Dual fuel light oil/ gas burners

Progressive two stage or modulating operation

<table>
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1 Information and general instructions

1.1 Information about the instruction manual

1.1.1 Introduction
The instruction manual supplied with the burner:
- is an integral and essential part of the product and must not be separated from it; it must therefore be kept carefully for any necessary consultation and must accompany the burner even if it is transferred to another owner or user, or to another system. If the manual is lost or damaged, another copy must be requested from the Technical Assistance Service of the area;
- is designed for use by qualified personnel;
- offers important indications and instructions relating to the installation safety, start-up, use and maintenance of the burner.

Symbols used in the manual
In some parts of the manual you will see triangular DANGER signs. Pay great attention to these, as they indicate a situation of potential danger.

1.1.2 General dangers
The dangers can be of 3 levels, as indicated below.

Maximum danger level!
This symbol indicates operations which, if not carried out correctly, cause serious injury, death or long-term health risks.

This symbol indicates operations which, if not carried out correctly, may cause serious injury, death or long-term health risks.

This symbol indicates operations which, if not carried out correctly, may cause damage to the machine and/or injury to people.

1.1.3 Safety precautions
Good safety practices must be used when working on burner equipment. The potential energy in the electrical supply, fuel and related equipment must be handled with extreme care to prevent equipment failures, injuries and potential death.

If you smell gas, open window, extinguish any open flames, stay away from electrical switches, evacuate the building and immediately call the gas company.

If this equipment is not installed, operated, operated and maintained in accordance with the manufacturers instructions, this product could expose you to substances in fuel or from fuel combustion which can cause death or serious illness.

Improper servicing of this equipment may create a potential hazard to equipment and operators.

Servicing must be done by a fully trained and qualified personnel.

1.1.4 Danger: live components
This symbol indicates operations which, if not carried out correctly, lead to electric shocks with lethal consequences.

Other symbols

ENVIRONMENTAL PROTECTION
This symbol gives indications for the use of the machine with respect for the environment.

This symbol indicates a list.

Abbreviations used
Ch. Chapter
Fig. Figure
Pag. Page
Sec. Section
Tab. Table

Delivery of the system and the instruction manual
When the system is delivered, it is important that:
- The instruction manual is supplied to the user by the system manufacturer, with the recommendation to keep it in the room where the heat generator is to be installed.
- The instruction manual shows:
  - the serial number of the burner;
  - the address and telephone number of the nearest Assistance Centre;
- The system supplier carefully informs the user about:
  - the use of the system,
  - any further tests that may be necessary before the system is started up,
  - maintenance and the need to have the system checked at least once a year by the manufacturer or another specialised technician.
To ensure a periodic check, the manufacturer recommends the drawing up of a Maintenance Contract.
1.2 Guarantee and responsibility

The manufacturer guarantees its new products from the installation date, in accordance with the regulations in force and/or the sales contract. At the moment of the first start-up, check that the burner is integral and complete.

Failure to observe the information given in this manual, operating negligence, incorrect installation and the carrying out of non authorised modifications will result in the annulment by the manufacturer of the guarantee that it supplies with the burner.

In particular, the rights to the guarantee and the responsibility will no longer be valid, in the event of damage to things or injury to people, if such damage/injury was due to any of the following causes:

- incorrect installation, start-up, use and maintenance of the burner;
- improper, incorrect or unreasonable use of the burner;
- intervention of unqualified personnel;
- carrying out of non authorised modifications on the equipment;
- use of the burner with safety devices that are faulty, incorrectly applied and/or not working;
- installation of untested supplementary components on the burner;
- powering of the burner with unsuitable fuels;
- faults in the fuel power supply system;
- use of the burner even following an error and/or an irregularity;
- repairs and/or overhauls incorrectly carried out;
- modification of the combustion chamber with inserts that prevent the regular development of the flame, as structurally established;
- insufficient and inappropriate surveillance and care of those burner components most subject to wear and tear;
- use of non-original components, including spare parts, kits, accessories and optionals;
- force majeure.

the manufacturer furthermore declines any and every responsibility for the failure to observe the contents of this manual.

1.2.1 Owner’s responsibility

Please pay attention to the Safety Warnings contained within this instruction manual. Keep this manual for your records and provide it to your qualified service agency for use in professionally setting up and maintaining your burner.

Your burner will provide years of efficient operation if it is professionally installed and maintained by a qualified service technician. If at any time the burner does not appear to be operating properly, immediately contact your qualified service agency for consultation.

We recommend annual inspection/service of your gas heating system by a qualified service agency.

Failure to follow these instructions, misuse, or incorrect adjustment of the burner could lead to equipment malfunction and result in asphyxiation, explosion or fire.

If you smell gas:

- Do not touch any electrical items.
- Open all windows.
- Close all gas supply valves.
- Contact your local gas authority immediately.

• Do not store flammable or hazardous materials in the vicinity of fuel burning appliances.
• Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death.
• Refer to this manual for instructional or additional information.
• Consult a certified installer, service representative or the gas supplier for further assistance.
• Burner shall be installed in accordance with manufacturers requirements as outlined in this manual, local codes and authorities having jurisdiction.
2.1 Introduction

The burners have been designed and built in compliance with current regulations and directives, applying the known technical rules of safety and envisaging all the potential danger situations. It is necessary, however, to bear in mind that the imprudent and clumsy use of the equipment may lead to situations of death risk for the user or third parties, as well as the damaging of the burner or other items. Inattention, thoughtlessness and excessive confidence often cause accidents; the same applies to tiredness and sleepiness.

It is a good idea to remember the following:

- The burner must only be used as expressly described. Any other use should be considered improper and therefore dangerous.
- In particular:
  - it can be applied to boilers operating with water, steam, diathermic oil, and to other users expressly named by the manufacturer;
- Modification of the burner to alter its performance and destinations is not allowed.
- The burner must be used in exemplary technical safety conditions. Any disturbances that could compromise safety must be quickly eliminated.
- Opening or tampering with the burner components is not allowed, apart from the parts requiring maintenance.
- Only those parts envisaged by the manufacturer can be replaced.

2.2 Personnel training

The user is the person, body or company that has acquired the machine and intends to use it for the specific purpose. He is responsible for the machine and for the training of the people working around it.

