INDICATOR LIGHT BURNER OPERATION
LF	4	LAMPADA SEGNALAZIONE FUNZIONAMENTO BRUCIATORE	INDICATOR LIGHT BURNER OPERATION
LOAD-0/4±20mA	5	SEGNALE IN CORRENTE PER % CARICO	CURRENT SIGNAL FOR % LOAD
LOAD-0±10V	5	SEGNALE IN TENSIONE PER % CARICO	VOLTAGE SIGNAL FOR % LOAD
LRP	3	LAMPADA SEGNALAZIONE FUNZIONAMENTO PRERISCALDATORE [RP]	INDICATOR LIGHT FOR PRE-HEATING RESISTOR [RP] OPERATION
LT	4	LAMPADA SEGNALAZIONE BLOCCO TERMICO MOTORE VENTILATORE	INDICATOR LIGHT FOR FAN MOTOR OVERLOAD THERMAL CUTOUT

(x)	(#)
UTILIZZATO SOLO PER VERSIONI "NAFTA 110 cSt a 50 °C" E "NAFTA 400 cSt a 50 °C" USED FOR "OIL 110 cSt a 50 °C" AND "OIL 400 cSt a 50 °C" VERSIONS ONLY	UTILIZZATO SOLO PER VERSIONI "NAFTA 400 cSt a 50 °C" USED FOR "OIL 400 cSt a 50 °C" VERSIONS ONLY

Data	10/02/2014	PREC.	FOGLIO
Revisione	00	7	8
Dis. N.	09 - 0409	SEGUE	TOTALE
		9	9

Sigla/Item	Foglio/Sheet	Funzione	Function
LTA	3	LAMPADA SEGNALAZIONE TRASFORMATORE DI ACCENSIONE	IGNITION TRANSFORMER INDICATOR LIGHT
LTRS	3	LAMPADA SEGNALAZIONE BLOCCO TERMOSTATO DI SICUREZZA [TRS]	INDICATOR LIGHT FOR [TRS] SAFETY THERMOSTAT
MCX06C	2	REGOLATORE TEMPERATURE NAFTA	OIL TEMPERATURE REGULATOR
MV	1	MOTORE VENTILATORE	FAN MOTOR
PS	3	PULSANTE SBLOCCO FIAMMA	FLAME UNLOCK BUTTON
PT100	5	SONDA DI TEMPERATURA	TEMPERATURE PROBE
QAE2../PT1000	5	SONDA DI TEMPERATURA	TEMPERATURE PROBE
QRI	4	SONDA UV RILEVAZIONE FIAMMA	UV FLAME DETECTOR
(x) RA	1	RESISTENZE AUSILIARIE	AUXILIARY HEATERS
RP	1	RESISTENZE PRERISCALDATORE NAFTA	PRE-HEATING TANK RESISTORS
S-EXIT	2	SONDA TEMPERATURA USCITA BARILOTTO	TANK OUTLET OIL TEMPERATURE PROBE
(#) S-TCI	2	SONDA TEMPERATURA CONSENSO IMPIANTO	PLANT CONSENT TEMPERATURE PROBE
S-TCN	2	SONDA TEMPERATURA CONSENSO NAFTA	OIL CONSENT TEMPERATURE PROBE
S-TR	2	SONDA TEMPERATURA RESISTENZE	RESISTOR TEMPERATURE PROBE
SD-4÷20mA	5	SEGNALE IN CORRENTE	CURRENT SIGNAL
SD-PRESS	5	SONDA DI PRESSIONE	PRESSURE PROBE
SIEMENS LMV51.100	3	APPARECCHIATURA DI COMANDO	CONTROL SCHEME
SQM4x.. AIR	6	SERVOCOMANDO SERRANDA ARIA	AIR DAMPER ACTUATOR
SQM4x.. OIL	6	SERVOCOMANDO REGOLATORE OLIO	OIL REGULATOR ACTUATOR
ST	4	SERIE TERMOSTATI/PRESSOSTATI	SERIES OF THERMOSTATS OR PRESSURE SWITCHES
TA	3	TRASFORMATORE DI ACCENSIONE	IGNITION TRANSFORMER
TRAFO	2	TRASFORMATORE AUSILIARIO	AUXILIARY TRANSFORMER
TV	1	TERMICO MOTORE VENTILATORE	FAN MOTOR THERMAL

