# KP60 - KP65
# KP72 - KP73A

## *Progressive and fully-modulating gas - heavy oil burners*

***MANUAL OF INSTALLATION - USE - MAINTENANCE***

CIB UNIGAS

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

M039193CE Rev. 4.2 10/2014

## DANGERS, WARNINGS AND NOTES OF CAUTION

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

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

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

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

### 1) GENERAL INTRODUCTION

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

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

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

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

Contact qualified personnel only.

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

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

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

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

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

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

### 2) SPECIAL INSTRUCTIONS FOR BURNERS

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

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

a Remove the power supply by disconnecting the power cord from the mains.

b) Disconnect the fuel supply by means of the hand-operated shut-off valve and remove the control handwheels from their spindles.

**Special warnings**

- Make sure that the burner has, on installation, been firmly secured to the appliance, so that the flame is generated inside the appliance firebox.
- Before the burner is started and, thereafter, at least once a year, have qualified personnel perform the following operations:

a set the burner fuel flow rate depending on the heat input of the appliance;

b set the flow rate of the combustion-supporting air to obtain a combustion efficiency level at least equal to the lower level required by the regulations in force;

c check the unit operation for proper combustion, to avoid any harmful or polluting unburnt gases in excess of the limits permitted by the regulations in force;

d make sure that control and safety devices are operating properly;

e make sure that exhaust ducts intended to discharge the products of combustion are operating properly;

f on completion of setting and adjustment operations, make sure that all mechanical locking devices of controls have been duly tightened;

g make sure that a copy of the burner use and maintenance instructions is available in the boiler room.

- In case of a burner shut-down, reser 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 saftey 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 2009/142/EC - Gas Appliances;
- Directive 2006/95/EC on low voltage;
- Directive 2004/108/EC on electromagnetic compatibility

**Harmonised standards :**

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

-CEI EN 60335-1(Household and similar electrical appliances - Safety. Part 1: General requirements;

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

-EN 60335-2-102 (Household and similar electrical appliances. Safety. Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections)

***Light oil burners***

**European directives:**

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

**Harmonised standards :**

-CEI EN 60335-1(Household and similar electrical appliances - Safety. Part 1: General requirements;

-UNI 267 Automatic forced draught burners for liquid fuels

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

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

**National standards :**

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

***Heavy oil burners***

**European directives:**

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

**Harmonised standards :**

-CEI EN 60335-1 Household and similar electrical appliances - SafetyPart 1: General requirements;

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

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

**National standards :**

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

***Gas - Light oil burners***

**European directives:**

- Directive 2009/142/EC - Gas Appliances;
- Directive 2006/95/EC on low voltage;
- Directive 2004/108/EC on electromagnetic compatibility

**Harmonised standards :**

-UNI EN 676 Gas Burners

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

-UNI 267 Automatic forced draught burners for liquid fuels

-CEI EN 60335-1(Household and similar electrical appliances - Safety. Part 1: General requirements;

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

**National standards :**

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

***Gas - Heavy oil burners***

**European directives:**

- Directive 2009/142/EC - Gas Appliances;
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- EN 50165 Electrical equipment of non-electric appliances for household and similar purposes. Safety requirements.

**National standards :**

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

***Industrial burners***

**European directives:**

- Directive 2009/142/EC - Gas Appliances;
- Directive 2006/95/EC on low voltage;
- Directive 2004/108/EC on electromagnetic compatibility

**Harmonised standards :**

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

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

-UNI EN 746-2: Industrial thermoprocessing equipment

## Burner data plate

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

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

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

**SYMBOLS USED**

***WARNING!***

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

***DANGER!***

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

***WARNING!***

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

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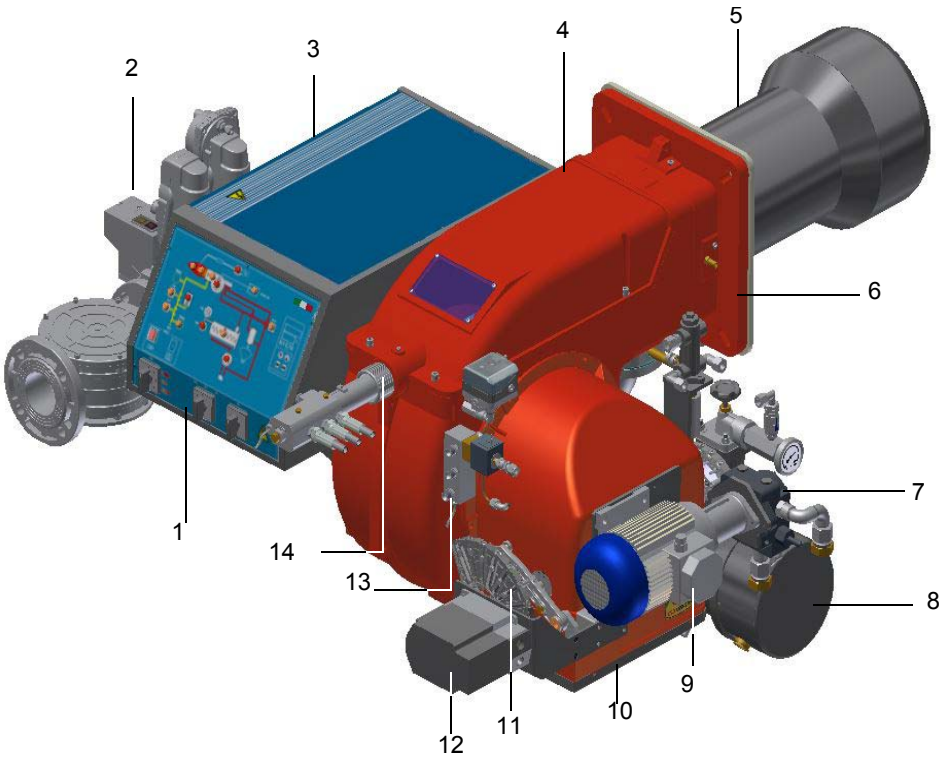
# PART I: INSTALLATION MANUAL

## *Burner model identification*

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

| Type | **KP60** | Model | **MN.** | **MD.** | **S.** | **.** | **A.** | **1.** | **60** |
|---|---|---|---|---|---|---|---|---|---|
| | **(1)** | | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** | **(8)** |

| | |
|---|---|
| (1) BURNER TYPE | **KP60 - KP65 - KP72 - KP73A** |
| (2) FUEL | M - Natural gas<br>N - Heavy oil, viscosity <= 50cSt (7° E) @ 50° C<br>E - Heavy oil, viscosity <= 110cSt (15°E) @ 50° C<br>D - Heavy oil, viscosity <= 400cSt (50° E) @ 50° C<br>P - Petroleum, viscosity 89cSt (12° E) @ 50° C<br>H = heavy oil, viscosity <= 4000cSt (530°E) a 50°C |
| (3) OPERATION | PR - Progressive<br>MD - Fully modulating |
| (4) BLAST TUBE | S - Standard |
| (5) 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+high gas pressure switch<br>8 = 2 Gas valves + gas proving system+high gas pressure switchl |
| (8) GAS CONNECTION | 40 = $Rp1_{1/2}$ 50 = Rp2 65 = DN65 80 = DN80 |




Note: the figure is indicative only

Keys
1 Mimic panel with startup switch
2 Gas train
3 Electrical panel
4 Cover
5 Blast tube - Combustion head
6 Flange
7 Pump
8 Preheater Tank
9 Motor Pump
10 Air intake
11 Adjusting cams
12 Actuator
13 Oil manifold
14 Head adjusting ring nut

## *Specifications*

| BURNERS | | KP60 |
|---|---|---|
| Output | min. kW - max. kW | 160 - 880 |
| Fuel | | Natural gas - Heavy oil |
| Gas category | | (see next paragraph) |
| Heavy oil viscosity | | See “Burner model identification” table |
| Oil train inlet pressure | bar | 2 max |
| Gas rate | min. - max. ($Stm^3/h$) | 17 - 93 |
| Gas pressure | min. - max. mbar | (Note2) |
| Heavy oil rate | min. - max. kg/h | 14 - 77 |
| Power supply | | 400V 3N ~ 50Hz |
| Total power consumption (Heavy oil) | kW | 6.65 |
| Fan motor | kW | 1.1 |
| Pump motor | kW | 0.55 |
| Pre-heater resistors (heavy oil) | kW | 4.5 |
| Protection | | IP40 |
| Operation | | Progressive - Fully modulating |
| Gas Train 40 | Valves size/Gas connection | 40 / $Rp1_{1/2}$ |
| Gas Train 50 | Valves size/Gas connection | 50 / Rp 2 |
| Gas Train 65 | Valves size/Gas connection | 65 / DN65 |
| Gas Train 80 | Valves size/Gas connection | 80 / DN80 |
| Operating temperature | °C | -10 ÷ +50 |
| Storage temperature | °C | -20 ÷ +60 |
| Working service * | | Intermitent |

| | |
|---|---|
| **Note1:** | **All gas flow rates are referred to $Stm^3/h$ (1013 mbar absolute pressure, 15 °C temperature) and are valid for G20 gas (net calorific value $H_i$ = 34.02 $MJ/Stm^3$).** |
| **Note2:** | **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.** |

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

| BURNERS | | KP72 ..0.xx | KP72 ..1.xx | KP73A |
|---|---|---|---|---|
| Output | min. kW - max. kW | 330 - 1200 | 330 - 1550 | 320 - 2300 |
| Fuel | | Natural gas - Heavy oil | | |
| Gas category | | (see next paragraph) | | |
| Heavy oil viscosity | | See “Burner model identification” table | | |
| Oil train inlet pressure | bar | 2 max | | |
| Gas rate | min. - max. ($Stm^3/h$) | 35 - 127 | 35 - 164 | 34 - 243 |
| Gas pressure | min. - max. mbar | (Note2) | | |
| Heavy oil rate | min. - max. kg/h | 29 - 107 | 29 - 138 | 28 - 205 |
| Power supply | | 400V 3N ~ 50Hz | | |
| Total power consumption (Heavy oil) | kW | 11.25 | 11.25 | 16.6 |
| Total power consumption (Petroleum) | kW | 7.75 | 7.75 | 12.6 |
| Fan motor | kW | 2.2 | 2.2 | 3 |
| Pump motor | kW | 0.55 | 0.55 | 1.1 |
| Pre-heater resistors (heavy oil) | kW | 8 | 8 | 12 |
| Pre-heater resistors (Petroleum) | kW | 4.5 | 4.5 | 8 |
| Protection | | IP40 | | |
| Operation | | Progressive - Fully modulating | | |
| Gas Train 50 | Valves size / Gas connection | 50 / Rp 2 | | |
| Gas Train 65 | Valves size / Gas connection | 65 / DN65 | | |
| Gas Train 80 | Valves size / Gas connection | 80 / DN80 | | |
| Operating temperature | °C | -10 ÷ +50 | | |
| Storage temperature | °C | -20 ÷ +60 | | |
| Working service | | Intermitent | | |

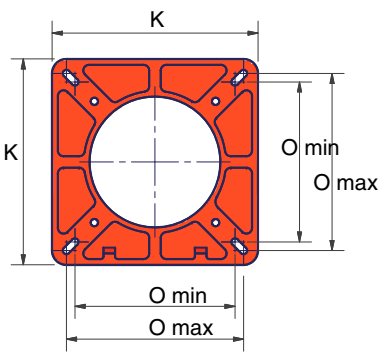
| | |
|---|---|
| **Note1:** | **All gas flow rates are referred to $Stm^3/h$ (1013 mbar absolute pressure, 15 °C temperature) and are valid for G20 gas (net calorific value $H_i$ = 34.02 $MJ/Stm^3$).** |
| **Note2:** | **Maximum gas pressure = 360mbar (with Dungs MBDLE/MBC valves)**<br>**= 500mbar (with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

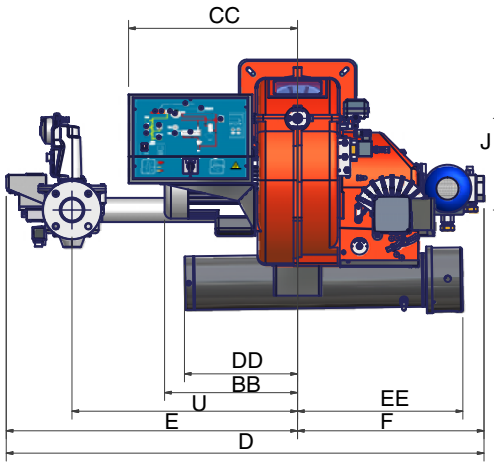
*** NOTE ON THE WORKING SERVICE: the control box automatically stops after 24h of continuous working. The control box immediately starts up, automatically.**

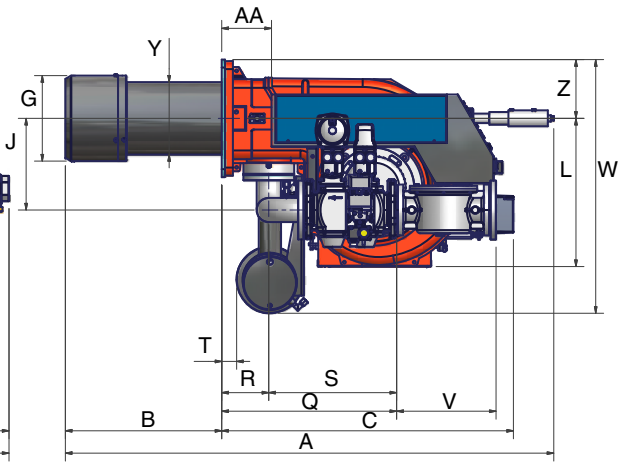
### *Country and usefulness gas categories*

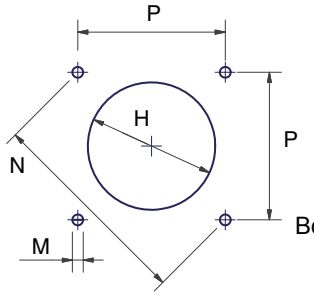
| GAS CATEGORY | COUNTRY | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $I_{2H}$ | AT | ES | GR | SE | FI | IE | HU | IS | NO | CZ | DK | GB | IT | PT | CY | EE | LV | SI | MT | SK | BG | LT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

## *Overall dimensions (mm)*



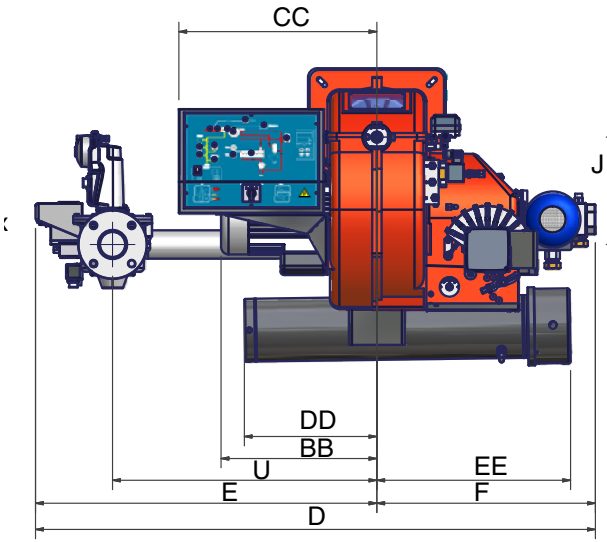



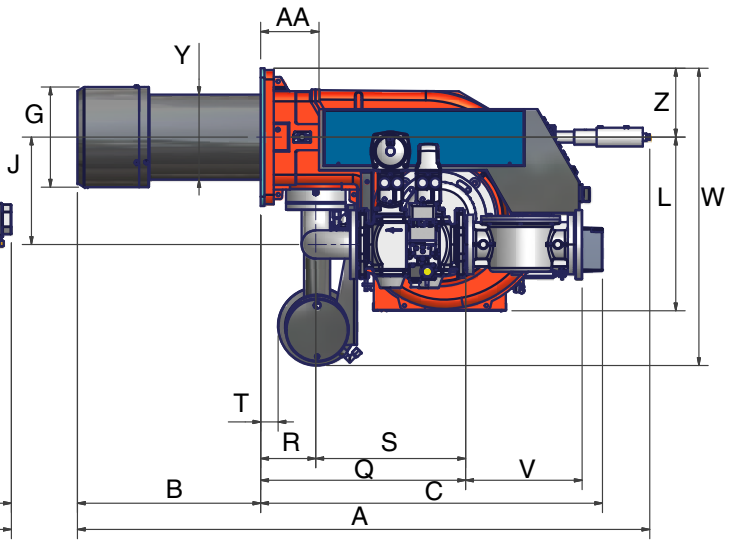

Boiler recommended drilling template

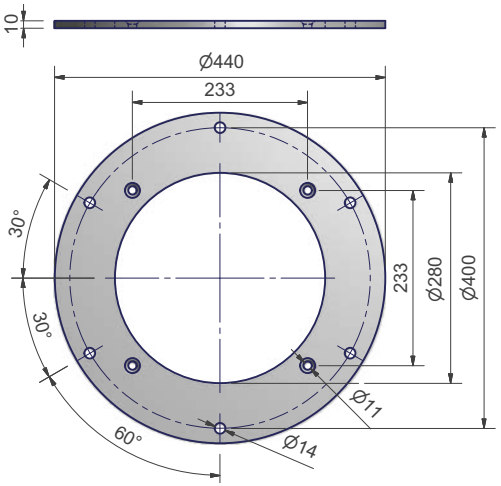
| | DN | A | AA | B | BB | C | CC | D | DD | E | EE | F | G | H | J | K | L | M | N | Omin | Omax | P | Q | R | S | T | U | V | W | Y | Z |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **KP60** | 40 | 1112 | - | 376 | - | 736 | - | 1040 | - | 500 | - | 540 | 250 | 280 | 210 | 240 | - | M10 | 269 | 190 | 190 | 190 | - | - | - | - | - | - | - | 190 | - |
| **KP60** | 50 | 1112 | - | 376 | - | 736 | - | 1040 | - | 500 | - | 540 | 250 | 280 | 210 | 240 | - | M10 | 269 | 190 | 190 | 190 | - | - | - | - | - | - | - | 190 | - |
| **KP60** | 65 | 1112 | - | 376 | - | 736 | - | 1225 | - | 685 | - | 540 | 250 | 280 | 250 | 240 | - | M10 | 269 | 190 | 190 | 190 | - | - | - | - | - | - | - | 190 | - |
| **KP65** | 50 | 1129 | - | 335 | - | 794 | - | 1100 | - | 580 | - | 520 | 250 | 280 | 230 | 300 | - | M10 | 330 | 216 | 250 | 233 | - | - | - | - | - | - | - | 198 | - |
| **KP65** | 65 | 1129 | - | 335 | - | 794 | - | 1230 | - | 710 | - | 520 | 250 | 280 | 265 | 300 | - | M10 | 330 | 216 | 250 | 233 | - | - | - | - | - | - | - | 198 | - |
| **KP65** | 80 | 1129 | - | 335 | - | 794 | - | 1245 | - | 725 | - | 520 | 250 | 280 | 265 | 300 | - | M10 | 330 | 216 | 250 | 233 | - | - | - | - | - | - | - | 198 | - |
| **KP73A** | 50 | 1320 | 140 | 500 | 373 | 830 | 495 | 1378 | 475 | 838 | 400 | 540 | 234 | 264 | 226 | 300 | 375 | M10 | 330 | 216 | 250 | 233 | 400 | 130 | 270 | 10 | 610 | 216 | 635 | 212 | 150 |
| **KP73A** | 65 | 1320 | 140 | 500 | 373 | 830 | 495 | 1302 | 475 | 762 | 400 | 540 | 234 | 264 | 275 | 300 | 375 | M10 | 330 | 216 | 250 | 233 | 400 | 130 | 270 | 10 | 565 | 313 | 635 | 212 | 150 |
| **KP73A** | 80 | 1320 | 140 | 500 | 373 | 830 | 495 | 1308 | 475 | 764 | 400 | 540 | 234 | 264 | 275 | 300 | 375 | M10 | 330 | 216 | 250 | 233 | 400 | 130 | 270 | 10 | 565 | 344 | 635 | 212 | 150 |

*DN = gas valves size

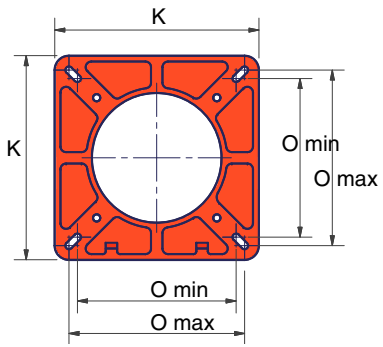
NOTE: the overall dimensions are referred to burners provided with Siemens VGD valves.