The user:

- Undertakes to entrust the machine exclusively to suitably trained and qualified personnel.
- Must take all the measures necessary to prevent unauthorised people gaining access to the machine.
- Undertakes to inform his personnel in a suitable way about the application and observance of the safety instructions. With that aim, he undertakes to ensure that everyone knows the use and safety instructions for his own duties.
- Must inform the manufacturer if faults or malfunctioning of the accident prevention systems are noticed, along with any presumed danger situation.
- Personnel must always use the personal protective equipment envisaged by legislation and follow the indications given in this manual.
- Personnel must follow all the danger and caution indications shown on the machine.
- Personnel must not carry out, on their own initiative, operations or interventions that are not within their province.
- Personnel are obliged to inform their superiors of every problem or dangerous situation that may arise.
- The assembly of parts of other makes, or any modifications, can alter the characteristics of the machine and hence compromise operating safety. The manufacturer therefore declines any and all responsibility for any damage that may be caused by the use of non-original parts.
## Technical description of the burner

### 3 Technical data

<table>
<thead>
<tr>
<th>Model</th>
<th>RLS 300/E</th>
<th>RLS 400/E</th>
<th>RLS 500/E</th>
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<td>kW MBtu/hr (4)</td>
<td>kW MBtu/hr (4)</td>
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<td>47.8 – 121.7 (110.6*)</td>
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<td>kW MBtu/hr (4)</td>
<td>kW MBtu/hr (4)</td>
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<td>Ambient temperature</td>
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<td>11362 – 24807 (22325*)</td>
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<td>Gas pressure at maximum delivery (2)</td>
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<td>Operation</td>
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<td>Standard applications</td>
<td>Boilers: water, steam, thermal oil</td>
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<td>Combustion air temperature</td>
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<td>pressure range</td>
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<td>fuel temperature</td>
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<td>Noise levels (3)</td>
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(*) Firing Rate for C-ETL Canadian Listing  
(1) Reference conditions: ambient temperature 68 °F (20°C) - Barometric pressure 394” WC - Altitude 329 ft.  
(2) Pressure at test point 5)(Fig. 3) with zero pressure in the combustion chamber and maximum burner output.  
(3) Sound pressure measured in manufacturer’s combustion laboratory, with burner operating on test boiler and at maximum rated output.  
(4) Equivalent Btu values based on 1 USGPH = 140,000 Btu/hr.
### 3.2 Electrical data

#### Fan motor and pump motor IE1

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<thead>
<tr>
<th>Model</th>
<th>RBNA Code</th>
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#### Tab. B
### Fan motor and pump motor IE2/EPACT

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Fan motor and pump motor IE2/EPACT

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<td>rpm</td>
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3.3 Burner models designation

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<th>Code RBNA</th>
<th>Voltage</th>
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<th>Flame safeguard</th>
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<td>tbd</td>
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<td>Star/Delta</td>
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<td>C9134010</td>
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<td>C9135010</td>
<td>575/3/60</td>
<td>Star/Delta</td>
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</tbody>
</table>

3.4 Packaging - weight - Approximate measurements

The packaging of the burner (Fig. 1) rests on a wooden platform that is particularly suitable for lift trucks. The overall dimensions of the packaging are shown in the Tab. E.

The weight of the burner complete with its packaging is shown in Tab. E.

<table>
<thead>
<tr>
<th>inch</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>lbs</th>
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<td>42 9/32</td>
<td>47 3/8</td>
<td>661</td>
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</table>

Fig. 1
3.5 Burner dimensions

The maximum dimensions of the burner are given in Fig. 2. Bear in mind that inspection of the combustion head requires the burner to be opened by rotating the rear part on the hinge.

The overall dimensions of the burner when open are indicated by L and R.

3.6 Standard equipment

<table>
<thead>
<tr>
<th>Tab. F</th>
<th>inch</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
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<th>I</th>
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<td>46 1/4&quot;</td>
<td>41 17/32&quot;</td>
<td>12 19/32&quot;</td>
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<td>6 7/16&quot;</td>
<td>12 5/16&quot;</td>
<td>23 5/32&quot;</td>
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<td>14 17/32&quot;</td>
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<td>ANSI 3&quot;</td>
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<td>41 17/32&quot;</td>
<td>12 19/32&quot;</td>
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Flange gasket ............................................. No. 1
Flange fixing screws (M16 x 50) ........................... No. 4
Screws (M18 x 60) to secure the burner flange to the boiler. No. 4
Spacers ....................................................... No. 2
Instruction booklet ........................................ No. 1
3.7 Burner description

1 Lifting eyebolts
2 Fan
3 Fan motor
4 Air gate valve servomotor
5 Gas pressure test point
6 Combustion head
7 Ignition pilot
8 Flame stability disk
9 Electric panel board - cover
10 Hinge for opening burner
11 Air inlet to fan
12 Manifold
13 Thermal insulation screen for securing burner to boiler
14 Gas train flange
15 Shutter
16 Lever for movement of combustion head
17 Gears for movement of air damper
18 Air pressure switch (differential operating type)
19 Air pressure test point
20 Max gas pressure switch with pressure test point
21 QRI flame detector
22 Air pressure test point “+”
23 Oil modulator and gas butterfly valve servomotor
24 Pump
25 Pump motor
26 Min oil pressure switch
27 Oil shutoff VOG valve
28 Nozzle delivery pressure gauge
29 Nozzle return pressure gauge
30 Oil modulator
31 Strainer
32 Check valve
33 Air pressure test point “-“

WARNING
The burner can be opened either on the right or left sides, irrespective of the side from which fuel is supplied. When the burner is closed, the hinge can be repositioned on the opposite side.
3.7.1 Panel board description

**STAR/DELTA START**

1. “OFF - LOCAL - REMOTE” switch
2. “POWER ON” signal
3. “CALL FOR HEAT” signal
4. “OIL - OFF - GAS” switch
5. “FUEL ON” signal
6. “ALARM SILENCE” button
7. “BURNER LOCK-OUT and RESET” pushbutton
8. Low air pressure switch
9. Operator panel with LCD display
10. Burner terminal board “X1”
11. Control box for checking flame and air/fuel ratio
12. Ignition transformer “TA”
13. Control box transformer
14. Step-down transformer (available)
15. Terminal strip “X2”
16. Fan motor contactor and thermal relay with reset button
17. Pump motor contactor and thermal relay with reset button
18. Bracket for shielded cables with thumbscrew
   **Warning:** used only to avoid a break in the cable’s shielding, hence do not overtighten.
19. Contactor with auxiliary contact for star/delta start (only for star/delta version)
20. Auxiliary fuse
21. DIN bar for relay, fuse holder and terminal strip “XAux”
22. Horn
23. “K1” relay
24. “K3” relay
25. “K5” relay
26. “K2” relay
27. Transformer, available for additional actuator or O₂ control
28. “KO” relay
29. “KG1” relay
30. DIN bar for “X2” terminal strip, thermal relays and contactors
31. Star/delta starter timer (only for star/delta version)
32. Holes for cables grommets for electrical wirings, accessories and power supply (to be carried out by the installer)
33. Plug/socket for maximum pressure switch
34. Plug/socket for air actuator
35. Plug/socket for QRI flame sensor
36. Terminal strip “XAux”
37. “KG2” relay

**DIRECT START**

**Three types of burner failure may occur:**

- **Flame safeguard lock-out**
  If the flame safeguard alarm 6(Fig. 4) lights up, it indicates that the burner is in lock-out. To reset, press the reset pushbutton.