(x)	(#)
UTILIZZATO SOLO PER VERSIONI "NAFTA 110 cSt a 50 °C" E "NAFTA 400 cSt a 50 °C" USED FOR "OIL 110 cSt a 50 °C" AND "OIL 400 cSt a 50 °C" VERSIONS ONLY	UTILIZZATO SOLO PER VERSIONI "NAFTA 400 cSt a 50 °C" USED FOR "OIL 400 cSt a 50 °C" VERSIONS ONLY

Data	10/02/2014	PREC.	FOGLIO
Revisione	00	8	9
Dis. N.	09 - 0409	SEQUE	TOTALE
		/	9

TROUBLESHOOTING

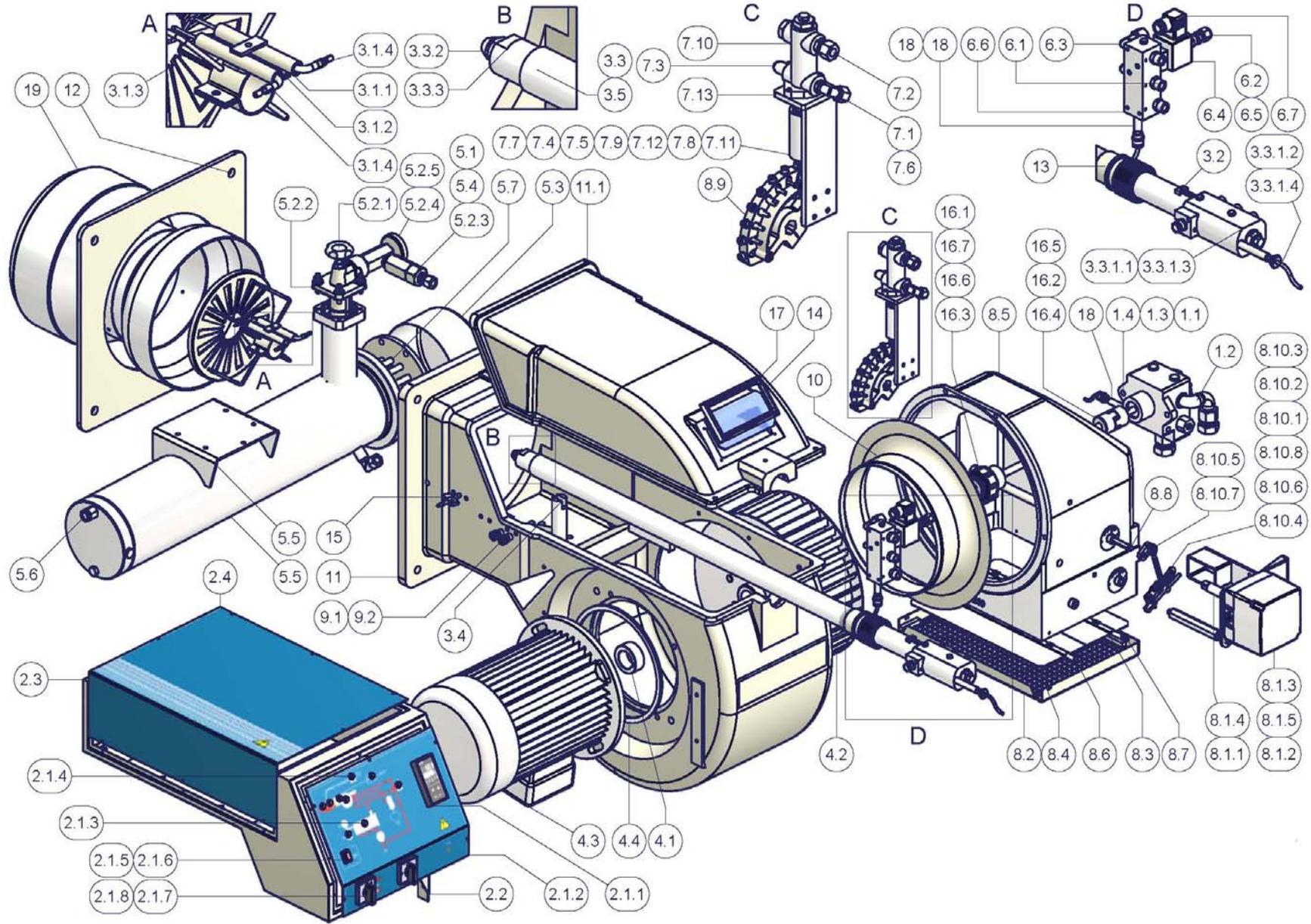
CAUSES/TROUBLES	DOES NOT START UP	CONTINUES PRE-PURGUE	BURNER STARTS UP WITH COLD OIL	DOES NOT IGNITE AND GOES TO SHUT DOWN	DOES NOT PASS TO HIGH FLAME	GOES TO SHUT DOWN DURING OPERATION	GOES OFF AND REPEATS THE CYCLE DURING OPERATION
MAIN SWITCH OFF	●						
LINE FUSES BLOWN	●						
MAXIMUM THERMOSTAT MALFUNCTION	●						
FAN THERMAL CUTOUT TRIPPED	●						
AUXILIARY FUSE BLOWN	●						
OIL RESISTOR FAULTY	●		●				
OIL ENABLING THERMOSTAT TRIPPED	●		●				
CONTROL UNIT MALFUNCTION	●	●		●	●	●	●
AIR SERVOCONTROL MALFUNCTION					●		
CIRCUIT ENABLING THERMOSTAT		●			●		
SMOKY FLAME						●	●
IGNITION TRANSFORMER FAULTY				●			
IGNITION ELECTRODES 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				●		●	●