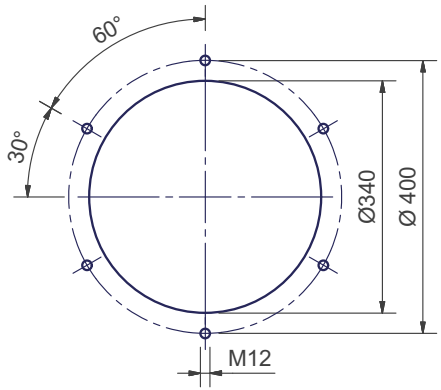




Reccomended counterflange




Burner flange




Boiler recommended drilling template

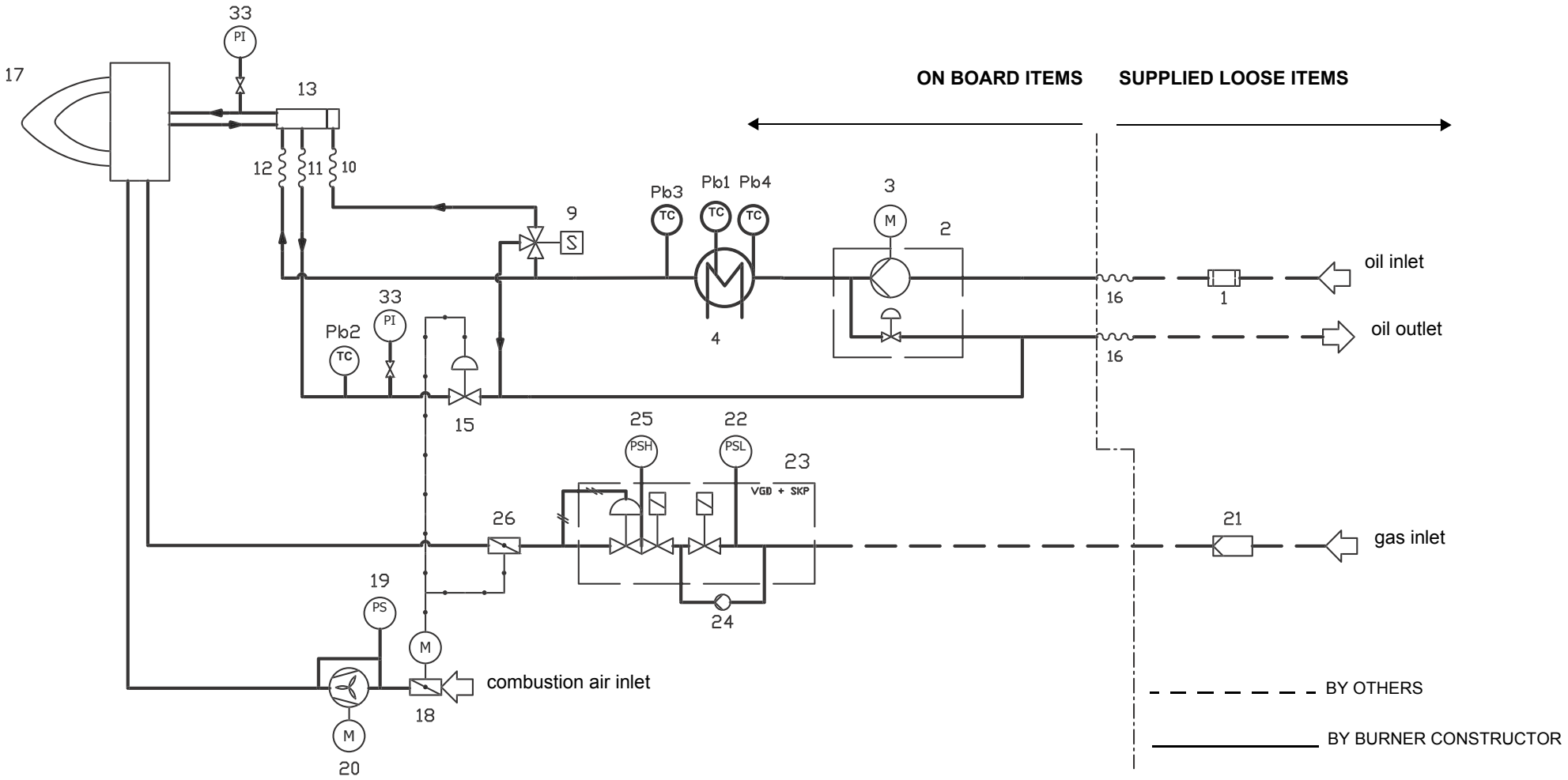
| | *DN | A | AA | B | BB | C | CC | D | DD | E | EE | F | G | H | J | K | L | M | Omin | Omax | Q | R | S | T | U | V | W | Y | Z |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **KP72 xx-...0.** | 50 | 1299 | - | 505 | - | 794 | - | 1100 | - | 580 | - | 520 | 300 | 340 | 230 | 300 | - | M12 | 216 | 250 | - | - | - | - | - | - | - | 211 | - |
| **KP72 xx-...0.** | 65 | 1299 | - | 505 | - | 794 | - | 1230 | - | 710 | - | 520 | 300 | 340 | 265 | 300 | - | M12 | 216 | 250 | - | - | - | - | - | - | - | 211 | - |
| **KP72 xx-...0.** | 80 | 1299 | - | 505 | - | 794 | - | 1245 | - | 725 | - | 520 | 300 | 340 | 265 | 300 | - | M12 | 216 | 250 | - | - | - | - | - | - | - | 211 | - |
| **KP72 xx-...1.** | 50 | 1299 | - | 505 | - | 794 | - | 1225 | - | 705 | - | 520 | 300 | 340 | 230 | 300 | - | M12 | 216 | 250 | - | - | - | - | - | - | - | 211 | - |
| **KP72 xx-...1.** | 65 | 1299 | - | 505 | - | 794 | - | 1340 | - | 810 | - | 520 | 300 | 340 | 265 | 300 | - | M12 | 216 | 250 | - | - | - | - | - | - | - | 211 | - |
| **KP72 xx-...1.** | 80 | 1299 | - | 505 | - | 794 | - | 1345 | - | 825 | - | 520 | 300 | 340 | 265 | 300 | - | M12 | 216 | 250 | - | - | - | - | - | - | - | 211 | - |

*DN = gas valves size

A COUNTERFLANGE IS MANDATORY:a gasket must be placed between the generator and the counterflange

NOTE: the overall dimensions are referred to burners provided with Siemens VGD valves.

Fig. 1 - 3I2MD11 v1 **Hydraulic diagram**

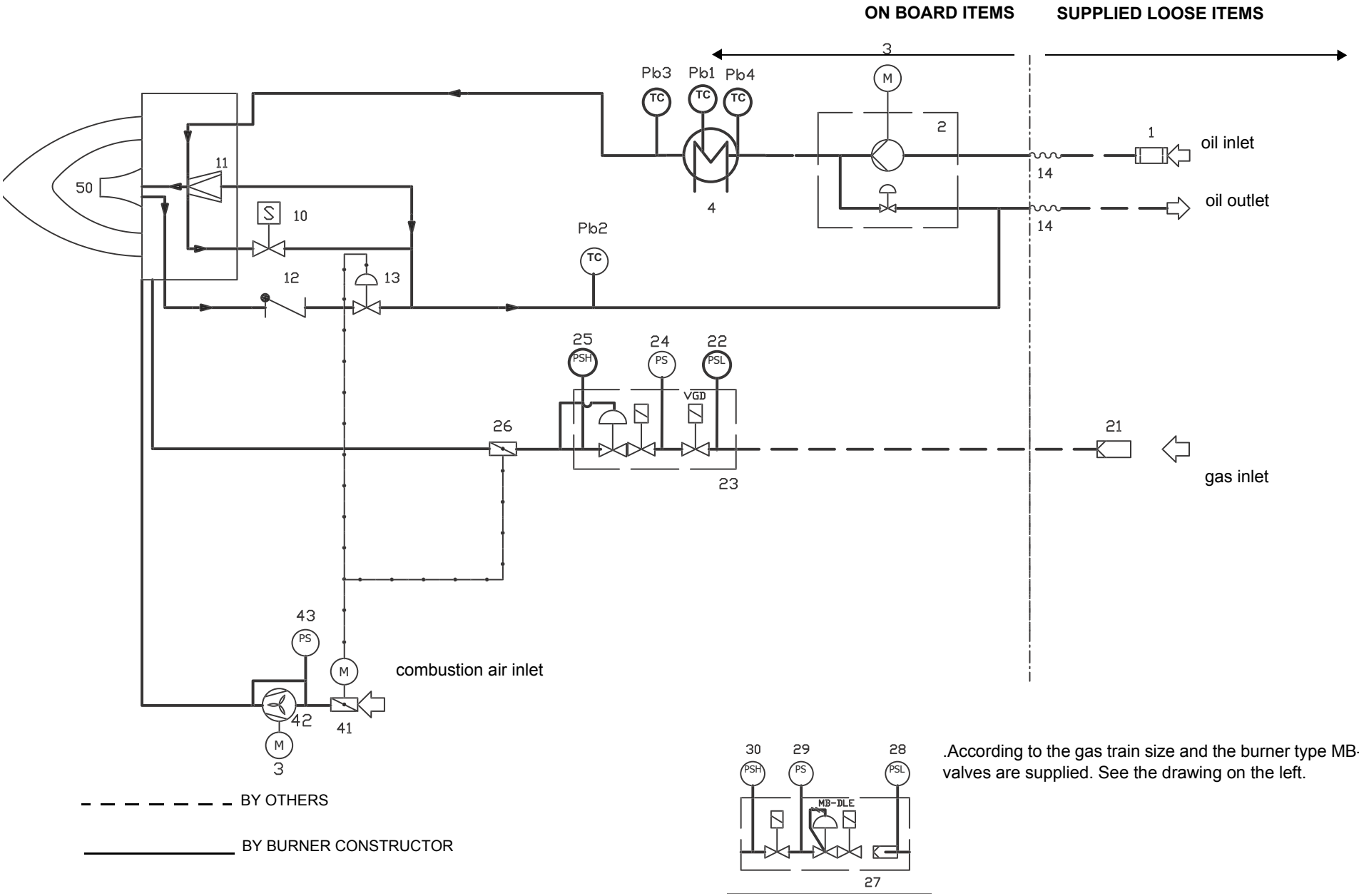


| 3LMMD11 rev.1 | LEGEND |
|---|---|

| POS | OIL TRAIN |
|---|---|
| 1 | Filter |
| 2 | Pump and pressure governor |
| 3 | Electrical motor |
| 33 | Pressure gauge with manual valve |
| 4 | Electrical preheater tank |
| Pb4 | Temperature probe |
| Pb1 | Temperature probe |
| Pb3 | Temperature probe |
| 9 | 3-way solenoid valve |
| 10 | Flexible hose |
| 11 | Flexible hose |
| Pb2 | Temperature probe |
| 13 | Oil distributor |
| 14 | Low thermostat - TCI |
| 15 | Pressure governor |
| 16 | Flexible hose |
| 17 | Burner |
| | **COMBUSTION AIR TRAIN** |
| 18 | Air damper with actuator |
| 19 | Pressure switch - PA |
| 20 | Draught fan with electromotor |
| | **MAIN GAS TRAIN** |
| 21 | Filter |
| 22 | Pressure switch - PGMIN |
| 23 | Safety valve with built in gas governor |
| 24 | Proving system |
| 25 | Pressure switch - PGMAX |
| 26 | Butterfly valve |

**NOTE** POS 25 is an optional supply

Fig. 2 - 3I2MD21 v1 **Hydraulic diagram**

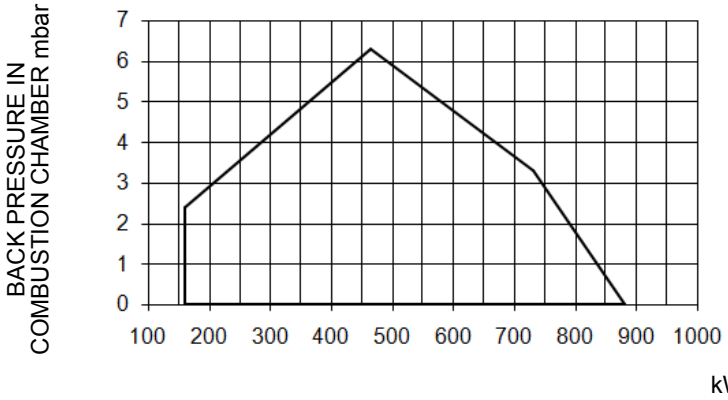


| 3LMMD21 rev.1 | LEGEND |
|---|---|
| **POS** | **OIL TRAIN** |
| 1 | Filter |
| 2 | Pump and pressure governor |
| 3 | Electrical motor |
| 4 | Electrical preheater tank |
| Pb4 | Temperature probe |
| Pb1 | Temperature probe |
| Pb3 | Temperature probe |
| 10 | Solenoid valve |
| 11 | Nozzle shut off needle |
| Pb2 | Temperature probe |
| 12 | One way valve |
| 13 | Pressure governor |
| 14 | Flexible hose |
| | **COMBUSTION AIR TRAIN** |
| 41 | Air damper with actuator |
| 43 | Pressure switch - PA |
| 42 | Draught fan with electromotor |
| | **MAIN GAS TRAIN** |
| 21 | Filter |
| 22 | Pressure switch - PGMIN |
| 23 | Safety valve with built in gas governor |
| 24 | Proving system pressure switch - PGCP |
| 25 | Pressure switch - PGMAX |
| 26 | Butterfly valve |
| 26 | Pressure switch - PGMIN |
| 27 | Safety valve with built in gas governor |
| 28 | Pressure switch - PGMIN |
| 29 | Proving system pressure switch - PGCP |
| 30 | Pressure switch - PGMAX |

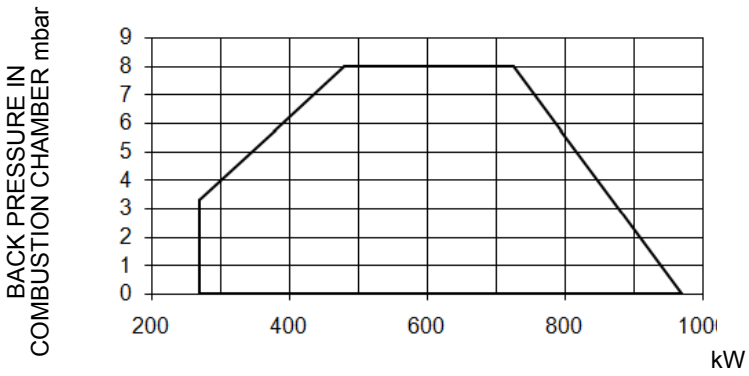
**NOTE** POS 25,30 are optional supply

## *Performance curves*

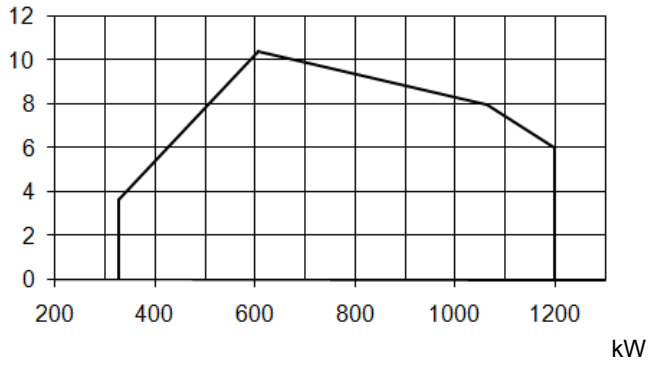
**KP60**



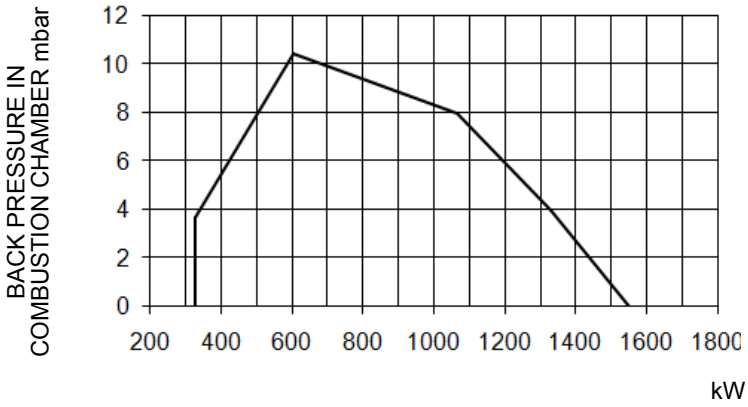

**KP65**



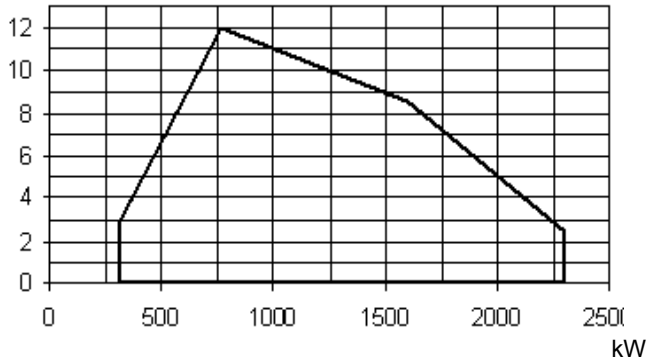

**KP72 ...0.xx**




**KP72 ...1.xx**




**KP73A ...1.xx**



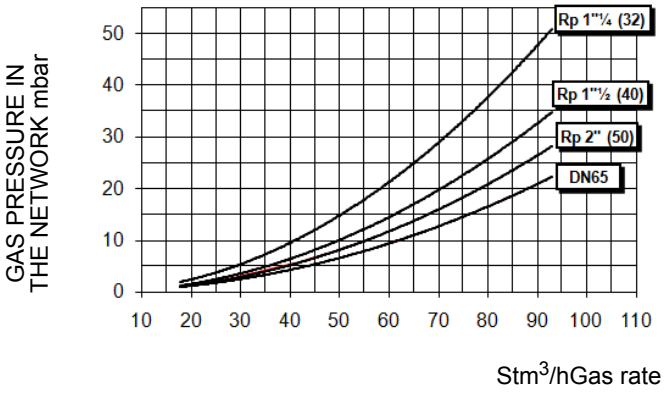

To get the output in kcal/h, multiply value in kW by 860.

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

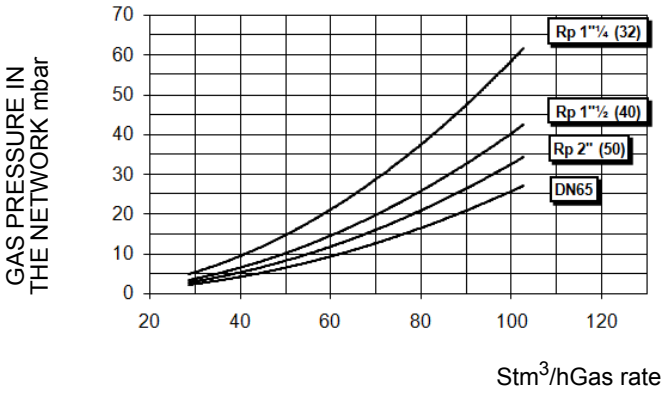
**NOTE:** The performance curve is a diagram that represents the burner performance in the type approval phase or in the laboratory tests, but does not represent the regulation range of the machine. On this diagram the maximum output point is usually reached by adjsuting the combustion head to its “MAX”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

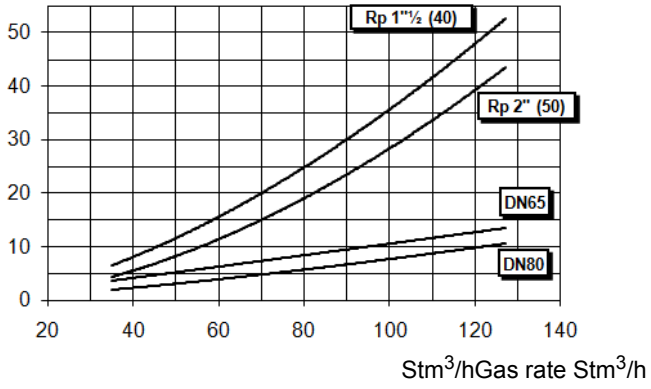
**KP60**



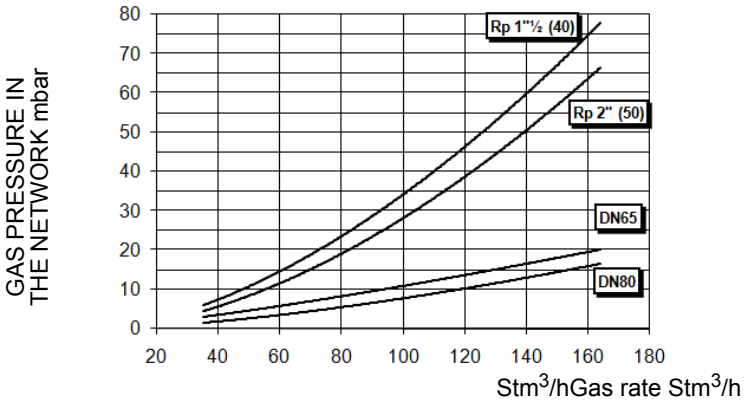

**KP65**



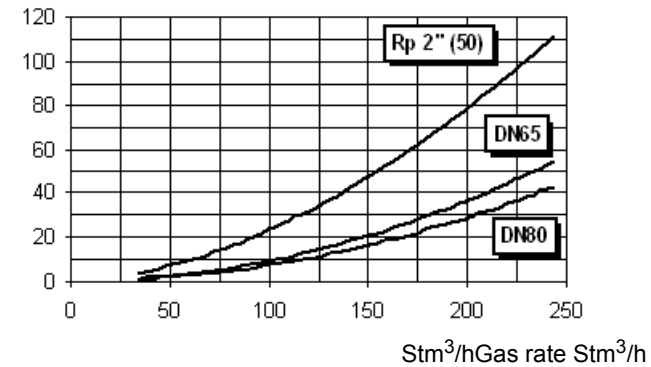

**KP72 ...0.xx**




**KP72 ...1.xx**




**KP73A ...1(8).xx**




***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.***

### *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 $O_2$ 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. 3, 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.