- **Fan motor trip**
  Release by pressing the push-button on thermal overload 16(Fig. 4). See “Thermal relay calibration” on page 36.

- **Pump motor trip**
  Release by pressing the push-button on thermal overload 17(Fig. 4). See “Thermal relay calibration” on page 36.

**WARNING**

The connection of the inverter and O₂ kits must be carried out by the client / installer following the instructions (electrical drawing) provided with the burner and the kits.
3.8 Firing rates

**Maximum output** must be selected in the hatched area of the diagram (Fig. 5).

**Minimum output** must not be lower than the minimum limit shown in the diagram.

The firing rate area values have been obtained considering an ambient temperature of 68 °F, and an atmospheric pressure of 394” WC and with the combustion head adjusted as shown on page 28.

<table>
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<th>MBtu/hr</th>
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<td>RLS 800/E</td>
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**Fig. 5**
3.8.1 Procedure to refer burner operating condition in high altitude plants

Find the CORRECTED BURNER CAPACITY for the plant’s altitude in chart 1 and the CORRECTED PRESSURE in chart 2. Check in the firing rate graph of the burner (Fig. 5), if the working point defined by the values above is within the range limits. If not, higher burner size is needed.

**Note**
- Charts are based only on altitude variation (reference temperature = 68°F, 20°C)
- To get the combined correction in case of different air temperature, a compensation of 1000 ft each 20°F (305 m each 11°C) is applicable (100 ft = 2°F).

**Example**
- Rated capacity = 3000 MBtu/hr - Rated air pressure = 1.5" WC
- Real altitude = 5000 ft - Real temperature = 108°F

\[ \Delta = 108°F - 68°F \text{ (reference temp.)} = 40°F \]

(equivalent 2000 ft variation)

\[ 40 : 2 = 20 \times 100 = 2000 \text{ ft} \]

Proceeding as described above and considering a “virtual altitude” of (5000 + 2000) ft:
- 3000 MBtu/hr at 7000 ft, the corrected capacity is 3847 MBtu/hr
- 1.5" WC at 7000 ft, the corrected burner air pressure is 1.92

**Reference conditions:**
- Ambient temperature 68 °F (20 °C)
- Barometric pressure 394" WC (1000 mbar)
- Altitude 328 ft a.s.l. (100 m a.s.l.)

### CORRECTED BURNER CAPACITY ACCORDING TO ALTITUDE

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<th>610</th>
<th>915</th>
<th>1220</th>
<th>1525</th>
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### 3.9 Minimum furnace dimensions

The firing rates were set in relation to certified test boilers. Fig. 6 indicates the diameter and length of the test combustion chamber.

**Example RLS 500/E:**

Output 18500 MBtu/hr: diameter 39.4 inch - length 16.5 ft.

![Fig. 6](image-url)
### Warning notes

To avoid injury to persons, damage to property or the environment, the following warning notes must be observed!

The LMV51... is a safety device! Do not open, interfere with or modify the unit.

Riello S.p.A. will not assume responsibility for any damage resulting from unauthorized interference! Risk of explosion!

Incorrect configuration can lead to excessive fuel supply which might cause an explosion!

Operators must be aware that incorrect settings made on the AZL5... display and operating unit and incorrect settings of the fuel and / or air actuator positions can lead to dangerous burner operating conditions.

* All activities (mounting, installation and service work, etc.) must be performed by qualified staff.
* Before making any wiring changes in the connection area of the LMV5..., completely isolate the plant from mains supply (all-polar disconnection). Ensure that the plant cannot be inadvertently switched on again and that it is indeed dead. If not observed, there is a risk of electric shock hazard.
* Protection against electrical shock hazard on the LMV5... and on all connected electrical components must be ensured through appropriate mounting.
* Each time work has been carried out (mounting, installation and service work, etc.), check to ensure that wiring is in an orderly state, that the parameters have been correctly set and make the safety checks.
* Fall or shock can adversely affect the safety functions. Such units must not be put into operation even if they do not exhibit any damage.
* In programming mode, the position check of actuators and VSD (checking electronic fuel / air ratio control) is different from the check during automatic operation. Like in automatic operation, the actuators are still jointly driven to their required positions. If an actuator does not reach the required position, corrections are made until that position is reached. However, in contrast to automatic operation, there are no time limits to these corrective actions. The other actuators maintain their positions until all actuators have reached the positions currently required. This is essential for setting fuel /air ratio control. This means that during the time the fuel /air ratio curves are programmed, the person making the plant settings must continuously monitor the quality of the combustion process (e.g. by means of a flue gas analyzer). Also, if combustion levels are poor, or in the event of dangerous situations, the commissioning engineer must take appropriate action (e.g. switching off manually).

To ensure the safety and reliability of the LMV5... system, the following points must also be observed:

- Condensation and ingress of humidity must be avoided. Should such conditions occur, make sure that the unit will be completely dry before switching on again!
- Static charges must be avoided since they can damage the unit’s electronic components when touched.

### Mechanical design

The LMV5... is a microprocessor-based burner management system with matching system components for the control and supervision of forced draft burners of medium to large capacity. The following components are integrated in the basic unit of the LMV5...:

- Burner control with gas valve proving system
- Electronic fuel / air ratio control with a maximum of 4 (LMV51...) or 6 (LMV52...) actuators
- Optional PID temperature / pressure controller (load controller)
- Optional VSD module

### Installation notes

- Ensure that the electrical wiring inside the boiler is in compliance with national and local safety regulations.
- Do not mix up live and neutral conductors.
- Make certain that strain relief of the connected cables is in compliance with the relevant standards (e.g. as per DIN EN 60730 and DIN EN 60 335).
- Ensure that spliced wires cannot get into contact with neighboring terminals. Use adequate ferrules.
- Always run high-voltage ignition cables separately while observing the greatest possible distance to the unit and to other cables.
- The burner manufacturer must protect unused AC 230 V terminals with dummy plugs (refer to sections Suppliers of other accessory items).
- When wiring the unit, ensure that AC 230 V mains voltage cables are run strictly separate from extra low-voltage cables to warrant protection against electrical shock hazard.
Electrical connection of ionization probe and flame detector

It is important to achieve practically disturbance- and loss-free signal transmission:

- Never run the detector cables together with other cables:
  - Line capacitance reduces the magnitude of the flame signal.
  - Use a separate cable.
- Observe the permissible cable lengths.
- The ionization probe is not protected against electrical shock hazard. The mains powered ionization probe must be protected against accidental contact.
- Locate the ignition electrode and the ionization probe such that the ignition spark cannot arc over to the ionization probe (risk of electrical overloads).