BURNER EXPLODED VIEW

ITEM	DESCRIPTION
1.1	NIPPLE
1.2	ELBOW
1.3	NIPPLE
1.4	PUMP
2.1.1	POWER CONTROLLER
2.1.2	FRONT CONTROL PANEL
2.1.3	LIGHT
2.1.4	LIGHT
2.1.5	LOCK-OUT RESET BUTTON
2.1.6	PROTECTION
2.1.7	SWITCH
2.1.8	SWITCH
2.2	BRACKET
2.3	BOARD
2.4	COVER
3.1.1	LONG IGNITION ELECTRODE
3.1.2	LONG IGNITION ELECTRODE
3.1.3	COMBUSTION HEAD
3.1.4	IGNITION CABLE
3.2	GUN TERMINAL
3.3	STANDARD COMPLETE OIL GUN
3.3.1.1	NIPPLE
3.3.1.2	RESISTOR FIXING SCREW
3.3.1.3	OIL MANIFOLD
3.3.1.4	RESISTOR
3.3.2	NOZZLE
3.3.3	NOZZLE HOLDER
3.4	OIL GUN HOLDER
3.5	COMBUSTION HEAD ADJUSTING PIPE
4.1	SPACER
4.2	FAN WHEEL
4.3	MOTOR
4.4	GAUGE RING
5.1	STRAIGHT UNION
5.2.1	OIL FILTER

ITEM	DESCRIPTION
5.2.2	GASKET
5.2.3	GAS BLEEDING VALVE
5.2.4	THERMOMETER
5.2.5	MUFF
5.3	COVER
5.4	REDUCTION
5.5	OIL PRE-HEATER
5.6	SHEATH
5.7	RESISTOR
6.1	NIPPLE
6.2	STRAIGHT JOINT
6.3	UNION ELBOW
6.4	OIL SOLENOID VALVE
6.5	REDUCTION
6.6	OIL MANIFOLD
6.7	CONNECTOR
7.1	UNION ELBOW
7.2	STRAIGHT UNION
7.3	UNION ELBOW
7.4	SCREW
7.5	ADJUSTING ROD
7.6	REDUCTION
7.7	WASHER
7.8	BUSH
7.9	BEARING
7.10	PRESSURE GOVERNOR
7.11	
7.12	BRACKET
7.13	BRACKET
8.1.1	SPACER
8.1.2	BUSH
8.1.3	ACTUATOR
8.1.4	ACTUATOR SHAFT
8.1.5	BRACKET
8.2	NET

ITEM	DESCRIPTION
8.3	AIR INTAKE DAMPER
8.4	AIR INTAKE DAMPER
8.5	AIR INTAKE
8.6	LOUVER SHAFT
8.7	LOUVER SHAFT
8.8	ADJUSTING CAM SHAFT
8.9	ADJUSTING CAM
8.10.1	SCREW
8.10.2	SCREW
8.10.3	SPACER
8.10.4	CAM
8.10.5	LEVERAGE
8.10.6	ROD
8.10.7	JOINT
8.10.8	JOINT
9.1	FAIRLEAD
9.2	FAIRLEAD
10	AIR INLET CONE
11	BURNER HOUSING
11.1	COVER
12	GENERATOR GASKET
13	RING NUT
14	INSPECTION GLASS
15	PHOTORESISTOR
16.1	PIN
16.2	ELASTIC RING
16.3	ELASTIC RING
16.4	HALF-COUPLING
16.5	HALF-COUPLING
16.6	HALF-COUPLING
16.7	HALF-COUPLING
17	BRACKET
18	RESISTOR
19	STANDARD BLAST TUBE





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Note: specifications and data subject to change without notice. Errors and omissions excepted.