

**HP60 - HP65  
HP72 - HP73A  
Dual fuel burners  
gas - light oil  
DOUBLE-STAGE**

MANUAL OF INSTALLATION - USE - MAINTENANCE

***CIB* UNIGAS**

BURNERS - BRUCIATORI - BRULERS - BRENNER - QUEMADORES - ГОРЕЛКИ

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## APPENDIX

## WARNINGS

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

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

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

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

### 1) GENERAL INTRODUCTION

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

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

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

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

Contact qualified personnel only.

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

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

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

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

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

### 2) SPECIAL INSTRUCTIONS FOR BURNERS

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

When the decision is made to discontinue the use of the burner, the user

shall have qualified personnel carry out the following operations:

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

#### Special warnings

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

### 3) GENERAL INSTRUCTIONS DEPENDING ON FUEL USED

#### 3a) ELECTRICAL CONNECTION

- For safety reasons the unit must be efficiently earthed and installed as required by current safety regulations.
  - It is vital that all safety requirements are met. In case of any doubt, ask for an accurate inspection of electrics by qualified personnel, since the manufacturer cannot be held liable for damages that may be caused by failure to correctly earth the equipment.
  - Qualified personnel must inspect the system to make sure that it is adequate to take the maximum power used by the equipment shown on the equipment rating plate. In particular, make sure that the system cable cross section is adequate for the power absorbed by the unit.
  - No adaptors, multiple outlet sockets and/or extension cables are permitted to connect the unit to the electric mains.
  - An omnipolar switch shall be provided for connection to mains, as required by the current safety regulations.
  - The use of any power-operated component implies observance of a few basic rules, for example:
    - do not touch the unit with wet or damp parts of the body and/or with bare feet;
    - do not pull electric cables;
    - do not leave the equipment exposed to weather (rain, sun, etc.) unless expressly required to do so;
    - do not allow children or inexperienced persons to use equipment;
  - The unit input cable shall not be replaced by the user.
- In case of damage to the cable, switch off the unit and contact qualified personnel to replace.
- When the unit is out of use for some time the electric switch supplying all the power-driven components in the system (i.e. pumps, burner, etc.) should be switched off.

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

#### GENERAL

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

#### SPECIAL INSTRUCTIONS FOR USING GAS

Have qualified personnel inspect the installation to ensure that:

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

#### Precautions if you can smell gas

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

### DIRECTIVES AND STANDARDS

#### *Gas burners*

##### European directives:

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

##### Harmonised standards :

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

#### *Light oil burners*

##### European directives:

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

##### Harmonised standards :

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

##### National standards :

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

#### *Heavy oil burners*

##### European directives:

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

##### Harmonised standards :

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

##### National standards :

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

#### *Gas - Light oil burners*

##### European directives:

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

##### Harmonised standards :

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

##### National standards :

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

#### *Gas - Heavy oil burners*

##### European directives:

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

##### Harmonised standards :

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

##### National standards :

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

## PART I: INSTALLATION MANUAL

## BURNER FEATURES

**Burner model identification**

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

| Type                                 | HP72                                                                                                                                                                               | Model | MG. | AB. | S.  | *   | A.  | O. | 40 |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----|-----|-----|-----|-----|----|----|
| (1)                                  | (2)                                                                                                                                                                                | (3)   | (4) | (5) | (6) | (7) | (8) |    |    |
| (1) BURNER TYPE                      | HP72                                                                                                                                                                               |       |     |     |     |     |     |    |    |
| (2) FUEL                             | M - Natural gas      G - Light oil                                                                                                                                                 |       |     |     |     |     |     |    |    |
| (3) OPERATION (Available versions()) | AB - Double stage                                                                                                                                                                  |       |     |     |     |     |     |    |    |
| (4) BLAST TUBE                       | S - standard                                                                                                                                                                       |       |     |     |     |     |     |    |    |
| (5) DESTINATION COUNTRY              | * - Destination country see data plate                                                                                                                                             |       |     |     |     |     |     |    |    |
| (6) BURNER VERSION                   | A - Standard                                                                                                                                                                       |       |     |     |     |     |     |    |    |
| (7) EQUIPMENT)                       | 0 = 2 gas valves<br>1 = 2 gas valves + gas proving system<br>7 = 2 gas valves + maximum gas pressure switch<br>8 = 2 gas valves + gas proving system + maximum gas pressure switch |       |     |     |     |     |     |    |    |
| (8) GAS CONNECTIONS                  | 40 = Rp1 1/2      50 = Rp2      65 = DN65      80 = DN80                                                                                                                           |       |     |     |     |     |     |    |    |

**Technical specifications**

| BURNER TYPE                    |                                   | HP60 MG....40         | HP60 MG....50/65       | HP65 MG....50/65       |
|--------------------------------|-----------------------------------|-----------------------|------------------------|------------------------|
| Output                         | min. - max.kW                     | 170 - 523             | 170 - 880              | 270-970                |
| Fuel                           |                                   | Nat. gas - Light oil  |                        |                        |
| Gas category                   |                                   | (see next paragraph)  |                        |                        |
| Gas rate                       | min. - max. (Stm <sup>3</sup> /h) | 18 - 55               | 18 - 93                | 29-103                 |
| Gas pressure                   | min. - max. mbar                  | (see Note 2)          |                        |                        |
| Light oil rate                 | min. - max. kg/h                  | 14 - 44               | 14 - 74                | 23-82                  |
| Light oil train inlet pressure | max. bar                          | 1                     |                        |                        |
| Oil viscosity                  |                                   | 2 - 7.4 cSt @ 40°C    |                        |                        |
| Oil density                    |                                   | 840 kg/m <sup>3</sup> |                        |                        |
| Power supply                   |                                   | 400V 3N ~ 50Hz        |                        |                        |
| Total power consumption        | kW                                | 2.15                  | 2.15                   | 2.55                   |
| Electric motor                 | kW                                | 1.1                   | 1.1                    | 1.5                    |
| Pump motor                     | kW                                | 0.55                  | 0.55                   | 0.55                   |
| Protection                     |                                   | IP40                  |                        |                        |
| Approx. weight                 | kg                                | 65                    | 72                     | 107                    |
| Operation                      |                                   | Double-stage          |                        |                        |
| Gas Train                      |                                   | 40                    | 50 - 65                | 50 - 65                |
| Valves size/Gas connection     |                                   | 1" 1/2 / Rp1 1/2      | 2" /Rp2 - 2" 1/2 /DN65 | 2" /Rp2 - 2" 1/2 /DN65 |
| Operating temperature          | °C                                | -10 ÷ +50             |                        |                        |
| Storage Temperature            | °C                                | -20 ÷ +60             |                        |                        |
| Working service*               |                                   | Intermittent          |                        |                        |

| BURNER TYPE                    |                                   | HP72 MG....0.50       | HP72 MG....0.65 | HP72 MG....0.80 |
|--------------------------------|-----------------------------------|-----------------------|-----------------|-----------------|
| Output                         | min. - max.kW                     | 330 - 1200            |                 |                 |
| Fuel                           |                                   | Nat. gas - Light oil  |                 |                 |
| Gas category                   |                                   | (see next paragraph)  |                 |                 |
| Gas rate                       | min. - max. (Stm <sup>3</sup> /h) | 35 - 127              |                 |                 |
| Gas pressure.                  | min. - max. mbar                  | (see Note 2)          |                 |                 |
| Light oil rate                 | min. - max. kg/h                  | 28 - 101              |                 |                 |
| Light oil train inlet pressure | max. bar                          | 1                     |                 |                 |
| Oil viscosity                  |                                   | 2 - 7.4 cSt @ 40°C    |                 |                 |
| Oil density                    |                                   | 840 kg/m <sup>3</sup> |                 |                 |
| Power supply                   |                                   | 400V 3N ~ 50Hz        |                 |                 |
| Total power consumption        | kW                                | 3.25                  |                 |                 |
| Electric motor                 | kW                                | 2.2                   |                 |                 |
| Pump motor                     | kW                                | 0.55                  |                 |                 |
| Protection                     |                                   | IP40                  |                 |                 |
| Approx. weight                 | kg                                | 107                   | 117             | 127             |
| Operation                      |                                   | Double-stage          |                 |                 |
| Gas Train                      |                                   | 50                    | 65              | 80              |
| Valves size / Gas connection   |                                   | 2" / Rp2              | 2" 1/2 / DN65   | 3" / DN80       |
| Operating temperature          | °C                                | -10 ÷ +50             |                 |                 |
| Storage Temperature            | °C                                | -20 ÷ +60             |                 |                 |
| Working service*               |                                   | Intermittent          |                 |                 |

| BURNER TYPE                    |                                   | HP72 MG.....1.50      | HP72 MG.....1.65         | HP72 MG.....1.80 |
|--------------------------------|-----------------------------------|-----------------------|--------------------------|------------------|
| Output                         | min. - max. kW                    | 330 - 1550            |                          |                  |
| Fuel                           |                                   | Nat. gas - Light oil  |                          |                  |
| Gas category                   |                                   | (see next paragraph)  |                          |                  |
| Gas rate                       | min. - max. (Stm <sup>3</sup> /h) | 35 - 164              |                          |                  |
| Gas pressure.                  | min. - max. mbar                  | (see Note 2)          |                          |                  |
| Light oil rate                 | min. - max. kg/h                  | 28 - 131              |                          |                  |
| Light oil train inlet pressure | max. bar                          | 1                     |                          |                  |
| Oil viscosity                  |                                   | 2 - 7.4 cSt @ 40°C    |                          |                  |
| Oil density                    |                                   | 840 kg/m <sup>3</sup> |                          |                  |
| Power supply                   |                                   | 400V 3N ~ 50Hz        |                          |                  |
| Total power consumption        | kW                                | 3.25                  |                          |                  |
| Fan motor                      | kW                                | 2.2                   |                          |                  |
| Pump motor                     | kW                                | 0.55                  |                          |                  |
| Protection                     |                                   | IP40                  |                          |                  |
| Approx. weight                 | kg                                | 107                   | 117                      | 127              |
| Operation                      |                                   | Double-stage          |                          |                  |
| Gas Train                      |                                   | 50                    | 65                       | 80               |
| Valves size / Gas connection   |                                   | 2" / Rp2              | 2" <sub>1/2</sub> / DN65 | 3" / DN80        |
| Operating temperature          | °C                                | -10 ÷ +50             |                          |                  |
| Storage Temperature            | °C                                | -20 ÷ +60             |                          |                  |
| Working service**              |                                   | Intermittent          |                          |                  |

| BURNER TYPE                    |                                   | HP73A MG.....50       | HP73A MG.....65          | HP73A MG.....80 |
|--------------------------------|-----------------------------------|-----------------------|--------------------------|-----------------|
| Output                         | min. - max.kW                     | 320 - 2300            |                          |                 |
| Fuel                           |                                   | Nat. gas - Light oil  |                          |                 |
| Gas category                   |                                   | (see next paragraph)  |                          |                 |
| Gas rate                       | min. - max. (Stm <sup>3</sup> /h) | 34 - 243              |                          |                 |
| Gas pressure.                  | min. - max. mbar                  | (see Note 2)          |                          |                 |
| Light oil rate                 | min. - max. kg/h                  | 27 - 194              |                          |                 |
| Light oil train inlet pressure | max. bar                          | 1                     |                          |                 |
| Oil viscosity                  |                                   | 2 - 7.4 cSt @ 40°C    |                          |                 |
| Oil density                    |                                   | 840 kg/m <sup>3</sup> |                          |                 |
| Power supply                   |                                   | 400V 3N ~ 50Hz        |                          |                 |
| Total power consumption        | kW                                | 3.5                   |                          |                 |
| Fan motor                      | kW                                | 3                     |                          |                 |
| Pump motor                     | kW                                | 0.55                  |                          |                 |
| Protection                     |                                   | IP40                  |                          |                 |
| Approx. weight                 | kg                                | 112                   | 122                      | 132             |
| Operation                      |                                   | Double stage          |                          |                 |
| Gas train                      |                                   | 50                    | 65                       | 80              |
| Valves size / Gas connection   |                                   | 2" / Rp2              | 2" <sub>1/2</sub> / DN65 | 3" / DN80       |
| Operating temperature          | °C                                | -10 ÷ +50             |                          |                 |
| Storage temperature            | °C                                | -20 ÷ +60             |                          |                 |
| Working service *              |                                   | Intermittent          |                          |                 |

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

|               |                                                                                                                                                                                                      |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Note1:</b> | All gas flow rates are referred to Stm <sup>3</sup> /h (1013 mbar absolute pressure, 15 °C temperature) and are valid for G20 gas (net calorific value H <sub>i</sub> = 34.02 MJ/Stm <sup>3</sup> ). |
| <b>Note2:</b> | Maximum gas pressure = 360mbar (with Dungs MBDLE/MBC valves)<br>= 500mbar (with Dungs MBC or Siemens VGD gas valves).<br>Minimum gas pressure = see gas curves.                                      |

## Country and usefulness gas categories

| GAS<br>CATEGORY        | COUNTRY |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
|------------------------|---------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|
|                        | AT      | ES | GR | SE | FI | IE | HU | IS | NO | CZ | DK | GB | IT | PT | CY | EE | LV | SI | MT | SK | BG | LT | RO | TR | CH |  |
| I <sub>2H</sub>        |         |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| I <sub>2E</sub>        | LU      | PL | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  |  |
| I <sub>2E( R ) B</sub> | BE      | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  |  |
| I <sub>2L</sub>        | NL      | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  |  |
| I <sub>2ELL</sub>      | DE      | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  |  |
| I <sub>2Er</sub>       | FR      | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  |  |

### 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 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 100 mm into the combustion chamber.
- Pressurised boilers with flame reversal: in this case the blast tube must penetrate at least 50 - 100 mm into combustion chamber in respect to the tube bundle plate.

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

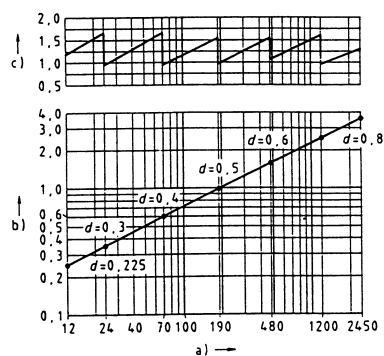


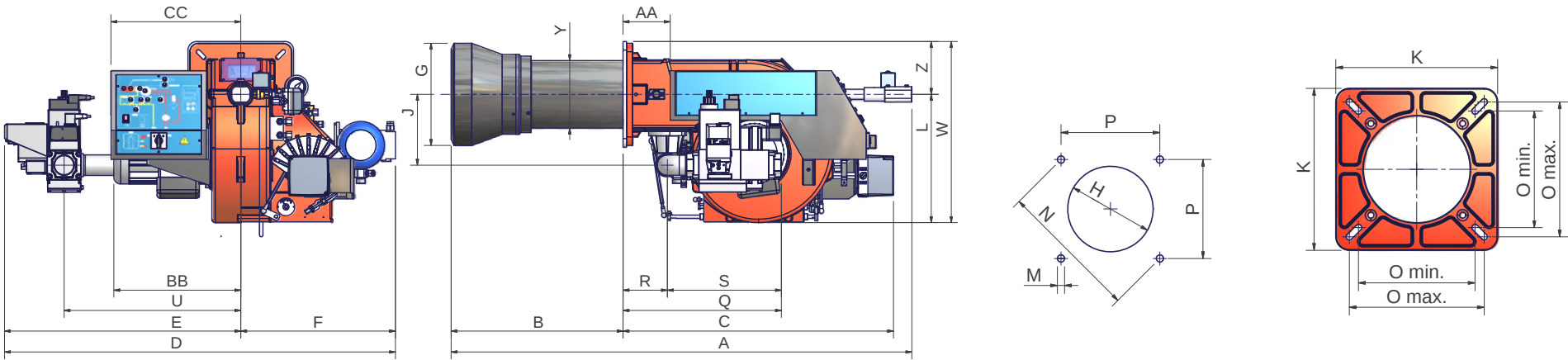
Fig. 1

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

Overall dimensions (mm)



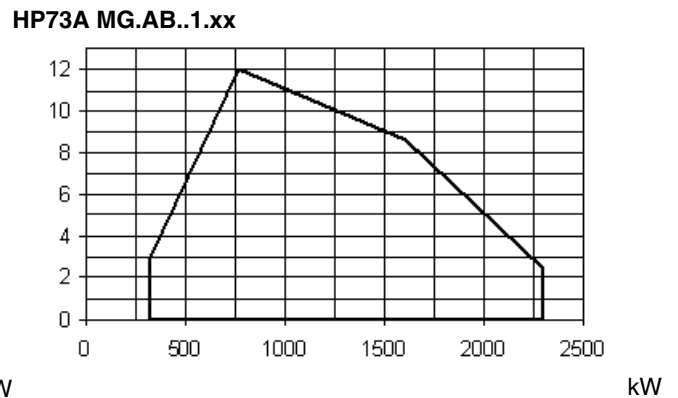
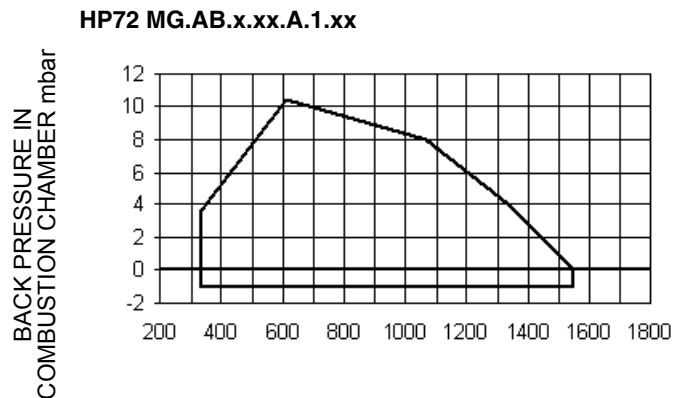
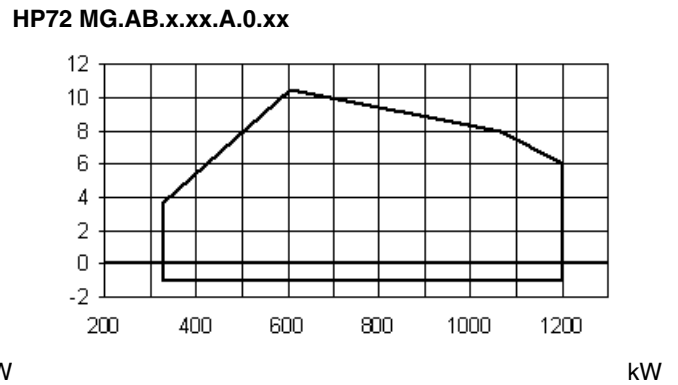
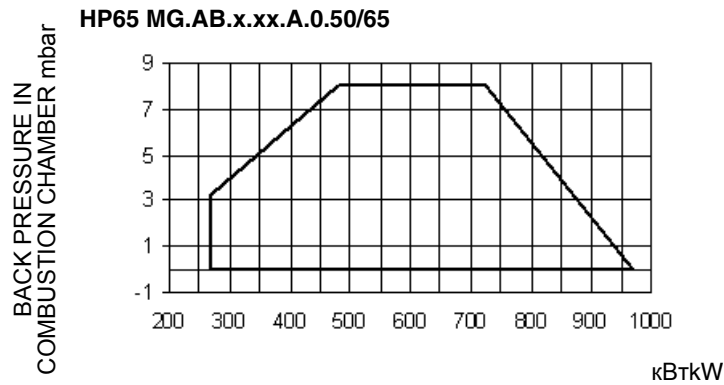
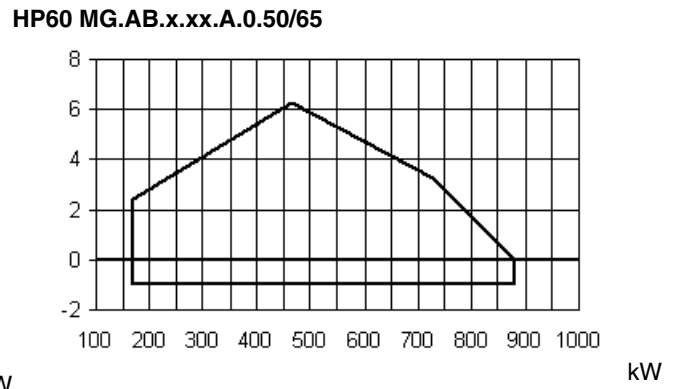
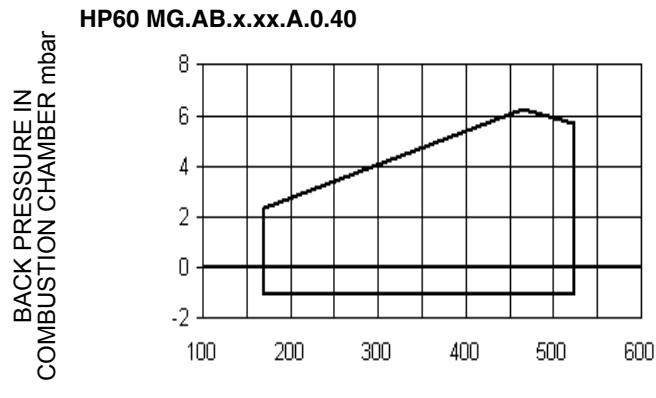
Boiler drilling plate and burner flange

|                 | DN | AS   | AA  | BS  | BB  | C   | CC  | D    | E   | F   | G   | H   | J   | K   | L   | M   | N   | O - min | O - max | P   | Q   | R   | S   | U   | V   | W   | Y   | Z   |
|-----------------|----|------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| HP60 AB - 0.40  | 40 | 1115 | 99  | 379 | 314 | 736 | 362 | 930  | 500 | 430 | 240 | 280 | 210 | 240 | 344 | M10 | 269 | 190     | 190     | 190 | 445 | 112 | 327 | 444 | x   | 464 | 162 | 120 |
| HP60 AB - 0.50  | 50 | 1115 | 99  | 379 | 314 | 736 | 362 | 930  | 500 | 430 | 240 | 280 | 210 | 240 | 344 | M10 | 269 | 190     | 190     | 190 | 445 | 112 | 335 | 444 | x   | 464 | 162 | 120 |
| HP60 AB - 0.65  | 65 | 1115 | 99  | 379 | 314 | 736 | 362 | 1115 | 685 | 430 | 240 | 280 | 250 | 240 | 420 | M10 | 269 | 190     | 190     | 190 | 845 | 112 | 403 | 540 | 313 | 540 | 162 | 120 |
| HP65 AB - 0.50  | 50 | 1156 | 139 | 362 | 347 | 794 | 382 | 1022 | 568 | 454 | 240 | 280 | 208 | 300 | 376 | M10 | 330 | 216     | 250     | 233 | 465 | 130 | 335 | 519 | x   | 531 | 198 | 155 |
| HP65 AB - 1.50  | 50 | 1156 | 139 | 362 | 347 | 794 | 382 | 1148 | 694 | 454 | 240 | 280 | 208 | 300 | 376 | M10 | 330 | 216     | 250     | 233 | 465 | 130 | 335 | 519 | x   | 531 | 198 | 155 |
| HP65 AB - 0.65  | 65 | 1156 | 139 | 362 | 347 | 794 | 382 | 1120 | 568 | 454 | 240 | 280 | 208 | 300 | 376 | M10 | 330 | 216     | 250     | 233 | 533 | 130 | 403 | 565 | 313 | 548 | 198 | 155 |
| HP65 AB - 1.65  | 65 | 1156 | 139 | 362 | 347 | 794 | 382 | 1226 | 666 | 454 | 240 | 280 | 208 | 300 | 376 | M10 | 330 | 216     | 250     | 233 | 533 | 130 | 403 | 565 | 313 | 548 | 198 | 155 |
| HP72 AB - 0.50  | 50 | 1353 | 139 | 505 | 373 | 794 | 382 | 1022 | 772 | 454 | 300 | 340 | 208 | 300 | 376 | M10 | 330 | 216     | 250     | 233 | 465 | 130 | 335 | 519 | x   | 531 | 198 | 155 |
| HP72 AB - 1.50  | 50 | 1353 | 139 | 505 | 373 | 794 | 382 | 1148 | 694 | 454 | 300 | 340 | 208 | 300 | 376 | M10 | 330 | 216     | 250     | 233 | 465 | 130 | 335 | 519 | x   | 531 | 198 | 155 |
| HP72 AB - 0.65  | 65 | 1353 | 139 | 505 | 373 | 794 | 382 | 1120 | 666 | 454 | 300 | 340 | 273 | 300 | 393 | M10 | 330 | 216     | 250     | 233 | 533 | 130 | 403 | 565 | 313 | 548 | 198 | 155 |
| HP72 AB - 1.65  | 65 | 1353 | 139 | 505 | 373 | 794 | 382 | 1226 | 772 | 454 | 300 | 340 | 273 | 300 | 393 | M10 | 330 | 216     | 250     | 233 | 533 | 130 | 403 | 565 | 313 | 548 | 198 | 155 |
| HP72 AB - 0.80  | 80 | 1353 | 139 | 505 | 373 | 794 | 382 | 1120 | 666 | 454 | 300 | 340 | 273 | 300 | 407 | M10 | 330 | 216     | 250     | 233 | 574 | 130 | 444 | 565 | 344 | 562 | 198 | 155 |
| HP72 AB - 1.80  | 80 | 1353 | 139 | 505 | 373 | 794 | 382 | 1228 | 774 | 454 | 300 | 340 | 273 | 300 | 407 | M10 | 330 | 216     | 250     | 233 | 574 | 130 | 444 | 565 | 344 | 562 | 198 | 155 |
| HP73A AB - 1.50 | 50 | 1294 | 139 | 500 | 373 | 794 | 382 | 1148 | 694 | 454 | 234 | 264 | 208 | 300 | 376 | M10 | 330 | 216     | 250     | 233 | 465 | 130 | 335 | 519 | x   | 531 | 198 | 155 |
| HP73A AB - 1.65 | 65 | 1294 | 139 | 500 | 373 | 794 | 382 | 1226 | 772 | 454 | 234 | 264 | 273 | 300 | 393 | M10 | 330 | 216     | 250     | 233 | 533 | 130 | 403 | 565 | 313 | 548 | 198 | 155 |
| HP73A AB - 1.80 | 80 | 1294 | 139 | 500 | 373 | 794 | 382 | 1228 | 774 | 454 | 234 | 264 | 273 | 300 | 407 | M10 | 330 | 216     | 250     | 233 | 574 | 130 | 444 | 565 | 344 | 562 | 198 | 155 |