Technical data

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<th>Mains voltage</th>
<th>AC 120 V -15 % / +10 %</th>
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Terminal loading

‘Inputs’

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<td>Restart on rise in mains voltage</td>
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‘Outputs’

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<td>- Ignition transformer</td>
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<td>- Valve</td>
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<td>- Oil pump / magnetic clutch</td>
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<td>Fuel valve oil (nominal voltage)</td>
</tr>
<tr>
<td>Nominal current</td>
</tr>
<tr>
<td>Power factor</td>
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</table>

| Cable lengths | Main line | Max. 100 m (100 pF/m) |

<table>
<thead>
<tr>
<th>Environmental conditions</th>
<th>Operation</th>
<th>DIN EN 60721-3-3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Climatic conditions</td>
<td>Class 3K3</td>
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<tr>
<td></td>
<td>Mechanical conditions</td>
<td>Class 3M3</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-20...+60 °C</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>&lt; 95 % r.h.</td>
<td></td>
</tr>
</tbody>
</table>
Technical description of the burner

Operation sequence of the burner

- **Fuel:** Gas, Oil
- **Actuators:** Actuator 1, 2, 3, 4, 5, 6
- **Inputs:** Timer 1, Timer 2, Ignition (Z), Fuel valve, SV, Fuel valve, PV, Air pressure switch (LP), Fan conductor contact (GSK), Timer 1, Timer 2, Fuel 1 (oil), Fuel 2 (gas), Timer + setpoint relation, Start release - oil
- **Outputs:** Oil pump / magnetic clutch
- **Fig. 8:** D9507

---

**Phase number**

- **Operation sequence of the burner** is shown with various inputs and outputs, including:
  - Ignition (Z)
  - Fuel valve, SV
  - Fuel valve, PV
  - Fan conductor contact (GSK)
  - Timer 1, Timer 2
  - Fuel 1 (oil), Fuel 2 (gas)

---

**Technical details**

- **Timer + setpoint relation**
- **Start release - oil**
- **Fuel valve, SV**
- **Fan conductor contact (GSK)**
- **Timer 1, Timer 2**

---

**Fig. 8**

---

**Technical diagram**

- **Diagram notes:**
  - Electrical connections
  - Pressure test
  - Direct start
  - Fan (M)
  - Safety relay arrest
  - Oil pump / magnetic clutch
**Technical description of the burner**

**Key to the sequence diagrams:**
Depending on the parameter, valve proving takes place:
between phase 62 and phase 70 or/and
between phase 30 and phase 32.

**Assignment of times:**
- t0: Postpurge lockout position
- t01: Max. time safety phase
- t10: Min. time home run
- t21: Min. time start release
- t22: Fan runup time
- t30: Prepurge time part 1
- t34: Prepurge time part 3
- t36: Min. ON time oil pump
- t38: Preignition time gas / oil
- t42: Preignition time OFF
- t44: Interval 1 gas / oil
- t62: Max. time low-fire
- t70: Afterburn time
- t74: Postpurge time 1 gas / oil (tn1)
- t78: Postpurge time 3 gas / oil (tn3)
- t80: Valve proving evacuate time
- t81: Leakage test time atmospheric pressure
- t82: Leakage test filling test
- t83: Leakage test time gas pressure
- tmn1: Min. time extraneous light test (5 s.) after skip over of prepurge
- tmx1: Max. damper running time
- tmx2: Max. time startup release
- tmx3: Max. time circulation heavy oil
- tn: Postpurge time
- TSA1: Safety time 1
- TSA2: Safety time 2
- tv: Prepurge time gas / oil

**Signal ON**  **Signal OFF**  **Next phase**

- 01  00, Rep = 0
- 01  12, Rep > 0

**Parameter direct start**
Checking with controller on
Deviation  →  10
No Rep. decrement

- 10
- 70

**Without VP70 with VP80**

- 62

**Stop, up to Ph – max. time**

- 01  00, Rep = 0
- 01  12, Rep > 0

**0-3 s.**

- 01  00, Rep = 0
- 01  12, Rep > 0

**0-30 s.**

- 01  00, Rep = 0
- 01  12, Rep > 0

**Param.**  79

**10

Input: don’t care
Output: OFF
Output: ON
Technical description of the burner

Permissible positioning range

In Standby: actuator can travel within the permissible positioning range, but is always driven to the home position. Must be in the home position before changing the phase.

0° Position as supplied (0°)
90° Actuator fully open (90°)
AGR Fuel gas recirculation
CPI Closed position indication
DP Pressure tester
PS-VP Pressure switch – valve proving
FCC Fan contactor contact
LF Air damper
APS Air pressure switch
N Postpurging
SR Safety relay
SLT Safety limit thermostat
TL Temperature limiter

Repetition counter:
k) Heavy oil
l) Restricted startup behavior
n) Restricted safety loop

In Standby: actuator can travel within the permissible positioning range, but is always driven to the home position. Must be in the home position before changing the phase.
3.11 Actuators

Warning notes

To avoid injury to persons, damage to property or the environment, the following warning notes should be observed!

Do not open, interfere with or modify the actuators!

- All activities (mounting, installation and service work, etc.) must be performed by qualified staff.
- Before making any wiring changes in the connection area of the actuator, completely isolate the burner control from the mains supply (all-polar disconnection).
- Ensure protection against electric shock hazard by providing adequate protection for the connection terminals and by securing the housing cover.
- Check to ensure that wiring is in an orderly state.
- Fall or shock can adversely affect the safety functions. Such units must not be put into operation, even if they do not exhibit any damage.

The housing cover may only be removed for short periods of time for wiring or when making the addressing.

It must be made certain that dust or dirt will not get inside the actuator while such work is carried out.

Use

The actuators (Fig. 9) are used to drive and position the air damper and the gas butterfly valve, without mechanical leverages but via the interposition of an elastic coupling.

When used in connection with burner controls or electronic fuel / air ratio control, the associated controlling elements are controlled depending on burner output.

Installation notes

- Always run the high-voltage ignition cables separate from the unit and other cables while observing the greatest possible distance.
- To ensure protection against electric shock hazard, make certain that the AC 230 V section of the actuator is strictly segregated from the functional low-voltage section.
- The holding torque is reduced when the actuator's power supply is switched off.

When servicing or replacing the actuators, take care not to invert the connectors.