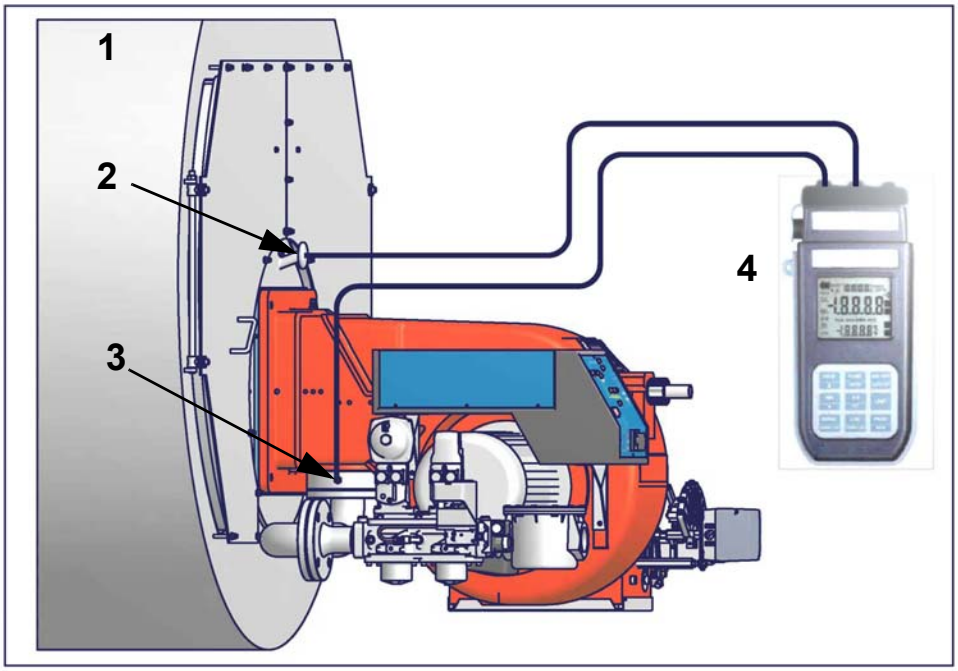



Fig. 3

**Key**

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

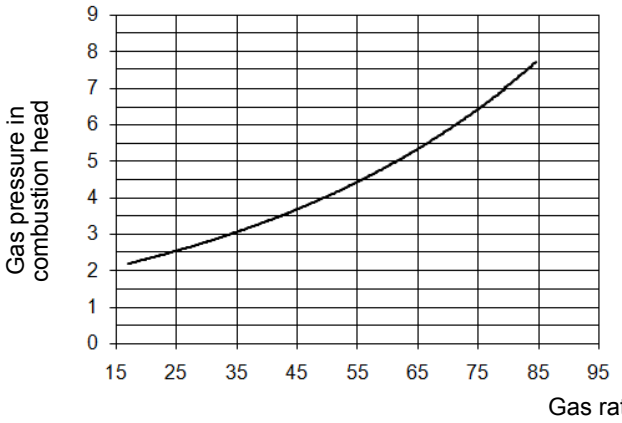
### *Measuring the gas pressure in the combustion head*

In order to measure the pressure in the combustion head, insert the pressure gauge probes: one into the combustion chamber's pressure outlet to get the pressure in the combustion chamber and the other one into the butterfly valve's pressure outlet of the burner. 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 $Stm^3/h$ (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.

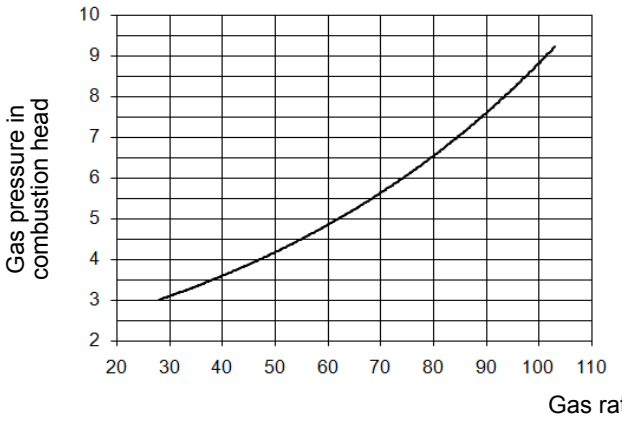
**NOTE: THE PRESSURE-RATE CURVES ARE GIVEN AS INFORMATION ONLY; FOR A PROPER SETTING OF THE GAS RATE, PLEASE REFER TO THE GAS METER READING.**

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

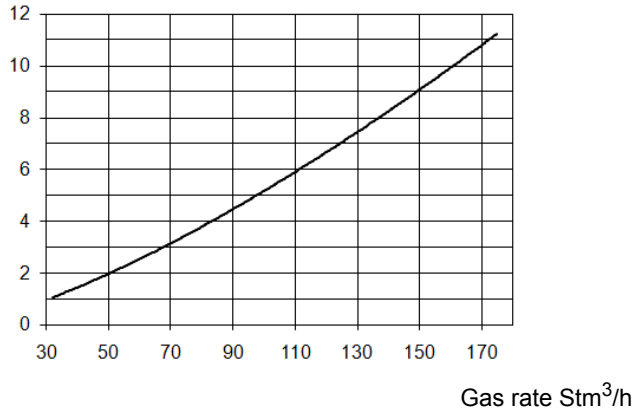
**KP60 ...**



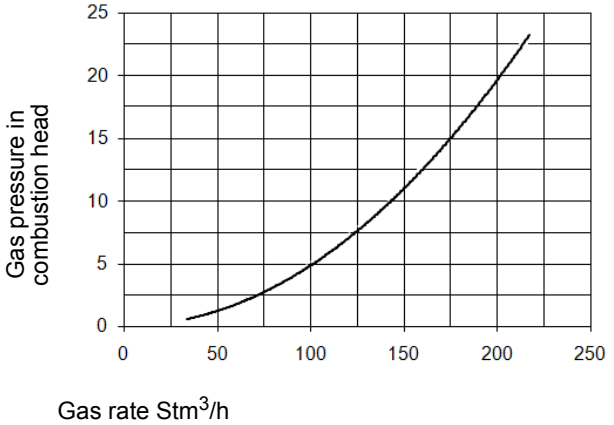

**KP65**




**KP72**



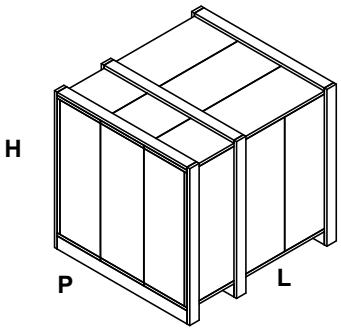

**KP73**



## MOUNTINGS AND CONNECTIONS

### *Packing*

The burners are despatched in cardboard boxes or wooden cages whose dimensions are:
1730mmx 1280mm x 1020mm (L x P x H)
Packing cases of this kind are affected by humidity and are not suitable for stacking. The following are placed in each packing case:



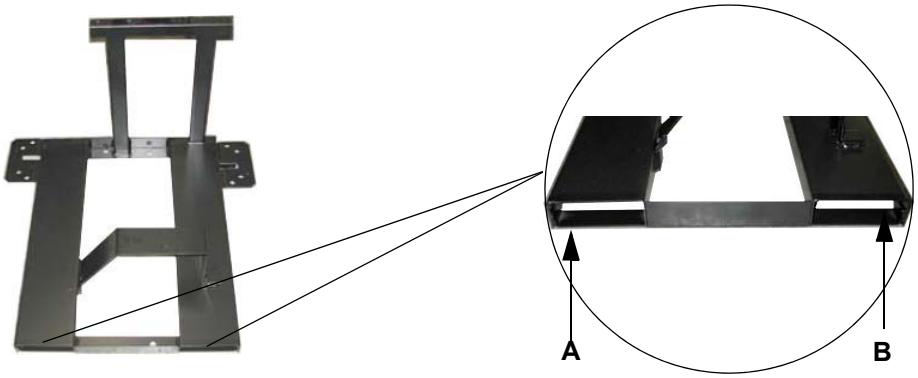

- burner with gas train detached;
- gasket to be inserted between the burner and the boiler;
- flexible oil pipes;
- oil filter;
- envelope containing this manual

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

### *Handling the burner*

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

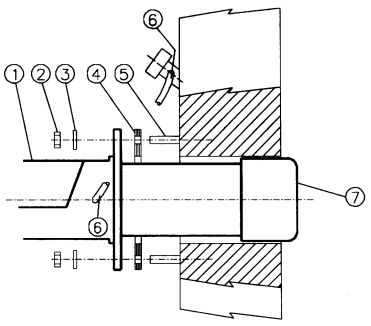
The burner is mounted on a stirrup provided for handling the burner by means of a fork lift truck: the forks must be inserted into the A anb B ways. Remove the stirrup only once the burner is installed to the boiler.




### *Fitting the burner to the boiler*

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

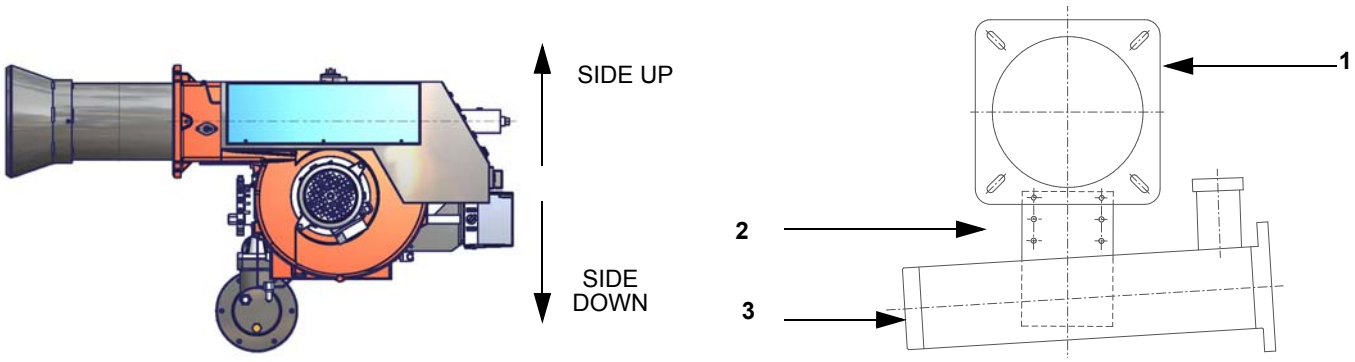
1 make a hole on the closing door of the combustion chamber as described on paragraph "Overall dimensions")
2 place the burner to the boiler: lift it up and handle it according to the procedure described on paragraph "Handling the burner";
3 place the stud bolts (5) on boiler's door, according to the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




**Keys**

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

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




**Key**

1 Burner flange (upper side indicated)

2 Bracket

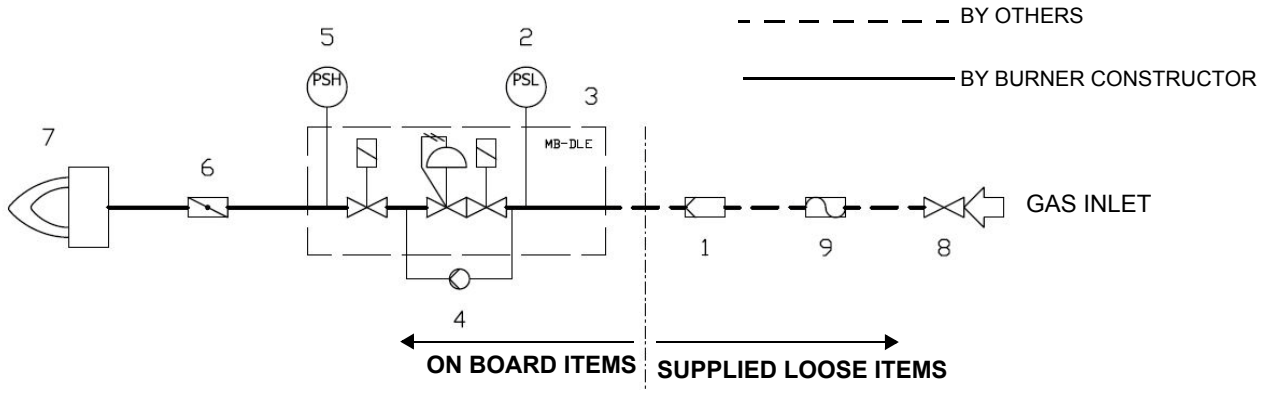
3 Pre-heating tank on the burner

## GAS TRAIN CONNECTIONS

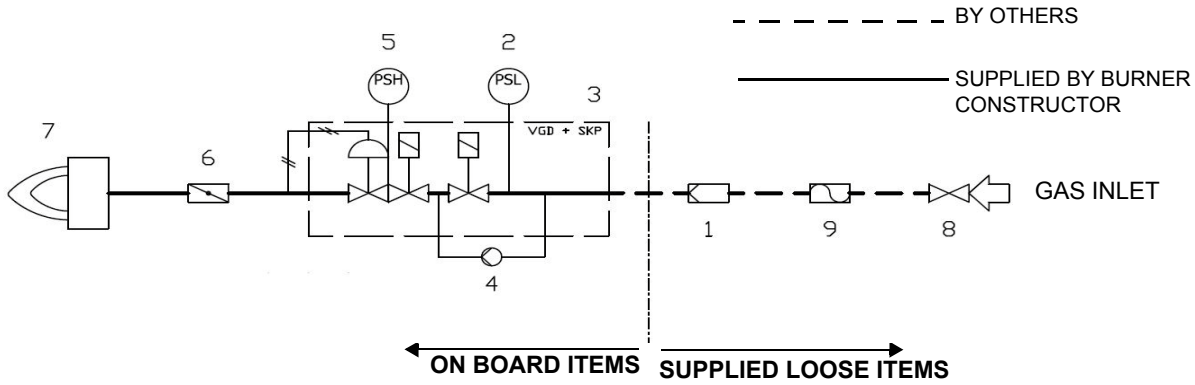
The diagrams show the components of the gas trai included in the delivery and which must be fitted by the installer.The diagrams are in compliance with the current laws.

***ATTENTION: BEFORE EXECUTING THE CONNECTIONS TO THE GAS PIPE NETWORK, BE SURE THAT THE MANUAL CUTOFF VALVES ARE CLOSED.***

Gas train with valves group MB-DLE (2 valves + gas filter + pressure governor) + VPS504 gas proving system




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




Key

| | | | |
|---|---|---|---|
| 1 | Filter (*optional) | 6 | Butterfly valve |
| 2 | Pressure switch - PGMIN | 7 | Main burner |
| 3 | Safety valve with built in gas governor | 8 | Manual valve(*optional) |
| 4 | Proving system | 9 | Bellows unit(*optional) |
| 5 | Pressure switch - PGMAX (*optional) | | |

### *Assembling the gas grain*

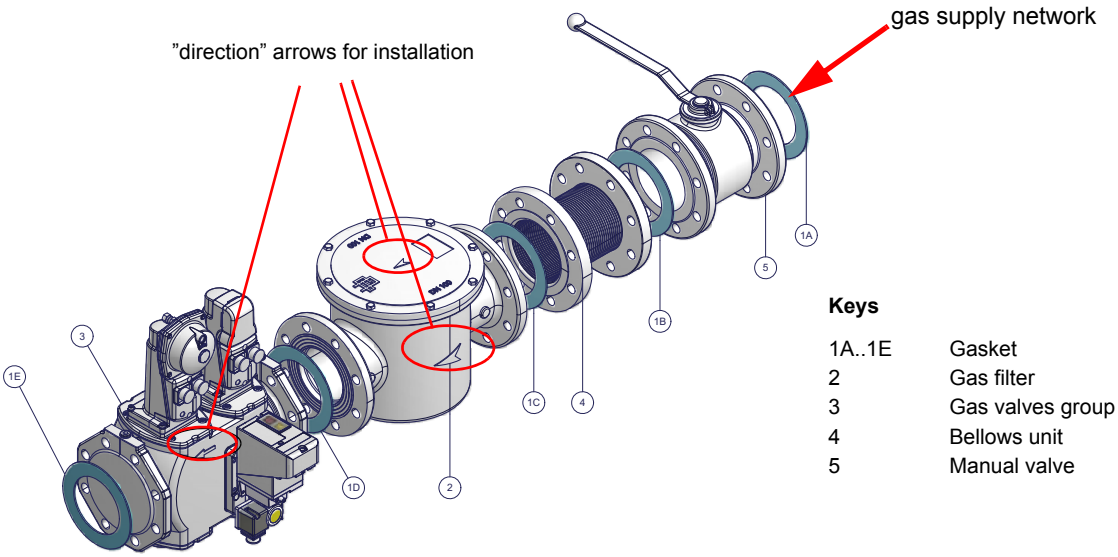



Fig. 4 - Example of gas train

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. 4) 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 on Fig. 4, the gas proving test mus be performed, according to the procedure set by the laws in force. |

⚠ ***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).***

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

- threaded gas trains with Multibloc Dungs MB-DLE or MBC700SE or Siemens VGD20..
- flanged gas trains with Multibloc Dungs MBC1900-3100-5000SE or Siemens VGD40..

**MULTIBLOC DUNGS MB-DLE 415..420**

**Mounting**

1. Loosen screws A and B **do not** unscrew (Fig. 5 - Fig. 6).
2. unscrew screws C and D (Fig. 5 - Fig. 6).
3. Remove MultiBloc between the threaded flanges (Fig. 6).
4. After mounting, perform leakage and functional tests.

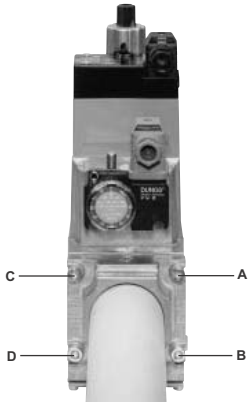



Fig. 5

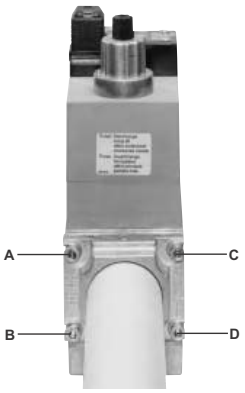



Fig. 6

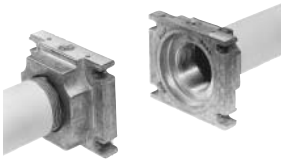


Fig. 7

MOUNTING POSITIONS

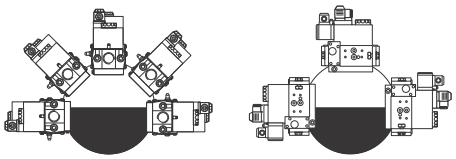


Fig. 8

### *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. 7).***

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

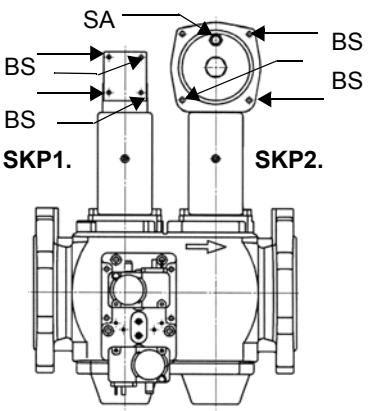



Fig. 9

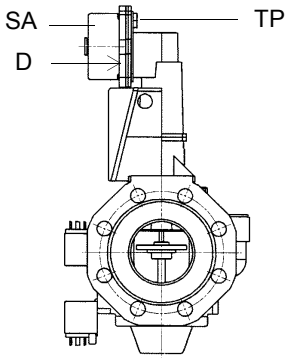
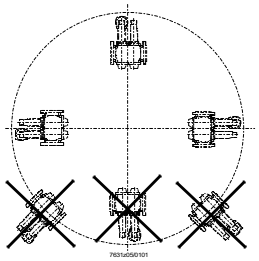



Fig. 10



SIEMENS VGD..MOUNTING POSITIONS

Fig. 11

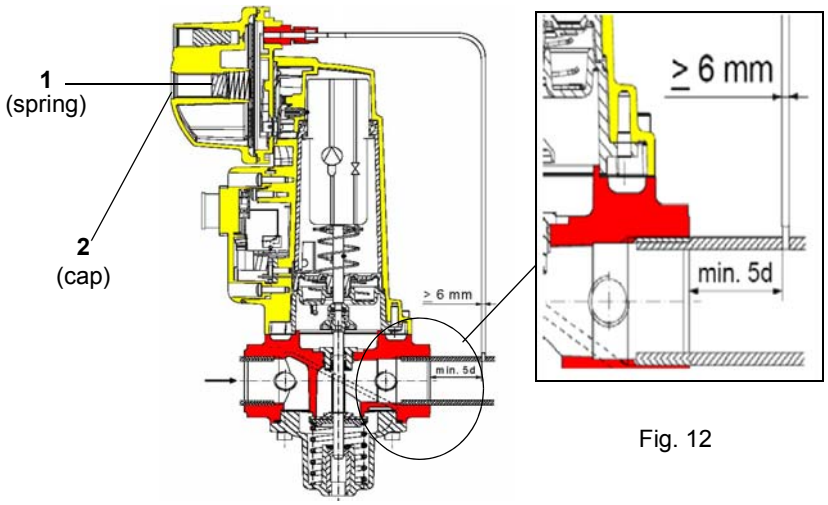



Fig. 12

**Siemens VGD valves with SKP actuator :**

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

| | | | |
|---|---|---|---|
| ***Performance range (mbar)*** | 0 - 22 | 15 - 120 | 100 - 250 |
| ***Spring colour*** | neutral | yellow | red |

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

**ATTENTION:** once the gas train is mounted according to the diagram on Fig. 4, the gas proving test mus be performed, according to the procedure set by the laws in force.

### *Double-pipe and single-pipe system*

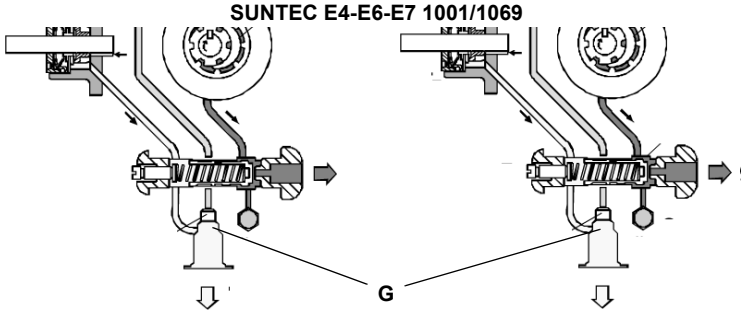
The pumps that are used can be installed both into single-pipe and double-pipe systems.