\*DN = gas valves size

HP60 - HP65 - HP72:

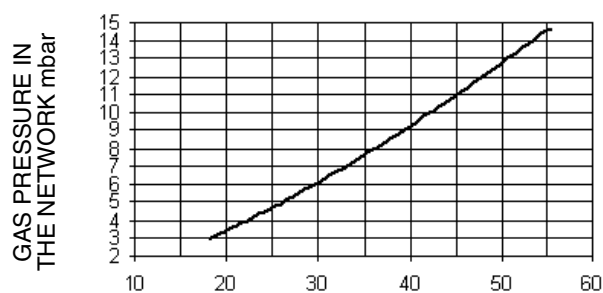
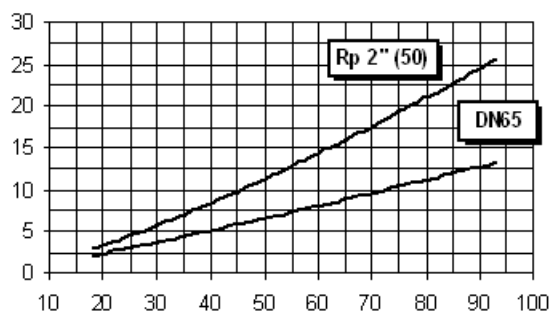
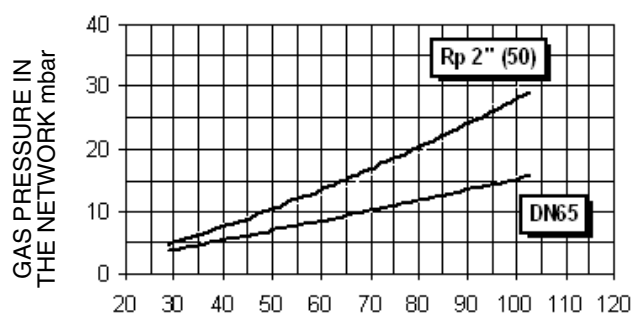
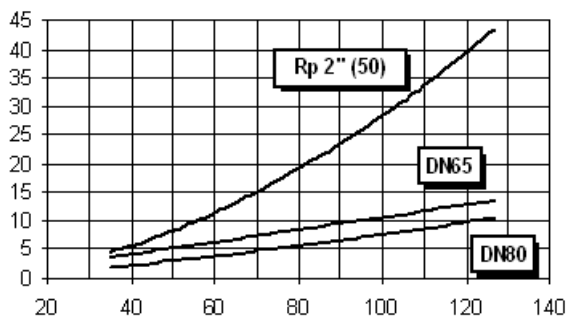
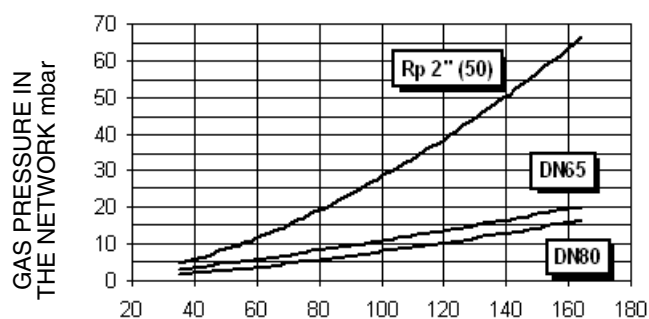
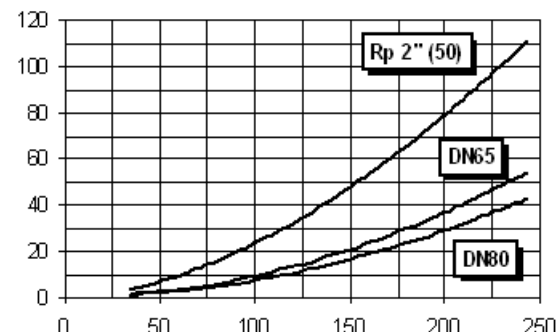
Fit a counterflange between burner and boiler. As an alternative, make a smaller hole H, but greather than Y and fit the blast tube from the internal side of boiler.

**Performance curves**

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

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

**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.

**Pressure in the network curves/gas rate****HP60 Rp1 1/2**Gas rate Stm<sup>3</sup>/h**HP60 Rp2 - DN65**Gas rate Stm<sup>3</sup>/h**HP65**Gas rate Stm<sup>3</sup>/h**HP72...0.xx**Gas rate Stm<sup>3</sup>/h**HP72...1.xx**Gas rate Stm<sup>3</sup>/h**HP73A**Gas rate Stm<sup>3</sup>/h

Caution: the gas rate value is quoted on the x-axis, the related network pressure is quoted on the y-axis (pressure value in the combustion chamber is not included). To know the minimum pressure at the gas train inlet, necessary to get the requested gas rate, add the pressure value in the combustion chamber to the value read on the y-axis.

## MOUNTINGS AND CONNECTIONS

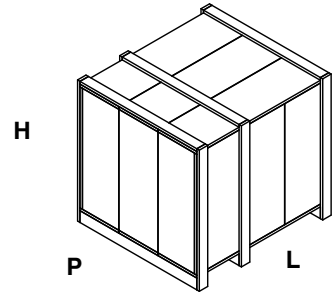
### Packing

Burners are despatched in cardboard packages and whose dimensions: **1280mm x 850mm x 760mm (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 with gas train detached;
- gasket to be inserted between the burner and the boiler;
- flexible oil pipes;
- oil filter;
- envelope containing this manual

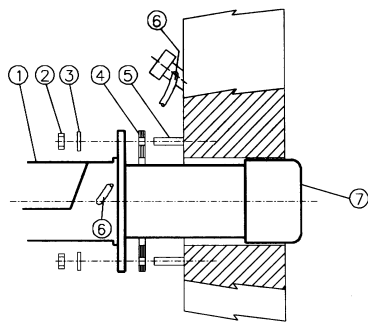
To get rid of the burner's packing, follow the procedures laid down by current laws on disposal of materials



### 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's 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

## GAS TRAIN CONNECTIONS

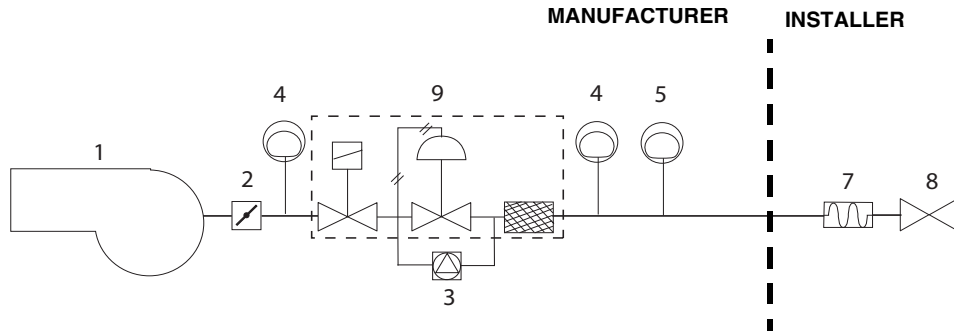
The diagrams show the components of the gas train included in the delivery and which must be fitted by the installer. The diagrams are in compliance with the current laws.



**ATTENTION:** BEFORE EXECUTING THE CONNECTIONS TO THE GAS PIPE NETWORK, BE SURE THAT THE MANUAL CUTOFF VALVES ARE CLOSED. READ CAREFULLY THE “WARNINGS” CHAPTER AT THE BEGINNING OF THIS MANUAL.

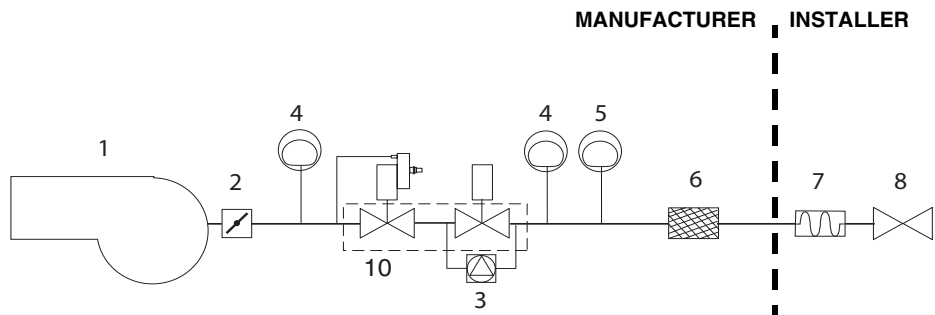
### Gas train - 1

Gas train with valves group VGD 20/40 with built-in gas pressure governor + VPS504 gas proving system



### Gas train - 2

Gas train with valves group VGD 20/40 with built-in gas pressure governor + VPS504 gas proving system



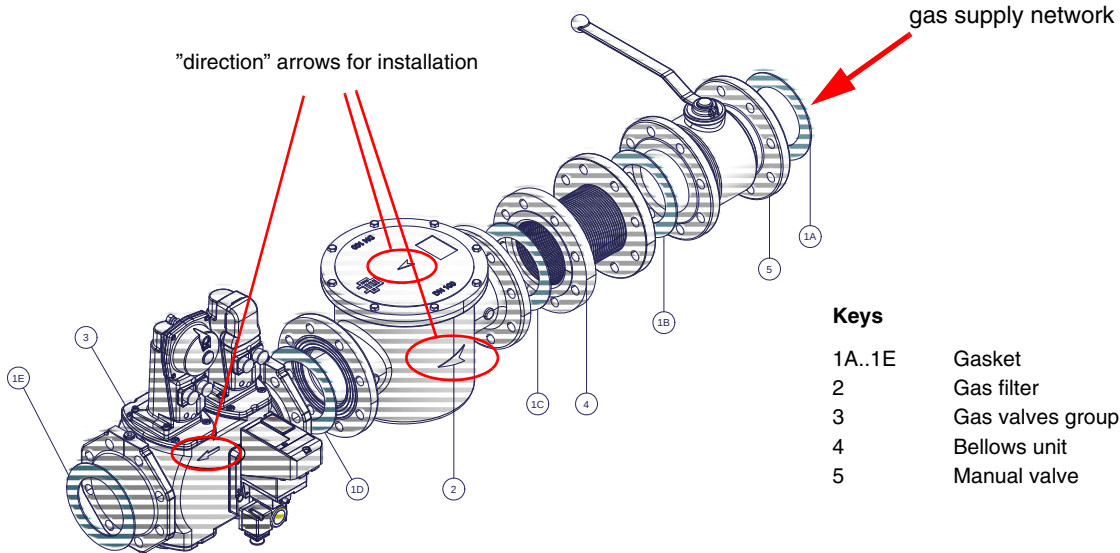
### Key

- 1 Burner
- 2 Butterfly valve
- 3 Gas proving system
- 4 High gas pressure switch (option\*)
- 5 Low gas pressure switch
- 6 Gas filter
- 7 Bellow unit
- 8 Manual shutoff valve
- 9 DUNGS MB-DLE valves group
- 10 VGD valves group

\* Note: the high gas pressure switch can be mounted either upstream the gas valve or downstream the gas valves but upstream the butterfly gas valve.

## Assembling the gas grain

To assemble the gas train, proceed as follows:



### Keys

|        |                  |
|--------|------------------|
| 1A..1E | Gasket           |
| 2      | Gas filter       |
| 3      | Gas valves group |
| 4      | Bellows unit     |
| 5      | Manual valve     |

Fig. 2 - Example of gas train

To mount the gas train, proceed as follows:

1-a) in case of threaded joints: use proper seals according to the gas used;

1-b) in case of flanged joints: place a gasket (no. 1A..1E - Fig. 2) between the elements

**NOTE:** the bellows unit, the manual valve and the gaskets are not part of the standard supply.



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

The procedures of installation for the gas valves are shown in the next paragraphs, according to the gas train used:

- threaded gas trains with Multibloc Dungs MB-DLE 415-420 or Siemens VGD20..
- flanged gas trains with Siemens VGD40..



**ATTENTION:** it is recommended to mount filter and gas valves to avoid that extraneous material drops inside the valves, during maintenance and cleaning operation of the filters (both the filters outside the valves group and the ones built-in the gas valves).

## MULTIBLOC DUNGS MB-DLE 415..420

### Mounting

1. Loosen screws A and B **do not** unscrew (Fig. 3 - Fig. 4).
2. unscrew screws C and D (Fig. 3 - Fig. 4).
3. Remove MultiBloc between the threaded flanges (Fig. 4).
4. After mounting, perform leakage and functional tests.

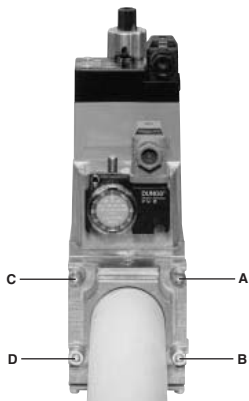


Fig. 3

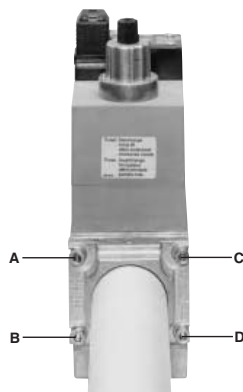


Fig. 4

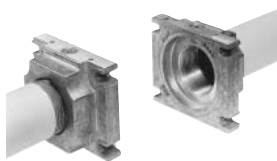


Fig. 5

### MOUNTING POSITIONS

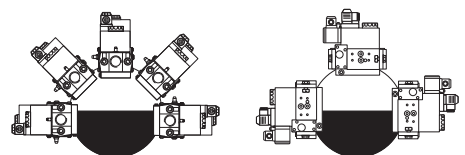


Fig. 6

**Siemens VGD20.. and VGD40.. gas valves - with SKP2.. (pressure governor)****Mounting**

- When mounting the VGD.. double gas valve, two flanges are required (as for VGD20.. model, the flanges are threaded);
- to prevent cuttings from falling inside the valve, first fit the flanges to the piping and then clean the associated parts;
- install the valve;
- the direction of gas flow must be in accordance with the direction of the arrow on the valve body;
- ensure that the bolts on the flanges are properly tightened;
- ensure that the connections with all components are tight;
- make certain that the O-rings and gaskets between the flanges and the double gas valve are fitted.
- Connect the reference gas pipe (TP in figure; 8mm-external size pipe supplied loose), to the gas pressure nipples placed on the gas pipe, downstream the gas valves: gas pressure must be measured at a distance that must be at least 5 times the pipe size. Leave the blowhole free (SA in figure). Should the spring fitted not permit satisfactory regulation, ask one of our service centres for a suitable replacement.

**⚠ Caution:** the SKP2 diaphragm **D** must be vertical (see Fig. 9).

**⚠ WARNING:** removing the four screws **BS** causes the device to be unserviceable!

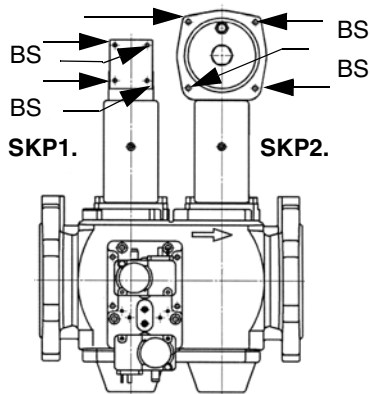


Fig. 7

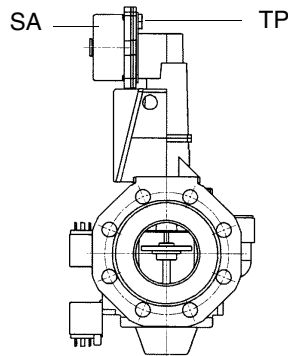


Fig. 8

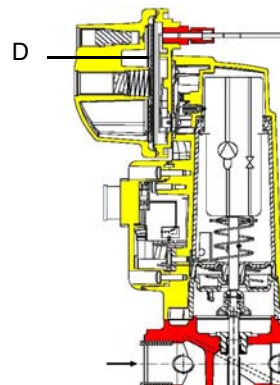


Fig. 9

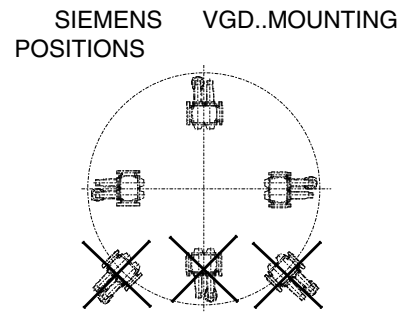


Fig. 10

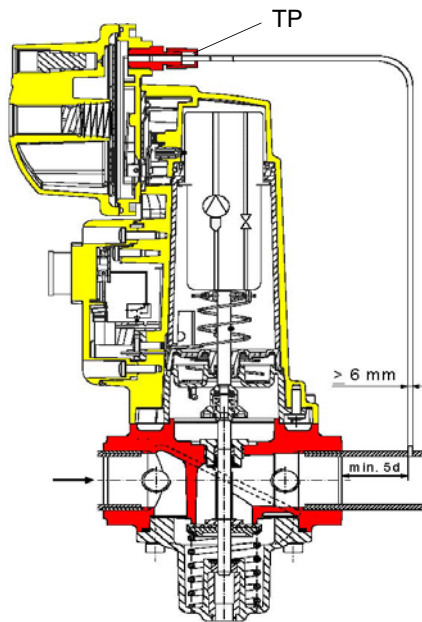


Fig. 11

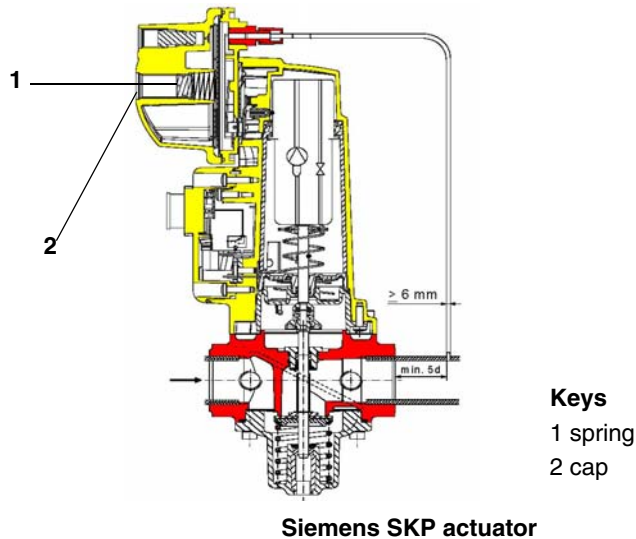
Once the train is installed, connect electrically all its elements: gas valves group, pressure switches, gas proving system (option).



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

### Pressure adjusting range

The pressure adjusting range, upstream the gas valves group, changes according to the spring provided with the valve group.



Siemens VGD valves with SKP actuator:

|                                 |         |          |           |
|---------------------------------|---------|----------|-----------|
| <b>Performance range (mbar)</b> | 0 - 22  | 15 - 120 | 100 - 250 |
| <b>Spring colour</b>            | neutral | yellow   | red       |

### Light oil piping installation diagram

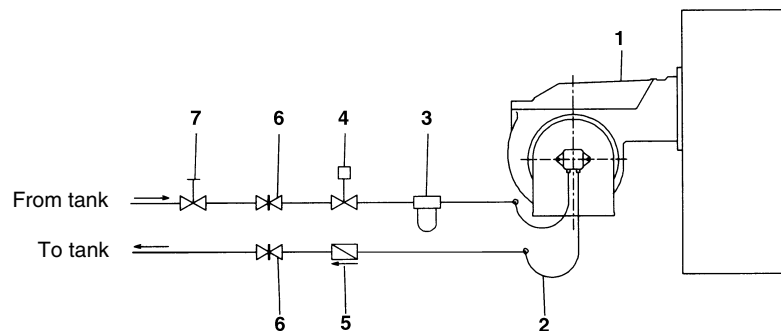


Fig. 12

#### Key

- 1 Burner
- 2 Flexible hoses (fitted)
- 3 Light oil filter (fitted)
- 4 Automatic interceptor (\*)
- 5 One-way valve (\*)
- 6 Gate valve
- 7 Quick-closing gate-valve (not in vicinity of tank or boiler)

(\*) Only for installations with gravity, siphon or forced circulation feed systems. If the device installed is a solenoid valve, a timer must be installed to delay the valve closing. The direct connection of the device without a timer may cause pump breaks.