Technical data

<table>
<thead>
<tr>
<th>Model</th>
<th>SQM45.295A9</th>
<th>SQM48.497A9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage</td>
<td>AC 2 x 12 V via bus cable from the basic unit or via a separate transformer</td>
<td></td>
</tr>
<tr>
<td>Safety class</td>
<td>Extra low-voltage with safe isolation from mains voltage</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>9...15 VA</td>
<td></td>
</tr>
<tr>
<td>Degree of protection</td>
<td>To EN 60 529, IP 54, provided adequate cable entries are used</td>
<td></td>
</tr>
<tr>
<td>On time</td>
<td>50 %, max. 3 min. continuously</td>
<td></td>
</tr>
<tr>
<td>Electrical connections</td>
<td>RAST3.5 terminals</td>
<td></td>
</tr>
<tr>
<td>Direction of rotation</td>
<td>Standard: counterclockwise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reverse: clockwise</td>
<td></td>
</tr>
<tr>
<td>Running time (min.) for 90°</td>
<td>10 s.</td>
<td>30s.</td>
</tr>
<tr>
<td>Holding torque (max.)</td>
<td>1.5 Nm</td>
<td>20 Nm</td>
</tr>
<tr>
<td>Nominal torque (max.)</td>
<td>3 Nm</td>
<td>20 Nm</td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 1 kg</td>
<td>approx. 1.6 kg</td>
</tr>
</tbody>
</table>

Environmental conditions:

<table>
<thead>
<tr>
<th>Operation</th>
<th>DIN EN 60721-3-1</th>
</tr>
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<tbody>
<tr>
<td>Climatic conditions</td>
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<tr>
<td>Mechanical conditions</td>
<td>class 1M2</td>
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<tr>
<td>Temperature range</td>
<td>-20...+60 °C</td>
</tr>
<tr>
<td>Humidity</td>
<td>&lt; 95 % r.h.</td>
</tr>
</tbody>
</table>
4 Installation

4.1 Notes on safety for the installation

After carefully cleaning all around the area where the burner will be installed, and arranging the correct lighting of the environment, proceed with the installation operations.

All the installation, maintenance and disassembly operations must be carried out with the electricity supply disconnected.

The installation of the burner must be carried out by qualified personnel, as indicated in this manual and in compliance with the standards and regulations of the laws in force.

4.2 Handling

The packaging of the burner includes a wooden platform, so it is possible to move the burner (still packaged) with a transpallet truck or fork lift truck.

The handling operations for the burner can be highly dangerous if not carried out with the greatest attention: keep any unauthorised people at a distance; check the integrity and suitableness of the available means of handling.

Check also that the area in which you are working is empty and that there is an adequate escape area (i.e. a free, safe area to which you can quickly move if the burner should fall).

During the handling, keep the load at not more than 20-25 cm from the ground.

After positioning the burner near the installation point, correctly dispose of all residual packaging, separating the various types of material.

Before proceeding with the installation operations, carefully clean all around the area where the burner will be installed.

4.3 Preliminary checks

Checking the consignment

After removing all the packaging, check the integrity of the contents. In the event of doubt, do not use the burner; contact the supplier.

The output of the burner must be within the boiler’s firing rate;

The packaging elements (wooden cage or cardboard box, nails, clips, plastic bags, etc.) must not be abandoned as they are potential sources of danger and pollution; they should be collected and disposed of in the appropriate places.

A burner label that has been tampered with, removed or is missing, along with anything else that prevents the definite identification of the burner makes any installation or maintenance work difficult.

4.4 Operation position

The burner is designed to operate only in the positions 1, 2, 3 and 4 (Fig. 10).

Installation 1 is preferable, as it is the only one that allows the maintenance operations as described in this manual.

Installations 2, 3 and 4 permit operation but make maintenance and inspection of the combustion head more difficult.

Any other position could compromise the correct operation of the appliance.

Installation 5 is prohibited for safety reasons.
4.5 Removal of the locking screws from the shutter

Remove the screws and the nuts 1)-2)(Fig. 11), before installing the burner on the boiler.
Replace them with the screws 3) M12 X 25 supplied with the burner.

4.6 Boiler plate

Drill the combustion chamber mounting plate as shown in Fig. 12.
The position of the threaded holes can be marked using the gasket supplied with the burner.

<table>
<thead>
<tr>
<th>inch</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>RLS 300/E</td>
<td>13 25/32&quot;</td>
<td>17 51/64&quot;</td>
<td>3/4&quot; coarse</td>
</tr>
<tr>
<td>RLS 400/E</td>
<td>13 25/32&quot;</td>
<td>17 51/64&quot;</td>
<td>3/4&quot; coarse</td>
</tr>
<tr>
<td>RLS 500/E</td>
<td>15 11/32&quot;</td>
<td>17 51/64&quot;</td>
<td>3/4&quot; coarse</td>
</tr>
<tr>
<td>RLS 650/E</td>
<td>17 5/16&quot;</td>
<td>19 31/64&quot;</td>
<td>3/4&quot; coarse</td>
</tr>
<tr>
<td>RLS 800/E</td>
<td>17 5/16&quot;</td>
<td>19 31/64&quot;</td>
<td>3/4&quot; coarse</td>
</tr>
</tbody>
</table>

4.7 Securing the burner to the boiler

4.7.1 Blast tube length
The length of the blast tube must be selected according to the indications provided by the manufacturer of the boiler, and in any case it must be greater than the thickness of the boiler door complete with its fettling (the head should not jut out more than 4 ÷ 5 inch Fig. 13).

4.7.2 Burner securing
► Create a suitable hoisting system by hooking onto the rings 4), removing the fastening screws 1) securing the cover 2) first.
► Slip the thermal protection onto the blast tube 3).
► Place entire burner on the boiler hole (arranged previously, see Fig. 12), and fasten with the screws given as standard equipment.
► The coupling of the burner-boiler must be airtight.
4.7.3 Accessibility to the interior of the combustion head

In order to reach inside the combustion head proceed as follows:

**RLS 300 - 400 - 500/E model (Fig. 14)**

- open burner at hinge (Fig. 14) after removing the 4 screws 1);
- disconnect the wires 2) from the electrodes;
- disconnect the oil pipes by unscrewing the two connectors 3);
- unscrew the under part of the elbow 4) until it comes free of its slot.
- Extract the internal part 5) of the combustion head.

**WARNING**

While unscrewing, some fuel may leak out.

**RLS 650 - 800/E model (Fig. 15)**

- Disconnect the electrical wiring related to oil pump/servomotor, air servomotor and gas pressure switch;
- disconnect the leverages related to air damper and head movement;
- unscrew the 4 x fixing screws 1);
- release the cable of the electrode 2);
- disconnect the oil pipes by unscrewing the two connectors 3).

**WARNING**

While unscrewing, some fuel may leak out.

- Release the ignition pilot retainer;
- remove the screw/gas pressure test point 6) of the combustion head;
- unscrew the under part of the elbow until it comes free of its slot;
- extract the internal part 5) of the combustion head.
4.8 Electrode and ignition pilot adjustment

Place the electrode and the ignition pilot observing the dimensions in Fig. 16 and Fig. 17.

**RLS 300 - 400 - 500/E model (Fig. 16)**

- 27/32" (27/32"
- 5/8"

**RLS 650 - 800/E model (Fig. 17)**

- 1-1/2"
- 5/8"
4.9 Nozzle

In order to guarantee that emissions do not vary, recommended and/or alternative nozzles specified by Riello in the Instruction and warning booklet should be used.

It is advisable to replace nozzles every year during regular maintenance operations.

4.9.1 Recommended nozzles

Fluidics type N2 angle 45°

Intermediate flow rates may be obtained by choosing the nozzle with a nominal flow rate slightly higher than that actually required.