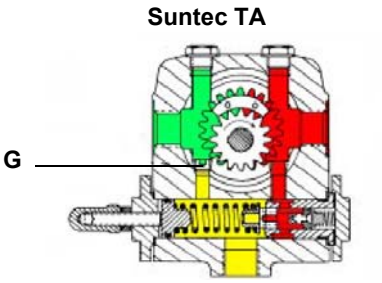
**Single-pipe system:** a single pipe drives the oil from the tank to the pump's inlet. Then, from the pump, the pressurised oil is driven to the nozzle: a part comes out from the nozzle while the othe part goes back to the pump. In this system, the by-pass pulg, if provided, must be removed and the 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 pum'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 decribed before.To change from a 1-pipe system to a 2-pipe-system, insert the by-pass plug **G** (as for ccw-rotation- referring to the pump shaft).

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




### *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*

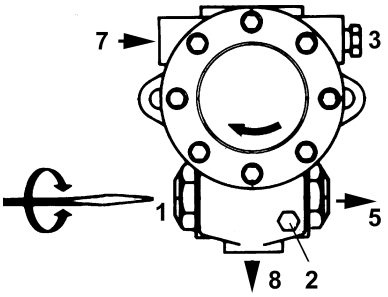
- Make sure that the by-pass plug is not used in a single pipe installation, because the fuel unit will not function properly and damage to the pump and burner motor could result.
- Do not use fuel with additives to avoid the possible formation over time of compounds which may deposit between the gear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

**KP60 - KP65 - KP72:**

- **Pumps for heavy-oil viscosity up to 7° E at 50° C (burner model MN.)**

| **Suntec E4 - E6 - E7 1001** | |
|---|---|
| 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

- **Pumps for heavy oil viscosity up to 50° E at 50° C (burner model MD.) or eco-heavy-oil viscosity 12 °E at 50°C (burner model ME.)**

| **Suntec E4 - E6 -E7 1069** | |
|---|---|
| Oil viscosity | 3 ÷ 75 cSt |
| Oil temperature | 0 ÷ 130°C |
| Minimum inlet pressure | - 0.35 to avoid gasing |
| Inlet maximum pressure | 3.5 bar |
| Maximum return pressure | 3.5 bar |
| Rotation speed max. | 3600 rpmобор/мин |

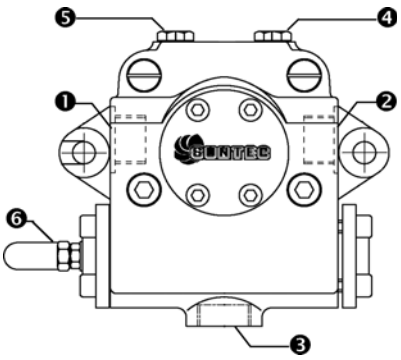
**SUNTEC**

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

Note: the 1069 pumps are fitted with mechanical seal and electric pre-heater (80 W).

**KP73A:**

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

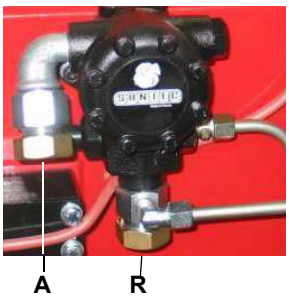
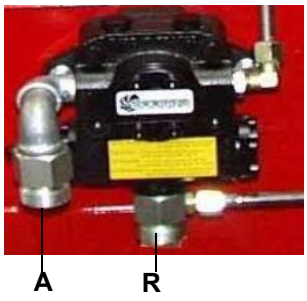



1 Inlet G1/2
2 To the nozzle G1/2
3 Return G1/2
4 Pressure gauge port G1/4
5 Vacuum gauge port G1/4
6 Pressure governor

### *Assembling the light oil flexible hoses*

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

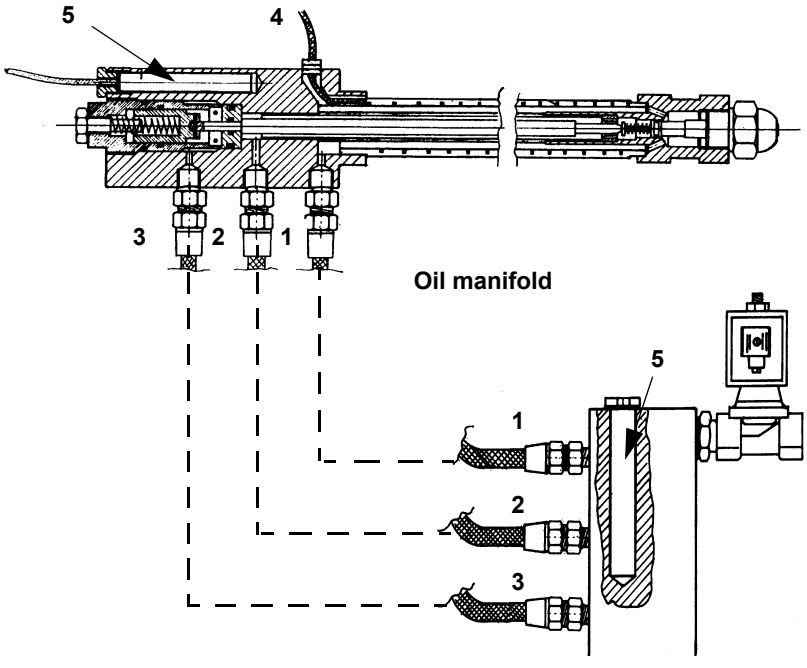
1 remove the closing nuts **A** and **R** on the inlet and return connections of the pump;
2 screw the rotating nut of the two flexible hoses on the pump **being careful to avoid exchanging the inlet and return lines**: see the arrows marked on the pump that show the inlet and the return (see prevoius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

| **Suntec E..** | **Suntec TA..** |
|---|---|
|  |  |
| A R | A R |

### *Connections to the oil gun (KP73A)*

1 Inlet
2 Return
3 Gun opening
4 Heating wire (only for high density oil burners)
5 Cartdrige-type heater (only for Ecoden or heavy oil burners)

**Gun with the oil nozzle inside**



### *Recommendations to design heavy oil feeding plants*

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

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

The oil viscosity is referred in various unit measures; the most common are: °E, cSt, Saybolt and Redwood scales. Table 3 shows the-various unit convertions (e.g.: 132 cSt viscosity corresponds to 17.5°E viscosity). The diagram in Fig. 14 shows how the heavy oil viscosity changes according to its temperature.

Example: an oil with 22°E viscosity at 50°C once heated to 100°C gets a 3 °E viscosity.As far as the pumping capability, it depends on the type of the pump that pushes the oil even if on diagram in Fig. 14 a generic limit is quoted at about 100 °E, so it is recommended to refer to the specifications of the pump provided. Usually the oil minimum temperature at the oil pump inlet increases as viscosity does, in order to make the oil easy to pump. Referring to the diagram on Fig. 15, it is possible to realise that to pump an oil with 50°E viscosity at 50°C, it must be heated at about 80°C.

### *Pipe heating system*

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

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

A very low pressure leads to cavitation (signalled by its peculiar noise): the pump manifacturer declares the minimum value. Therefore, check the pump technical sheets. By increasing the oil temperature, also the minimum inlet pressure at the pump must increase, to avoid the gassification of the oil low-boiling products and the cavitation. The cavitation compromises the burner operation, it causes the pump to break too. The diagram on Fig. 16 roughly shows the inlet pump pressure according to the oil temperature.

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

Remember that pumps and all the system components through which the oil circulates, feature an upper limit. Always read the technical documentation for each component. Schemes on Fig. 19 and Fig. 18 are taken from UNI 9248 "liquid fuel feeding lines from tank to burner" standard and show how a feeding line should be designed. For other countries, see related laws in force. The pipe dimensioning, the execution and the winding dimensioning and other construcitve details must be provided by the installer.

### *Adjusting the supplying oil ring*

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

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

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

Tab. 1

**Viscosity units conversion table**

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

Tab. 2

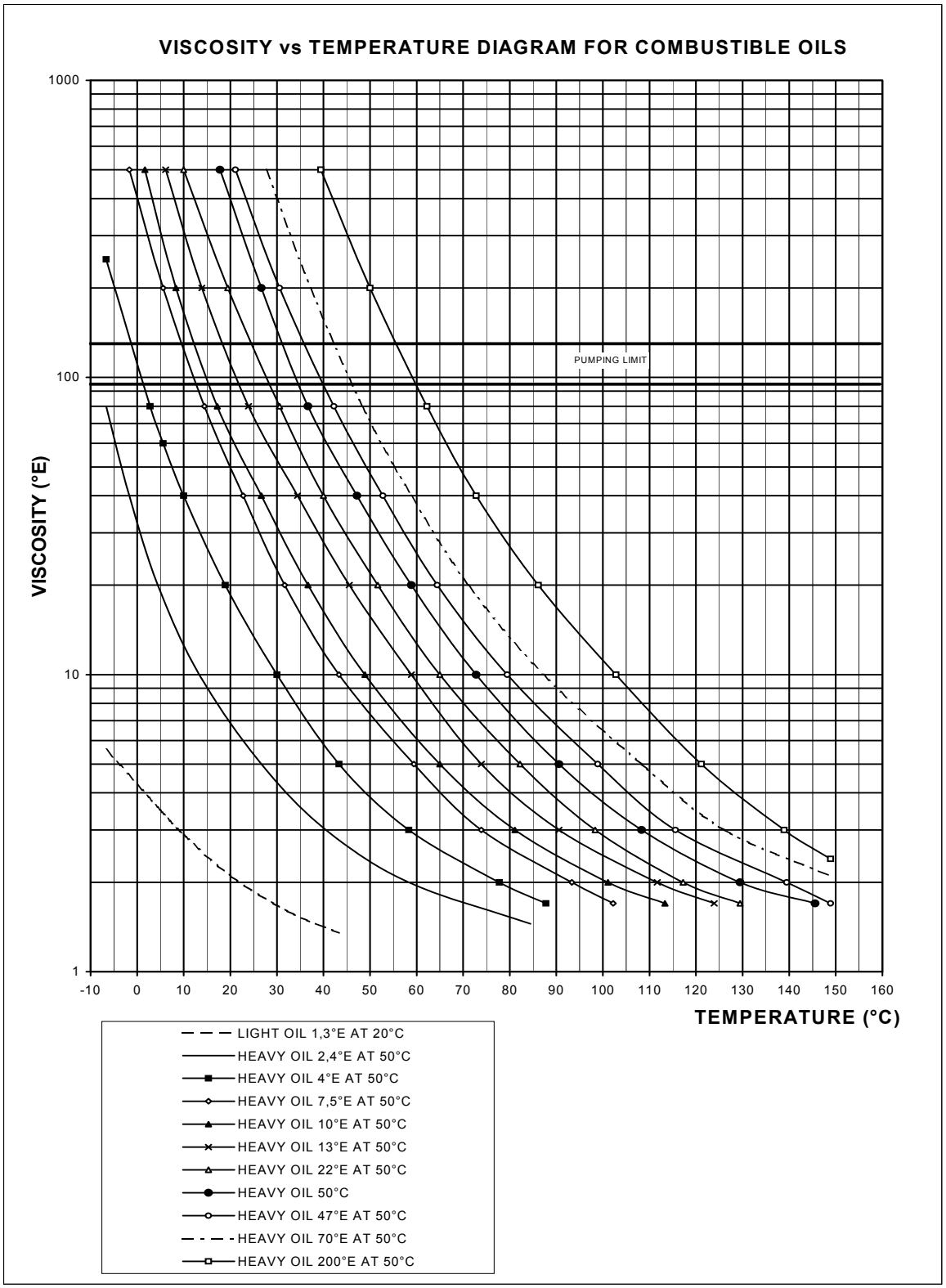

VISCOSITY vs TEMPERATURE DIAGRAM FOR COMBUSTIBLE OILS
VISCOSITY (°E)
1000
100
10
1
PUMPING LIMIT
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
TEMPERATURE (°C)
LIGHT OIL 1,3°E AT 20°C
HEAVY OIL 2,4°E AT 50°C
HEAVY OIL 4°E AT 50°C
HEAVY OIL 7,5°E AT 50°C
HEAVY OIL 10°E AT 50°C
HEAVY OIL 13°E AT 50°C
HEAVY OIL 22°E AT 50°C
HEAVY OIL 50°C
HEAVY OIL 47°E AT 50°C
HEAVY OIL 70°E AT 50°C
HEAVY OIL 200°E AT 50°C