### Hidraulic system

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

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

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

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

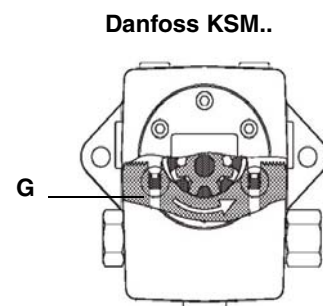
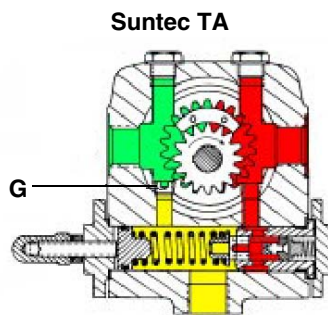
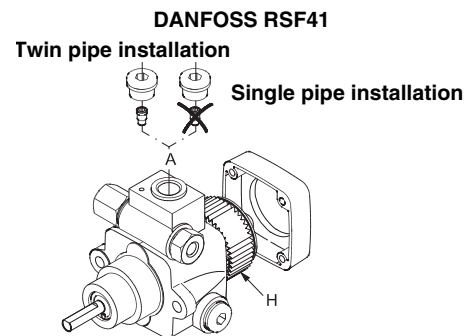
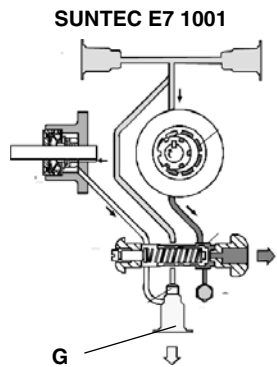
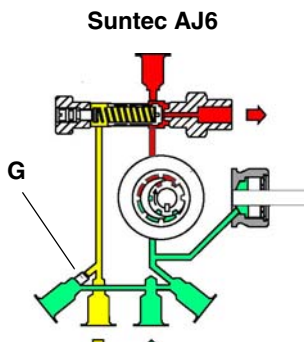
tion- referring to the pump shaft).

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

HP60 - HP65: Suntec AJ6

HP72: Suntec E7/ Danfoss RSF41

HP73A: Suntec TA2 / Danfoss KSM50



### **Bleed**

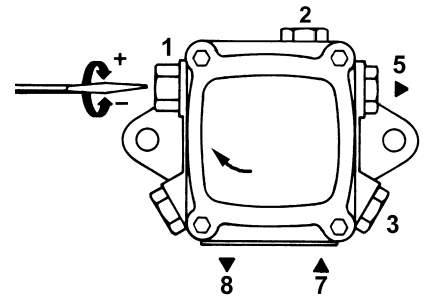
Bleeding in two-pipe operation is automatic : it is assured by a bleed flat on the piston. In one-pipe operation, the plug of a pressure gauge port must be loosened until the air is evacuated from the system.

### **About the use of fuel pumps**

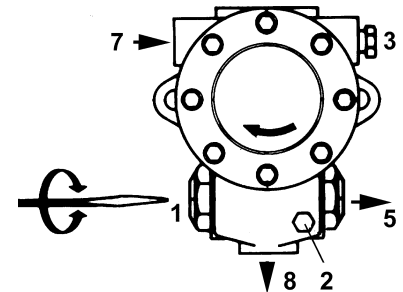
- Make sure that the by-pass plug is not used in a single pipe installation, because the fuel unit will not function properly and damage to the pump and burner motor could result.
- Do not use fuel with additives to avoid the possible formation over time of compounds which may deposit between the gear 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.

**Oil pumps**

| <b>Suntec AJ6</b>      |                            |
|------------------------|----------------------------|
| Viscosity              | 2 - 75 cSt                 |
| Oil temperature        | 60°C max                   |
| Inlet maximum pressure | 2 bar                      |
| Inlet minimum pressure | - 0.45 bar to avoid gasing |
| Rated speed            | 3600 rpm max.              |

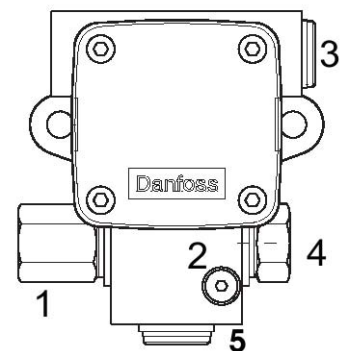


| <b>Suntec E7 1001</b>   |                        |
|-------------------------|------------------------|
| Oil viscosity           | 2,8 ÷ 450 cSt          |
| Oil temperature         | 0 ÷ 90°C               |
| Inlet maximum pressure  | 1,5 bar                |
| Maximum return pressure | 1,5 bar                |
| Minimum inlet pressure  | - 0,45 to avoid gasing |
| Rotation speed max.     | 3600 rpm               |



Pump : Suntec E

| <b>Danfoss RSF41</b>    |                        |
|-------------------------|------------------------|
| Oil viscosity           | 2,5 ÷ 450 cSt          |
| Oil temperature         | -10 ÷ 120°C            |
| Inlet maximum pressure  | 4 bar                  |
| Maximum return pressure | 4 bar                  |
| Minimum inlet pressure  | - 0,45 to avoid gasing |
| Rotation speed max.     | 3600 rpm               |



Pump : Danfoss RSF

**SUNTECKey AJ6**

- 1 Pressure governor
- 2 Pressure gauge
- 3 Vacuum pressure gauge
- 5 To the nozzle
- 7 Inlet
- 8 Return

**SUNTECKey E7**

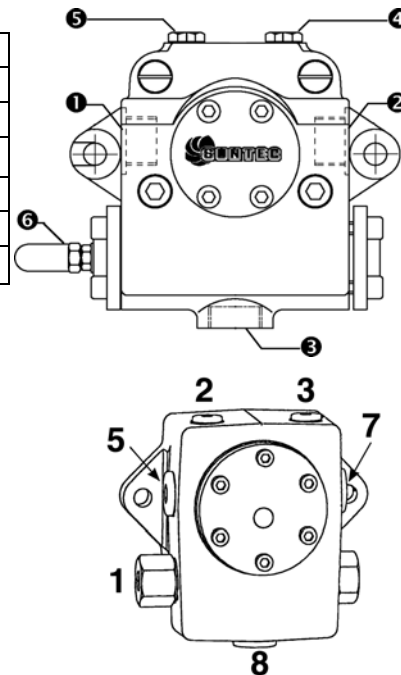
- 1 Pressure governor
- 2 Pressure gauge
- 3 Vacuum pressure gauge
- 4 To the nozzle
- 5 Inlet
- 6 Return

**DANFOSSKey RSF41**

- 1 Pressure governor
- 2 Pump pressure gauge
- 3 Inlet
- 4 To the nozzle
- 5 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.              |

**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              |

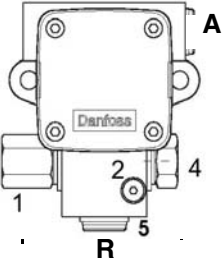
**Keys**

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

**Assembling the light oil flexible hoses**

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

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

| Suntec AJ6                                                                          | Suntec E7                                                                           | Danfoss RSF41                                                                       | Suntec TA2                                                                           | Danfoss KSM50                                                                         |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |  |  |  |  |

## Hydraulic diagrams for light oil supplying circuits

Fig. 13 - Gravity circuit

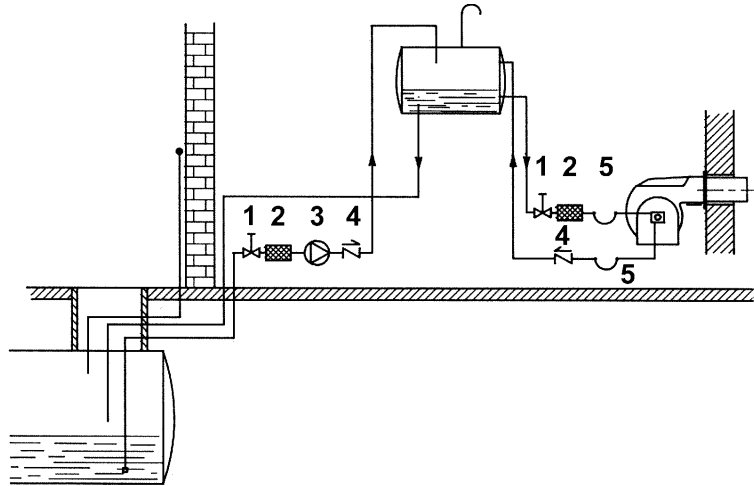


Fig. 14 - Ring circuit

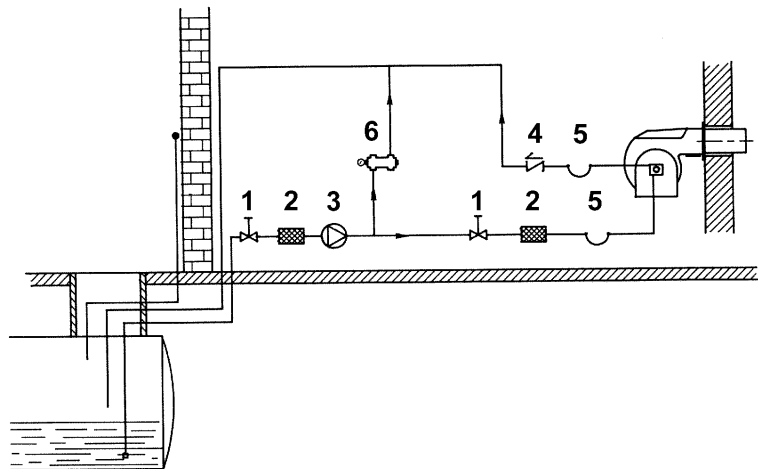
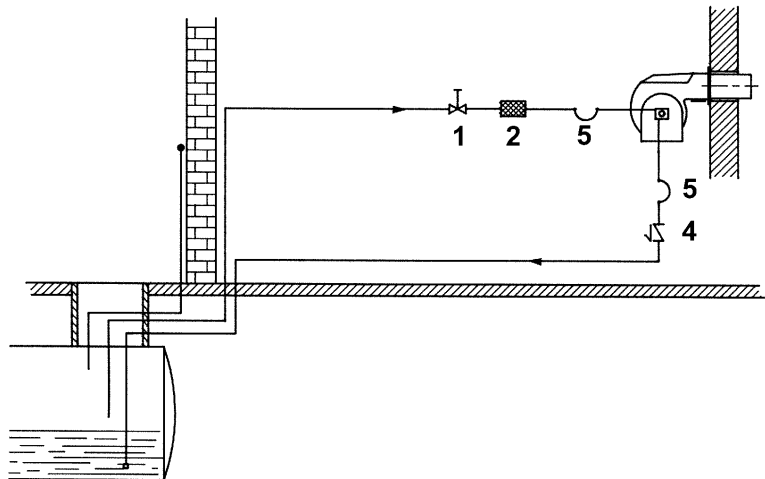


Fig. 15 - Suction circuit



### Key

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

Burners are the factory set ready for twin-pipe feeding. They can be adapted for a single pipe system (recommended in the case of gravity feed). Refer to the appendix for details.

NOTE: in plants using the gravity or ring feed system, install an automatic interception device (see n. 4 in Fig. 12).

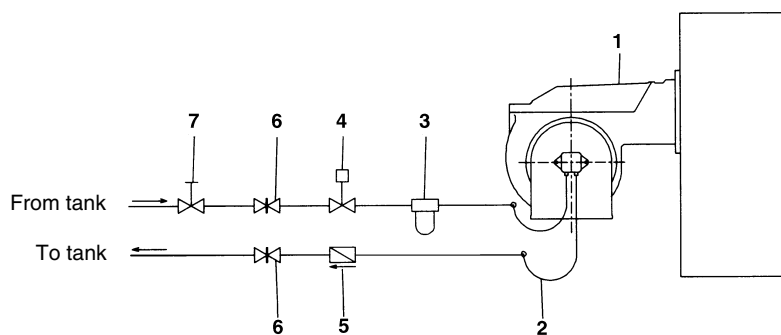
**Light oil piping installation diagram**

Fig. 16

**Key**

- 1 Burner
- 2 Flexible hoses (fitted)
- 3 Light oil filter (fitted)
- 4 Automatic interceptor (\*)
- 5 One-way valve (\*)
- 6 Gate valve
- 7 Quick-closing gate-valve (not in vicinity of tank or boiler)

(\*) Only for installations with gravity, siphon or forced circulation feed systems. If the device installed is a solenoid valve, a timer must be installed to delay the valve closing. The direct connection of the device without a timer may cause pump breaks.

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

To execute the electrical connections, proceed as follows:

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

Connect the three-phase supply to terminals L1, L2, L3 and PE (ground); then shunt the phase and neutral wires (Fig. 17) for the auxiliaries on the printed circuit (N-terminal = neutral; L-terminal = phase)

### MC supply terminal block



#### Keys

IG: main switch  
 KM1: fan motor contactor  
 KM2: pump motor contactor  
 MP: pump motor  
 MV: fan motor  
 TP: pump motor thermal cutout  
 TV: fan motor thermal cutout

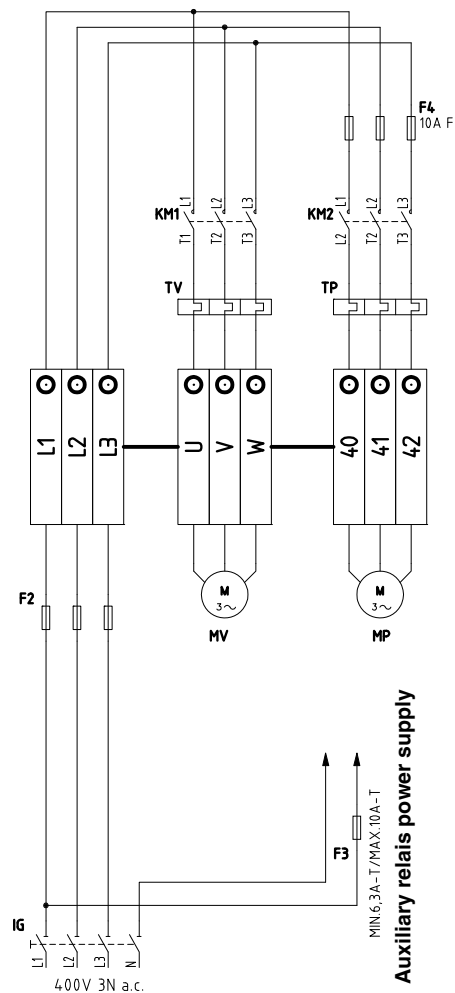


Fig. 17

As far as connections, refer to the terminal block showed on next picture.

- 1 Connect the signal conductors from the boiler to the burner, as for the next elements (Fig. 18):

**ST:** thermostat/pressure switch series

**TAB:** High/low flame thermostat

- 2 Connect the signal conductors from the burner to the boiler, as for the next elements (Fig. 18)

**LB:** Burner's lockout signalling LED

**LSPG:** Gas proving system' lockout signalling LED

**MA terminal block for burners with printed circuit board provided (standard)**

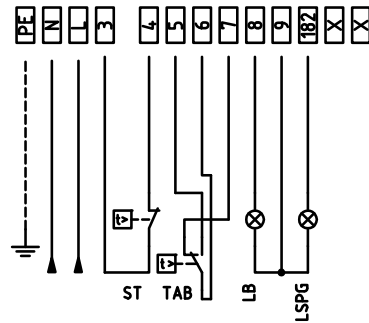
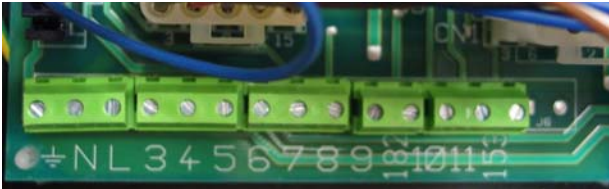


Fig. 18



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

**Electrical wiring diagram for burners with no printed circuit board provided provided**

If the burner is ordered without printed circuit board, follow the next connections diagrams.

**MA terminal block for burners with no printed circuit board provided**

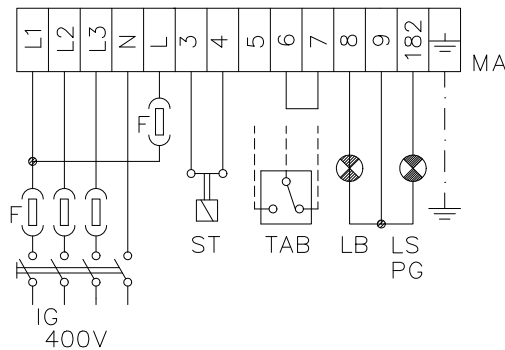


Fig. 19

**Rotation of fan motor and pump motor**

Once the burner's electrical connection is accomplished, remember to check the rotation of the fan and pump motors. The motor should rotate in counterclockwise direction looking at motor's cooling fan. In case of incorrect rotation, reverse the three-phase supply and check again the rotation of the motor.

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

## ADJUSTEMENTS

|                                                                                  |                                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>ATTENTION:</b> before starting the burner up, be sure that the manual cutoff valves are open and check that the pressure upstream the gas train complies the value quoted on paragraph “Technical specifications”. Be sure that the mains switch is closed. |
|                                                                                  | <b>ATTENTION:</b> 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.    |
|                                                                                  | <b>WARNING: NEVER LOOSE THE SEALED SCREWS! OTHERWISE, THE DEVICE WARRANTY WILL BE INVALIDATE!</b>                                                                                                                                                              |
|                                                                                  | <b>ATTENTION!</b> before starting the burner up, make sure that the return pipe to the tank is not obstructed. Any obstruction would cause the pump seal to break.                                                                                             |

|                                                                                   |                                                                                                       |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
|  | <b>IMPORTANT!</b> the combustion air excess must be adjusted according to the in the following chart: |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|

| Recommended combustion parameters |                                 |                                |
|-----------------------------------|---------------------------------|--------------------------------|
| Fuel                              | Recommended (%) CO <sub>2</sub> | Recommended (%) O <sub>2</sub> |
| Natural gas                       | 9 ÷ 10                          | 3 ÷ 4.8                        |
| Light oil                         | 11.5 ÷ 13                       | 2.9 ÷ 4.9                      |

**Combustion head gas pressure curves depending on the flow rate**

**Curves are referred to pressure = 0mbar in the combustion head!**

The curves referred to the gas pressure in the combustion head, depending on the gas flow rate, are referred to the burner properly adjusted (percentage of residual O<sub>2</sub> in the flues as shown in the “Recommended combustion values” table and CO in the standard limits). During this stage, the combustion head, the gas butterfly valve and the actuator are at the maximum opening. Refer to Fig. 20, showing the correct way to measure the gas pressure, considering the values of pressure in combustion chamber, surveyed by means of the pressure gauge or taken from the boiler’s Technical specifications.

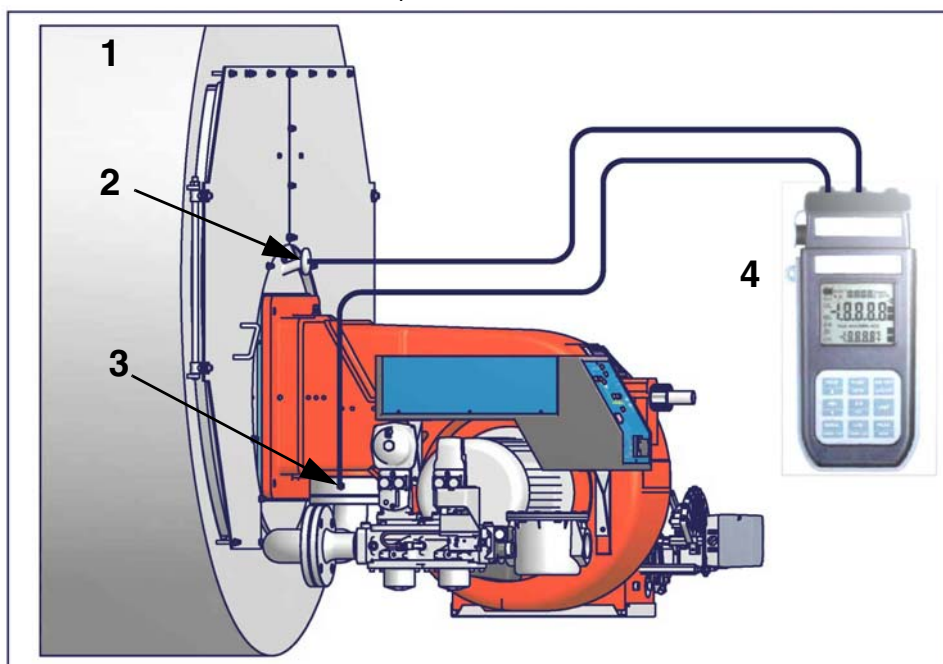


Fig. 20

**Key**

- 1 Generator
- 2 Pressure outlet on the combustion chamber
- 3 Gas pressure outlet on the butterfly valve
- 4 Differential pressure gauge

**Measuring the gas pressure in the combustion head**

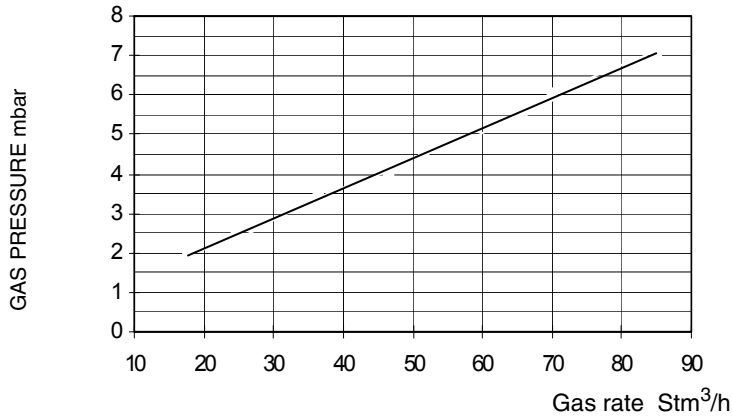
In order to measure the pressure in the combustion head, insert the pressure gauge probes: one into the combustion chamber’s pressure outlet (Fig. 20-2) to get the pressure in the combustion chamber and the other one into the butterfly valve’s pressure outlet of the burner (Fig. 20-3). On the basis of the measured differential pressure, it is possible to get the maximum flow rate: in the pressure - rate curves (showed on the next paragraph), it is easy to find out the burner’s output in Stm<sup>3</sup>/h (quoted on the x axis) from the pressure

measured in the combustion head (quoted on the y axis). The data obtained must be considered when adjusting the gas flow rate.