<table>
<thead>
<tr>
<th>MODULATING PRESSURE</th>
<th>NOZZLE</th>
<th>HIGH FIRE</th>
<th>LOW FIRE</th>
</tr>
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<tbody>
<tr>
<td>BURNER MODEL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RLS 300</td>
<td></td>
<td></td>
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<tr>
<td>RLS 400</td>
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<td>RLS 500</td>
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<tr>
<td>RLS 650</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RLS 800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal size</td>
<td>Fluidics N2 45°</td>
<td>By-pass pressure</td>
<td>Flow rate</td>
</tr>
<tr>
<td>kg/h</td>
<td>Code</td>
<td>PSI</td>
<td>kg/h</td>
</tr>
<tr>
<td>X</td>
<td>130</td>
<td>270</td>
<td>105,0</td>
</tr>
<tr>
<td>X</td>
<td>150</td>
<td>258</td>
<td>149,4</td>
</tr>
<tr>
<td>X</td>
<td>200</td>
<td>267</td>
<td>187,5</td>
</tr>
<tr>
<td>X</td>
<td>250</td>
<td>260</td>
<td>211,3</td>
</tr>
<tr>
<td>X</td>
<td>250</td>
<td>262</td>
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<tr>
<td>X</td>
<td>275</td>
<td>268</td>
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<td>X</td>
<td>300</td>
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<td>256,3</td>
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<td>X</td>
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<td>531,3</td>
</tr>
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</tr>
<tr>
<td>X</td>
<td>750</td>
<td>244</td>
<td>656,3</td>
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<tr>
<td>X</td>
<td>750</td>
<td>247</td>
<td>674,4</td>
</tr>
</tbody>
</table>

Tab. G
4.9.2 Nozzle installation

- Fit the nozzle with the box spanner, fitting the spanner through the central hole in the flame stability disk (Fig. 18).
- Nozzles with no fuel shutoff needle must be fitted on the nozzle holder.
- To set the delivery range within which the nozzle must work, nozzle return line fuel pressure must be adjusted according to Tab. G.

> Do not use any sealing products such as gaskets, sealing compound, or tape.
> Be careful to avoid damaging the nozzle sealing seat.
> The nozzles must be screwed into place tightly but not to the maximum torque value provided by the wrench.
4.10 Combustion head setting

In addition to varying air flow depending on the output requested, the air gate valve servomotor 4)(Fig. 3) by means of a lifting assembly - varies the setting of the combustion head.

This system allows an optimal setting even at a minimum firing rate.

For the same servomotor rotation, combustion head opening can be varied by moving the tie rod onto holes 1-2-3, Fig. 19.

The choice of the hole (1-2-3) to be used is decided on the basis of diagram (Fig. 21) against the required maximum output.

Setting is pre-arranged in the plant for the maximum run (hole 3) (Fig. 19).

When dealing with boilers featuring a strong back pressure, if air delivery is insufficient even with the damper fully open, you can use a different setting to that illustrated in diagram (Fig. 21) do this by moving the tie rod onto the next highest index, thus increasing the combustion head's opening and hence air delivery.

If combustion requirements require you to move spacer 1)(Fig. 20) onto the 1st or 2nd hole of the gear and, at the same time, the hinge is on the right, you need to fit the spacers 4)(Fig. 20) supplied with the burner.

Proceed as follows:
- first unscrew nuts 2), remove tie rod 3), unscrew spacer 1) and position it on the hole you want,
- screw the spacers 4) onto spacer 1) and screw 5) respectively,
- once done, refit the tie rod and nuts.
4.10.1 Adjustment at the maximum output (for gas)

**Only for RLS 400/E model**

To achieve operation at minimum output, the combustion head’s gas pipes must be adjusted to hole position 5 (Fig. 22).

![Fig. 22](D3418)

**Only for RLS 650/E model**

The adjustment at the maximum output requires the disassembly of the 6 nozzles as indicated in Fig. 23.

Proceed as follows:

- disassemble from the burner of the complete combustion head assembly;
- unscrew the screws and remove the 8 tangential tubes 1);
- unscrew the 4 screws and disassemble the diffuser disc 2);
- unscrew and remove the 6 nozzles 3);

Re-assemble with reverse procedure, re-placing all the burner components as originally.

![Fig. 23](D10479)
4.11 Hydraulic system

4.11.1 Double-pipe circuit
The burner is equipped with a self-priming pump which is capable of feeding itself within the limits listed in the Tab. H.

The tank higher than the burner A
The distance "P" must not exceed 33 ft in order to avoid subjecting the pump's seal to excessive strain; the distance "V" must not exceed 4 meters in order to permit pump self-priming even when the tank is almost completely empty.

The tank lower than the burner B
Pump depression values higher than 0.45 bar (35 cm Hg) must not be exceeded because at higher levels gas is released from the fuel, the pump starts making noise and its working life-span decreases.

It is good practice to ensure that the return and suction lines enter the burner from the same height; in this way it will be more improbable that the suction line fails to prime or stops priming.

4.11.2 The loop circuit
A loop circuit consists of a loop of piping departing from and returning to the tank with an auxiliary pump that circulates the fuel under pressure.
A branch connection from the loop goes to feed the burner.
This circuit is extremely useful whenever the burner pump does not succeed in self-priming because the tank distance and/or height difference are higher than the values listed in the Tab. H.

Key (Fig. 24)
1 Burner
2 Pump
3 Filter
4 Manual on/off valve
5 Suction line
6 Foot valve
7 Rapid closing manual valve remote controlled (only Italy)
8 On/off solenoid valve (only Italy). See layout of electric panel board. Electrical connections set by installer (SV)
9 Return line
10 Check valve (only Italy)
H Pump/foot valve height difference
L Piping length
Ø Inside pipe diameter

<table>
<thead>
<tr>
<th>+/− H (ft)</th>
<th>L (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>197</td>
</tr>
<tr>
<td>10</td>
<td>164</td>
</tr>
<tr>
<td>6.6</td>
<td>132</td>
</tr>
<tr>
<td>4.8</td>
<td>115</td>
</tr>
<tr>
<td>3.3</td>
<td>99</td>
</tr>
<tr>
<td>1.6</td>
<td>82</td>
</tr>
<tr>
<td>0</td>
<td>66</td>
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<td>59</td>
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<tr>
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<td>49</td>
</tr>
<tr>
<td>-4.8</td>
<td>43</td>
</tr>
<tr>
<td>-6.6</td>
<td>33</td>
</tr>
<tr>
<td>-10</td>
<td>16</td>
</tr>
<tr>
<td>-13</td>
<td>-</td>
</tr>
</tbody>
</table>

Tab. H
4.12 Hydraulic connections

The pumps are equipped with a by-pass that connects return line and suction line. The pumps are installed on the burner with the by-pass closed by screw 6)(Fig. 26). It is therefore necessary to connect both hoses to the pump.