Fig. 13

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

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

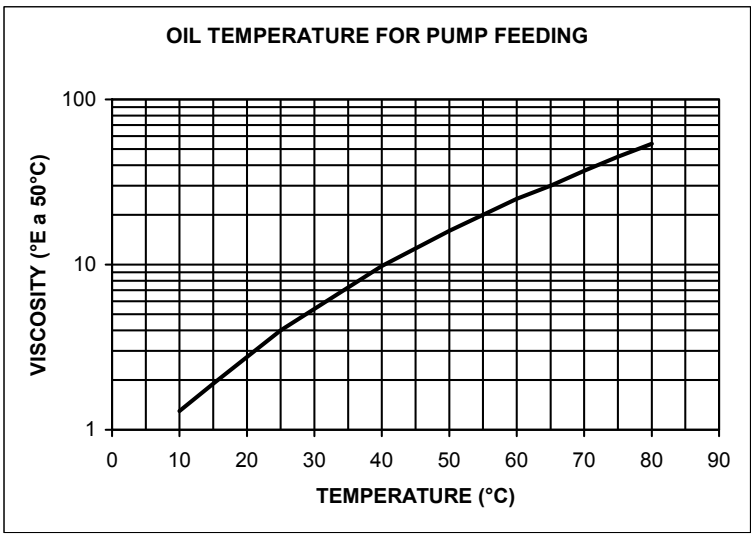



Fig. 14

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

PRESSION D'ALIMENTATION POMPE

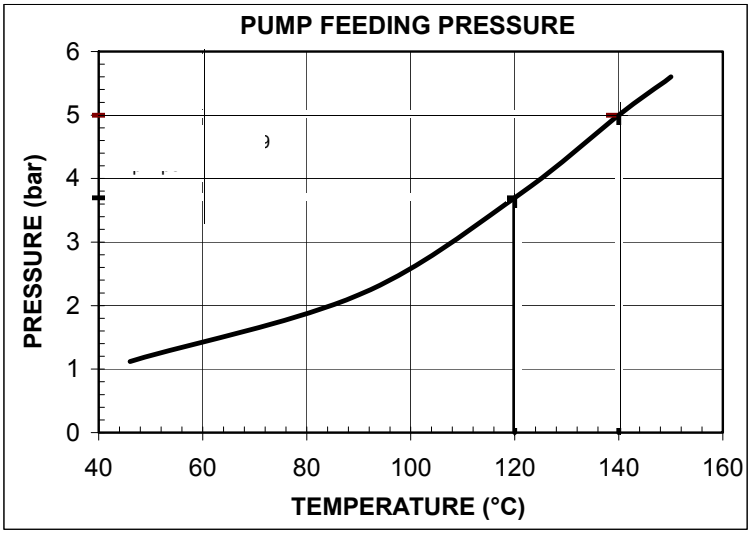



Fig. 15

**Indicative diagram showing the oil atomising temperature according to its viscosity**

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

**VISCOSITY vs. TEMPERATURE DIAGRAM**

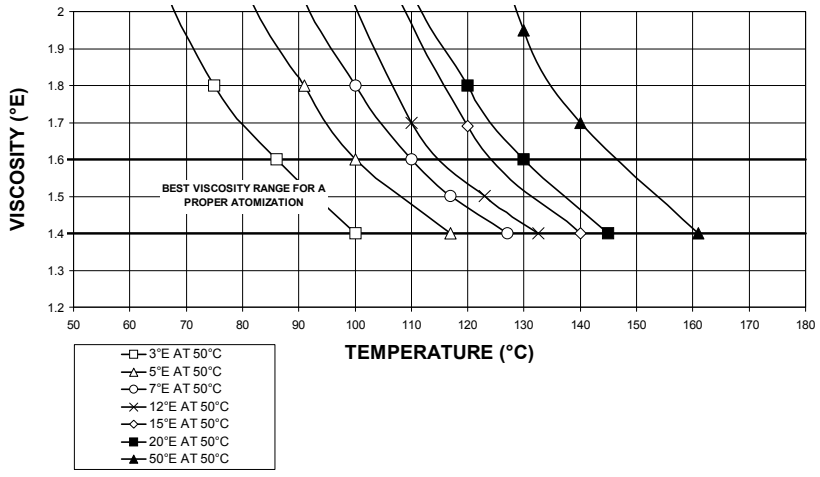



Fig. 16

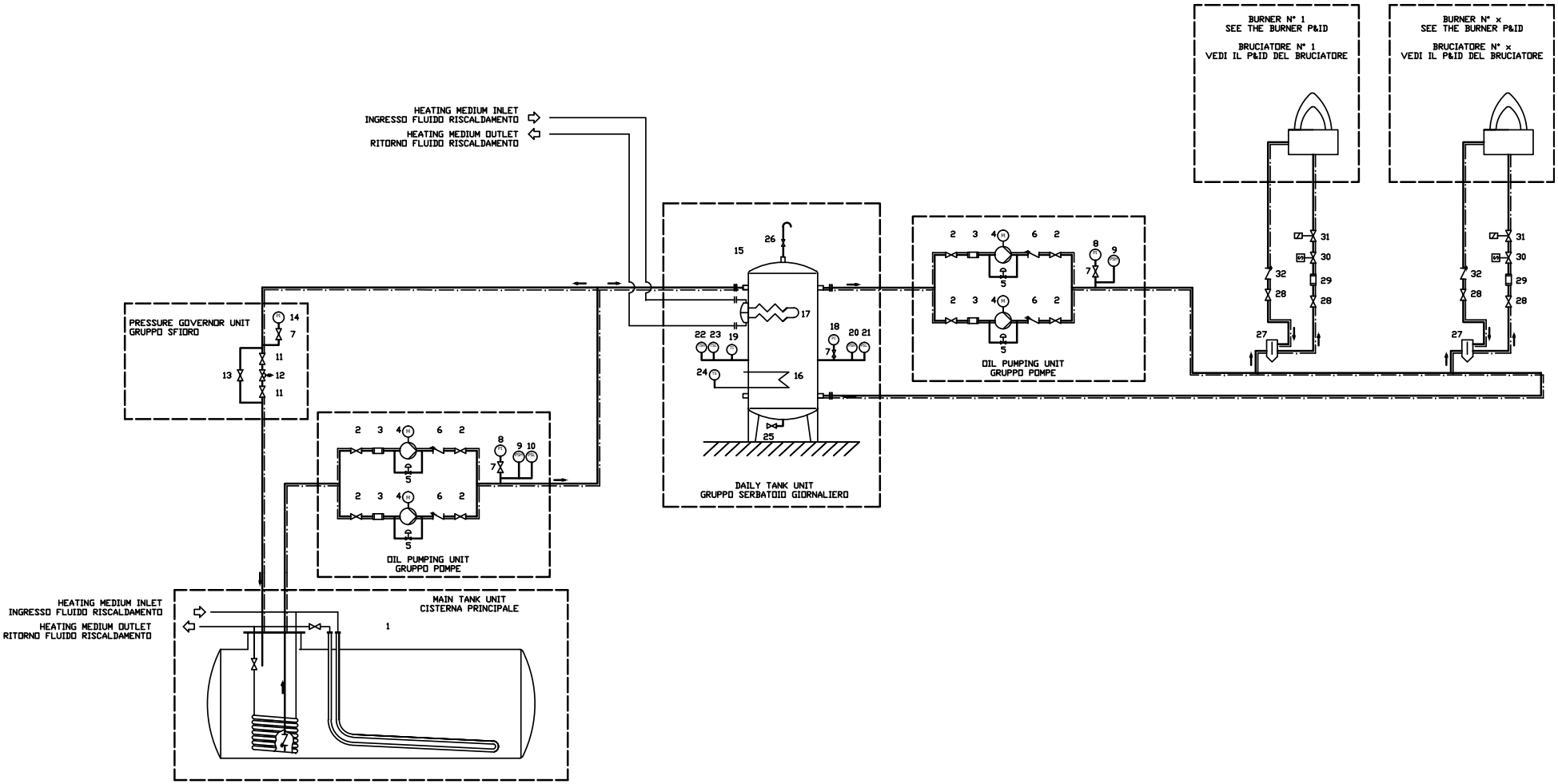



Fig. 17 - 3ID00014 v2 **Hydraulic diagram - Two or more burners configuration**

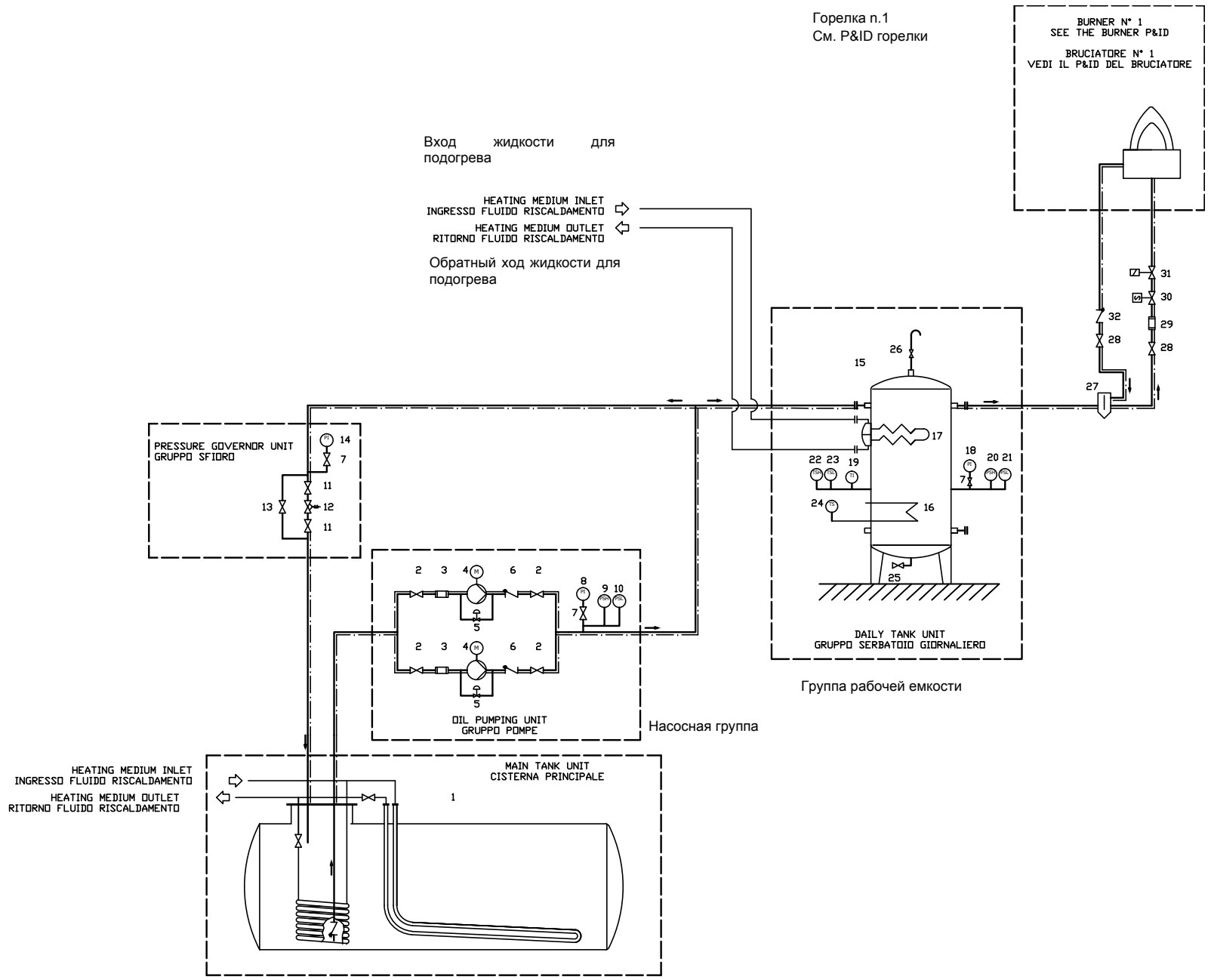



Fig. 18 - 3ID0023 v2 - **Hydraulic diagram - Single burner configuration**

| | LEGEND |
|---|---|
| **POS** | **OIL TRAIN** |
| 1 | Main tank |
| | **OIL PUMPING UNIT** |
| 2 | Manual valve |
| 3 | Filter |
| 4 | Pump coupled to electrical motor |
| 5 | Safety valve |
| 6 | One-way valve |
| 7 | Manual valve |
| 8 | Pressure gauge |
| 9 | Maximum pressure switch |
| 10 | Minimum pressure switch |
| | **PRESSURE GOVERNOR UNIT** |
| 11 | Manual valve |
| 12 | Pressure governor |
| 13 | Needle valve |
| 14 | Pressure gauge |
| | **DAILY TANK** |
| 15 | Daily tank |
| 16 | Electrical resistor |
| 17 | Heating device |
| 18 | Pressure gauge |
| 19 | Thermometer |
| 20 | High pressure switch |
| 21 | Low pressure switch |
| 22 | Thermostat (high) |
| 23 | Thermostat (low) |
| 24 | Thermostat |
| 25 | Manual valve |
| 26 | Manual valve |
| | **TO THE BURNER** |
| 27 | Degassing bottle |
| 28 | Manual valve |
| 29 | Filter (supplied loose with the burner) |
| 30 | Solenoide valve |
| 31 | Safety valve |
| 31 | One-way valve |

## Electrical connections

| | |
|---|---|
| | **Respect the basic safety rules. make sure of the connection to the earthing system. do not reverse the phase and neutral connections. fit a differential thermal magnet switch adequate for connection to the mains.** |
| | **ATTENTION: before executing the electrical connections, pay attention to turn the plant's switch to OFF and be sure that the burner's main switch is in 0 position (OFF) too. Read carefully the chapter "WARNINGS", and the "Electrical connections" section.** |

To execute the electrical connections, proceed as follows:

1 remove the cover from the electrical board, unscrewing the fixing screws;

2 execute the electrical connections to the supply terminal board as shown in the attached wiring diagrams;

3 check the direction of the fan motor (see next paragraph);

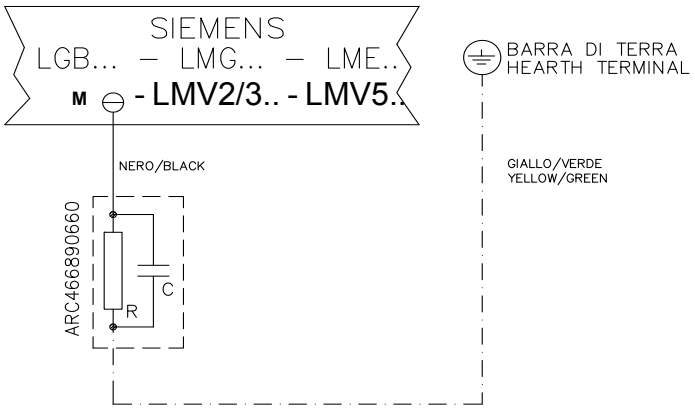
4 refit the panel cover.

### *Note on elecrtical supply*

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

**Key**

C - Capacitor (22nF/250V)
LME / LMV - Siemens control box
R - Resistor (1Mohm)
M - Terminal 2 (LGB,LMC,LME), terminal X3-04-4 ( LMV2x, LMV3x, LMV5, LME7x)
RC466890660 - RC Siemens filter




For LMV5 control box, please refer to the clabeling recommendations avaible on the Siemens CD attached to the burner

### *Rotation of electric motor*

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

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

**NOTE: the burners are supplied for three-phase 380 V or 400 V supply, and in the case of three-phase 220 V or 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.**

### *Connecting the oil heating resistors*

**2.4 - 4.5 kW**

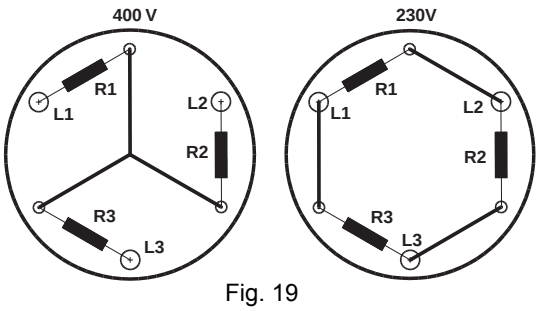



Fig. 19

**8 - 12 kW**

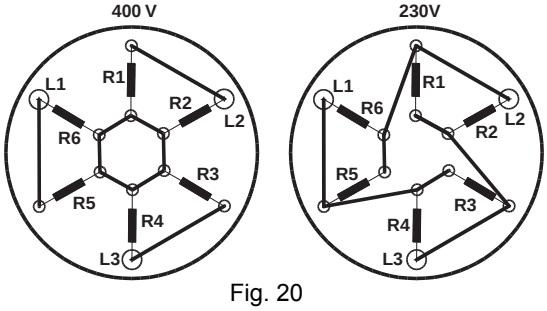



Fig. 20

**18 - 24 kW**

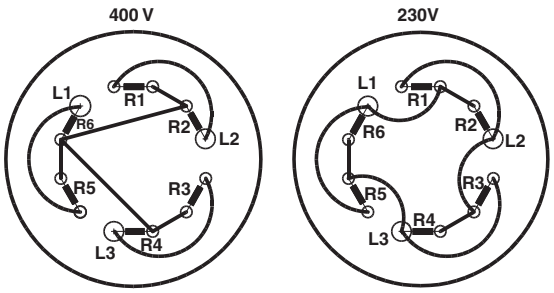



Fig. 21

**ELECTRIC MOTOR CONNECTION**

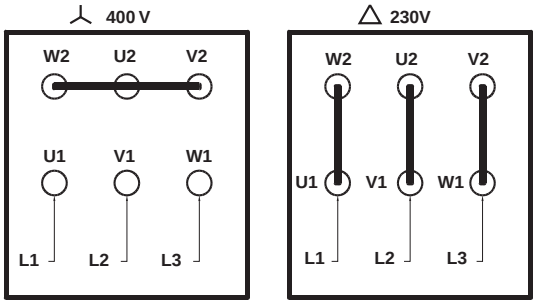



Fig. 22

## ADJUSTMENT

### *Oil thermostat adjustment*

To find the thermostats, remove the cover of the burner switchboard. Adjust them using a screwdriver on the **VR** screw as shown in the next picture.

**NOTE:** thermostat **TCI** is provided on burners fired with fuel oil having a 50° E at 50° C viscosity only.

## AIR FLOW AND FUEL ADJUSTMENT

### Adjustments - brief description

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

- Check that the combustion parameters are in the suggested limits.
- .Check the flow rate measuring it on the counter or, if it was not possible, verifying the combustion head pressure by means of a differential pressure gauge.
- Then, adjust the combustion values corresponding to the points between maximum and minimum: set the shape of the adjusting cam foil. The adjusting cam sets the air/gas ratio in those points, regulating the opening-closing of the throttle gas valve.
- 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.

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

***WARNING! 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.***

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

| **Recommended combustion parameters** | | |
|---|---|---|
| Fuel | Recommended (%) $CO_2$ | Recommended (%) $O_2$ |
| Natural gas | 9 ÷ 10 | 3 ÷ 4.8 |
| Heavy oil | 11 ÷ 12.5 | 4.7 ÷ 6.7 |
| Heavy oil <=7°E a 50 °C | 11 ÷ 12 | 4.2 ÷ 6.2 |

ADJUSTMENTS FOR GAS OPERATION

1 check the fan motor rotation.

2 Only for burners provided with **Multibloc MB-DLE gas valves:** before starting the burner up, set the slow opening. To set the slow 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**!

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

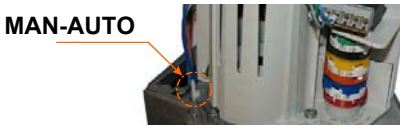
3 Before starting the burner up, drive the high flame actuator microswitch matching the low flame one (in order to let the burner operates at the lowest output) to safely achieve the high flame stage.

4 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;

5 drive the burner to high flame stage, by means fo the thermostat **TAB**.

6 Then move progressively the microswitch to higher values until it reaches the high flame position; always check the combustion values and eventually adjusting the gas by means of the valves group stabiliser.

7 go on adjusting air and gas flow rates: check, continuosly, the flue gas analisys, as to avoid combustion with little air; dose the air according to the gas flow rate change following the steps quoted below;




Siemens SQM40

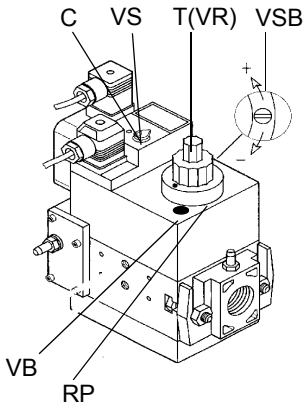

**Actuator cams (SQM40)**

| | |
|---|---|
| I | High flame |
| II | Stand-by |
| III | Low flame - gas |
| IV | Low flame - oil |
| V | Ignition - oil |
| VI | Ignition - gas |

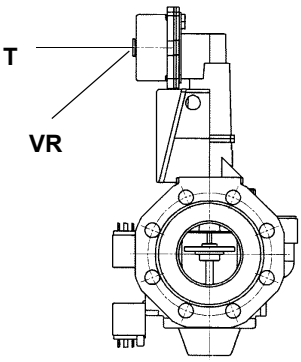
8 acting on the pressure stabiliser of the valves group, adjust the **gas flow rate in the high flame stage** as to meet the values requested by the boiler/utilisation:

-**Multibloc MB-DLE:**The pressure governor 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. 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; screwind **VR** the rate increases, unscrewing it decreases (see next figure).



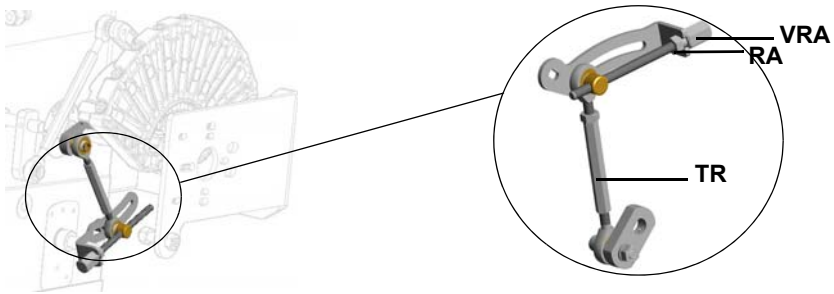

**Dungs Multibloc MB-DLE**




**Siemens VGD..**

9 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 perfomed, be sure that the blocking nut **RA** is fasten. Do not change the position of the air damper rods.




10 If necessary, adjust the combustion head position (see the dedicated paragraph)..

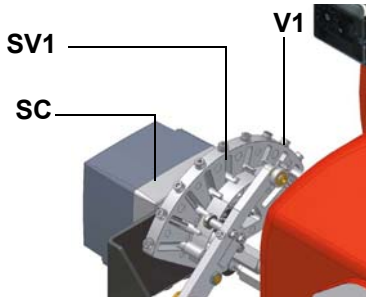
***Attention! if it is necessary to change the head position, repeat the air and gas adjustments described above.***

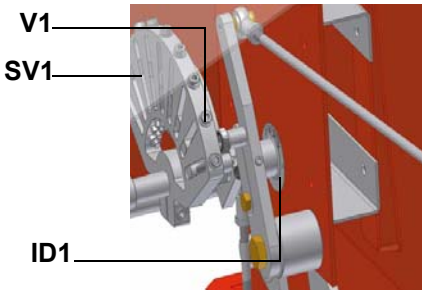
11 The air and gas rate are now adjusted at the maximum power stage, go on with the point to point adjustement on the **SV1** (gas side) adjusting cam as to reach the minimum output point.

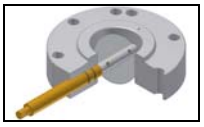
12 as for the point-to-point regulation, move the gas low flame microswitch a little lower than the maximum position (90°);

13 set the **TAB** thermostat to the minimum in order that the actuator moves progressively towards the low flame position;

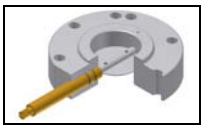
14 move the gas low flame microswitch to the minimum to move the actuator towards the low flame until the two bearings find the adjusting screw that refers to the lower position: screw **V1** to increase the rate, unscrew to decrease.



Gas throttle valve open



Gas throttle valve closed

15 Move again the gas low flame microswitch towards the minimum to meet the next screw on the adjusting cam and repeat the previous step; go on this way as to reach the desired low flame point.

16 Now adjust the pressure switches.

### *Multibloc MB-DLE*

The multibloc unit is a compact unit consisting of two valves, gas pressure switch, pressure stabilizer and gas filter.

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. 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 replacemente of the coil.

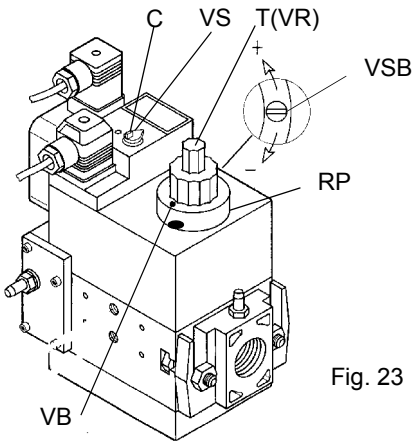



Fig. 23

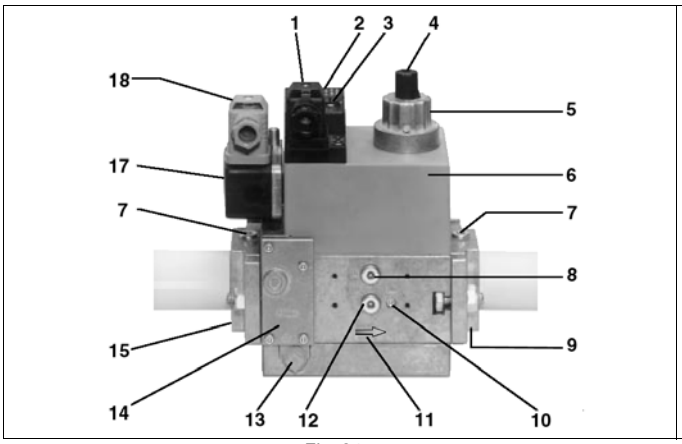



Fig. 24

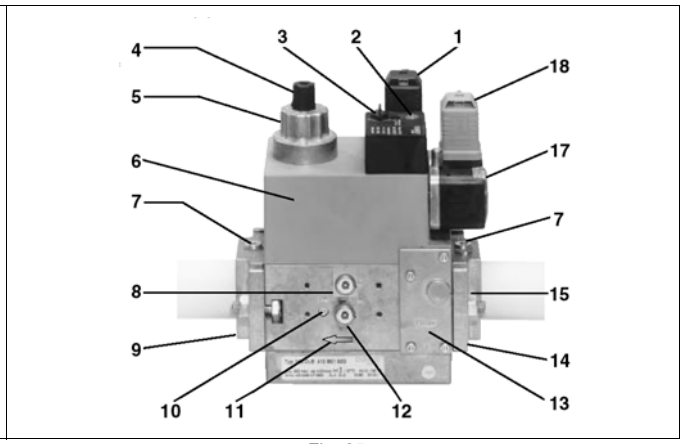


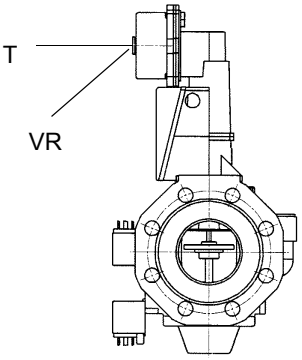

Fig. 25

**Key**

1 Electrical connection for valves
2 Operation display (optional)
3 Pressure governor closing tap
4 Start setting cap
5 Hydraulic brake and rate regulator
6 Coil
7 Test point connection G 1/8
8 Test point connection G 1/8 downstream of valve 1, on both sides
9 Output flange
10 Test point connection M4 downstream of valve 2
11 Gas flow direction
12 Test connection G 1/8 downstream of valve 1, on both sides
13 Vent nozzle pressure regulator
14 Filter (below cover)
15 Input flange
17 Pressure switch
18 Pressure switch electric connection

### *Gas valves Siemens VGD - Version with SKP2. (provided with pressure stabilizer).*

To increase or decrease gas pressure, and therefore gas flow rate, remove the cap **T** and use a screwdriver to adjust the regulating screw **VR**. Turn clockwise to increase the flow rate, counterclockwise to reduce it.




### *Setting 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 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 maximum gas pressure switch (when provided)*

To calibrate the maximum 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 upstreaam 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 paragrph. 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.

### *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 o 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.

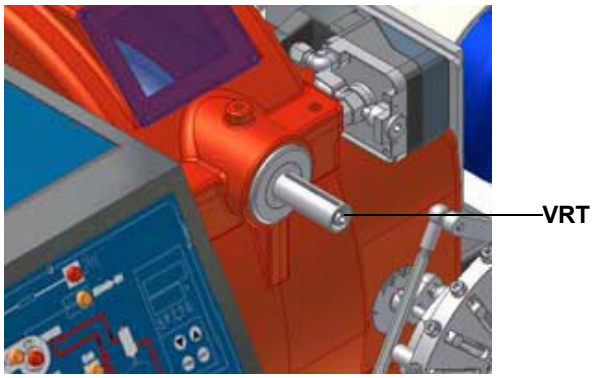
### *PGCP Gas leakage pressure switch (witn Siemens LDU/LME7x burner control/Siemens LMV Burner Management System)*

- remove the pressure switch plastic cover;
- adjust the PGCP pressure switch to the same value set for the minimum gas pressure switch;
- replace the plastic cover.

### *Adjusting the combustion head*

**KP60 - KP65 - KP72**

Only if necessary, change the combusiton head position. 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.



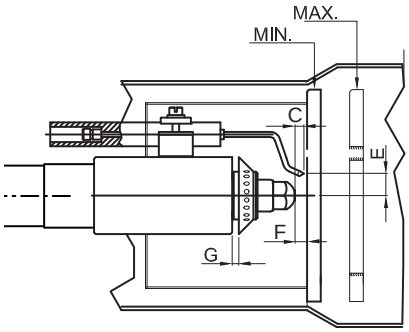
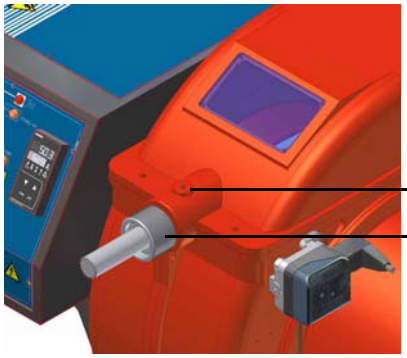
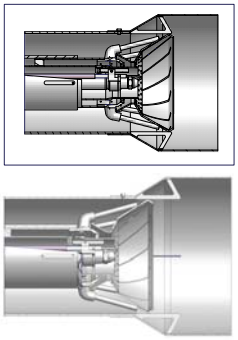




Fig. 26

**KP73A**

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



"MAX" head position

head position

Fig. 27

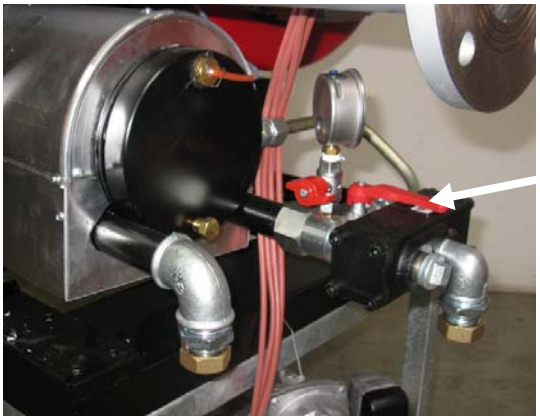
**Attention!** if it is necessary to change the head position, repeat the air and gas adjustments described above.