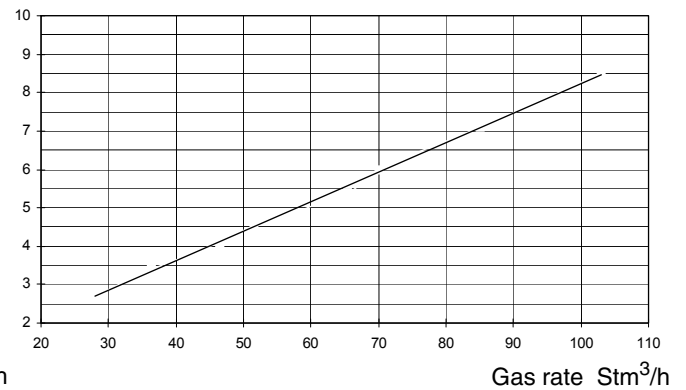
**NOTE: THE PRESSURE-RATE CURVES ARE GIVEN AS INFORMATION ONLY; FOR A PROPER SETTING OF THE GAS RATE, PLEASE REFER TO THE GAS METER READING.**

**Pressure in combustion head- gas rate curves**

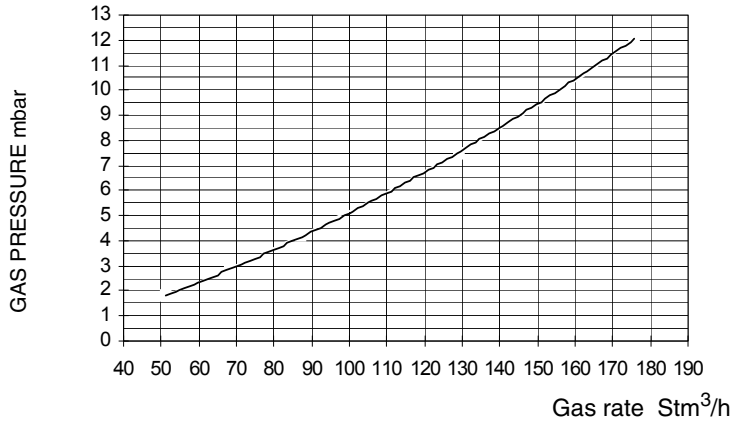
**HP60**



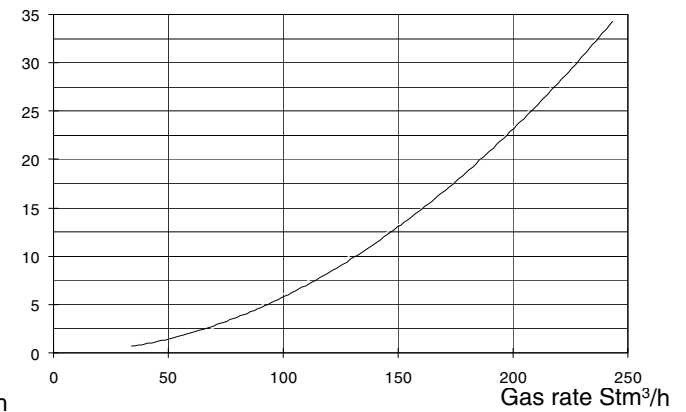
**HP65**



**HP72**



**HP73A**



**Oil nozzles**

The light 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 table below and the diagram on the next pictures (as far as reading the pressure values, see next paragraphs).

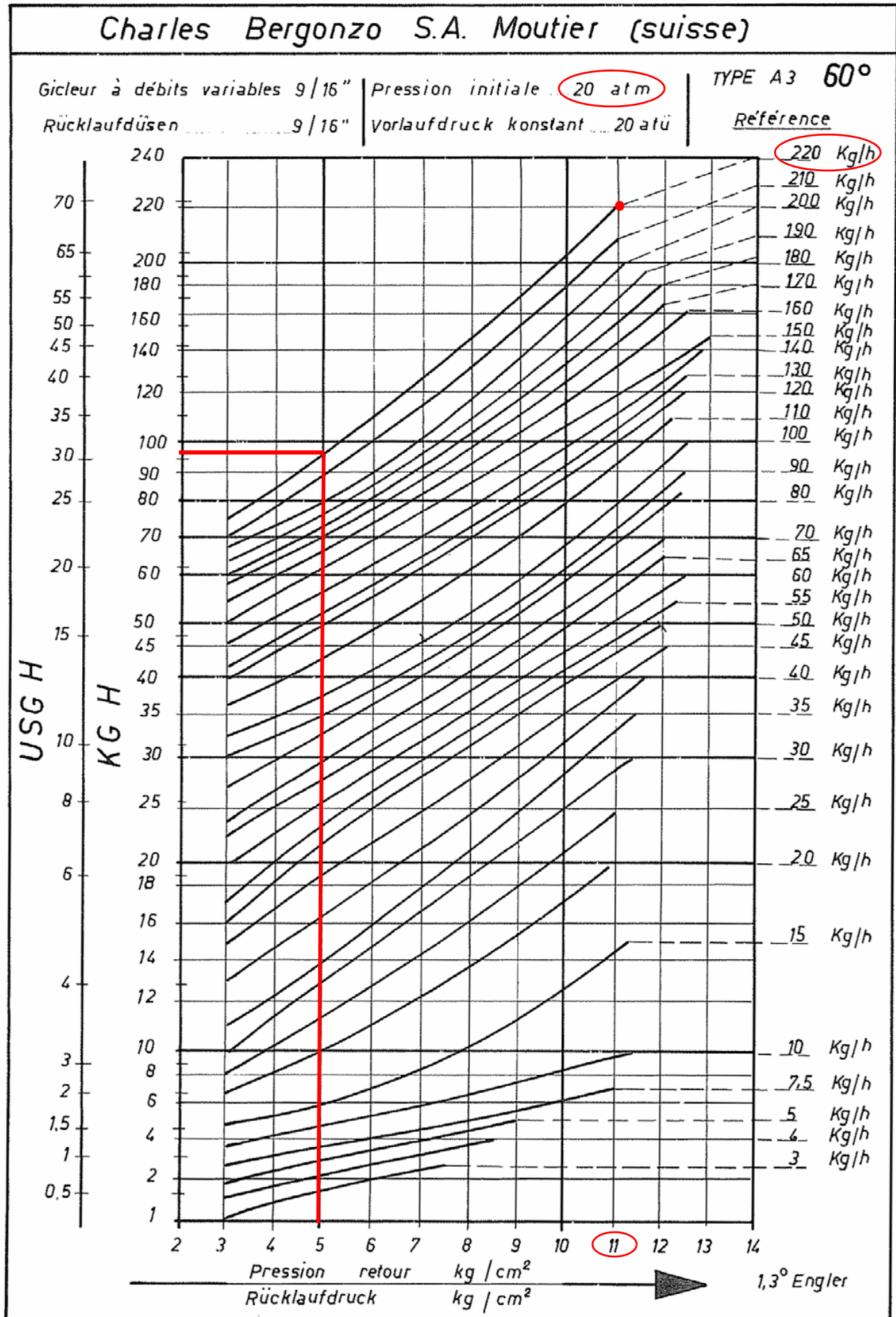
| NOZZLE      | NOZZLE<br>SUPPLY PRESSURE<br>bar | HIGH FLAME<br>RETURN PRESSURE<br>bar | LOW FLAME<br>RETURN PRESSURE<br>bar |
|-------------|----------------------------------|--------------------------------------|-------------------------------------|
| MONARCH BPS | 20                               | See table below                      | See table below                     |
| BERGONZO A3 | 20                               | 11 ÷ 13                              | 5 (recommended)                     |

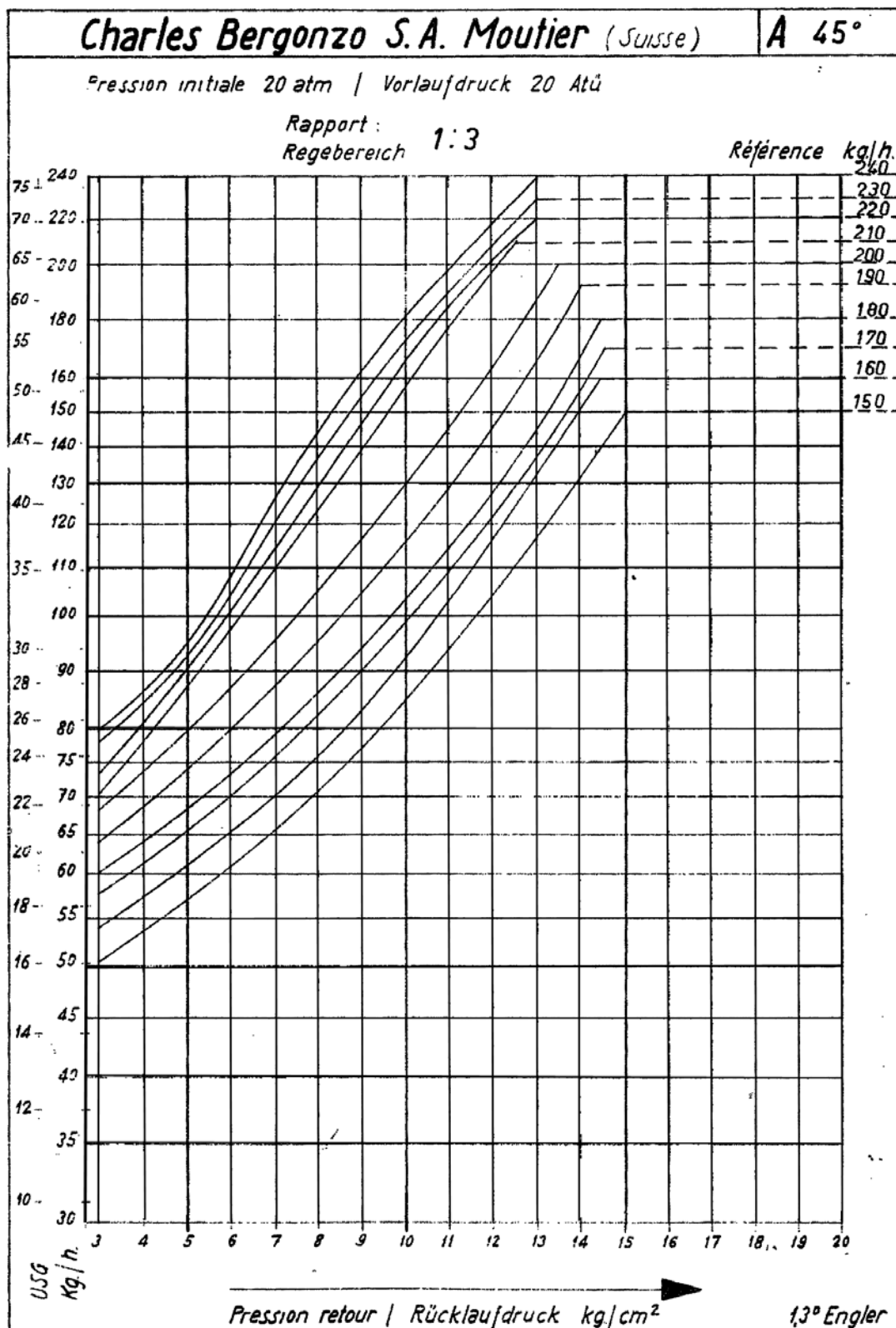
| RETURN PRESSURE bar     |      |      |       |       |       |       |       |       |       |       |       |       |                                        |                                                            |
|-------------------------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------------------------------------|------------------------------------------------------------|
| Nozzle<br>size<br>(GPH) | 0    | 1,4  | 2,8   | 4,1   | 5,5   | 6,9   | 8,3   | 9,6   | 11    | 12,4  | 13,8  | 15,2  | Flow rate in kg/h with<br>close return | Pressure with close return to<br>use in the nozzle choice) |
| 0,75                    | 1,3  | 1,6  | 2,1   | 2,5   |       |       |       |       |       |       |       |       | 3,2                                    | 5,5                                                        |
| 1,0                     | 2,1  | 2,1  | 2,4   | 3,0   | 3,7   | 4,6   | 5,2   |       |       |       |       |       | 5,4                                    | 8,6                                                        |
| 1,5                     | 2,9  | 3,0  | 3,3   | 4,1   | 4,9   | 6,0   | 7,0   |       |       |       |       |       | 7,9                                    | 9,3                                                        |
| 2,0                     | 4,6  | 5,1  | 5,4   | 6,4   | 7,5   | 8,7   | 9,9   |       |       |       |       |       | 10,5                                   | 9,3                                                        |
| 2,5                     | 3,5  | 4,1  | 4,9   | 5,9   | 7,5   | 9,1   | 10,8  | 12,4  |       |       |       |       | 13,5                                   | 10,7                                                       |
| 3,0                     | 5,6  | 5,9  | 6,2   | 7,2   | 8,7   | 10,0  | 11,9  | 13,8  |       |       |       |       | 15,3                                   | 11,0                                                       |
| 3,5                     | 7,0  | 7,2  | 7,8   | 8,7   | 9,9   | 11,3  | 12,4  | 13,7  | 18,4  |       |       |       | 19,7                                   | 12,1                                                       |
| 4,0                     | 7,8  | 7,9  | 8,3   | 8,6   | 10,3  | 11,6  | 13,0  | 14,1  | 17,3  | 20,2  |       |       | 21,0                                   | 12,8                                                       |
| 4,5                     | 9,2  | 9,4  | 10,0  | 11,0  | 11,9  | 12,9  | 14,3  | 15,3  | 17,2  | 24,5  |       |       | 24,8                                   | 14,1                                                       |
| 5,0                     | 10,8 | 11,0 | 11,3  | 11,6  | 13,0  | 14,3  | 15,6  | 17,0  | 18,6  | 24,3  |       |       | 26,2                                   | 13,4                                                       |
| 5,5                     | 9,7  | 10,0 | 10,2  | 11,1  | 12,1  | 13,4  | 14,8  | 16,4  | 18,1  |       |       |       | 29,7                                   | 12,4                                                       |
| 6,0                     | 9,2  | 9,5  | 9,9   | 10,0  | 10,8  | 12,4  | 14,1  | 15,7  | 17,5  | 18,9  | 29,3  |       | 33,1                                   | 14,8                                                       |
| 6,5                     | 10,5 | 10,8 | 11,1  | 11,4  | 12,1  | 13,8  | 15,3  | 16,5  | 18,4  | 20,0  | 22,4  | 36,2  | 36,7                                   | 15,5                                                       |
| 7,0                     | 8,7  | 9,4  | 10,0  | 11,4  | 13,2  | 14,9  | 17,2  | 19,6  | 23,1  | 25,1  | 33,2  |       | 33,7                                   | 15,2                                                       |
| 7,5                     | 11,3 | 11,8 | 10,3  | 13,0  | 14,3  | 15,3  | 17,2  | 19,2  | 21,8  | 24,2  | 30,4  |       | 39,3                                   | 14,1                                                       |
| 8,0                     | 9,9  | 9,9  | 10,2  | 11,3  | 12,6  | 14,3  | 16,1  | 18,4  | 21,1  | 24,3  |       |       | 39,7                                   | 13,8                                                       |
| 9,0                     | 10,8 | 11,0 | 11,1  | 12,6  | 14,5  | 16,1  | 18,8  | 21,8  | 25,1  | 28,9  |       |       | 45,9                                   | 13,8                                                       |
| 9,5                     | 11,4 | 11,6 | 12,2  | 13,7  | 15,3  | 17,3  | 19,7  | 23,2  | 26,5  | 30,0  | 33,5  |       | 49,1                                   | 14,5                                                       |
| 10,5                    | 11,6 | 11,6 | 12,2  | 13,7  | 15,4  | 17,6  | 20,7  | 24,0  | 27,3  | 31,2  | 35,5  |       | 50,9                                   | 15,2                                                       |
| 12,0                    | 13,7 | 14,0 | 14,3  | 15,6  | 18,1  | 21,9  | 25,8  | 30,2  | 34,7  | 39,7  | 44,5  |       | 61,7                                   | 14,5                                                       |
| 13,8                    | 13,4 | 13,4 | 13,7  | 15,6  | 18,1  | 23,2  | 28,3  | 34,7  | 41,0  | 47,7  | 54,7  |       | 71,2                                   | 15,2                                                       |
| 15,3                    | 16,5 | 16,9 | 17,2  | 18,4  | 20,7  | 23,8  | 28,3  | 33,1  | 36,9  | 44,5  | 51,8  |       | 76,0                                   | 15,2                                                       |
| 17,5                    | 21,6 | 21,9 | 21,9  | 23,2  | 25,8  | 29,6  | 34,7  | 40,7  | 46,4  | 54,0  | 62,3  | 71,2  | 89,7                                   | 15,5                                                       |
| 19,5                    | 19,7 | 20,0 | 20,3  | 21,3  | 23,8  | 28,0  | 32,7  | 39,7  | 47,1  | 55,3  | 66,4  | 75,0  | 97,3                                   | 16,2                                                       |
| 21,5                    | 24,8 | 24,8 | 25,1  | 26,1  | 28,3  | 33,4  | 37,8  | 45,1  | 53,1  | 61,7  | 73,8  | 83,9  | 106,5                                  | 16,6                                                       |
| 24,0                    | 26,7 | 27,0 | 27,7  | 29,3  | 31,8  | 36,6  | 45,8  | 55,0  | 65,5  | 77,3  | 90,9  | 106,2 | 111,6                                  | 15,9                                                       |
| 28,0                    | 28,6 | 28,9 | 30,5  | 35,3  | 43,6  | 42,1  | 67,1  | 85,5  | 107,1 | 127,8 | 151,7 |       | 154,8                                  | 14,8                                                       |
| 30,0                    | 25,8 | 25,8 | 28,6  | 35,9  | 43,2  | 56,3  | 73,8  | 90,6  | 102,4 | 120,8 | 144,0 | 160,9 | 164,1                                  | 15,5                                                       |
| 35,0                    | 34,3 | 35,0 | 40,7  | 49,9  | 63,6  | 82,7  | 103,6 | 122,1 | 145,9 | 120,8 |       |       | 186,0                                  | 13,8                                                       |
| 40,0                    | 52,8 | 53,1 | 60,4  | 70,6  | 86,8  | 106,5 | 128,8 | 149,7 | 179,6 | 172,6 |       |       | 217,2                                  | 13,1                                                       |
| 45,0                    | 73,4 | 73,4 | 83,0  | 93,5  | 112,2 | 134,5 | 157,7 | 185,0 | 225,7 | 209,8 |       |       | 242,3                                  | 12,4                                                       |
| 50,0                    | 92,5 | 94,4 | 104,6 | 118,9 | 139,9 | 167,2 | 196,8 | 231,8 | 263,3 |       |       |       | 266,8                                  | 11,4                                                       |

Tab. 1 - Monarch nozzle

N.B. Specific gravity of the light oil: 0.840kg/dm<sup>3</sup>

## BERGONZO NOZZLE DIAGRAMS





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

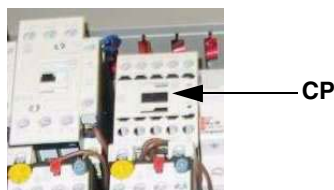
If the nozzle provided is mod. MONARCH 10.5 GPH, when the return pressure is about 13.80bar, the flow rate will be 35.5kg/h (see example on Tab. 2). If the return pressure is 8.3bar (with the same nozzle), the flow rate value will be 20.7kg/h. The flow rate in the High-flame operation is related to the nozzle provided with close return. The flow rate in the Low-flame operation can be adjusted by means of the manual pressure regulator, taking care no to go under 8bar (see par. "Manual pressure regulator"). The burned flow rate depends on the pressure set on the return by means of the pressure regulator V screw (see Fig. 23).

### Adjustments - brief description

- 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" on page 23.
- Adjust the combustion values in the high-flame stage.
- Set, now, the low flame output, acting on the low flame microswitch of the actuator in order to avoid the low flame output increasing too much or that the flues temperature gets too low to cause condensation in the chimney.

### Adjustment procedure for light oil operation

- 1 The light oil flow rate is set by choosing a nozzle that suits the boiler/utilisation output and setting the delivery and return pressure values according to the ones quoted on the table below and the diagram on page 25 (as far as reading the pressure values, see next paragraphs). Once the air and gas flow rates are adjusted, turn the burner off, switch the **CM** switch to the heavy oil operation (OIL, on the burner control panel (see page 35).
- 2 with the electrical panel open, prime the oil pump acting on the related **CP** contactor (see next picture): check the pump motor rotation and keep pressing for some seconds until the oil circuit is charged;



- 3 start the burner up by means of the thermostat series;
- 4 bleed the air from the **M** pressure gauge port (Fig. 21) by loosening the cap without removing it, then release the contactor.

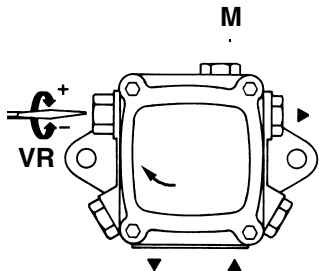
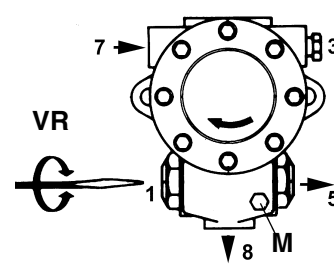
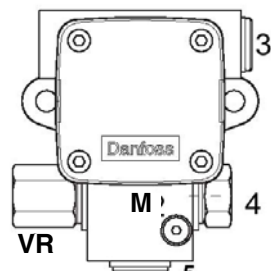
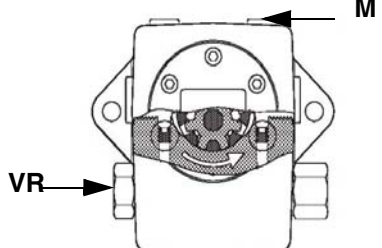
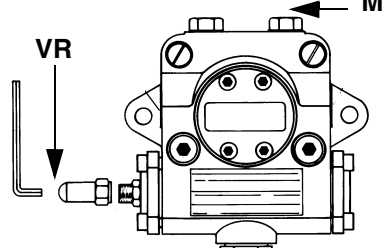
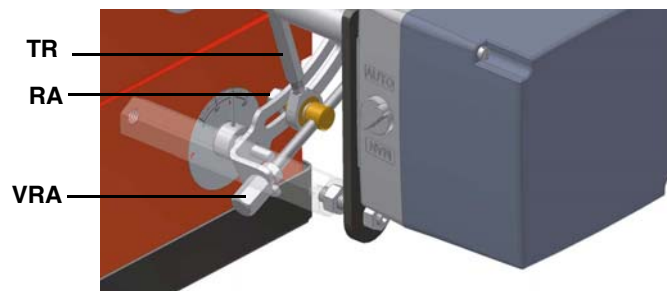
| Suntec AJ6                                                                          | Suntec E7                                                                            | Danfoss RSF41                                                                         |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |  |  |
| Danfoss KSM..L..                                                                    | Suntec TA.                                                                           |                                                                                       |
|  |  |                                                                                       |

Fig. 21

- 5 drive the burner to high flame stage, by means of the thermostat **TAB** (high/low flame thermostat - see Wiring diagrams).
- 6 the nozzle supply pressure is already factory-set and must not be changed. Only if necessary, adjust the supply pressure as follows (see related paragraph); insert a pressure gauge into the port shown on Fig. 22 and act on the pump adjusting screw **VR** (see Fig. 23) as to get the nozzle pressure at 20bar (Monarch or Fluidics nozzles - see page 25).
- 7 the oil flow rate in the high flame stage is the maximum pressure with the return line closed
- 8 To adjust the **air flow rate in the high flame stage**, loose the **RA** nut and screw **VRA** as to get the desired air flow rate: moving the rod **TR** towards the air damper shaft, the air damper opens and consequently the air flow rate increases, moving it far from the shaft the air damper closes and the air flow rate decreases.