- **CAUTION**
  - The pump will break immediately if it is run with the return line closed and the by-pass screw inserted.
- Remove the plugs from the suction and return connections of the pump.
- Insert the hose connections with the supplied seals into the connections and screw them down.

- **WARNING**
  - Take care that the hoses are not stretched or twisted during installation.
- Install the hoses where they cannot be stepped on or come into contact with hot surfaces of the boiler and where they do not hamper the opening of the burner.
- Now connect the other end of the hoses to the suction and return lines by using the supplied nipples.

**4.12.1 Pressure variator**

The pressure variator (Fig. 25) of the oil circuit makes it possible to vary the pressure on return of the nozzle depending on the flow rate required.

Governing of the pressure on return is obtained with the variation of a section by rotating the servomotor 23)(Fig. 3 on page 11) which simultaneously also controls the gas butterfly valve.

- Pressure governor at 0° (maximum opening) = minimum pressure on nozzle return.
- Pressure governor at 90° (minimum opening) = maximum pressure on nozzle return.

The servomotor is operated by the electronic cam 11)(Fig. 4 on page 12); by means of this device it is possible to set different curves for oil and gas on the same servomotor (the air gate valve servomotor 4)(Fig. 3 on page 11) may be operated in the same way.

- In adjusting with gas it is advisable to set the servomotor at 90° in order to reduce losses from the gas butterfly valve.
- In regulating with oil, setting is made depending on the type of nozzle used and on the modulation required.
  - Under the conditions of minimum firing rate, 20° rotation may be sufficient.

---

### Key (Fig. 25)

1. Nozzle pressure gauge
2. Position indicator (0 - 90) of pressure variator

---

**WARNING**

Take care that the hoses are not stretched or twisted during installation.

---

**CAUTION**

Take care that the hoses are not stretched or twisted during installation.

---
4.13 Pump

4.13.1 Technical data

<table>
<thead>
<tr>
<th>Pump model</th>
<th>TA3 (RLS 300-400/E)</th>
<th>TA4 (RLS 500/E)</th>
<th>TA5 (RLS 650-800/E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. delivery rate at 300 PSI pressure</td>
<td>GPH</td>
<td>218</td>
<td>290</td>
</tr>
<tr>
<td>Delivery pressure range</td>
<td>PSI</td>
<td>102 - 580</td>
<td>102 - 435</td>
</tr>
<tr>
<td>Max. suction pressure</td>
<td>PSI</td>
<td>7.0</td>
<td></td>
</tr>
<tr>
<td>Viscosity range</td>
<td>cSt</td>
<td>3 - 75</td>
<td></td>
</tr>
<tr>
<td>Max. oil temperature</td>
<td>°F</td>
<td>302 (150 °C)</td>
<td></td>
</tr>
<tr>
<td>Max. return pressure</td>
<td>PSI</td>
<td>73.0</td>
<td></td>
</tr>
<tr>
<td>Pressure calibration in the factory</td>
<td>PSI</td>
<td>300</td>
<td></td>
</tr>
</tbody>
</table>

Tab. I

Key (Fig. 26)
1 Suction 3/4" NPT
2 Return 3/4" NPT
3 Pressure switch attachment G 1/4"
4 Vacuum meter connection G 1/4"
5 Pressure governor
6 By-pass screw

![Diagram of pump components]

Fig. 26

4.13.2 Priming pump

Before starting the burner, make sure that the tank return line is not clogged.

Obstructions in the line could cause the sealing organ located on the pump shaft to break.

The time required for this operation depends upon the diameter and length of the suction tubing.

If the pump fails to prime at the first starting of the burner and the burner locks out, wait approx. 15 seconds, reset the burner, as often as required.

After 5 or 6 starting operations allow 2 or 3 minutes for the transformer to cool.

Do not illuminate the QRI cell or the burner will lock out; the burner should lock out anyway about 10 seconds after it starts.

The a.m. operation is possible because the pump is already full of fuel when it leaves the factory.

If the pump has been drained, fill it with fuel through the opening on the vacuum meter 4)(Fig. 26) prior to starting; otherwise, the pump will seize.

Whenever the length of the suction piping exceeds 20-30 meters, the supply line must be filled using a separate pump.
4.14 Gas supply

4.14.1 Gas train
The gas train is to be connected on the right of the burner, by flange 1)(Fig. 27). If necessary connect it on the left, proceed as follows:
- loosen nuts and screws 3) and 4);
- remove blind flange 2) together with its gasket;
- fit them to flange 1) tightening the nuts and screws.

Once assembled the gas train, check for leaks.

4.14.2 Gas feeding line
It must be type-approved according to required standards and is supplied separately from the burner (Fig. 28).

Key (Fig. 28)
1 Gas input pipe for main burner
2 Manual valve
3 Min gas pressure switch
4 Safety shut-off valve
5 NO vent valve
6 Regulating shut off valve
7 Gas input pipe for pilot
8 Gas adjustment butterfly valve
9 Burner
10 Max gas pressure switch
11 Manual valve (for seal control)
12 Pilot regulator
4.14.3 Gas pressure

The Tab. J shows minimum pressure losses along the gas supply line depending on the maximum burner output operation. The values shown in the Tab. J refer to natural gas (GCV).

**Column 1**
Pressure loss at combustion head.
Gas pressure measured at the test point 1)(Fig. 29), with:
- combustion chamber at "WC;
- burner working at maximum output;
- combustion head adjusted as in the diagram of Fig. 21 on page 28.

**Column 2**
Pressure loss at gas butterfly valve 2)(Fig. 29) with maximum opening: 90°.

Calculate the approximate maximum output of the burner as follows:
- subtract the combustion chamber pressure from the gas pressure measured at test point 1)(Fig. 29);
- find, in the Tab. J relating to the burner concerned, the pressure value closest to the result of the subtraction;
- read off the corresponding output on the left.

**Example for RLS 500/E:**
- Maximum output operation
- Gas pressure at test point 1)(Fig. 29) = 11.7 "WC
- Pressure in combustion chamber = 2 "WC

An output of 15148 MBtu/hr shown in Tab. J corresponds to 9.7 "WC pressure, column 1.

This value serves as a rough guide, the effective delivery must be measured at the gas meter.