## ADJUSTMENTS FOR OIL OPERATION

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

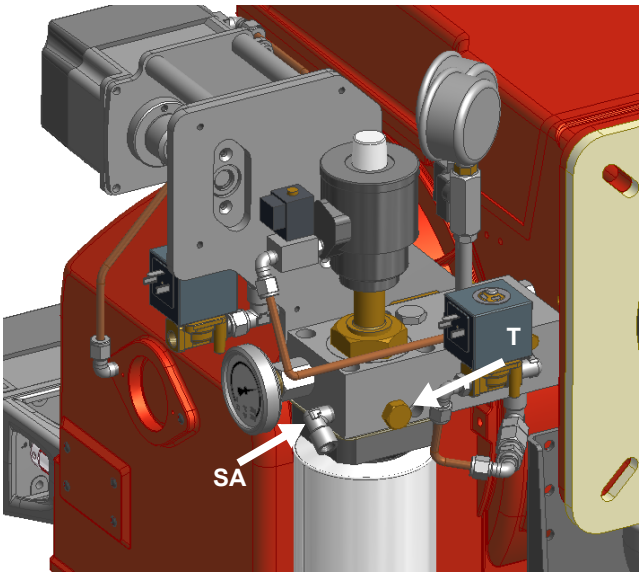
***ATTENTION:*** **before starting the burner up, be sure that the manual cutoff valves are open. Be sure that the mains switch is closed.**

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




### *Air vent*

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




### *Oil thermostat adjustment*

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

Fig. 28 - Danfoss MCX

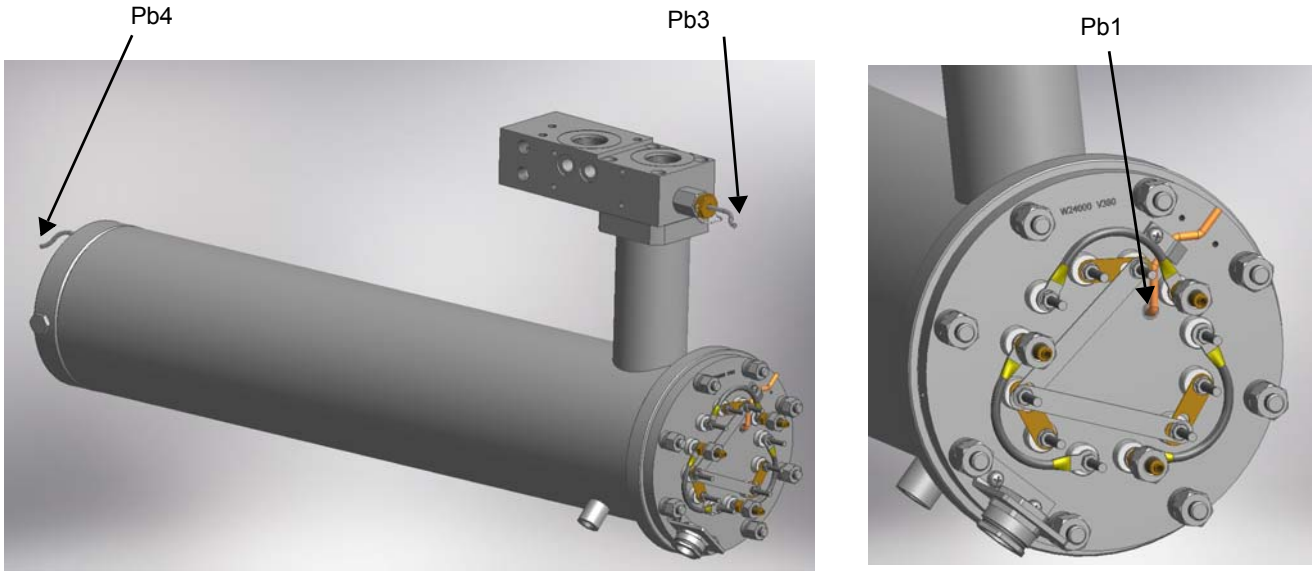



Fig. 29 - Probe connections (Danfoss MCX)

| **Menu path** | | | | Oil viscosity at 50 °C according to the letter shown in the burner model | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | **P** | **N** | **E** | **D** | **H** |
| | | | | 89 cSt | < 50 cSt | > 50 cSt<br>< 110 cSt | > 110 cSt<br>< 400 cSt | > 400 cSt<br>< 4000 cSt |
| | | | | 12 °E | < 7°E | > 7 °E<br>< 15 °E | > 15 °E<br>< 50 °E | > 50 °E<br>< 530 °E |
| Par | | | | | | | | |
| rEG | Pb1 | tr | Oil heater temperature probe | parameter not visible | | | | |
| | Pb2 | tCI | Plant consent temperature probe (when installed) | 20 °C | 70 °C | 70 °C | 70 °C | --- |
| | Pb3 | Oil | oil heater output temperature probe (PID regulation); | 60-70 °C | 110-120 °C | 120-130 °C | 130-140 °C | 140-150 °C |
| | | SP0 | Set-point oil heater with oil pump stopped (stand-by) | 45 °C | 120 °C | 130 °C | 140 °C | 150 °C |
| | Pb4 | tcn | Oil heater consent temperature probe | 40 °C | 100 °C | 100 °C | 110 °C | 120 °C |
| | | trS | Safety temperature tank resistors (manual reset) | 120 °C | 190-200 °C | 190-200 °C | 190-200 °C | 190-200 °C |

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

### *Adjustment in the heavy oil operation*

The heavy oil flow rate can be adjusted choosing a by-pass nozzle that suits the boiler/utilisation output and setting the delivery and return pressure values according to the ones quoted on the chart below and the diagram on Fig. 31-Fig. 32.

KP60 - KP65 - KP72: BERGONZO A3 - KP73A: FLUIDICS WR2

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

BERGONZO NOZZLE DIAGRAMS

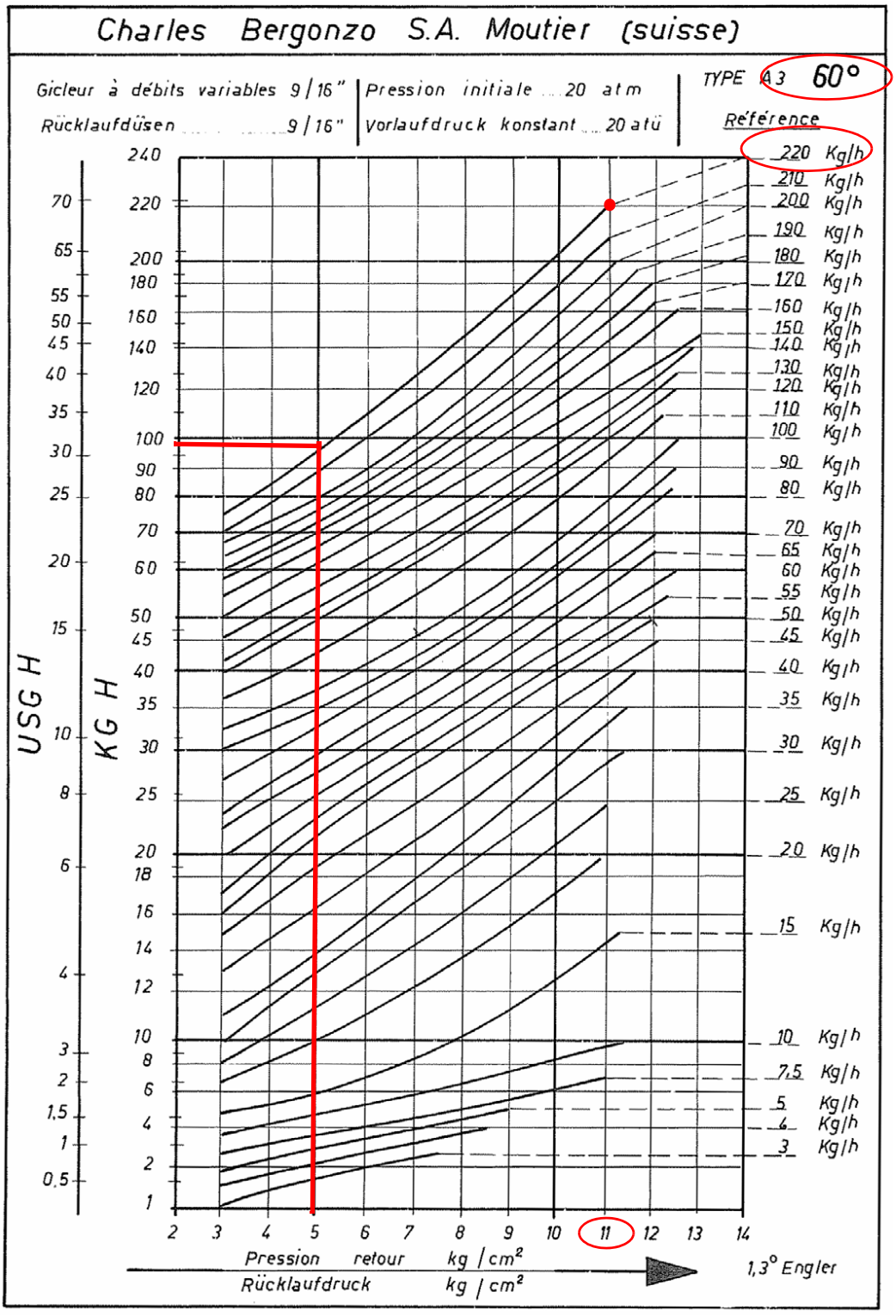



Fig. 30

**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.

FLUIDICS

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

Tab. 3

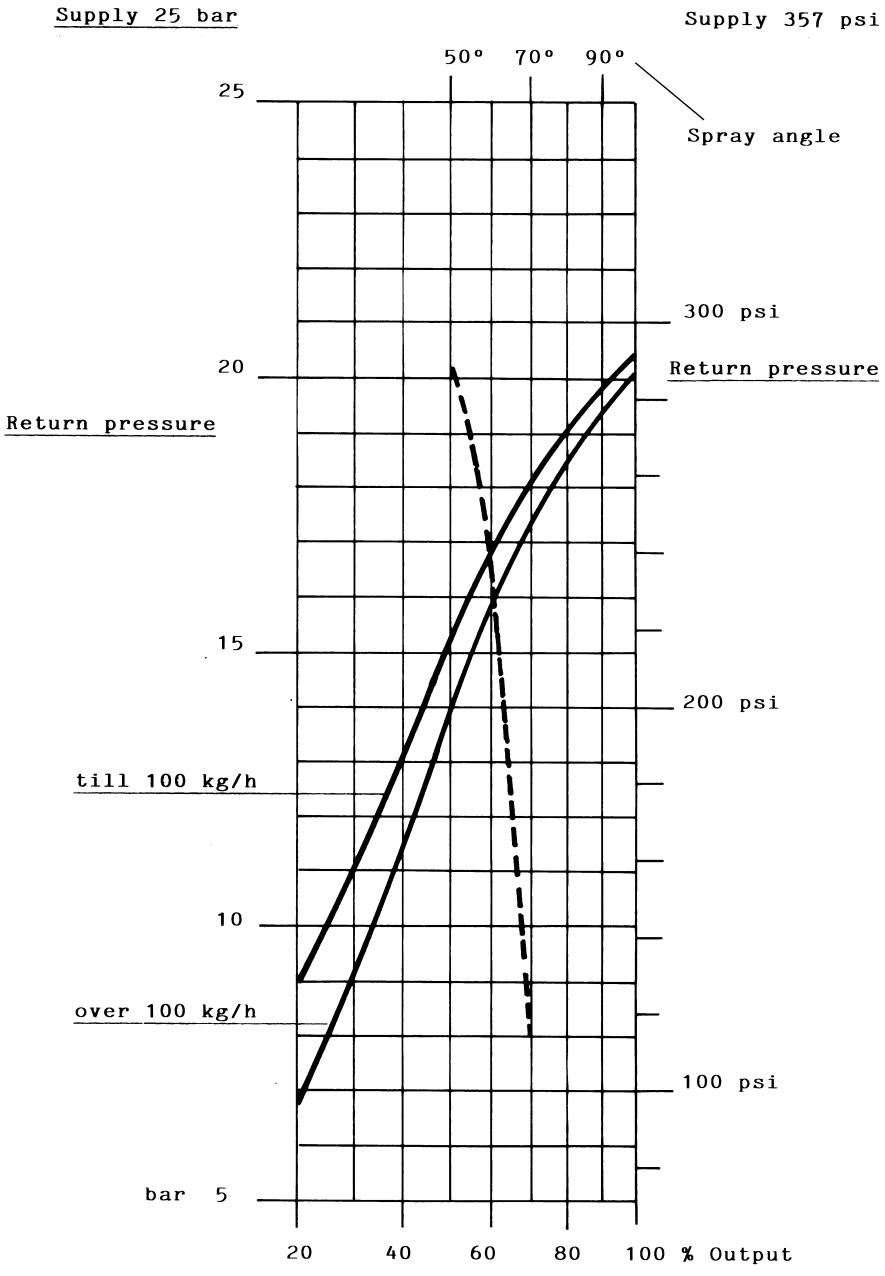



Fig. 31

----------Atomisation angle according to the return pressure

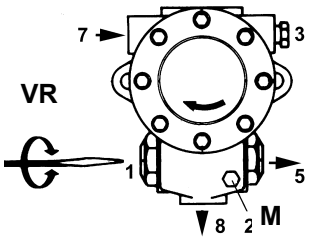
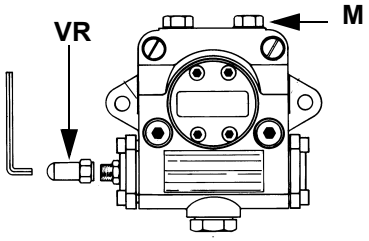
_____ % Flow rate

ADJUSTMENTS FOR OIL OPERATION

1 Once the air and gas flow rates are adjusted, turn the burner off, switch to the oil operation (OIL, on the burner control panel).

2 with the electrical panel open, prime the oil pump acting directly 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 bleed the air from the **M** pressure gauge port by loosing the cap without removing it, then release the contactor.

| Suntec E.. | Suntec TA. |
|---|---|
|  |  |

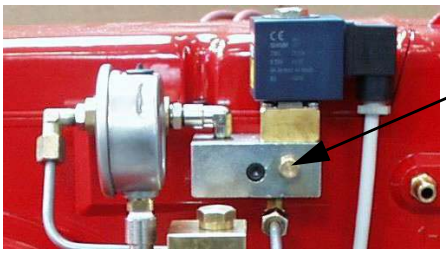


4 Before starting the burner up, drive the high flame actuator microswitch matching the low flame one (in order to let the burner operates at the lowest output) to safely achieve the high flame stage .

5 Start the burner up by means of the thermostat series and wait until the pre-purge time comes to an end and that the bruner starts up;

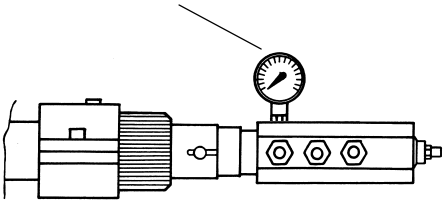
6 drive the burner to high flame stage, by means fo the thermostat **TAB** (as far as fully-modulating burners, see the related paragraph).

7 Then move progressively the microswitch to higher values until it reaches the high flame position; always check the combustion values and eventually adjusting the oil pressure (see next step).




**KP60-KP65-KP72**

Pressure gauge port



**KP73A**

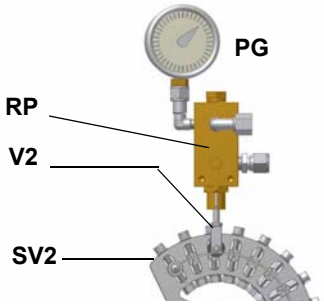



Fig. 32

8 Only if necessary, adjust the supply pressure as follows;insert a pressure gauge into the port shown on figure and act on on the pump adjusting screw **VR**. Pressure values are indicated at the beginning of this paragraph.

9 in order to get the maximum oil flow rate, adjust the pressure (reading its value on the **PG** pressure gauge) without changing the air flow rate set during the gas operation adjustments (see previous paragraph): checking always the combustion parameters, the adjustment is to be performed by means of the **SV2** adjusting cam screw (see picture) when the cam has reached the high flame position.

10 once the oil rate is adjusted at the maximum output (the air rate was adjusted in the gas regulation), go on with the point to point adjustment on the **SV2** (light oil side) adjusting cam as to reach the minimum output point, as described on the next steps.

11 as for the point-to-point regulation, move the gas low flame microswitch a little lower than the maximum position (90°);

12 set the **TAB** thermostat to the minimum in order that the actuator moves progressively towards the low flame position (as far as fully-modulating burners, see the related paragraph);

13 move the low flame cam to the minimum to move the actuator towards the low flame until the two bearings find the adjusting screw that refers to the lower position: screw **V2** to increase the rate, unscrew to decrease.

14 Move again cam III towards the minimum to meet the next screw on the adjusting cam and repeat the previous step; go on this way as to reach the desired low flame point.

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

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

# 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 AUTHORISED BY THE COMPANY MANUFACTURING THE BURNER.**

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

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

**NEVER OPEN OR DISMANTLE ANY COMPONENT OF THE MACHINE.**

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

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

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

## OPERATION

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

- Select the fuel by turning the switch CM on the burner control panel .

**N.B. if the heavy oil is used, be sure the cutoff valves on the delivery and return pipes are OPEN.**

- Check that the burner is not locked (LED **E** lights up); if so, reset it by pressing the reset button **N**.
- Check that the series of thermostats (or pressure switches) enable the burner to start up.

### *Gas Operation*

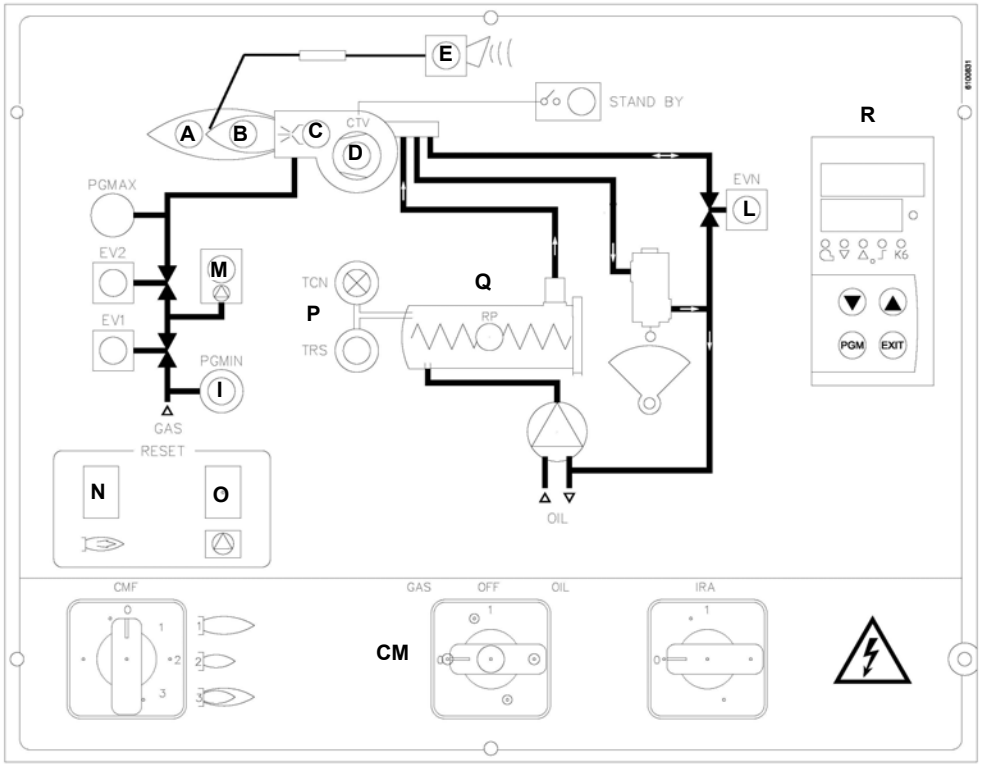
- Check that the gas pressure in the circuit is high enough (LED **I** on).
- The valve proving test begins.
- At the beginning of the start-up cycle the the air damper moves to the maximum opening, the fan motor starts and the pre-purge phase begins. During the pre-purge phase the complete opening of the air damper is signalled by the LED **F** on the front panel.
- At the end of the pre-purge stage, the air damper moves to the ignition position, the ignition transformer is energised (signalled by LED **C** on the panel) and, after few sec.onds the two gas valves EV1 and EV2 are energised (indicator lights **H** and **G** on). Few seconds after the opening of the gas valves, the ignition transformer is de-energised and LED **C** is off.
- To move from the low flame position, the actuator opening time (<10 s) is controlled by the control box. When this time elapses, the burner operates according the plant needs.

### *Heavy oil Operation*

- At the beginning of the start-up cycle the air damper moves to the maximum opening, the fan motor starts and the pre-purge phase begins. During the pre-purge phase the complete opening of the air damper is signalled by LED **F** on the front panel.
- At the end of the pre-purge the air damper is brought to the ignition position and the ignition transformer is energised (signalled by LED **C** on the panel). Few seconds later, the oil valve opens and the ignition transformer is de-energized (LED **C** off).
- The burner is now operating and after some seconds the burner is automatically driven into high flame (LED **A** on), or remains in low flame (LED **B** on) according to the plant needs.