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



- 9 drive the burner to low flame by means of the **TAB** thermostat.
- 10 To perform the regulation, remove the cap **D** and loosen the screw **V** (see Fig. 25), by means of a screwdriver (see Fig. 25). The regulating screw **V** acts on the return pressure from the nozzle. Set the pressure to the minimum value of 5 bar. Read the values on the pressure gauge placed on the regulator's coupling **M**. Once the regulation is accomplished, replace cap **D**.



**Note:** After a certain operating period, the pressure can change because of some dirt on the needle's seal: remove the screw **VT** (see Fig. 23) and clean.

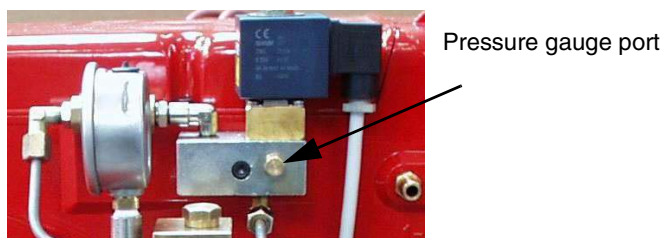


Fig. 22



Fig. 23 - Oil manual governor

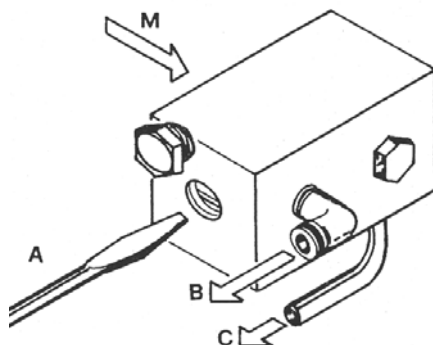


Fig. 24

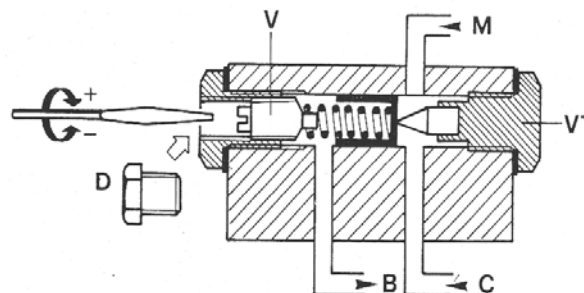


Fig. 25

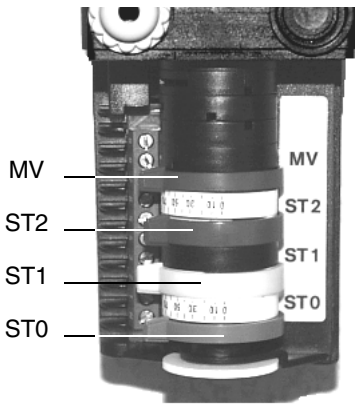
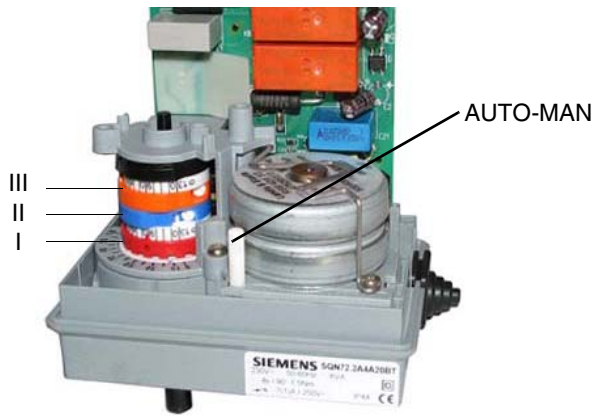
- D** Adjusting screw cap
- V** Pressure adjusting screw
- M** Pressure gauge port
- VT** Needle screw
- B** Return to tank
- C** Return from nozzle

- 11 always checking the combustion values, adjust the low flame air flow rate by means of the actuator ST1 (Berger)/III (Siemens) cam;
- 12 The low flame position must never match the ignition position that is why cam MV (Berger)/IV (Siemens) must be set 20° - 30° more than the ignition position ST1 (Berger)/III (Siemens).
- 13 Turn the burner off and go on with the gas operation adjustment.

**Attention:**

- **Berger actuator: cams can be moved manually**

- **Siemens actuator:** set the MAN/AUTO lever to MAN to move the cams, remember to set it to AUTO once the adjustment is accomplished.

| Berger STA12 B 3.41                                                                                                              | Siemens SQN72                                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                 |                                                                           |
| <p>ST2 = High flame cam<br/>ST0 = Ignition position<br/>ST1 = Low flame<br/>MV = Auxiliary cam for the second valve enabling</p> | <p>I = High flame cam (red)<br/>II = Ignition position (blue)<br/>III = Low flame (orange)<br/>IV = Auxiliary cam for the second valve enabling (black)</p> |

### Adjustment procedure for gas operation

- 1 set GAS fuel by means of the burner **CM** switch (it is placed on the burner control panel - see page 35)
- 2 check the fan motor rotation (see pag. 22).

Only for burners provided with **Dungs Multibloc MB-DLE gas valves**: before starting the burner up, adjust the valves slow opening. To set the fast opening remove cover **T**, reverse it upside down and use it as a tool to rotate screw **VR**. Clockwise rotation reduces start flow rate, anticlockwise rotation increases it. Do not use a screwdriver on the screw **VR**! The pressure stabilizer is adjusted by operating the screw **VS** located under the cover **C**. By screwing down the pressure is increased and by unscrewing it is reduced.

**Note:** the screw **VSB** must be removed only in case of replacement of the coil.

Only for burners provided with **Dungs Multibloc MB-DLE gas valves**: before starting the burner up, adjust the valves slow opening. To set the fast opening remove cover **T**, reverse it upside down and use it as a tool to rotate screw **VR**. Clockwise rotation reduces start flow rate, anticlockwise rotation increases it. Do not use a screwdriver on the screw **VR**! The pressure stabilizer is adjusted by operating the screw **VS** located under the cover **C**. By screwing down the pressure is increased and by unscrewing it is reduced.

**Note:** the screw **VSB** must be removed only in case of replacement of the coil.

- 3 Start the burner up by means of the thermostat series and wait until the pre-purge time comes to an end and that the burner starts up;
- 4 drive the burner to high flame stage, by means of the thermostat **TAB**.
- 5 do not change the air flow rate adjustment set in the light oil operation (see previous paragraph);
- 6 acting on the pressure stabiliser of the valves group, adjust the **gas flow rate in the high flame stage** as to meet the values requested by the boiler/utilisation:

- **Multibloc MB-DLE:** the valve is adjusted by means of the **RP** regulator after slackening the locking screw **VB** by a number of turns. By unscrewing the regulator **RP** the valve opens, screwing the valve closes. - **Siemens VGD valves group:** remove cap **T** and act on the **VR** adjusting screw to increase or decrease the pressure and consequently the gas rate; screwing **VR** the rate increases, unscrewing it decreases (see next figure).

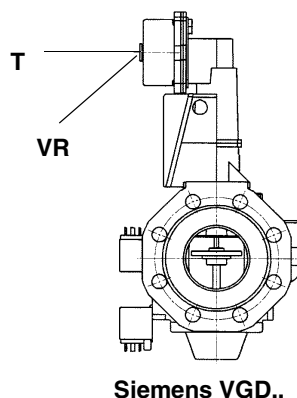
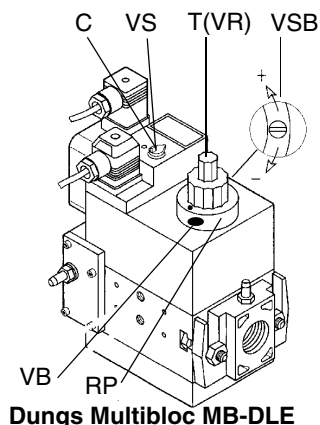
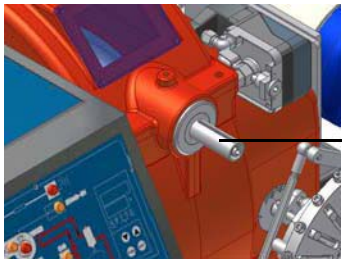


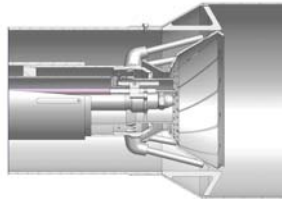
Fig. 26

**⚠** Pressure stabiliser is factory-set. The setting values must be locally adapted to machine conditions. Important! Follow the instructions carefully!

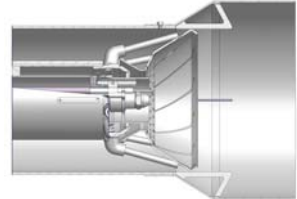
- 7 The burner is factory-set with the head in its MAX position (maximum output). To let the burner operate at a lower output, turn clockwise the **VRT** screw and move progressively the combustion head back towards the MIN position. **Attention!** if it is necessary to change the head position, repeat the air and gas adjustments described above.



VRT



"MAX" head position



"MIN" head position

- 8 drive the burner to the low flame stage by means of the **TAB** thermostat;
- 9 In order to change the gas flow rate slacken the nuts **DB** (Fig. 27) and adjust the opening angle of the gas butterfly valve by rotating the rod **TG** (clockwise rotation increases gas flow, anticlockwise rotation decreases it). The mark on the butterfly valve shaft shows the measured opening degree of the valve regarding the horizontal axis (Fig. 27).

**NOTE:** At the end of settings, make sure the locking screws **RA** and **DB** are fully tightened.

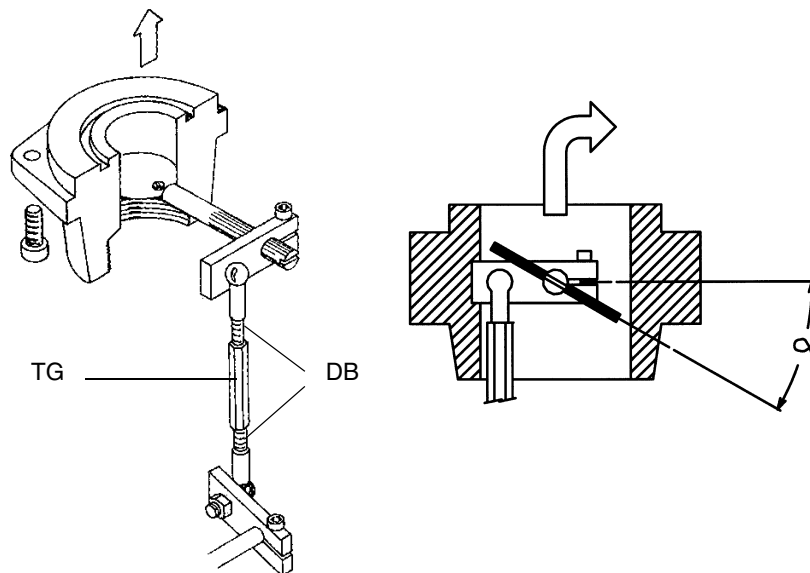


Fig. 27

- 10 Now adjust the pressure switches (see pag. 32).
- 11 In the case that the flue gas temperature is not the one required, go back to the light oil operation and adjust the oil flow rate as to meet the flue gas temperature values requested. Consequently adjust the air always observing the combustion analysis. Then go back to the gas operation and repeat only the gas adjustments (because the air rate has already been set in the light oil operation); always check the combustion values.
- 12 Turn the burner off and then start it up again. If the adjustment is not correct, repeat the previous steps.

## **Calibration of air and gas pressure switches**

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

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

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

To calibrate the air pressure switch, proceed as follows:

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

### **Calibration of low gas pressure switch**

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

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

### **Adjusting the high gas pressure switch (when provided)**

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

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

## OPERATING PRINCIPLE FOR LIGHT OIL CIRCUIT

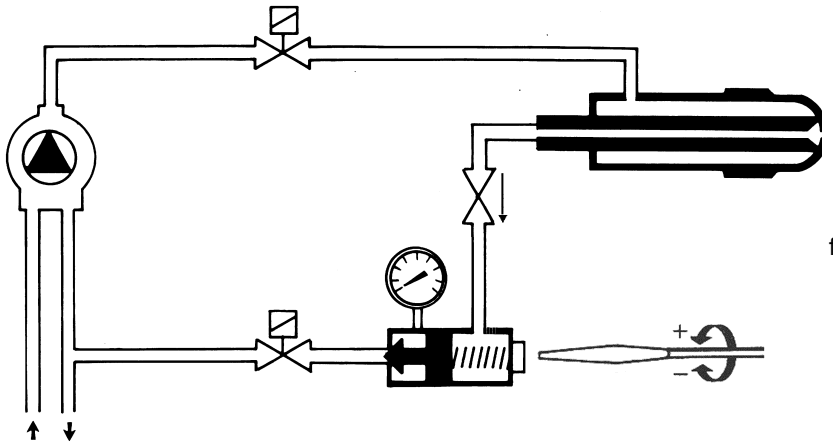


Fig. 28

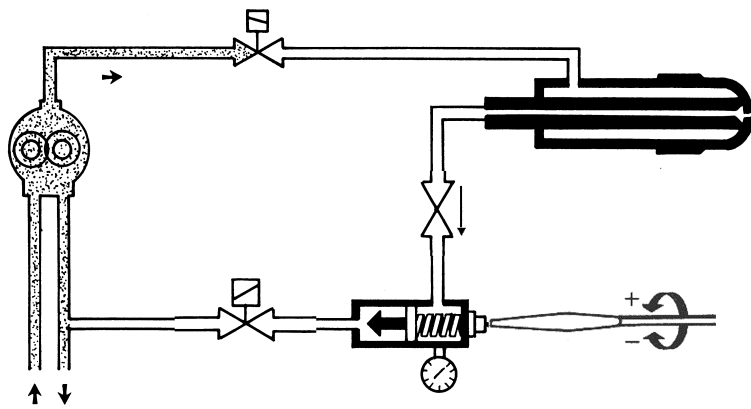


Fig. 29 - Pre-purge

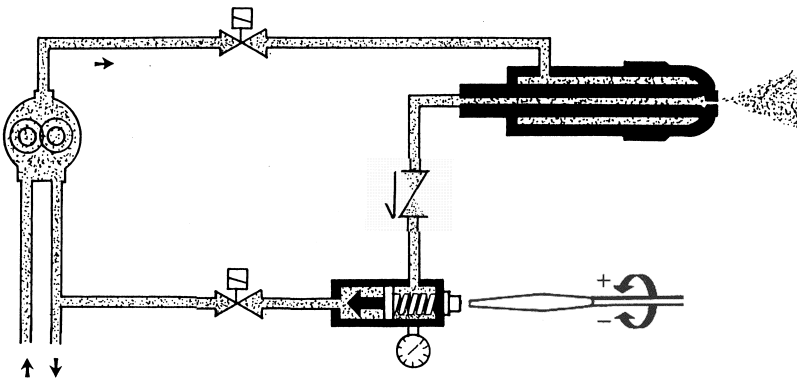


Fig. 30 - Low flame

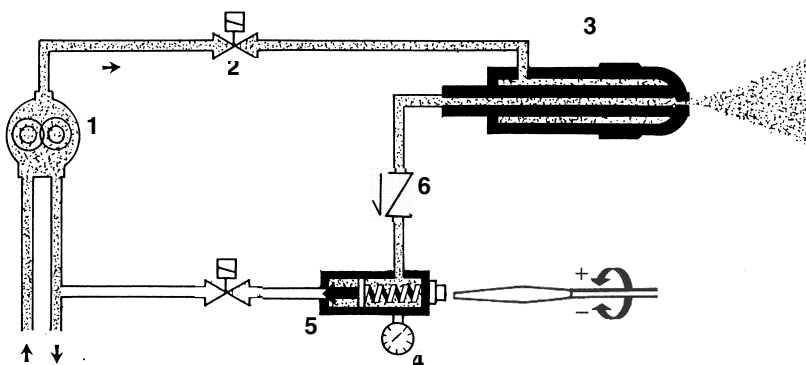


Fig. 31 - High flame

**Keys**

- 1 Light oil pump
- 2 Light oil solenoid valve
- 3 Nozzle
- 4 Pressure gauge
- 5 Pressure regulator
- 6 Nonreturn valve

## 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).

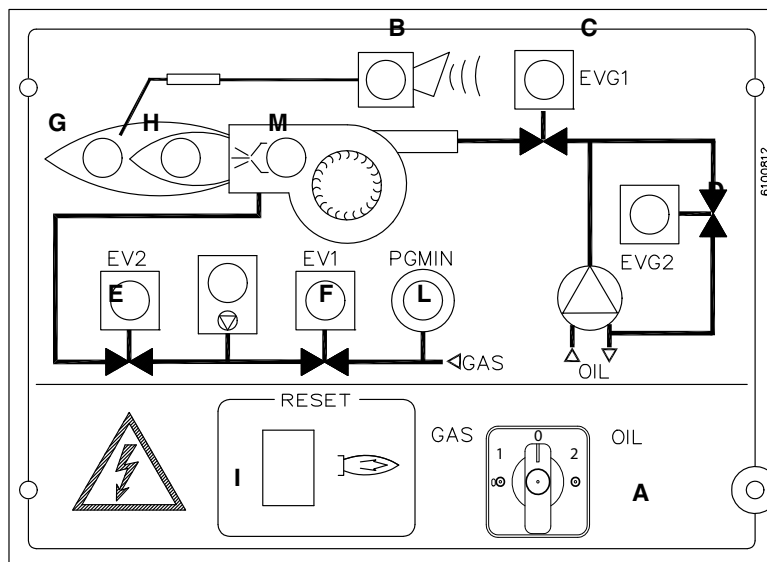
NEVER OPEN OR DISMANTLE ANY COMPONENT OF THE MACHINE.

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.

### Burner control panel



#### Keys

- A Manual operation switch: 0 - OFF; 1 - Gas; 2 - Light oil
- B Burner lockout signalling lamp
- C EVG1 light oil solenoid valve's opening signalling lamp
- D EVG2 light oil solenoid valve's opening signalling lamp
- E EV2 gas solenoid valve's opening signalling lamp
- F EV1 gas solenoid valve's opening signalling lamp
- G High flame gas solenoid valve's opening signalling lamp
- H Low flame gas solenoid valve's opening signalling lamp
- I Flame control device's unlock pushbutton
- L Gas pressure switch control signalling lamp
- M Ignition transformer's operation signalling lamp

## 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”.

- Choose the type of fuel by turning the **A** switch, on the burner control panel.  
**CAUTION:** if the fuel chosen is light oil, be sure the cutoff valves on the feed and return pipes are open.

- Check the control box is not locked (signalling light **O**, on); if so, reset it by means of the pushbutton **C**.
- Check the series of thermostats and pressure switches turn the burner to on.

- 1 Select the fuel by means of the **A** switch on the burner's control panel.

**NOTE:** if the fuel chosen is light oil, be sure the cutoff valves on the feed and return pipes are open.

- 2 Check the control box is not in block condition (signalling light **B** must be off), eventually release it by means of the pushbutton **I** on the burner's front panel (reset).

- 3 Check the series of thermostats (or pressure switches) gives the signal to operation to the burner.

- **Gas operation**

- 1 Set the **A** switch to 1 (GAS - gas operation).
- 2 Check the gas supply pressure is sufficient (lamp **L** on).

**Burners fitted with gas proving system:** the check of the gas proving system begins; the when the check is performed the lamp on the gas proving system, is on. At the end of the check, the startup cycle of the burner begins. In case of leakage in a valve, the gas proving system stops the burner and the lamp **B** turns to on. Reset it, by means of the reset pushbutton on the gas proving system.

- 3 At the beginning of start-up, the servocontrol drives the air damper to the maximum opening position, the fan's motor starts up and the pre-purge phase begins. During this phase, the air damper's complete opening is signalled by the lamp **G** on the front panel.

- 4 At the end of the pre-purge phase, the air damper goes to the ignition position, the ignition transformer is energised (lamp **M** on) and, 3 seconds later, the two gas valves **EV1** and **EV2** are energised (Lamps **F** and **E** respectively on the graphic panel) .

- 5 3 seconds after the gas valves opening, the transformer is turned off and the lamp **M** as well.

- 6 The burner is now in low-operation (LED **H** on),

- 7 8 seconds later the double-stage operation begins and the burner switches automatically to high flame (LED **G** on) or remains in low flame operation, according to the temperature detected by the thermostats or the pressure detected by the pressure switches (according to the boiler model).

- **Light-oil operation**

- 1 Set the **A** switch to 2 (OIL - light oil operation).

- 2 The fan and the pump's motors start up: the pre-purge phase begins.

- 3 At the end of the pre-purge phase, the ignition transformer is energised (lamp **H** on) and the light oil valve **EVG1** is supplied (lamp **C** on).

- 4 Some seconds later, if the **TAB** thermostat is closed to high flame stage, the burner drives to high flame enabling the light oil valve **EVG2** (lamp **D** on).

## PART III: MAINTENANCE

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



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

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

### ROUTINE MAINTENANCE

- Check and clean the gas filter cartridge (see Fig. 32), replace it if necessary;
- Check and clean the light oil filter cartridge, replace it if necessary;
- Check for condition of the light oil pipes, verify for possible leaks;
- Check and clean the filter on 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;
- Remove, check and clean the combustion head (page 37);
- Check the ignition electrodes, clean and eventually adjust it, if necessary replace it (page 38);
- Remove and clean the oil nozzle (Important: use solvents for cleaning, not metal utensils) 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.
- Check and carefully clean the UV detector, replace it if necessary; if in doubt, check the ionization current, after having started the burner, following the directions in Fig. 36.
- Clean and grease joints and rotating parts.

### Removing the filter in the MULTIBLOC DUNGS MB-DLE 415 - 420 B01 1" 1/2 - 2"

- Check the filter at least once a year!
- Change the filter if the pressure difference between pressure connection 1 and 2 (Fig. 32-Fig. 33)  $\Delta p > 10$  mbar.
- Change the filter if the pressure difference between pressure connection 1 and 2 (Fig. 32-Fig. 33) is twice as high compared to the last check.

You can change the filter without removing the fitting.

- 1 Interrupt the gas supply closing the on-off valve.
- 2 Remove screws 1 ÷ 6 (Fig. 34).
- 3 Change filter insert.
- 4 Re-insert filter housing, screw in screws 1 ÷ 6 without using any force and fasten.
- 5 Perform leakage and functional test,  $p_{\max.} = 360$  mbar.

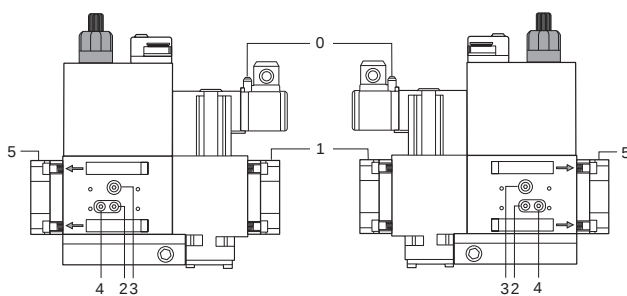


Fig. 32

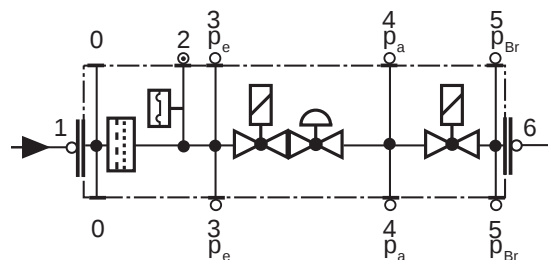


Fig. 33

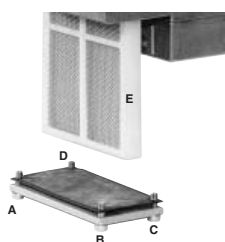


Fig. 34

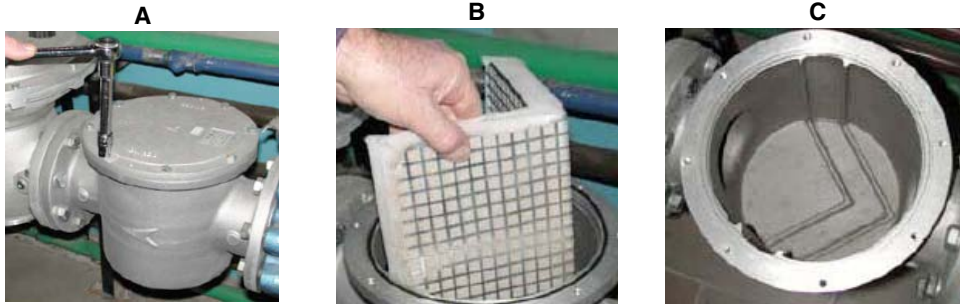
## Gas filter maintenance



**ATTENTION:** Before opening the filter, close the manual cutoff valve downstream the filter and bleed the gas; check that inside the filter there is no pressurised gas.

To clean or remove the filter, proceed as follows:

- 1 remove the cap unscrewing the fixing screws (A);
- 2 remove the filtering cartridge (B), clean it using water and soap, blow it with compressed air (or replace it, if necessary)
- 3 replace the cartridge in its proper position taking care to place it inbetween the guides as not to hamper the cap replacement;
- 4 be sure to replace the "O" ring into its place (C) and replace the cover fastening by the proper screws (A).

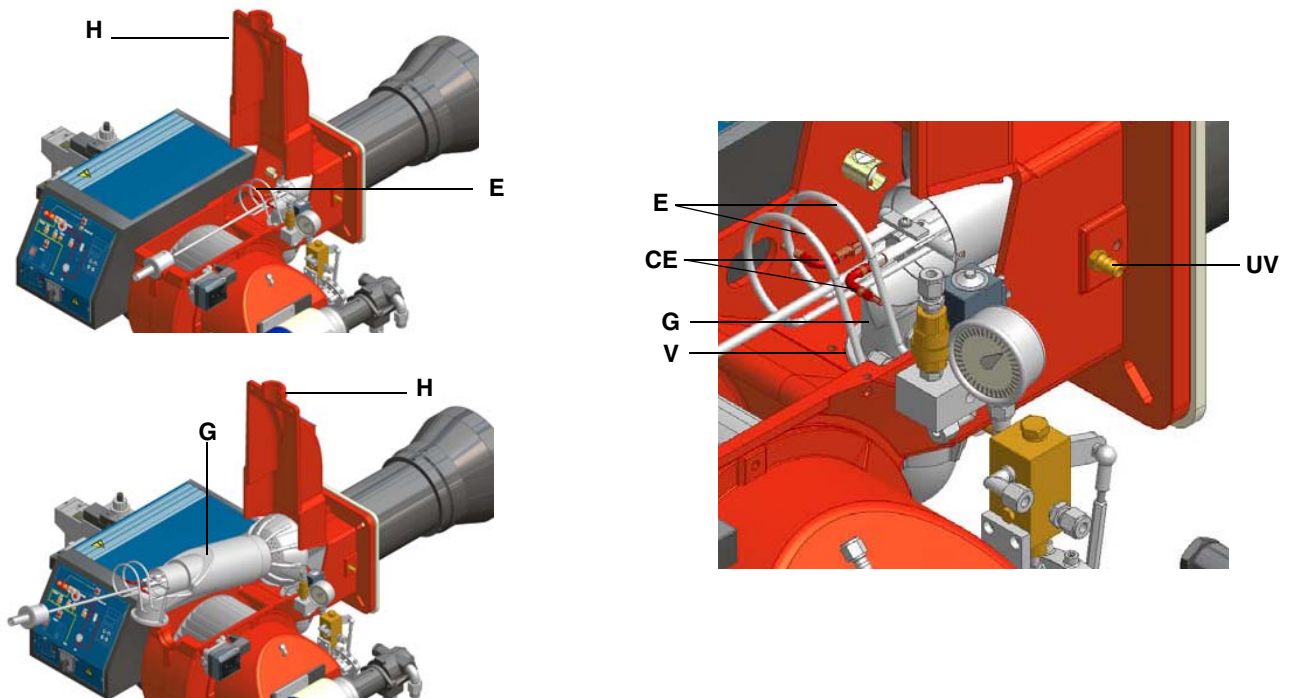


## Removing the combustion head

- 1 Remove the top **H**.
- 2 Disconnect the electrode cables **CE**.
- 3 Remove the **UV** detector out of its housing: disconnect electrode cables and the light oil flexible hoses.
- 4 Unscrew screws **S** that fasten **VR** group: unscrew **VR** until the threaded rod is free.
- 5 Loosen the screws **V** holding the gas manifold **G**, loosen the two connectors **E** and remove the assembly as shown.

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

- 6 Clean the combustion head by means of a vacuum cleaner; scrape off the scale by means of a metallic brush.



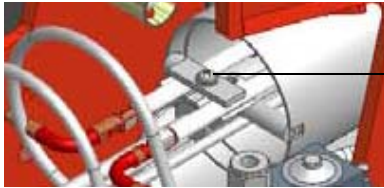
## Cleaning/replacing the electrodes



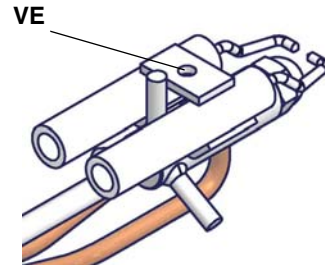
**ATTENTION:** avoid the electrodes to get in touch with metallic parts (blast tube, head, etc.), otherwise the boiler operation would be compromised. Check the electrodes position after any intervention on the combustion head.

To clean/replace the electrodes, proceed as follows:

- 1 remove the combustion head as described in the previous paragraph;
- 2 remove the electrodes ass.y and clean them;
- 3 in order to replace the electrodes, unscrew the **VE** fixing screws and remove them: place the new electrodes being careful to observe the measures in the previous paragraph; reassemble the electrodes and the combustion head following the reversed procedure.



VE



## Adjusting the electrodes position



**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 adjust the electrodes position with respect to the combustion head, slacken the screw **VE** and move the oil lance as necessary. At the end of settings check the electrodes position and tighten the screw **VE**.

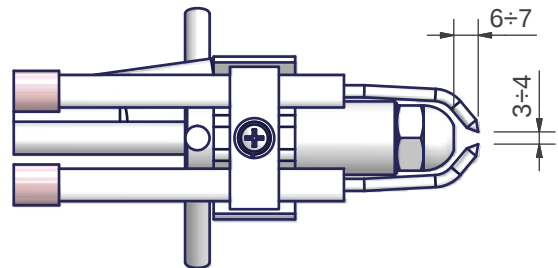
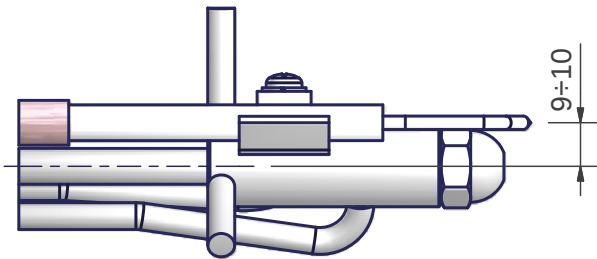


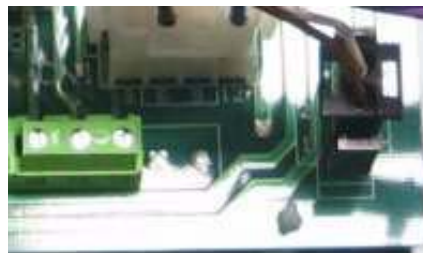
Fig. 35

## Check the detection current

To check the ionization current follow the diagram in Fig. 36. If the current intensity is not in the recommended range, check contacts, if the combustion head is dirty and the UV detector position, replace it if necessary.

| Control box      | Minimum detection signal |
|------------------|--------------------------|
| Siemens LME21-22 | 200 $\mu$ A              |

Photocell connector



2 = -FC

1 = +FC

Fig. 36

**Seasonal stop**

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

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

**Burner disposal**

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

**TROUBLESHOOTING**

| FAULTS / CAUSES                            | BURNER DOESN'T START | CONTINUES PRE-PURGE PHASE | DOESN'T START AND GOES TO LOCKOUT | DOESN'T START AND REPEATS CYCLE | STARTS AND REPEATS CYCLE | DOESN'T SWITCH TO HIGH FLAME | LOCKOUT DURING OPERATION | SHUTS OFF AND REPEATS CYCLE DURING OPERATION | NOISY FUEL PUMP |
|--------------------------------------------|----------------------|---------------------------|-----------------------------------|---------------------------------|--------------------------|------------------------------|--------------------------|----------------------------------------------|-----------------|
| MAIN SWITCH OPEN                           | ●                    |                           |                                   |                                 |                          |                              |                          |                                              |                 |
| LINE FUSES BROKEN                          | ●                    |                           |                                   |                                 |                          |                              |                          |                                              |                 |
| LACK OF GAS                                | ●                    |                           |                                   |                                 |                          |                              |                          |                                              |                 |
| GAS PRESSURE SWITCH DEFECTIVE              | ●                    |                           |                                   |                                 |                          |                              |                          |                                              |                 |
| MAX. THERMOSTAT DEFECTIVE                  | ●                    |                           |                                   |                                 |                          |                              |                          |                                              |                 |
| FAN THERMAL CUTOUT INTERVENTION            | ●                    |                           |                                   |                                 |                          |                              |                          |                                              |                 |
| AUXILIARIES FUSE INTERVENTION              | ●                    |                           |                                   |                                 |                          |                              |                          |                                              |                 |
| AIR PRESSURE SWITCH DEFECTIVE              | ●                    |                           | ●                                 |                                 |                          |                              | ●                        |                                              |                 |
| CONTROL BOX DEFECTIVE                      | ●                    | ●                         | ●                                 |                                 |                          |                              | ●                        |                                              |                 |
| SERVOCONTROL DEFECTIVE                     |                      | ●                         |                                   |                                 |                          |                              |                          |                                              |                 |
| AIR PRESSURE SWITCH UNCALIBRATED OR FAULTY |                      |                           |                                   |                                 |                          |                              | ●                        |                                              |                 |
| GAS PRESSURE SWITCH UNCALIBRATED           |                      |                           | ●                                 | ●                               | ●                        |                              |                          | ●                                            |                 |
| IGNITION TRANSFORMER DEFECTIVE             |                      |                           | ●                                 |                                 |                          |                              |                          |                                              |                 |
| ELECTRODES BAD POSITION                    |                      |                           | ●                                 |                                 |                          |                              |                          |                                              |                 |
| GAS BUTTERFLY UNCALIBRATED                 |                      |                           | ●                                 |                                 |                          |                              |                          |                                              |                 |
| GAS GOVERNOR DEFECTIVE                     |                      |                           |                                   | ●                               | ●                        |                              |                          | ●                                            |                 |
| HI-LO FLAME THERMOSTAT DEFECTIVE           |                      |                           |                                   |                                 |                          | ●                            |                          |                                              |                 |
| SERVOCONTROL CAM UNCALIBRATED              |                      |                           |                                   |                                 |                          | ●                            |                          |                                              |                 |
| UV DETECTOR BAD POSITION                   |                      |                           |                                   |                                 |                          |                              | ●                        |                                              |                 |
| DIRTY FUEL FILTERS                         |                      |                           |                                   |                                 |                          |                              |                          |                                              | ●               |

**SPARE PARTS**

| DESCRIPTION                        | HP60      |           |           | HP65      |           |
|------------------------------------|-----------|-----------|-----------|-----------|-----------|
|                                    | M-AB...40 | M-AB...50 | M-AB...65 | M-...50   | M-...65   |
| CONTROL BOX                        | 2020468   | 2020468   | 2020468   | 2020468   | 2020468   |
| IGNITION ELECTRODE                 | 20802B1   | 20802B1   | 20802B1   | 20802B1   | 20802B1   |
| GAS FILTER                         | ---       | ---       | 2090117   | ---       | 2090117   |
| LIGHT OIL FILTER                   | 2090025   | 2090025   | 2090025   | 2090025   | 2090025   |
| GASKET                             | 2110013   | 2110013   | 2110013   | 2110033   | 2110033   |
| FAN WHEEL                          | 2150044   | 2150044   | 2150044   | 2150038   | 2150038   |
| AIR PRESSURE SWITCH                | 2160065   | 2160065   | 2160065   | 2160065   | 2160065   |
| MAX GAS PRESSURE SWITCH (OPTIONAL) | 2160087   | 2160087   | 2160087   | 2160087   | 2160087   |
| MIN GAS PRESSURE SWITCH            | 2160077   | 2160077   | 2160076   | 2160077   | 2160076   |
| IGNITION TRANSFORMER               | 2170140   | 2170140   | 2170140   | 2170140   | 2170140   |
| PUMP MOTOR                         | 2180201   | 2180201   | 2180201   | 2180201   | 2180201   |
| FAN ELECTRIC MOTOR                 | 218025501 | 218025501 | 218025501 | 218020301 | 218020301 |
| MULTIBLOC VALVES ASSEMBLY          | 21903L3   | 21903L4   | ---       | 21903L4   | ---       |
| VGD GAS DOUBLE VALVE GROUP         | ---       | ---       | 2190172   | ---       | 2190172   |
| SKP15 ACTUATOR                     | ---       | ---       | 2190181   | ---       | 2190181   |
| SKP25 ACTUATOR                     | ---       | ---       | 2190183   | ---       | 2190183   |
| OIL SOLENOID VALVE - L122          | 2190420   | 2190420   | 2190420   | 2190420   | 2190420   |
| OIL SOLENOID VALVE - L256          | 2190404   | 2190404   | 2190404   | 2190404   | 2190404   |
| GAS PROVING SYSTEM (OPTION)        | 2191604   | 2191604   | 2191604   | 2191604   | 2191604   |
| LIGHT OIL FLEXIBLE HOSES           | 2340002   | 2340002   | 2340002   | 2340002   | 2340002   |
| ACTUATOR- BERGER STA               | 2480042   | 2480042   | 2480042   | 2480042   | 2480042   |
| ACTUATOR - SIEMENS SQN72           | 24800A3   | 24800A3   | 24800A3   | 24800A3   | 24800A3   |
| PHOTOCELL                          | 2510001   | 2510001   | 2510001   | 2510001   | 2510001   |
| AGQ 1.1A27 PHOTOCELL'S ADAPTER     | 2510114   | 2510114   | 2510114   | 2510114   | 2510114   |
| PUMP COUPLING COMPLETE SET         | 2540125   | 2540125   | 2540125   | 2540125   | 2540125   |
| OIL PRESSURE GOVERNOR              | 2570056   | 2570056   | 2570056   | 2570056   | 2570056   |
| PUMP                               | 2590103   | 2590103   | 2590103   | 2590103   | 2590103   |
| NOZZLE                             | 2610101   | 2610101   | 2610101   | 2610101   | 2610101   |
| COMBUSTION HEAD                    | 3060238   | 3060238   | 3060238   | 3060238   | 3060238   |
| BLAST TUBE                         | 30900M9   | 30900M9   | 30900M9   | 30900N6   | 30900N6   |
| IGNITION CABLE                     | 6050150   | 6050150   | 6050160   | 6050160   | 6050160   |
| PRINTED CIRCUIT BOARD              | 6100551   | 6100551   | 6100551   | 6100551   | 6100551   |

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

| DESCRIPTION                        | HP72      |           |           | HP73A     |           |           |
|------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
|                                    | M-AB...50 | M-AB...65 | M-AB...80 | M-AB...50 | M-AB...65 | M-AB...80 |
| CONTROL BOX                        | 2020468   | 2020468   | 2020468   | 2020468   | 2020468   | 2020468   |
| IGNITION ELECTRODE                 | 2080280   | 2080280   | 2080280   | 2080278   | 2080278   | 2080278   |
| GAS FILTER                         | ---       | 2090117   | 2090117   | ---       | 2090117   | 2090112   |
| LIGHT OIL FILTER                   | 2090018   | 2090018   | 2090018   | 2090018   | 2090018   | 2090018   |
| GASKET                             | 2110033   | 2110033   | 2110033   | 2110033   | 2110033   | 2110033   |
| FAN WHEEL                          | 2150038   | 2150038   | 2150038   | 2150068   | 2150068   | 2150068   |
| AIR PRESSURE SWITCH                | 2160065   | 2160065   | 2160065   | 2160065   | 2160065   | 2160065   |
| MIN GAS PRESSURE SWITCH            | 2160077   | 2160076   | 2160076   | 2160077   | 2160076   | 2160076   |
| MAX GAS PRESSURE SWITCH (OPTIONAL) | 2160087   | 2160087   | 2160087   | 2160087   | 2160087   | 2160087   |
| IGNITION TRANSFORMER               | 2170140   | 2170140   | 2170140   | 2170140   | 2170140   | 2170140   |
| PUMP MOTOR                         | 2180201   | 2180201   | 2180201   | 2180201   | 2180201   | 2180201   |
| FAN ELECTRIC MOTOR                 | 218021101 | 218021101 | 218021101 | 218025601 | 218025601 | 218025601 |
| VGD GAS DOUBLE VALVE GROUP         | ---       | 2190172   | 2190169   | ---       | 2190172   | 2190169   |
| ACTUATOR                           | ---       | 2190181   | 2190181   | ---       | 2190181   | 2190181   |
| SKP ACTUATOR                       | ---       | 2190183   | 2190183   | ---       | 2190183   | 2190183   |
| MULTIBLOC VALVES ASSEMBLY          | 21903L4   | ---       | ---       | 21903N2   | ---       | ---       |
| OIL SOLENOID VALVE - L159          | 2190403   | 2190403   | 2190403   | 2190403   | 2190403   | 2190403   |
| OIL SOLENOID VALVE - L256          | 2190404   | 2190404   | 2190404   | 2190404   | 2190404   | 2190404   |
| GAS PROVING SYSTEM (WHEN PROVIDED) | 2191604   | 2191604   | 2191604   | 2191604   | 2191604   | 2191604   |
| LIGHT OIL FLEXIBLE HOSES           | 2340003   | 2340003   | 2340003   | 2340003   | 2340003   | 2340003   |
| ACTUATOR- BERGER STA               | 2480042   | 2480042   | 2480042   | 2480042   | 2480042   | 2480042   |
| ACTUATOR - SIEMENS SQN72           | 24800A3   | 24800A3   | 24800A3   | 24800A3   | 24800A3   | 24800A3   |
| PHOTOCELL                          | 2510001   | 2510001   | 2510001   | 2510001   | 2510001   | 2510001   |
| AGQ 1.1A27 PHOTOCELL'S ADAPTER     | 2510114   | 2510114   | 2510114   | 2510114   | 2510114   | 2510114   |
| PUMP COUPLING COMPLETE SET         | 2540125   | 2540125   | 2540125   | 2540010   | 2540010   | 2540010   |
| OIL PRESSURE GOVERNOR              | 2570056   | 2570056   | 2570056   | 2570056   | 2570056   | 2570056   |
| PUMP mod. DANFOSS                  | 2590316   | 2590316   | 2590316   | 2590310   | 2590310   | 2590310   |
| PUMP mod. SUNTEC                   | 2590106   | 2590106   | 2590106   | 2590118   | 2590118   | 2590118   |
| NOZZLE                             | 2610101   | 2610101   | 2610101   | 2610202   | 2610202   | 2610202   |
| COMBUSTION HEAD                    | 3060239   | 3060239   | 3060239   | 3060291   | 3060291   | 3060291   |
| COMPLETE BLAST TUBE                | 30910Q7   | 30910Q7   | 30910Q7   | 30910P8   | 30910P8   | 30910P8   |
| PRINTED CIRCUIT BOARD              | 6100551   | 6100551   | 6100551   | 6100551   | 6100551   | 6100551   |