## *Burner front panel*

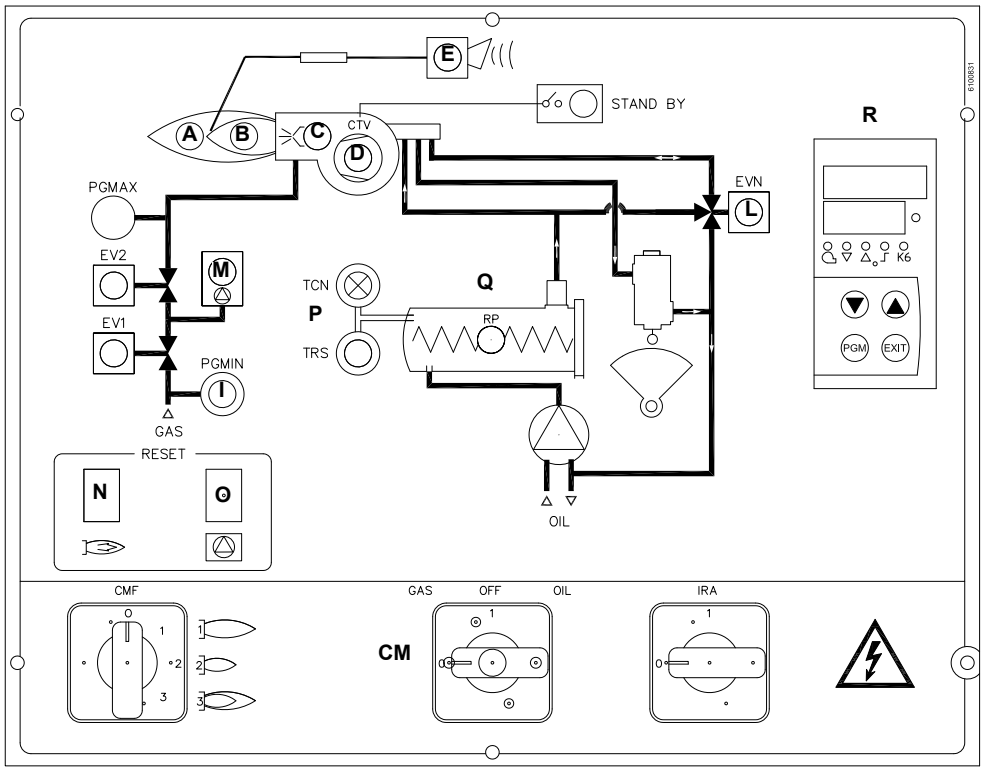
### KP60-65-72




**Key**

| | |
|---|---|
| A | High flame mode indicating light |
| B | Low flame mode indicating light |
| C | Ignition transformer operation |
| CM | Main switch/operation mode (Gas / Oil) |
| D | Fan motor overload tripped intervention |
| E | Burner lockout iindicationg light |
| F | Stand-by mode indicating light |
| G | Gas valve EV2 operation |
| H | Gas valve EV1 operation |
| I | Gas pressure switch consent |
| IRA | Pre-heater resistor switch |
| L | Oil solenoid valve operation |
| M | Gas proving system intervention |
| N | Flame monitor device reset pushbutton |
| O | Gas proving system device reset pushbutton |
| P | Pre-heating resistors safety thermostat |
| Q | Pre-heating oil tank |
| R | Modulator |

### KP73A



## 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 MANAUL CUTOFF VALVES CLOSED!***

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

### ROUTINE MAINTENANCE

- Clean and examine the gas filter cartridge and replace it if necesssary (see next paragraph).
- Check and clean the oil filter cartridge; replace it if necessary (see next paragraphs).
- Examine the condition of the oil flexible hoses and check for possible leaks.
- Check and clean if necessary the oil heaters and the tank, according to the fuel type and its use; remove the heaters flange fixing nuts and remove the heaters from the tank: clean by using steam or solvents and not metallic things.
- Clean and examine the filter inside the oil pump. Filter must be thoroughly cleaned at least once in a season to ensure correct working of the fuel unit. To remove the filter, unscrew the four screws on the cover. When reassemble, make sure that the filter is mounted with the feet toward the pump body. If the gasket between cover and pump housing should be damaged, it must be replaced. An external filter should always be installed in the suction line upstream of the fuel unit.
- Remove and clean the combustion head (page 50).
- Examine and clean the ignition electrodes, adjust and replace if necessary (see page 50).
- Examine and clean the detection probe, adjust and replace if necessary (see page 55).
- Examine the detection current (see page 52).
- Remove and clean (page 53) the heavy 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.
- Clean and grease joints and rotating parts.

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

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

### *Gas filter maintenance*

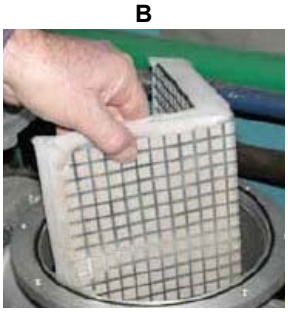
| | |
|---|---|
| | **ATTENTION:** Before opening the filter, close the manual cutoff valve downstream the filter and bleed the gas; check that inside the filter there is no pressurised gas. |

To clean or remove the filter, proceed as follows:

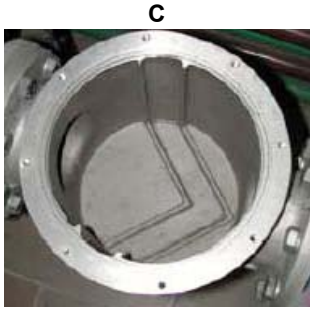
1 remove the cap unscrewing the fixing screws (A);
2 remove the filtering cartridge (B), clean it using water and soap, blow it with compressed air(or replace it, if necessary)
3 replace the cartridge in its proper position taking care to place it inbetween the guides as not to hamper the cap replacement;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

**A**

**B**



**C**



### *Inspection and replacement of the MULTIBLOC DUNGS MBC..SE filter (Threaded valves group)*

Inspect the filter at least once a year.

- Change the filter, if pressure value between pressure connections 1 and 2 is greather than 10 mbar.
- Change the filter, if pressure value between pressure connections 1 and 2 is twice as high compared to the last inspection.

1. Interrupt gas supply: close ball valve
2. Remove screws 1-2
3. Replace the filter insert 3
4. Screw in screws 1-2 without use force to fasten.
5. Perform leakage and funcion test.
6. Pay attention that dirt does not fall inside the valve.

Space requirements for fitting filter, A: from 150 to 230 mm.

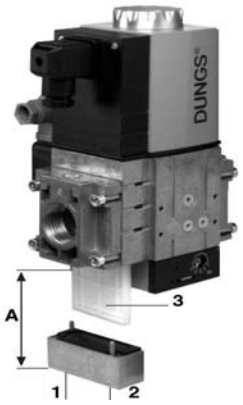
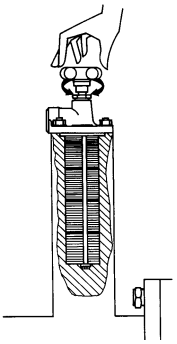



Fig.33

**Self-cleaning filter**

Fitted only on high viscosity oil burners. Periodically turn the knob to clean the filter.

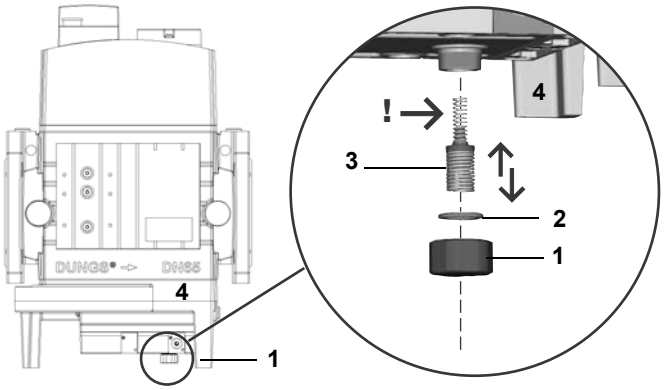


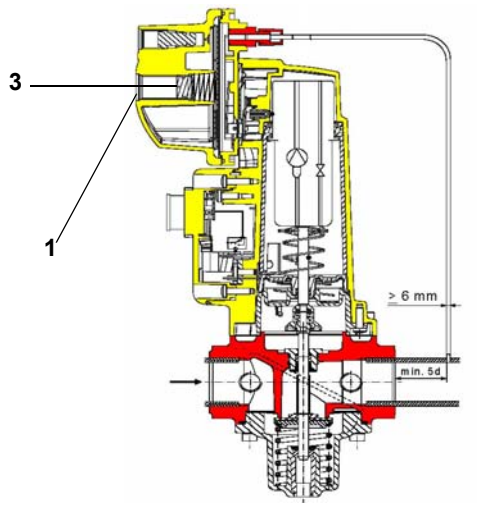
### *Replacing the spring in the gas valve group*

To replace the spring in the gas valve group,proceed as follows:

1 Carefully twist the protection cap 1 and the O-ring 2.
2 remove the “set value” spring 3 from housing 4.
3 Replace spring 3.
4 Carefully insert the new “set value” spring. Pay attention to mount properly. First insert the spring part with smaller diameter in the housing.
5 Place O-ring 2 in protective cap 1. Screw in the protective cap with the O-ring in it.
6 Stick the adhesive label for spring identification on the type plate.
7

**DUNGS MBC..SE**



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

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

To remove the oil gun, proceed as follows:

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

**Caution**: adjust the nozzle position according to the procedure on the next paragraph.

### *Electrodes Adjustment*

**Important Note: Check the ignition and detection electrodes after removing/adjusting the combustion head.**

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

Adjust the electrodes position, according to the quotes shown othe next picture

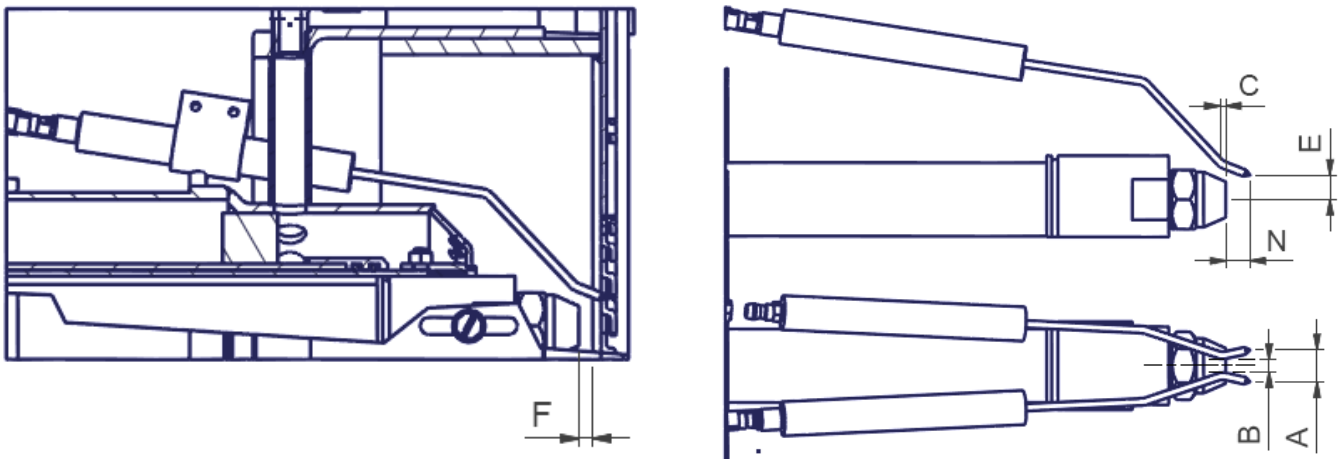


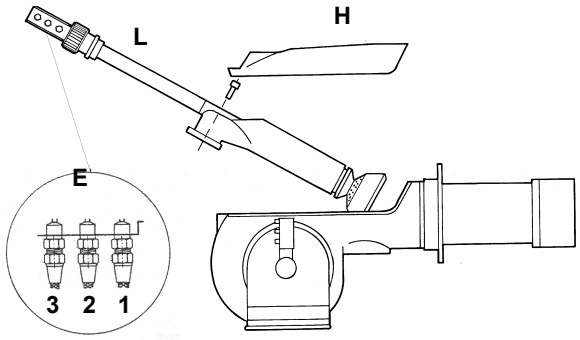

Fig. 34

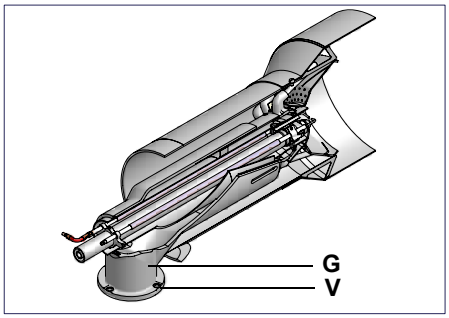
| A | B | C | E | F | N |
|---|---|---|---|---|---|
| 10÷15 | 3÷5 | 3÷4 | 10÷13 | 8 | 10÷13 |

### *Removing the combustion head (KP73A)*

1 Remove the cover **H**.
2 Slide the photoresistance out of its housing.
3 Unscrew the **V** screws that block the gas collector **G**, loosen the three jionts **E** and remove the ass.y as shown on the following picture.
4 Clean the combustion head by means fo a vacuum cleaner; scrape off the scale by means fo a metallic brush.

**Note:** to remount the burner, floow the same procedure in the reversed order.




**Key**

1 Inlet
2 Return
3 Gun opening
E Oil piping connections
G Gas manifold
H Cover
L Oil gun
V Screws

### *Removing the oil gun, replacing the nozzle and the electrodes (KP73A)*

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

To remove the oil gun, proceed as follows:

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

**Caution**: adjust the nozzle position according to the air pipe, by means of the **VU** screw, ance the **VL** screw is fastened.

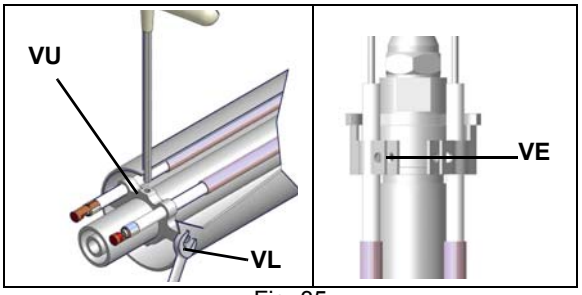
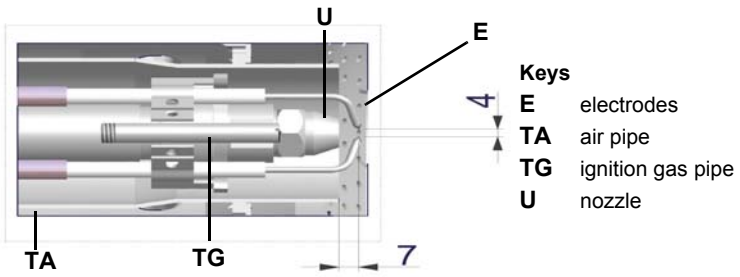



Fig. 35

### *Adjusting the electrodes position (KP73A)*

Adjust the electrodes position, according to the quotes shown in the next picture.




**Keys**

**E** electrodes
**TA** air pipe
**TG** ignition gas pipe
**U** nozzle

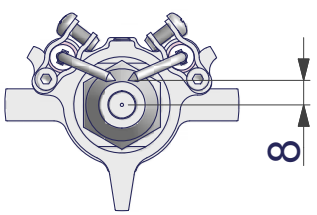



Fig. 36

### *Checking the detection current*

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

| Control box | Minimum detection signal |
|---|---|
| Siemens LFL1.3.. | 70µA with UV detector) |

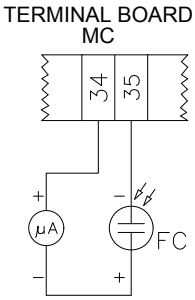



Fig. 37: Detection by photocell QRA..

### *Cleaning and replacing the detection photocell*

The photocell working life is about 10000 working hours (about 1 year), at max 50°C after which it must be replaced.

To clean/replace the detection photocell, proceed as follows:

1 Disconnect the system from the electrical power supply.
2 Shut off the fuel supply
3 remove the photocell from its slot (see next figure);
4 clean the bulbe if dirty, taking care not to touch it with bare hands;
5 if necessary, replace the bulb;
6 replace the photocell into its slot.

### *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

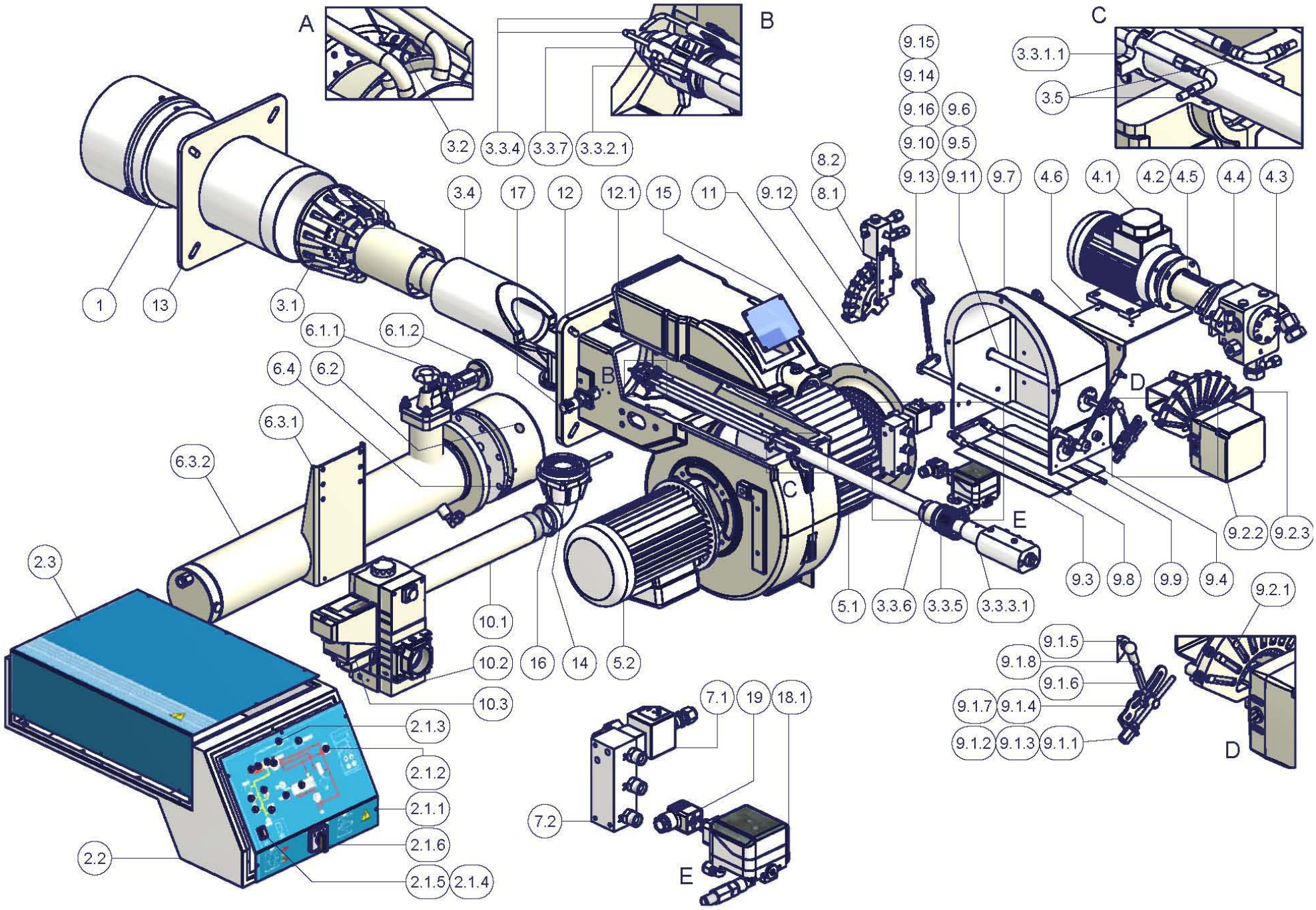
| CAUSE | TROUBLE | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | THE BURNER DOESN'TSTART | CONTINUE WITH PRE-PURGE | DOESN'T START AND LOCK-OUT | DOESN'T START AND REPEATS THE CYCLE | STARTS AND REPEATS THE CYCLE | STARTS AND LOCK-OUTB | THE FLAME MONITOR DEVICE DOESN'T GIVECONSENT TO START | DOESEN'T SWITCH TO HIGH FLAME | DOESEN'T RETURN IN LOW FLAME | HE SERVO CONTROL IS LOCK AND VIBRATE | LOCK-OUT DURING OPERATION | TURNS OF AND REPEATS CYCLE DURING OPERATION | URNS OF AND REPEATS CYCLE DURING OPERATION | URNS OF AND REPEATS CYCLE DURING OPERATION |
| MAIN SWITCH OPEN | ● | | | | | | | | | | | | | |
| LACK OF GAS | ● | | | ● | | | | | | | | | | |
| MAXIMUM GAS PRESSURE SWITCH DEFECTIVE (IF PROVIDED) | ● | | ● | | | | | | | | | | | |
| THERMOSTATS/PRESSURE SWITCHES DEFECTIVE | ● | | | ● | | | | | | | | ● | | |
| FAN MOTOR THERMAL CUTOUT INTERVENTION | ● | | | | | | | | | | | | | |
| OVERLOAD TRIPPED INTERVENTION | ● | | | | | | | | | | | | | ● |
| AUXILIARY FUSES INTERRUPTED | ● | | | | | | | | | | | | | |
| CONTROL BOX FAULTY | ● | ● | ● | | | ● | | | | | ● | | | |
| DEFECTIVE ACTUATOR | ● | ● | ● | | | | ● | | | | | | | |
| AIR PRESSURE SWITCH FAULT OR BAD SETTING | ● | | | | | ● | ● | | | | ● | | | |
| MINIMUM GAS PRESSURE SWITCH DEFECTIVE OR GAS FILTER DIRTY | ● | | | ● | ● | | ● | | | | | ● | | |
| IGNITION TRANSFORMER FAULT | | | ● | | | | | | | | | | | |
| IGNITION ELECTRODES BAD POSITION | | | ● | | | | | | | | | | | |
| BUTTERFLY VALVE BAD SETTING | | | ● | | | ● | | | | | | | | |
| DEFECTIVE GAS GOVERNOR | | | ● | ● | ● | | | | | | | ● | | |
| GAS VALVE DEFECTIVE | | | ● | | | | | | | | | | | |
| BAD CONNECTION OR DEFECTIVE HIGH/LOW FLAME THERMOSTAT OR PRESSURE SWITCH | | | | | | | | ● | ● | ● | | | | |
| WRONG SETTING ACTUATOR CAM | | | | | | | ● | ● | ● | | | | | |
| UV PROBE DIRTY OR DEFECTIVE | | | ● | | | ● | | | | | ● | | | |
| OIL FILTER DIRTY | | | | | | | | | | | | | ● | |