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

## WIRING DIAGRAMS

### Complete key

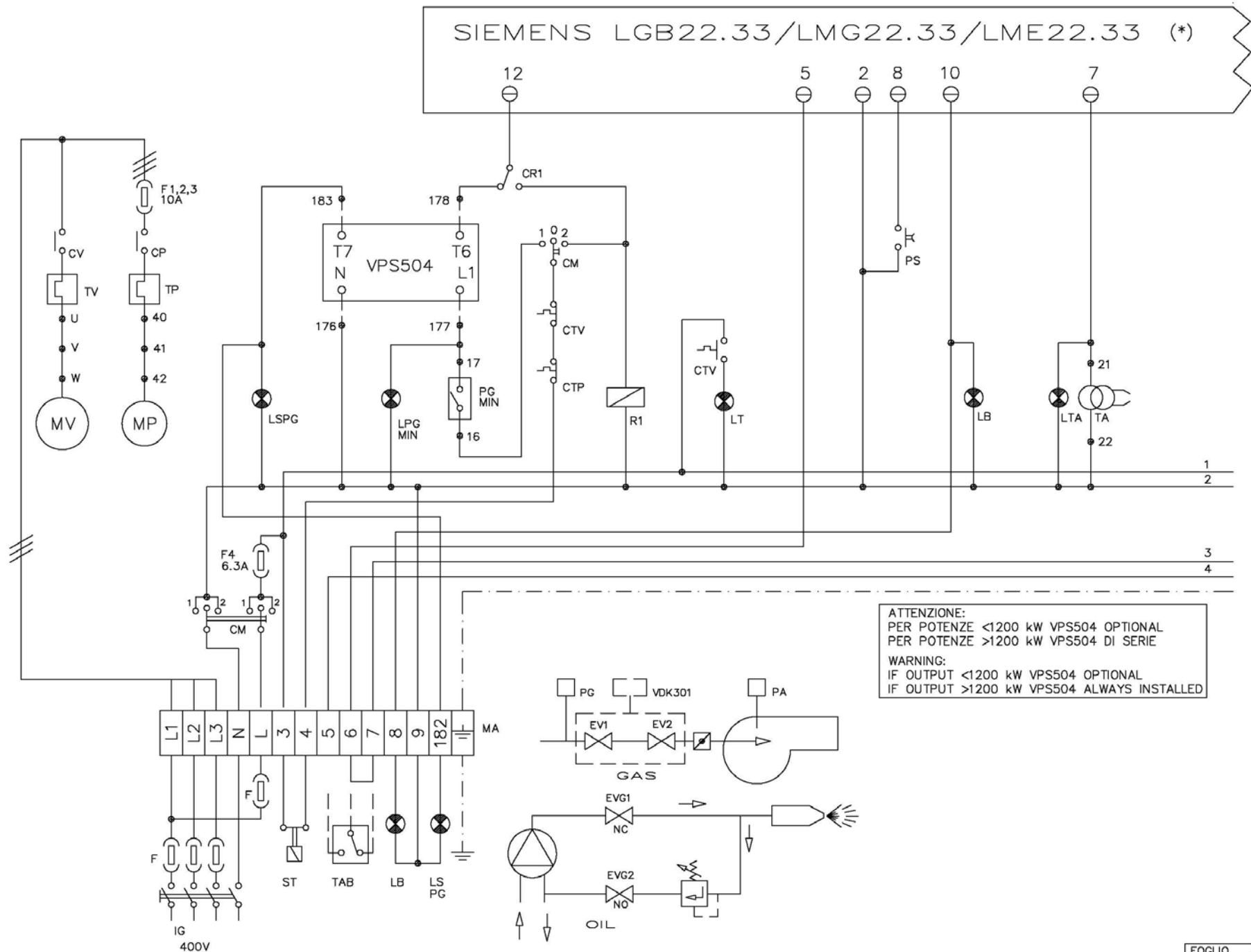
|                  |                                                                                                                            |
|------------------|----------------------------------------------------------------------------------------------------------------------------|
| AGQx.1A27        | Auxiliary device for UV probe                                                                                              |
| BP               | Light oil pump contactor coil                                                                                              |
| BV               | Fan motor contactor coil                                                                                                   |
| CM               | Operation selector 0) Off - 1) Gas - 2) Light oil                                                                          |
| CMF              | Manual operation selector 0) Stop - 1) High flame - 2) Low flame - 3) Automatic                                            |
| CP               | Contacts on pump motor contactor                                                                                           |
| CR1              | Contacts on auxiliary relays                                                                                               |
| CTP              | Contacts on pump motor thermal cutout                                                                                      |
| CTV              | Contacts on fan motor thermal cutout                                                                                       |
| CV               | Contacts on fan motor contactor                                                                                            |
| EV1              | Gas solenoid valve, network side (or valves group)                                                                         |
| EV2              | Gas solenoid valve, burner side (or valves group)                                                                          |
| EVG1             | Light oil solenoid valve 1st stage                                                                                         |
| EVG2             | Light oil solenoid valve 2nd stage                                                                                         |
| F÷F4             | Fuses                                                                                                                      |
| FC               | UV probe                                                                                                                   |
| IM               | Fan motor switch                                                                                                           |
| IL               | Auxiliary line switch                                                                                                      |
| L                | Phase                                                                                                                      |
| LAF              | High flame operation signaling lamp                                                                                        |
| LB               | Burner lockout signalling lamp                                                                                             |
| LBF              | Low flame operation signaling lamp                                                                                         |
| LEV1             | EV1's opening signaling lamp                                                                                               |
| LEV2             | EV2's opening signaling lamp                                                                                               |
| LEV1             | EVG1's opening signaling lamp                                                                                              |
| LEV2             | EVG2's opening signaling lamp                                                                                              |
| LGB/LMG/LME22.33 | SIEMENS control box                                                                                                        |
| LPG              | Low gas pressure in the network signaling lamp                                                                             |
| LS               | Burner in stop position (STAND-BY) signaling lamp                                                                          |
| LSPG             | Gas valves leakage signaling lamp                                                                                          |
| LT               | Intervention of thermal cutout signaling lamp                                                                              |
| LTA              | Ignition transformer in operation signaling lamp                                                                           |
| MA               | Burner power supply terminal board                                                                                         |
| MC               | Burner components terminal board                                                                                           |
| MP               | Pump motor                                                                                                                 |
| MV               | Fan motor                                                                                                                  |
| N                | Neutral                                                                                                                    |
| PA               | Air pressure switch                                                                                                        |
| PGMAX            | Maximum gas pressure switch (optional, if provided remove the connection between terminals 156 e 158 in terminal board MC) |
| PGMIN            | Minimum gas pressure switch                                                                                                |
| PS               | Reset pushbutton for LGB/LMG/LME                                                                                           |
| Pt100            | Connection for Pt100                                                                                                       |
| R1               | Auxiliary relay                                                                                                            |
| SQN72/STA        | Actuator for air damper,                                                                                                   |
| ST               | Series of thermostats or pressure switches                                                                                 |
| TA               | Ignition transformer                                                                                                       |
| TP               | Pump motor thermal cutout                                                                                                  |
| TV               | Fan motor thermal cutout                                                                                                   |
| VPS504           | DUNGS Leakage control device (optional, if provided remove the connection between 177 and 178 on terminal board MC)        |

### ATTENTION:

- 1 - Electrical supply 400V 50Hz 3 N a.c.
- 2 - Don't reverse phase with neutral
- 3 - Ensure to the burner a proper hearthing

Wiring diagram Cod. 05-573.

Electrical wiring diagram Cod. 18-119 -Burners provided with printed circuit



|                  |                                                                                                                                         |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| AGQx.1A27        | Apparecchio ausiliario per sonda UV                                                                                                     |
| BV               | Bobina contattore motore ventilatore                                                                                                    |
| BP               | Bobina contattore motore pompa                                                                                                          |
| CM               | Commutatore di funzionamento 0) spento 1) gas 2) gasolio                                                                                |
| CP               | Contatti contattore pompa                                                                                                               |
| CR1              | Contatti relè ausiliari                                                                                                                 |
| CTP              | Contatti termico motore pompa                                                                                                           |
| CTV              | Contatti termico motore ventilatore                                                                                                     |
| CV               | Contatti contattore motore ventilatore                                                                                                  |
| EV1              | Elettrovalvola gas lato rete (o gruppo valvole)                                                                                         |
| EV2              | Elettrovalvola gas lato bruciatore (o gruppo valvole)                                                                                   |
| EVG1             | Elettrovalvola gasolio I° stadio                                                                                                        |
| EVG2             | Elettrovalvola gasolio II° stage                                                                                                        |
| F+F4             | Fusibili                                                                                                                                |
| FC               | Sonda UV                                                                                                                                |
| IG               | Interruttore generale                                                                                                                   |
| L                | Fase                                                                                                                                    |
| LAF              | Lampada segnalazione bruciatore in alta fiamma                                                                                          |
| LB               | Lampada segnalazione blocco bruciatore                                                                                                  |
| LBF              | Lampada segnalazione bruciatore in bassa fiamma                                                                                         |
| LEV1             | Lampada segnalazione apertura elettrovalvola EV1                                                                                        |
| LEV2             | Lampada segnalazione apertura elettrovalvola EV2                                                                                        |
| LEV1             | Lampada segnalazione apertura elettrovalvola gasolio EVG1                                                                               |
| LEV2             | Lampada segnalazione apertura elettrovalvola gasolio EVG2                                                                               |
| LGB/LMG/LME22.33 | Apparecchiatura SIEMENS controllo fiamma                                                                                                |
| LPG              | Lampada segnalazione bassa pressione gas in rete                                                                                        |
| LSPG             | Lampada segnalazione perdite valvole gas                                                                                                |
| LT               | Lampada segnalazione termico motore ventilatore                                                                                         |
| LTA              | Lampada segnalazione trasformatore di accensione                                                                                        |
| MA               | Morsettiera di alimentazione bruciatore                                                                                                 |
| MC               | Morsettiera di collegamento componenti bruciatore                                                                                       |
| MP               | Motore pompa                                                                                                                            |
| MV               | Motore ventilatore                                                                                                                      |
| N                | Neutro                                                                                                                                  |
| PA               | Pressostato aria comburente                                                                                                             |
| PGMAX            | Pressostato gas di massima (optional se previsto togliere il ponte tra i morsetti 156 e 158 nella morsettiera MC)                       |
| PGMIN            | Pressostato gas di minima pressione                                                                                                     |
| PS               | Pulsante di sblocco LGB..                                                                                                               |
| R1               | Relè ausiliario                                                                                                                         |
| TAB              | Termostato alta/bassa fiamma (dove previsto togliere il ponte tra i morsetti 6 e 7 nella morsettiera MA )                               |
| SQN30/STA6B      | Servocomando SIEMENS o BERGER serranda aria                                                                                             |
| ST               | Serie termostati o pressostati                                                                                                          |
| TA               | Trasformatore di accensione                                                                                                             |
| TP               | Termico motore pompa                                                                                                                    |
| TV               | Termico motore ventilatore                                                                                                              |
| VPS504           | Apparecchiatura DUNGS controllo perdita valvole ( optional se previsto togliere il ponte tra i morsetti 177 e 178 nella morsettiera MC) |

#### CAMME SERVOCOMANDO

|           |                                 |
|-----------|---------------------------------|
| SIEMENS   | BERGER                          |
| SQN30.151 | STA6B3.41                       |
| I         | ST2 Alta fiamma                 |
| II        | ST0 Accensione                  |
| III       | ST1 Bassa fiamma                |
| V         | MV Apertura elettrovalvola EVG2 |

#### ATTENZIONE :

- 1 - Alimentazione e 400V 50Hz 3N a.c.
- 2 - Non invertire fasneutro
- 3 - Assicurare una buona messa a terra del bruciatore

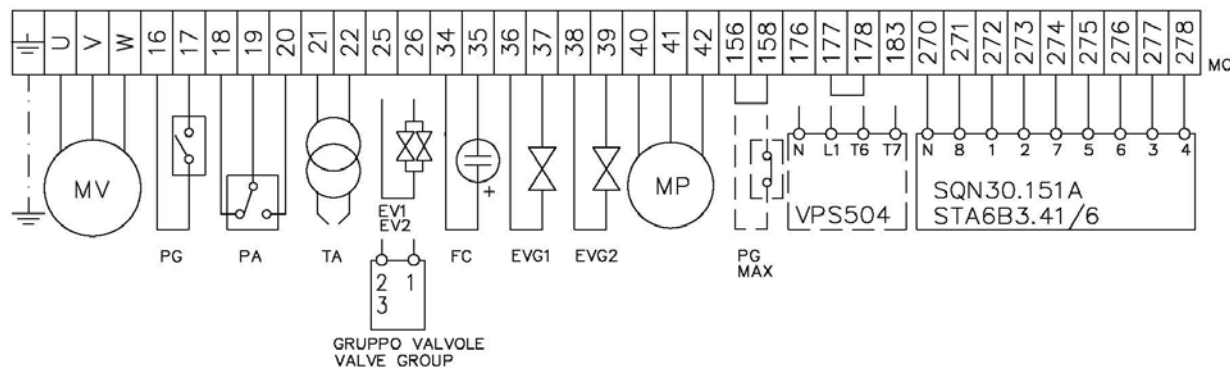
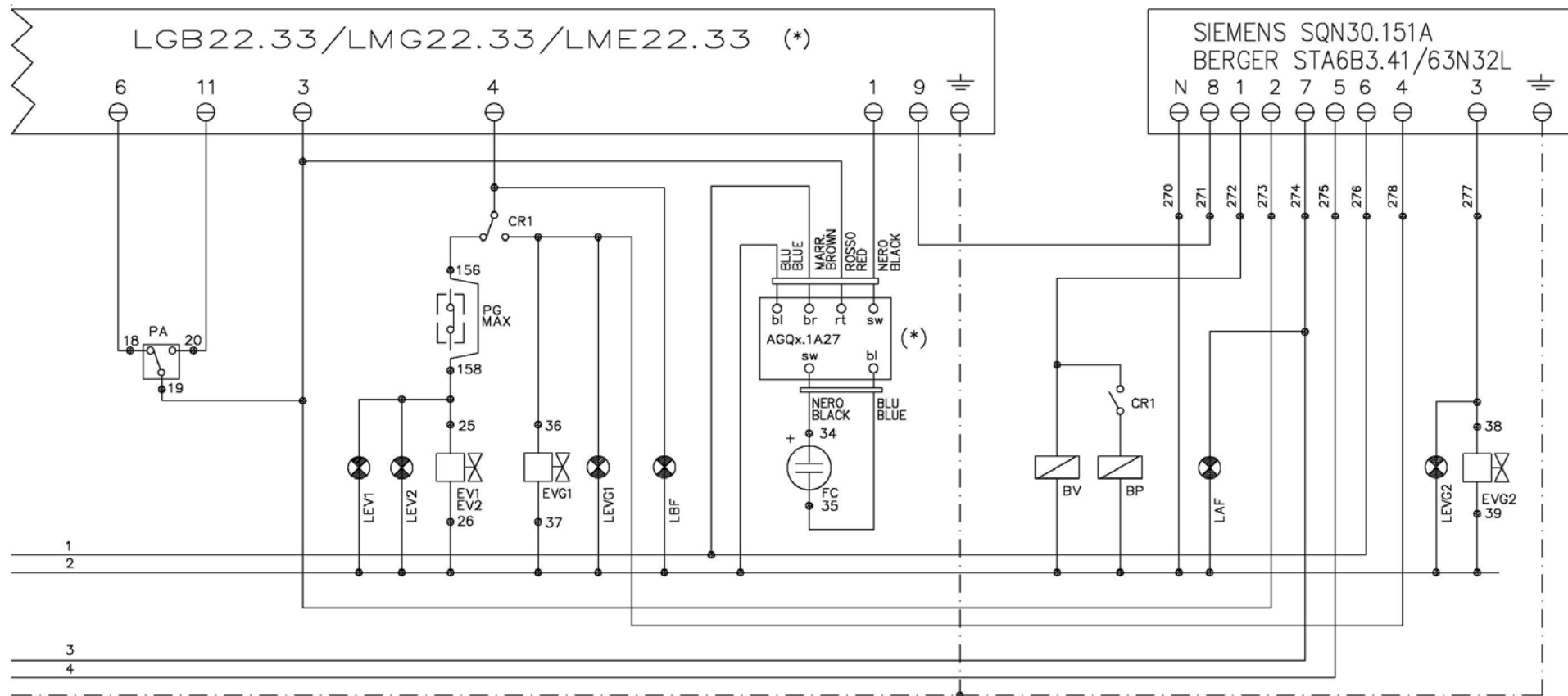
|                  |                                                                                                                           |
|------------------|---------------------------------------------------------------------------------------------------------------------------|
| AGQx.1A27        | Auxiliary unit for UV probe                                                                                               |
| BP               | Pump motor remote contactor coil                                                                                          |
| BV               | Fan motor remote contactor coil                                                                                           |
| CM               | Manual operation switch 0) off 1) gas 2) light oil                                                                        |
| CP               | Pump motor contactor                                                                                                      |
| CR1              | Relay contacts                                                                                                            |
| CTP              | Pump motor overload contacts                                                                                              |
| CTV              | Fan motor overload contacts                                                                                               |
| CV               | Fan motor contactor                                                                                                       |
| EV1              | Gas electro-valve upstream (or valve group)                                                                               |
| EV2              | Gas electro-valve downstream (or valve group)                                                                             |
| EVG1             | Light oil electro-valve I° stage                                                                                          |
| EVG2             | Light oil electro-valve II° stage                                                                                         |
| F+F4             | Fuses                                                                                                                     |
| FC               | UV flame detector                                                                                                         |
| IG               | Main switch                                                                                                               |
| L                | Phase                                                                                                                     |
| LAF              | Burner in high flame indicator light                                                                                      |
| LB               | Burner lockout indicator light                                                                                            |
| LBF              | Burner in low flame indicator light                                                                                       |
| LEV1             | Indicator light for opening of electro-valve EV1                                                                          |
| LEV2             | Indicator light for opening of electro-valve EV2                                                                          |
| LEV1             | Indicator light for opening of electro-valve EVG1                                                                         |
| LEV2             | Indicator light for opening of electro-valve EVG2                                                                         |
| LGB/LMG/LME22.33 | SIEMENS flame monitor device                                                                                              |
| LPG              | Indicator light for presence of gas in the network                                                                        |
| LSPG             | Indicator light for leakage of valves                                                                                     |
| LT               | Indicator light for fan overload tripped                                                                                  |
| LTA              | Ignition transformer indicator light                                                                                      |
| MA               | Supply terminal block                                                                                                     |
| MC               | Terminal block for connection of burner components                                                                        |
| MP               | Pump motor                                                                                                                |
| MV               | Fan motor                                                                                                                 |
| N                | Neutral                                                                                                                   |
| PA               | Combustion air pressure switch                                                                                            |
| PGMAX            | High gas pressure switch (where supplied, remove the bridge between terminals 156 and 158 in terminal block MC)           |
| PGMIN            | Low gas pressure switch                                                                                                   |
| PS               | Lockout reset button LGB..                                                                                                |
| R1               | Auxiliary relay                                                                                                           |
| TAB              | High/low thermostat (where supplied, remove the bridge between terminal 6 and 7 in terminal block MA )                    |
| SQN30/STA6B      | Servo control SIEMENS or BERGER air damper                                                                                |
| ST               | Series thermostats or pressure switches                                                                                   |
| TA               | Ignition transformer                                                                                                      |
| TP               | Pump motor thermal                                                                                                        |
| TV               | Fan motor thermal                                                                                                         |
| VPS504           | DUNGS valve leakage monitor device (where supplied, remove the bridge between terminals 177 and 178 in terminal block MC) |

#### SERVO CONTROL CAMS

|           |                |
|-----------|----------------|
| SIEMENS   | BERGER         |
| SQN30.151 | STA6B3.41      |
| I         | ST2 High flame |
| II        | ST0 Start-up   |
| III       | ST1 Low flame  |
| V         | MV Open EVG2   |

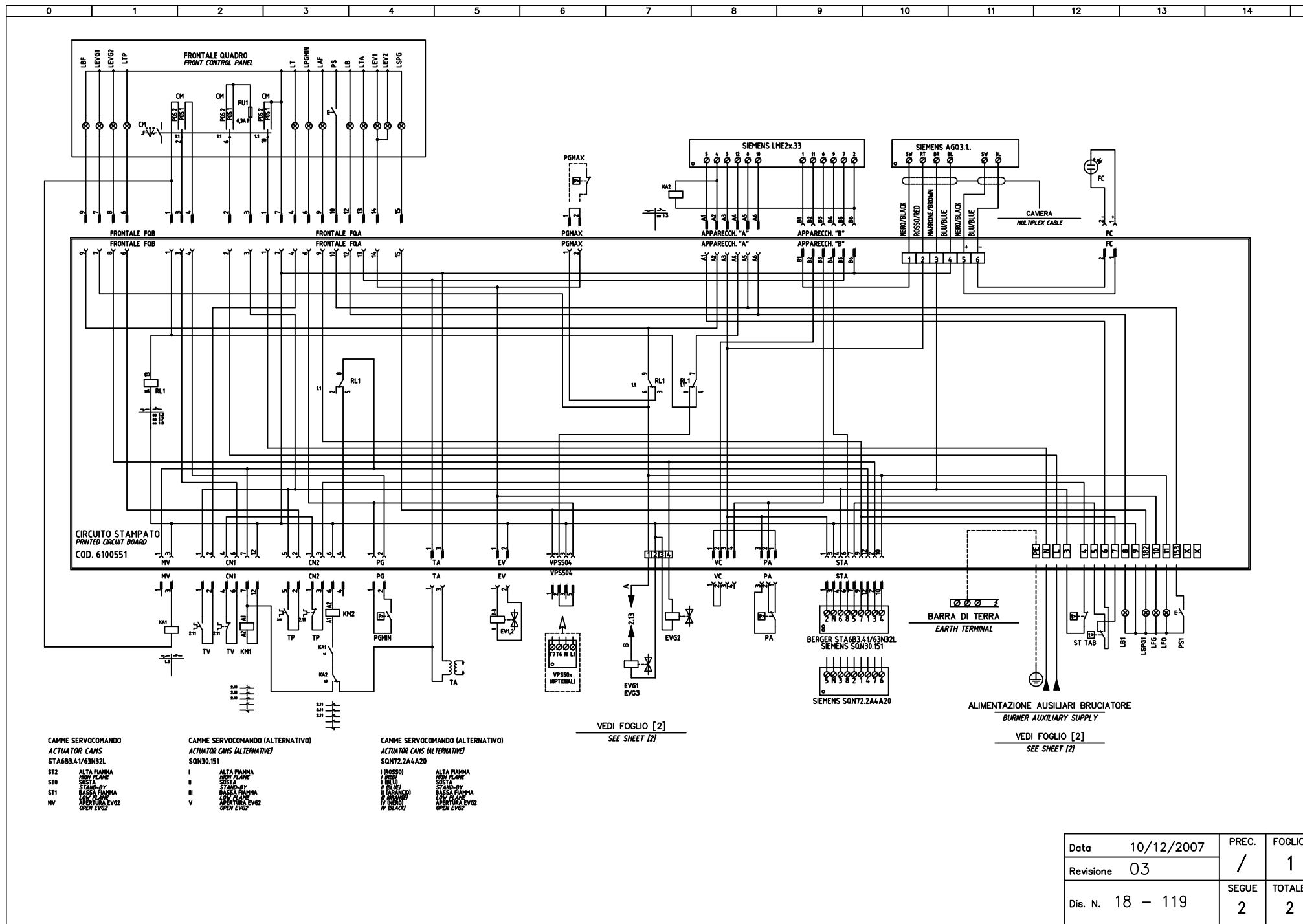
#### WARNING :

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



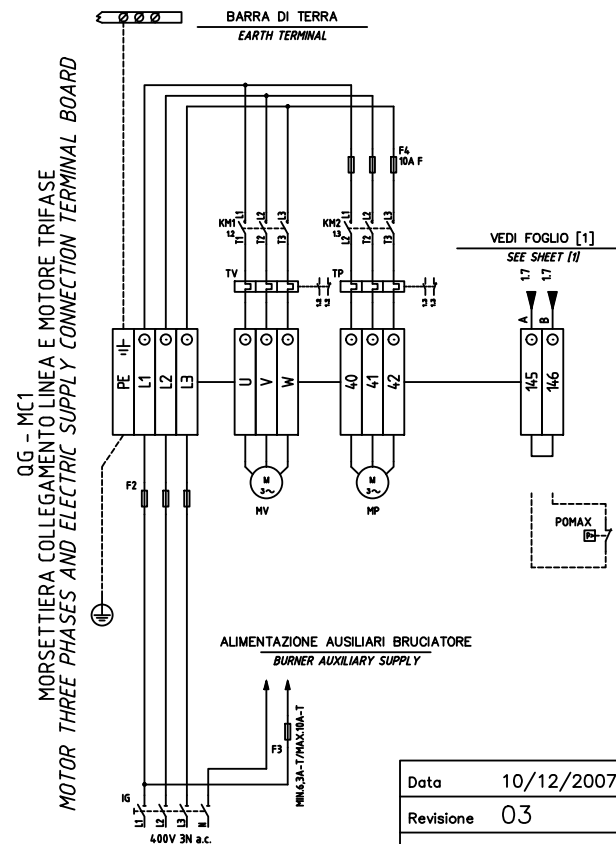
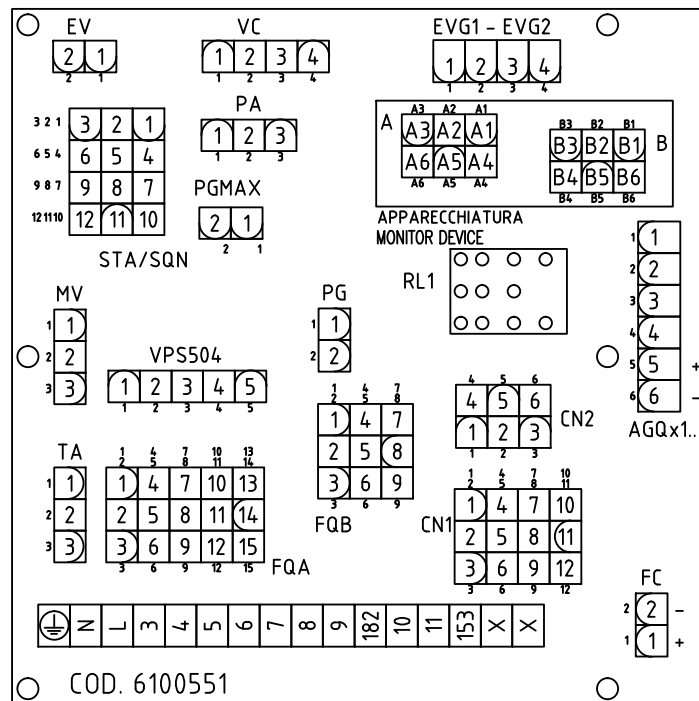
| NA | NC |
|----|----|
| I1 | I1 |
| H2 | G2 |
| Q2 |    |
| R1 |    |

(\*)  
 LGB22.33 + AGQ1.1A27  
 LMG22.33 + AGQ2.1A27  
 LME22.33 + AGQ3.1A27



| SIGLA/ITEM            | FUNZIONE                                                | FUNCTION                                           |
|-----------------------|---------------------------------------------------------|----------------------------------------------------|
| BERGER STA683.1/63032 | SERVOCOMANDO SERRANDA ARIA                              | AIR DAMPER ACTUATOR                                |
| CM                    | SELETTORE MANUALE COMBUSTIBILE 1) GAS 0) OFF 2) GASOLIO | COMBUSTIBLE SELECTOR 1)GAS 0)OFF 2)LIGHT OIL       |
| EV12                  | ELETTROVALVOLE GAS (0 GRUPPO VALVOLE)                   | GAS ELECTRO-VALVES (OR VALVES GROUP)               |
| EVG1                  | ELETTROVALVOLE GASOLIO                                  | LIGHT OIL ELECTRO VALVE                            |
| EVG2                  | ELETTROVALVOLE GASOLIO                                  | LIGHT OIL SOLENOID VALVE                           |
| F2                    | FUSIBILI LINEA MOTORE VENTILATORE                       | FAN MOTOR LINE FUSES                               |
| F3                    | FUSIBILE DI LINEA                                       | LINE FUSE                                          |
| F4                    | FUSIBILI LINEA POMPA                                    | PUMP LINE FUSES                                    |
| FC                    | SONDA UV RILEVAZIONE FIAMMA                             | UV FLAME DETECTOR                                  |
| FU1                   | FUSIBILE DI LINEA                                       | LINE FUSE                                          |
| IG                    | INTERRUTTORE GENERALE                                   | MAINS SWITCH                                       |
| KA1                   | RELE' AUSILIARIO                                        | AUXILIARY RELAY                                    |
| KA2                   | RELE' AUSILIARIO                                        | AUXILIARY RELAY                                    |
| KM1                   | CONTATTORE MOTORE VENTILATORE                           | FAN MOTOR CONTACTOR                                |
| KM2                   | CONTATTORE MOTORE POMPA GASOLIO                         | LIGHT OIL PUMP MOTOR CONTACTOR                     |
| LAF                   | LAMPADA SEGNALE ALTA FIAMMA BRUCIATORE                  | BURNER IN HIGH FLAME INDICATOR LIGHT               |
| LB                    | LAMPADA SEGNALE BLOCCO BRUCIATORE                       | INDICATOR LIGHT FOR BURNER LOCK-OUT                |
| LB1                   | LAMPADA SEGNALE BLOCCO BRUCIATORE                       | INDICATOR LIGHT FOR BURNER LOCK-OUT                |
| LB2                   | LAMPADA SEGNALE BLOCCO BRUCIATORE                       | BURNER IN LOW FLAME INDICATOR LIGHT                |
| LEV1                  | LAMPADA SEGNALE APERTURA [EV1]                          | INDICATOR LIGHT FOR OPENING OF ELECTRO-VALVE [EV1] |
| LEV2                  | LAMPADA SEGNALE APERTURA [EV2]                          | INDICATOR LIGHT FOR OPENING OF ELECTRO-VALVE [EV2] |
| LEV1                  | LAMPADA SEGNALE APERTURA [EV1]                          | INDICATOR LIGHT FOR OPENING OF ELECTRO-VALVE [EV1] |
| LEV2                  | LAMPADA SEGNALE APERTURA [EV2]                          | INDICATOR LIGHT FOR OPENING OF ELECTRO-VALVE [EV2] |
| LFG                   | LAMPADA SEGNALE FUNZIONAMENTO BRUCIATORE A GAS          | BURNER GAS OPERATION INDICATOR LIGHT               |
| LFO                   | LAMPADA SEGNALE FUNZIONAMENTO BRUCIATORE A GASOLIO      | BURNER LIGHT OIL OPERATION INDICATOR LIGHT         |

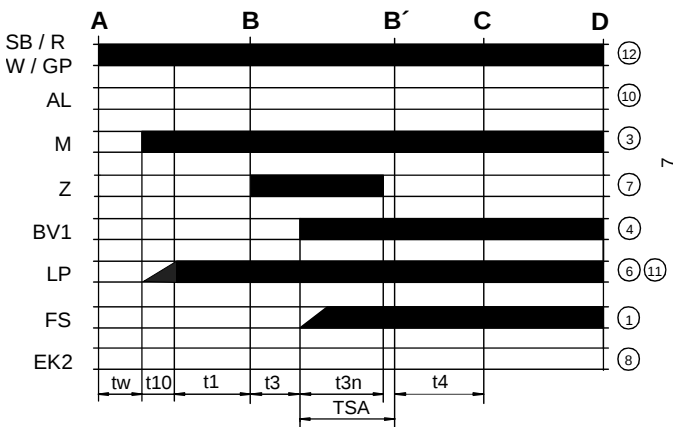
| SIGLA/ITEM           | FUNZIONE                                          | FUNCTION                                               |
|----------------------|---------------------------------------------------|--------------------------------------------------------|
| LPGMIN               | LAMPADA SEGNALE PRESENZA GAS IN RETE              | INDICATOR LIGHT FOR PRESENCE OF GAS IN THE NETWORK     |
| LSPG                 | LAMPADA SEGNALE BLOCCO CONTROLLO TENUTA VALVOLE   | INDICATOR LIGHT FOR LEAKAGE OF VALVES                  |
| LSPG1                | LAMPADA SEGNALE BLOCCO CONTROLLO TENUTA VALVOLE   | INDICATOR LIGHT FOR LEAKAGE OF VALVES                  |
| LT                   | LAMPADA SEGNALE BLOCCO TERMICO MOTORE VENTILATORE | INDICATOR LIGHT FOR FAN MOTOR OVERLOAD THERMAL CUTOUT  |
| LTA                  | LAMPADA SEGNALE TRASFORMATORE DI ACCENSIONE       | IGNITION TRANSFORMER INDICATOR LIGHT                   |
| LTP                  | LAMPADA SEGNALE BLOCCO TERMICO MOTORE POMPA       | INDICATOR LIGHT FOR PUMP MOTOR OVERLOAD THERMAL CUTOUT |
| MP                   | MOTORE POMPA GASOLIO                              | LIGHT OIL PUMP MOTOR                                   |
| MV                   | MOTORE VENTILATORE                                | FAN MOTOR                                              |
| PA                   | PRESSOSTATO ARIA                                  | AIR PRESSURE SWITCH                                    |
| PGMAX                | PRESSOSTATO GAS DI MASSIMA PRESSIONE (OPZIONALE)  | MAXIMUM PRESSURE GAS SWITCH (OPTIONAL)                 |
| PGMIN                | PRESSOSTATO GAS DI MINIMA PRESSIONE               | MINIMUM GAS PRESSURE SWITCH                            |
| POMAX                | PRESSOSTATO DI MASSIMA PRESSIONE OLIO (OPZIONALE) | MAXIMUM OIL PRESSURE SWITCH (OPTIONAL)                 |
| PS                   | PULSANTE SBLOCCO FIAMMA                           | LOCK-OUT RESET BUTTON                                  |
| PS1                  | PULSANTE SBLOCCO FIAMMA                           | LOCK-OUT RESET BUTTON                                  |
| RL1                  | RELE' AUSILIARIO                                  | AUXILIARY RELAY                                        |
| SIEMENS AGQ3.1.      | ADATTATORE PER Sonda UV RILEVAZIONE FIAMMA        | ADAPTER FOR UV FLAME DETECTOR                          |
| SIEMENS LME2x.33     | APPARECCHIATURA CONTROLLO FIAMMA                  | CONTROL BOX                                            |
| SIEMENS SQN30.151    | SERVOCOMANDO SERRANDA ARIA (ALTERNATIVO)          | AIR DAMPER ACTUATOR (ALTERNATIVE)                      |
| SIEMENS SQN72.2A4A20 | SERVOCOMANDO SERRANDA ARIA (ALTERNATIVO)          | AIR DAMPER ACTUATOR (ALTERNATIVE)                      |
| ST                   | SERIE TERMOSTATI/PRESSOSTATI                      | SERIES OF THERMOSTATS OR PRESSURE SWITCHES             |
| TA                   | TRASFORMATORE DI ACCENSIONE                       | IGNITION TRANSFORMER                                   |
| TAB                  | TERMOSTATO/PRESSOSTATO ALTA-BASSA FIAMMA          | HIGH-LOW THERMOSTAT/PRESSURE SWITCHES                  |
| TP                   | TERMICO MOTORE POMPA GASOLIO                      | LIGHT OIL PUMP MOTOR THERMAL                           |
| TV                   | TERMICO MOTORE VENTILATORE                        | FAN MOTOR THERMAL                                      |
| VPS50x               | CONTROLLO DI TENUTA VALVOLE GAS (OPZIONALE)       | GAS PROVING SYSTEM (OPTIONAL)                          |



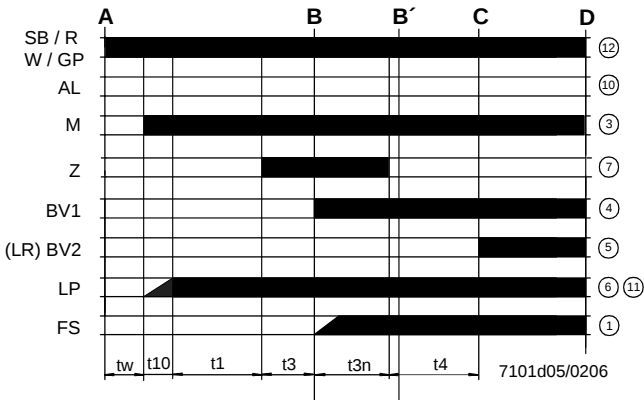
|           |            |       |        |
|-----------|------------|-------|--------|
| Data      | 10/12/2007 | PREC. | FOGLIO |
| Revisione | 03         | 1     | 2      |
| Dis. N.   | 18 - 119   | SEGUE | TOTALE |
|           |            | /     | 2      |



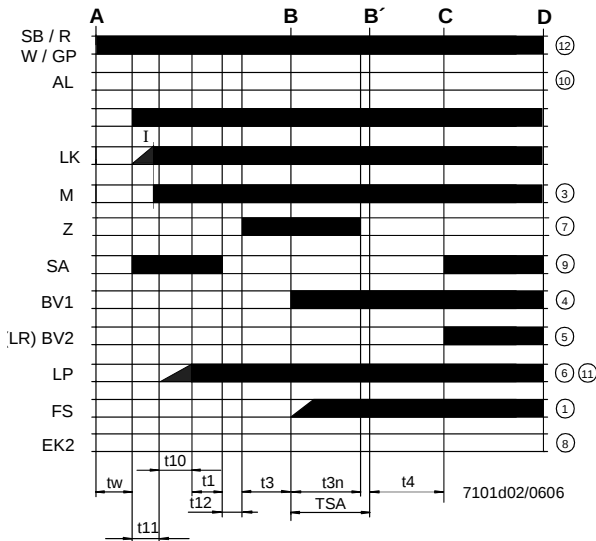
LME11 control sequence



LME21 control sequence



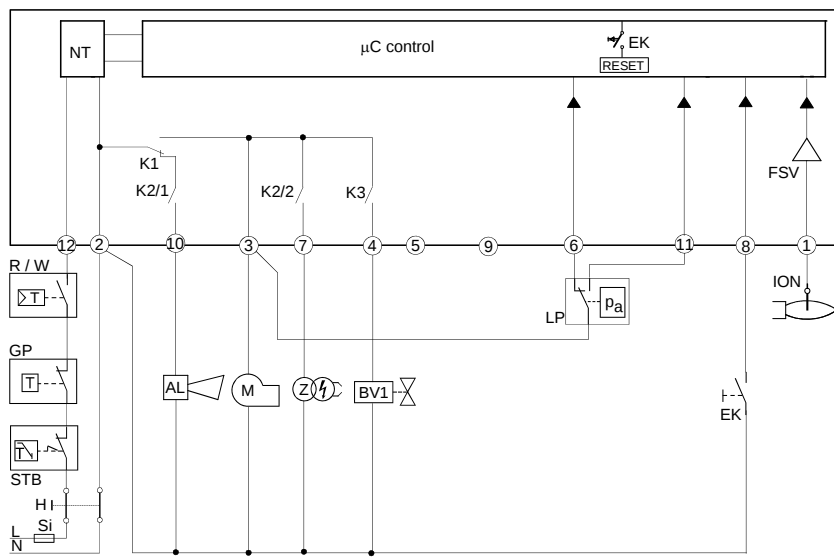
LME22 control sequence



Control sequence

- tw Waiting time
- t1 Purge time
- TSA Ignition safety time
- t3 Preignition time
- t3n Postignition time
- t4 Interval between BV1 and BV2/LR
- t10 Specified time for air pressure signal
- t11 Programmed opening time for actuator SA
- t12 Programmed closing time for actuator SA

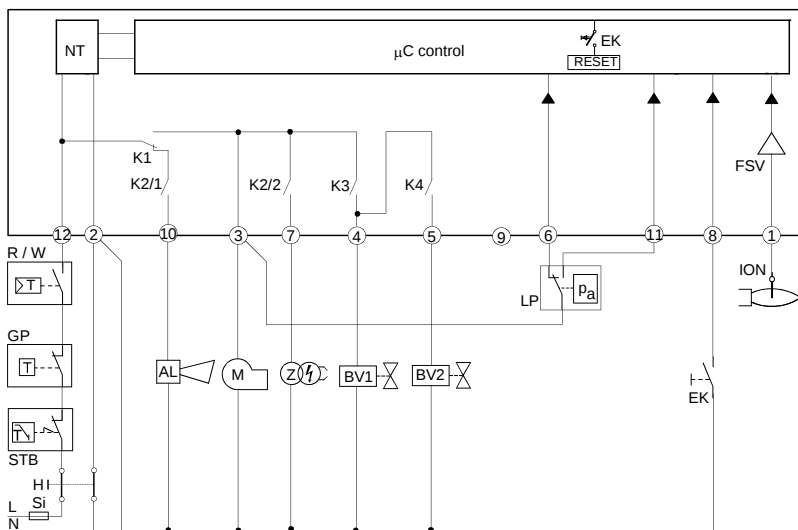
**LME11 connection diagram**



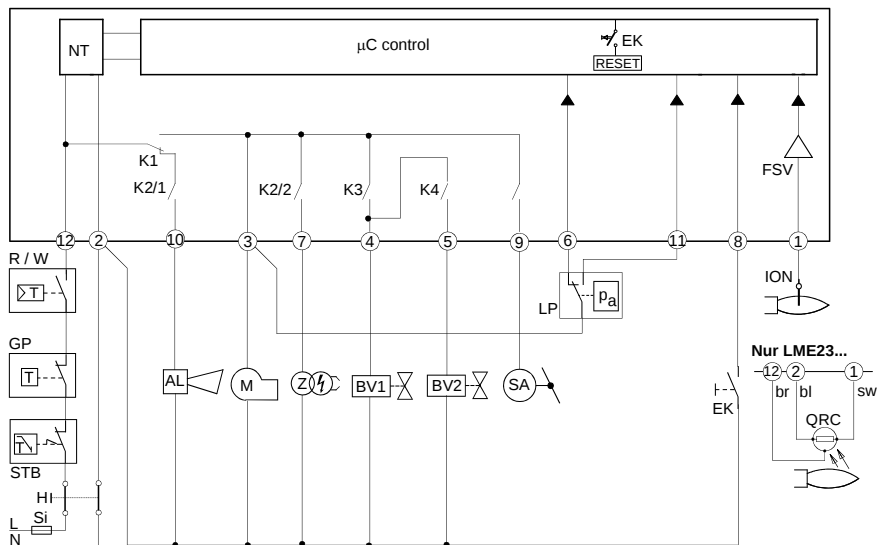
**Connection diagram**

- AL Error message (alarm)
- BV Fuel valve
- EK2 Remote lockout reset button
- FS Flame signal
- GP Gas pressure switch
- LP Air pressure switch
- LR Load controller
- M Fan motor
- R Control thermostat/pressurestat
- SB Safety limit thermostat
- W Limit thermostat /pressure switch
- Z Ignition transformer

**LME21 connection diagram**



**LME22 connection diagram**



## CONTROL PROGRAM IN THE EVENT OF FAULT

- If a fault occurs, all outputs will immediately be deactivated (in less than 1s).
- After an interruption of power, a restart will be made with the full program sequence.
- If the operating voltage drops below the undervoltage threshold, a safety shutdown is performed.
- If the operating voltage exceeds the undervoltage threshold, a restart will be performed.
- In case of extraneous light during "t1", a lockout occurs.
- In case of extraneous light during "tw", there is a prevention of startup and a lockout after 30 seconds.
- In case of no flame at the end of TSA, there will be max. 3 repetitions of the startup cycle, followed by a lockout at the end of TSA, for mod. LME11..; directly a lockout at the end of TSA for LME21-22 models.
- For LME11 model: if a loss of flame occurs during operation, in case of an establishment of flame at the end of TSA, there will be max. 3 repetitions, otherwise a lockout will occur.
- For LME21-22 models: if a loss of flame occurs during operation, there will be a lockout.
- If the contact of air pressure monitor LP is in working position, a prevention of startup and lockout after 65 seconds will occur.
- If the contact of air pressure monitor LP is in normal position, a lockout occurs at the end of t10.
- If no air pressure signal is present after completion of t1, a lockout will occur.

## CONTROL BOX LOCKED

In the event of lockout, the LME.. remains locked and the red signal lamp (LED) will light up. The burner control can immediately be reset. This state is also maintained in the case of mains failure.

## DIAGNOSTICS OF THE CAUSE OF FAULT

- Press the lockout reset button for more than 3 seconds to activate the visual diagnostics.
- Count the number of blinks of the red signal lamp and check the fault condition on the "Error code table" (the device repeats the blinks for regular intervals).

During diagnostics, the control outputs are deactivated:

- the burner remains shut down;
- external fault indication is deactivated;
- fault status is showed by the red LED, inside the LME's lockout reset button according to the "Error code table":

| ERROR CODE TABLE                 |                                                                                                                                                                                                                                                                    |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2 blinks **                      | <b>No establishment of flame at the end of TSA</b> <ul style="list-style-type: none"><li>- Faulty or soiled fuel valves</li><li>- Faulty or soiled flame detector</li><li>- Inadequate adjustment of burner, no fuel</li><li>- Faulty ignition equipment</li></ul> |
| 3 blinks ***                     | <b>The air pressure switch does not switch or remains in idle position:</b> <ul style="list-style-type: none"><li>- LP is faulty</li><li>- Loss of air pressure signal after t10</li><li>- LP is welded in normal position.</li></ul>                              |
| 4 blinks ****                    | - Extraneous light when burner starts up.                                                                                                                                                                                                                          |
| 5 blinks *****                   | - LP is working position.                                                                                                                                                                                                                                          |
| 6 blinks *****                   | Free.                                                                                                                                                                                                                                                              |
| 7 blinks *****                   | <b>Loss of flame during operation</b> <ul style="list-style-type: none"><li>- Faulty or soiled fuel valves</li><li>- Faulty or soiled flame detector</li><li>- Inadequate adjustment of burner</li></ul>                                                           |
| 8 ÷ 9 blinks                     | Free                                                                                                                                                                                                                                                               |
| 10 blinks *****                  | <b>Faulty output contacts</b><br><b>Attention: "lockout" remote signal (terminal no. 10) not enabled</b> <ul style="list-style-type: none"><li>- Wiring error</li><li>- Anomalous voltage on output terminals</li><li>- Other faults</li></ul>                     |
| 14 blinks ***** (only for LME4x) | - CPI contact (gas valve microswitch) not closed.                                                                                                                                                                                                                  |

## RESETTING THE BURNER CONTROL

When lockout occurs, the burner control can immediately be reset, by pressing the lockout reset button for about 1..3 seconds. The LME.. can only be reset when all contacts in the line are closed and when there is no undervoltage.

## LIMITATION OF REPETITIONS (only for LME11.. model)

If no flame is established at the end of TSA, or if the flame is lost during operation, a maximum of 3 repetitions per controller startup can be performed via "R", otherwise lockout will be initiated. Counting of repetitions is restarted each time a controlled startup via "R" takes place.

**⚠ Condensation, formation of ice and ingress of water are not permitted!**

## TECHNICAL CHARACTERISTICS

|                                             |                                            |
|---------------------------------------------|--------------------------------------------|
| Mains voltage                               | 120V AC +10% / -15%<br>230V AC +10% / -15% |
| Frequency                                   | 50 ... 60 Hz +/- 6%                        |
| Power consumption                           | 12VA                                       |
| External primary fuse                       | max. 10 A (slow)                           |
| input current at terminal 12                | max. 5 A                                   |
| Detection cable length                      | max. 3m (for electrode)                    |
| Detection cable length                      | max. 20 m (laid separately, for QRA probe) |
| Reset cable length                          | max. 20 m (posato separatamente)           |
| Term. 8 & 10 cable length                   | max. 20 m                                  |
| Thermostat cable length and other terminals | max. 3 m                                   |
| Safety class                                | I                                          |
| Index of protection                         | IP40 (to be ensured during mounting)       |
| Operating conditions                        | -20... +60 °C, < 95% UR                    |
| Storage conditions                          | -20... +60 °C, < 95% UR                    |
| Weight                                      | approx. 160 g                              |



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