## BURNER EXPLODED VIEW

| ITEM | DESCRIPTION |
|---|---|
| 1 | BLAST TUBE |
| 2.1.1 | FRONT CONTROL PANEL |
| 2.1.2 | LIGHT |
| 2.1.3 | LIGHT |
| 2.1.4 | RESET BUTTON |
| 2.1.5 | PROTECTION |
| 2.1.6 | SWITCH |
| 2.2 | BOARD |
| 2.3 | BOARD COVER |
| 3.1 | COMBUSTION HEAD |
| 3.2 | PIN |
| 3.3.1.1 | BRACKET |
| 3.3.2.1 | BRACKET |
| 3.3.3.1 | OIL MANIFOLD |
| 3.3.4 | IGNITION ELECTRODE |
| 3.3.5 | RING NUT |
| 3.3.6 | ADJUSTING BUSH |
| 3.3.7 | NOZZLE |
| 3.4 | GAS MANIFOLD |
| 3.5 | IGNITION CABLE |
| 4.1 | MOTOR |
| 4.2 | COUPLING FOR MOTOR-PUMP |
| 4.3 | PUMP |
| 4.4 | BRACKET |
| 4.5 | BRACKET |
| 4.6 | BRACKET |
| 5.1 | FAN WHEEL |

| ITEM | DESCRIPTION |
|---|---|
| 5.2 | MOTOR |
| 6.1.1 | GAS BLEEDING VALVE |
| 6.1.2 | THERMOMETER |
| 6.2 | COVER |
| 6.3.1 | BRACKET |
| 6.3.2 | TANK |
| 6.4 | RESISTOR |
| 7.1 | SOLENOID VALVE |
| 7.2 | OIL MANIFOLD |
| 8.1 | PRESSURE GOVERNOR |
| 8.2 | PLATE |
| 9.1.1 | NUT |
| 9.1.2 | SCREW |
| 9.1.3 | CAM REGULATING SCREW |
| 9.1.4 | ADJUSTING CAM |
| 9.1.5 | CONNECTING ROD |
| 9.1.6 | ROD |
| 9.1.7 | JOINT |
| 9.1.8 | JOINT |
| 9.2.1 | ADJUSTING CAM |
| 9.2.2 | ACTUATOR |
| 9.2.3 | BRACKET |
| 9.3 | AIR INTAKE DAMPER |
| 9.4 | AIR INTAKE DAMPER |
| 9.5 | BUSH |
| 9.6 | BUSH |
| 9.7 | AIR INTAKE |

| ITEM | DESCRIPTION |
|---|---|
| 9.8 | PIN |
| 9.9 | PIN |
| 9.10 | PIN |
| 9.11 | PIN |
| 9.12 | ADJUSTING CAM |
| 9.13 | CONNECTING ROD |
| 9.14 | ROD |
| 9.15 | JOINT |
| 9.16 | JOINT |
| 10.1 | THREADED PIPE |
| 10.2 | GAS VALVES GROUP |
| 10.3 | GAS PROVING SYSTEM |
| 11 | AIR INLET CONE |
| 12 | BURNER HOUSING |
| 12.1 | COVER |
| 13 | GASKET |
| 14 | GASKET |
| 15 | INSPECTION GLASS |
| 16 | BUTTERFLY GAS VALVE |
| 17 | PHOTOCELL |
| 18.1 | AIR PRESSURE SWITCH |
| 19 | CONNECTOR |
| | |
| | |
| | |
| | |
| | |


A
B
C
D
E
1
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3.1
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3.3.4
3.3.7
3.3.2.1
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3.5
3.4
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12.1
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2.1.1
2.1.6
2.1.5
2.1.4
2.2
7.1
19
18.1
7.2

# APPENDIX

**SIEMENS LFL 1.3.. CONTROL BOX**

Automatic programme in the event of interruption and indication of position when interrupted

By default, in the event of any kind of interruption, the flow of fuel is immediately interrupted. At the same time the programmer stops and this indicates the position at the time of the interruption.

A symbol on the indicator disc shows each time the type of stoppage:

◄ No start-up (for example fault in the CLOSED signal for the limit contact "Z" at terminal 8 or some other contact between the terminals 12 and 4 or 4 and 5 is not closed).

◄ Start-up suspended because of a fault in the OPEN signal for the limit contact "A" at terminal 8.

**P** Block due to absence of air pressure signal. From this moment onwards any absence of air pressure will cause a block.

■ Block due to malfunction of the flame detector circuit.

▼ Start-up interrupted because there is a fault in the MINIMUM signal for the auxiliary contact of the damper servo motor at terminal 8.

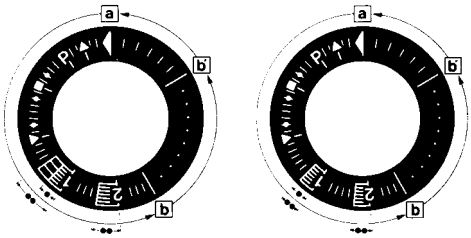
**1** Block due to absence of flame signal at the end of the 1st safety period.

From this moment onwards any absence of a flame signal will cause a block.

**2** Blockdue to absence of flame signal at the end of the 2nd safety period (flame signal of main burner).

▌ Blockdue to absence of flame signal or air pressure during operation.

Where a block stoppage occurs at any moment between switch on and pre-ignition without registering any symbol, the cause is normally an unscheduled flame signal.




a-b Start-up programme

b-b' For time variants:move the programmer on to the automatic stop after the burner starts up (b' = position of the programmer during normal burner operation).

b(b')-aPost-ventilation programme after a regulation stop.At the start-up position "a" the programmer stops automatically.

. Safety time duration for mono-tube burners

.. Safety time duration for twin-tube burners

The apparatus can be reset immediately after a block. After resetting (and after the elimination of any problem causing the stoppage or after a power failure) the programmer returns to its start-up position. In this event only the terminals 7, 9, 10 and 11 are live in accordance with the monitoring programme. Only after this the device programs a new startup.

**Operation**

The wiring system and also the control system of the programmer "P" have already been given in this manual. The response signals required for the active parts and the flame monitor circuit are shown by a hatching.

In the absence of these response signals the mechanism interrupts the start-up programme; the exact time of the interruption can be identified from the visual indicator and will cause a block if the safety code requires it.

A consent to start-up by means of the thermostat or pressostat "R"

A-B start-up program

B-C normal burner operation

C regulation stop caused by "R"

C-D programmer returns to start-up position A.

During the regulation stop only terminals 11 and 12 are live and the damper, through the limit contact "Z" of its servo-motor is in the CLOSED position.The flame detector circuit F is activated (terminals 22 and 23 or 23/4) for the detector test and the paracitic light test.

Where the burners do not have dampers (or have an independent 00 damper control mechanism) there must be a bridge between terminals 6 and 8, otherwise the mechanism will not start up the burner.

For a burner to start up the following conditions must be met:

- Mechanism not blocked/reset.
- Damper closed.Limit contact switchZ must be in the CLOSED position and allow current to flow between terminals 11 and 8.
- Any contacts checking that the fuel valve (bv...) is closed, or other contacts with similar functions, must be closed between terminal 12 and the air pressostat LP.
- The contact for the air pressostat LP must be in the off position (LP test) so as to feed terminal 4.
- The gas pressostat contacts GP and the safety thermostat and pressostat contacts W must also be closed.

**Start-up program**

A Start-up

(R closes the start-up control ring between terminals 4 and 5)

The programmer starts up.At the same time the ventilator motor is fed through terminal 6 ( only for pre-ventilation) and, after t7, the ventilator motor or the combustion gas exhaust fan is fed through terminal 7 (pre-ventilation and post-ventilation).

At the end of t16, the command opening the damper passes through terminal 9; during the damper opening time the programmer does not move since terminal 8, through which the programmer is fed, is dead.

Only once the damper is fully open and the limit contact switch A has switched on, feeding terminal 8, does the programme proceed.

t1 Pre-ventilation time with damper fully open (nominal air flow).

Shortly after the beginning of the pre-ventilation time, the air pressostat should switch off the current between terminals 4 and 13;otherwisethe apparatus would block (air pressure monitor).

At the same time the terminal 14 should be live since current feeding the ignition transformer and the fuel valves passes through this circuit.

During pre-ventilation time the flame detector circuit is checked and in the event of an operational defect the monitor brings about a block.

At the end of the pre-ventilation time the monitor automatically moves the damper servo-motor, through terminal 10, to the flame ignition position which is governed by the auxiliary contact "M".

During this period the programmer stops until terminal 8, is again activatedthrough contact "M".

After a few seconds the little programmer motor is directly fed by the active part of the apparatus.

After this point terminal 8 plays no further part in the burner ignition process.

**Mono-tube burner**

t3 Pre-ignition time waiting the response from the fuel valve at terminal 18.

t2 Safety time (start up flame strenght); at the end of the safety time a flame signal should appear at terminal 22 of the amplifier and it should stay on until a regulation stop; if this does not happen the mechanism will block.

t4 Interval; at the end of t4, terminal 19 is live.

t5 Interval At the end of t5 terminal 20 is live.At the same time the monitor outlets from 9 and 11 and terminal 8 into the active part of the apparatus are kept galvanically separatedso as to protect the monitor itself from recovery voltage through the capacity regulator circuit.

**Twin-tube burners (**)**

t3 Preignition time until the all clear to the pilot burner valve at terminal 17.

t2 First safety time (pilot flame strenght); at the end of the safety time a flame signal should appear at terminal 22 of the amplifier and it should stay on, until a regulation stop; if it does not, the apparatus will block.

t4 Interval until the consent to the fuel valve at terminal 19, for the first flame of the main burner.

t9 2nd safety time; at the end of the second safety time the main burner should be lit by means of the pilot. At the end of this period, terminal 17 is dead and therefore the pilot burner will be out.

t5 Interval; at the end of t5 terminal 20 is live. At the same time the monitor outlets from 9 to 11 and the terminal 8at the input of the active part of the apparatus are galvanically separated so as to protect the apparatus itself from recovery voltage through the strenght regulator circuit.

When the strenght regulator LR at terminal 20 gives the consent, the start-up programme for the apparatus comes to an end. Depending on time variants, the programmer stops either immediately or at the end of a set time, without effecting the position of the contacts.

B Operational position of the burner

B-C Burner operation (production of heat)

While the burner is working the strnght regulator controls the damper, according to the demand for heat, by means of the positioning at nominal load of the auxiliary contact "V" of the damper servocontrol.

C Regulation stop for operation of "R"

When there is a regulation stop the fuel valves immediately close. At the same time the programmer starts to programme:

t6 Post-ventilation time (post-ventilation with the ventilator "G" at terminal 7).Shortly after beginning of the post-ventilation time terminal 10 becomes live and moves the damper to the "MIN" position. The full closure of the damper only happens towards the end of the post-ventilation time and is prompted by an automatic signal from terminal 11

t13 Admissible post-ignition time

During this time the flame monitor circuit may still receive a flame signal without the apparatus blocking.

D-A End of automatic programme

At the end of t6, at the point where the programmer and the automatic contacts have reverted to the starter position, the detection probe test restarts.

During an operational stop even an unscheduled flame signal lasting a few seconds can cause a block because during this period an NTC in the circuit acts as retarder.This means that brief unscheduled influences cannot cause a block.

(**) Times t3, t2 and t4 only apply only to safety devices in the series 01.

**Specifications**

| | |
|---|---|
| Mains voltage | 220V -15%...240V +10% |
| Frequency | 50Hz -6%...60Hz +6% |
| Absorbed capacity | 3.5 VA |
| Built-in fuse | T6.3/250E slow action DIN41571 No. 451915070 |
| External fuse | max. 16A |
| Interference | N-VDE0875 |
| Flow permitted at terminal 1 | 5A (DIN 0660 AC3) |
| Flow permitted at control terminals | 4A (DIN 0660 AC3) |
| Flow at monitor contacts: | |
| input at terminals 4 & 5 | 1A, 250V |
| input at terminals 4 & 11 | 1A, 250V |
| input at terminals 4 & 14 | function of the load at terminals 16 and 19, min.1A, 250V |
| Emplacement | Any |
| Protection | IP40 |
| Permitted ambient temp | -20...+60° C |
| Min.temperature (trans/storage) | -50° C |
| Weight: | |
| apparatus | approx. 1,000g. |
| base | approx. 165g. |

**Ionisation monitor**

| | |
|---|---|
| voltage in detector electrode | |
| normal working | 330V ±10% |
| test | 380V ±10% |
| short circuit current | max. 0,5 mA |
| Ionisation current, min.request | 6 µA |
| max. permitted length for connecting cables | |
| normal cable (laid separately**) | 80m |
| armoured cable(high frequency) | protection at terminal 22 140m |

UV monitor

| | |
|---|---|
| Voltage in UV detector | |
| normal working | 330V ±10% |
| test | 380V ±10% |
| Detector current, min. request* | 70µA |
| Max. detector current | |
| normal working | 630 µA |
| test | 1300 µA |
| Max.length of connecting cable | |
| normal cable (laid separately**) | 100m |
| armoured cable (high frequency) | protected at terminal 22 200m |
| Weight | |
| QRA2 | 60 g |
| QRA10 | 450 g. |

*Connect up in parallel to the measuring device a condenser 100µF, 10...25V.

** The wire connecting up the detector electrode should not be in the same sleeve as the other conductor wires.

Ignition spark monitor with QRE1 series 02 detector

| | |
|---|---|
| Minimum detector current | 30µA |

**Operating times**

| | | |
|---|---|---|
| t7 initial delay for ventilator G2 | 2 | |
| t16 initial delay of air damper OPEN consent | | 4 |
| t11 opening time for damper | any | |
| t10 initial delay for air pressure monitor | 8 | |
| t1 pre-ventilation time with damper open | 36 | |
| t12 travel time for air damper to MIN position | any | |
| t3 t3' pre-ignition time | t3 | 4 |
| | t3 | '- |
| t2 t2' safety time (1st safety time for burners with intermittent pilot lighter | t2 | 2 |
| | t2 | '- |
| t4 t4' interval between start of t2 and response to valve at terminal 19 | t4 | 10 |
| | t4 | '- |
| t9 2nd safety time for burners with intermittent pilot lighter | 2 | |
| t5 interval between end of t4 and response at terminal 20 | 10 | |
| t20 interval before programmer cuts out after start-up- | | |
| duration of start-up | | 60 |
| t6 post-ventilation time (G2 only) | | 12 |
| t13 permitted post-ignition time | | 12 |

t16 initial delay from opening consent of the air damper

t20 interval until the automatic shut-off of the programming mechanism after the burner start

**Key**

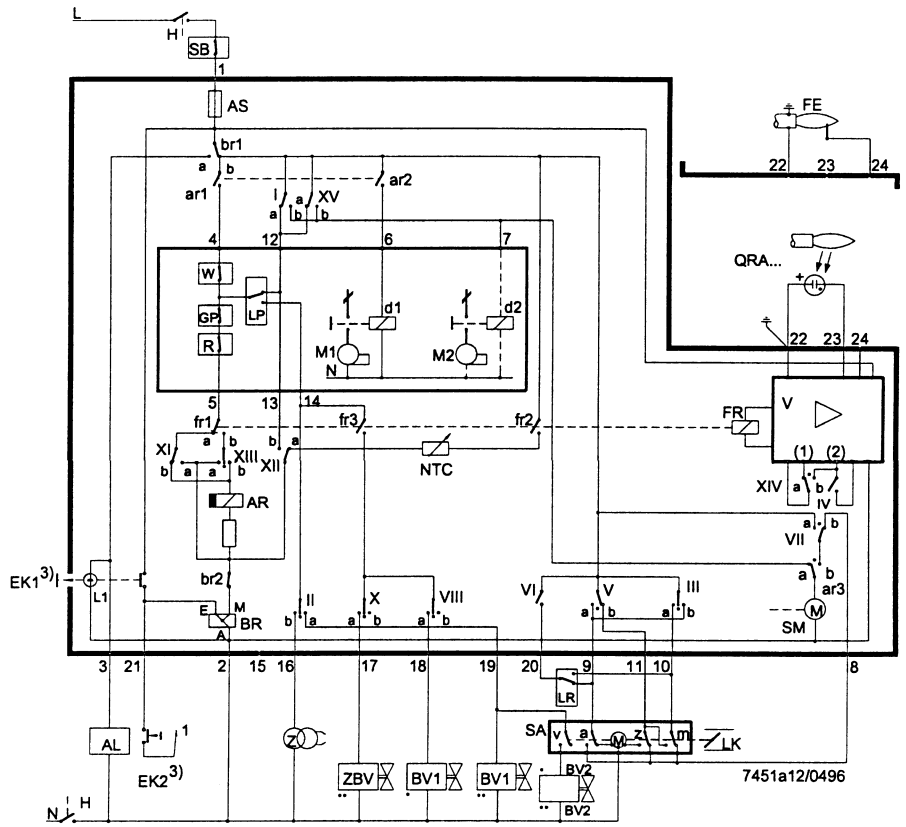
| | |
|---|---|
| A | limit contact switch for damper OPEN position |
| AI | block remote signal |
| AR | main relay (working network) with contacts "ar" |
| AS | Monitor fuse |
| BR | block relay with "br" contacts |
| BV | fuel valve |
| EK | reset button |
| FE | detector electrode of ionisation circuit |
| FR | flame relay with "fr" contacts |
| G | ventilator motor or burner motor |
| GP | gas pressure switch |
| H | main interruptor switch |
| L | block stoppage LED |
| LK | air damper |
| LP | air pressostat |
| LR | safety regulator |
| M | auxiliary contact switch for damper "MIN" position |
| QRA | UV detector |
| QRE | ignition spark detector |
| R | thermostat or pressostat |
| S | fuse |
| SA | damper servo-motor |
| SM | synchronous programmer motor |
| V | flame signal amplifier |
| V | in case of servo-motor: auxiliary contact for response to fuel valve with regard of damper position |
| W | safety pressostat or thermostat |
| Z | ignition transformer |
| Z | in case of servomotor: end of limit contact switch for damper CLOSED position |
| ZBV | pilot burner fuel valve |
| ° | for mono-tube burners |
| °° | for twin-tube burners |

| | |
|---|---|
| (1) | input for raising QRA detector voltage to test level |
| (2) | input for excitation of flame relay during flame detector test circuit (contact XIV) and during safety time (contact IV) |
| (3) | Do not press EK for more than 10 seconds |

**Programmer diagram**

| | |
|---|---|
| t1 | pre-ventilation time |
| t2 | safety time |
| *t2 | '1st safety time |
| t3 | pre-ignition time |
| *t3 | 'pre-ignition time |
| t4 | interval for creating current between terminals 18 and 19 |
| *t4 | 'interval for creating current between terminals 17 and 19 |
| t5 | interval for creating current between terminals 19 and 20 |
| t6 | post-ventilation time |
| t7 | interval between startup consent and current created at terminal 7 |
| t8 | duration of start-up |
| *t9 | 2nd safety time |
| t10 | interval before air pressure monitoring begins |
| t11 | damper opening travel time |
| t12 | damper closure travel time |
| t13 | permissible post-combustion time |
| t16 | initial delay of damper OPEN response |
| t20 | interval before programmer automatically stops |

* These times are valid with the use of a series 01 safety device for monitoring burners with intermittent pilot lighter.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23
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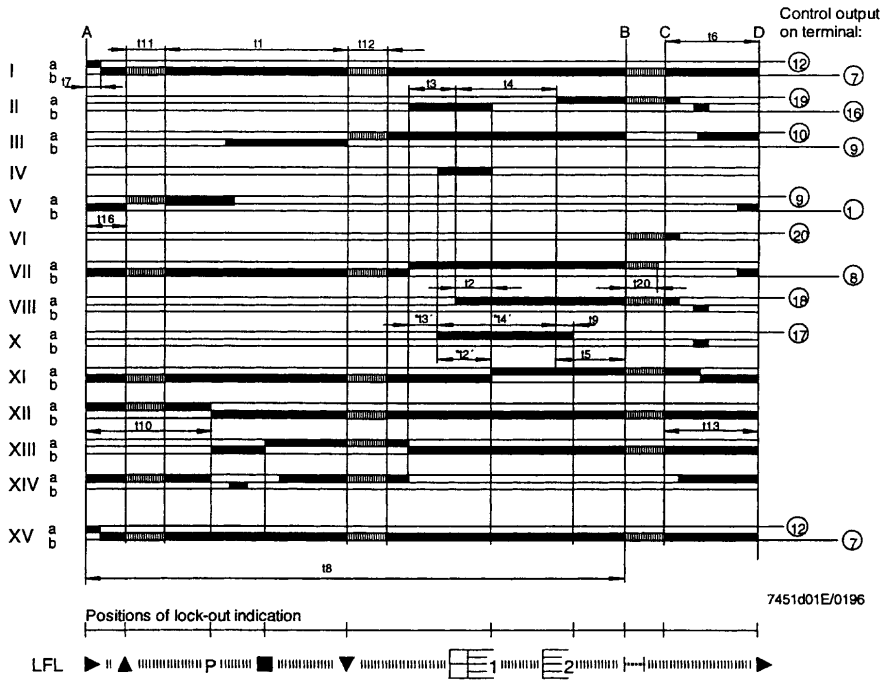
Control output on terminal:
A
B
C
D
t11
t1
t12
t6
t7
t3
t4
t16
t2
t20
t13
t14
t9
t12
t5
t10
t13
t8
I
II
III
IV
V
VI
VII
VIII
X
XI
XII
XIII
XIV
XV
12
7
10
9
1
20
8
18
17
7451d01E/0196
Positions of lock-out indication
LFL
P
1
2


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