<table>
<thead>
<tr>
<th>MBtu/hr (GCV)</th>
<th>1 ( \Delta p ) (&quot;WC)</th>
<th>2 ( \Delta p ) (&quot;WC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5112</td>
<td>3.3</td>
<td>0.63</td>
</tr>
<tr>
<td>5680</td>
<td>3.7</td>
<td>0.79</td>
</tr>
<tr>
<td>7574</td>
<td>4.9</td>
<td>1.38</td>
</tr>
<tr>
<td>9467</td>
<td>5.4</td>
<td>2.13</td>
</tr>
<tr>
<td>11361</td>
<td>5.9</td>
<td>3</td>
</tr>
<tr>
<td>13254</td>
<td>7.9</td>
<td>4.2</td>
</tr>
<tr>
<td>14390</td>
<td>9</td>
<td>5.1</td>
</tr>
<tr>
<td>6816</td>
<td>2.3</td>
<td>1.1</td>
</tr>
<tr>
<td>7574</td>
<td>3</td>
<td>1.38</td>
</tr>
<tr>
<td>9467</td>
<td>4.7</td>
<td>2.13</td>
</tr>
<tr>
<td>11361</td>
<td>6.4</td>
<td>3</td>
</tr>
<tr>
<td>12307</td>
<td>7.3</td>
<td>3.62</td>
</tr>
<tr>
<td>13254</td>
<td>8.3</td>
<td>5.17</td>
</tr>
<tr>
<td>15148</td>
<td>10.8</td>
<td>5.47</td>
</tr>
<tr>
<td>17042</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>9467</td>
<td>4.4</td>
<td>1.81</td>
</tr>
<tr>
<td>11361</td>
<td>6</td>
<td>2.64</td>
</tr>
<tr>
<td>13254</td>
<td>7.7</td>
<td>3</td>
</tr>
<tr>
<td>15148</td>
<td>9.7</td>
<td>3.82</td>
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<tr>
<td>17042</td>
<td>11.8</td>
<td>4.64</td>
</tr>
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<td>18935</td>
<td>14.1</td>
<td>5.55</td>
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<tr>
<td>19692</td>
<td>15</td>
<td>5.9</td>
</tr>
<tr>
<td>11362</td>
<td>2.8</td>
<td>1</td>
</tr>
<tr>
<td>13255</td>
<td>4</td>
<td>1.4</td>
</tr>
<tr>
<td>15149</td>
<td>5.1</td>
<td>1.8</td>
</tr>
<tr>
<td>17043</td>
<td>6.2</td>
<td>2.2</td>
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<tr>
<td>18936</td>
<td>7.7</td>
<td>2.8</td>
</tr>
<tr>
<td>20830</td>
<td>9.3</td>
<td>3.3</td>
</tr>
<tr>
<td>22724</td>
<td>10.9</td>
<td>4</td>
</tr>
<tr>
<td>24617</td>
<td>12.6</td>
<td>4.7</td>
</tr>
<tr>
<td>24805</td>
<td>13.1</td>
<td>4.9</td>
</tr>
<tr>
<td>13255</td>
<td>4.5</td>
<td>1.1</td>
</tr>
<tr>
<td>15149</td>
<td>6</td>
<td>1.4</td>
</tr>
<tr>
<td>17043</td>
<td>7.5</td>
<td>1.8</td>
</tr>
<tr>
<td>18936</td>
<td>8.9</td>
<td>2.2</td>
</tr>
<tr>
<td>20830</td>
<td>10.4</td>
<td>2.6</td>
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<td>22724</td>
<td>11.9</td>
<td>3.1</td>
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<td>24617</td>
<td>13.9</td>
<td>3.7</td>
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<tr>
<td>26511</td>
<td>15.3</td>
<td>4.3</td>
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<tr>
<td>28405</td>
<td>17.6</td>
<td>4.9</td>
</tr>
<tr>
<td>30299</td>
<td>19.9</td>
<td>5.6</td>
</tr>
</tbody>
</table>

**Note**
See the accompanying instructions for the adjustment of the gas train.
4.15 Electrical wiring

Notes on safety for the electrical wiring

- The electrical wiring must be carried out with the electrical supply disconnected.
- Electrical wiring must be carried out by qualified personnel and in compliance with the regulations currently in force in the country of destination. Refer to the electrical layouts.
- The manufacturer declines all responsibility for modifications or connections different from those shown in the electrical layouts.
- Check that the electrical supply of the burner corresponds to that shown on the identification label and in this manual.
- Do not invert the neutral with the phase in the electrical supply line. Any inversion would cause a lockout due to firing failure.
- The electrical safety of the device is obtained only when it is correctly connected to an efficient earthing system, made according to current standards.
- It is necessary to check this fundamental safety requirement. In the event of doubt, have the electrical system checked by qualified personnel.

Do not use the gas tubes as an earthing system for electrical devices.

- The electrical system must be suitable for the maximum input power of the device, as indicated on the label and in the manual, checking in particular that the section of the cables is suitable for the input power of the device.
- For the main power supply of the device from the electricity mains:
  - do not use adapters, multiple sockets or extensions;
  - use an omnipolar switch with an opening of at least 1/8" (overvoltage category) between the contacts, as indicated by the current safety standards.
- Do not touch the device with wet or damp body parts and/or in bare feet.
- Do not pull the electric cables.

Before carrying out any maintenance, cleaning or checking operations:

- disconnect the electricity supply from the burner by means of the main switch of the system;
- close the fuel interception tap.

If the cover is still present, remove it and proceed with the electrical wiring.

All the cables to be connected to the burner are fed through the grommets (Fig. 30).

The use of the cable grommets can take various forms. By way of example we indicate the following mode (according to UL795):
1 Three phase power supply with 1 inch cable grommet
2 Single phase power supply with 1/2 inch cable grommet
3 Available: single phase power supply and other devices with 1/2 inch cable grommet
4 Available: consents/safety, minimum gas pressure switch, gas valves and other devices with 3/8 inch cable grommet
5 Motor earth cable
6 Available
7 Entry plug-socket branch unit

The control panel is in compliance with UL508A.

WARNING

DANGER disconnect the electricity supply from the burner by means of the main switch of the system;

DANGER close the fuel interception tap.

Fig. 30
4.16 Thermal relay calibration

Depending on the burner type, there are two different thermal relays:
- Electro-mechanical thermal relay (used for single phase motors)
- Electronic thermal relay (used for three phase motors)

4.16.1 Electro-mechanical thermal relay

The electro-mechanical thermal relay (Fig. 31) is used to avoid damage to the motor owing to a strong increase in absorption or the lack of a phase.

For the calibration, refer to the table given in electrical layout. If the minimum value of the scale of the thermal relay is greater than the rating absorption of the motor, protection is still ensured. This arises when the power supply of the motor is 400V.

➢ To reset, in the case of an intervention of the thermal relay, press the button “RESET” (Fig. 31).
➢ The button “STOP” (Fig. 31) opens the NC (95-96) contact and stops the motor.

![Fig. 31](image1)

4.16.2 Electronic thermal relay

➢ To reset, in the case of an intervention of the thermal relay, press the button “RESET” (Fig. 33).

There are two different solutions to test the electronic thermal relay:
➢ Device test (Fig. 34)
   Push slowly the button in the window with a little screwdriver.

➢ Contact test NC (95-96) and NO (97-98) (Fig. 35)
   Insert in the window a little screwdriver and move it in the sense of the arrow.

![Fig. 33](image2)

![Fig. 34](image3)

![Fig. 35](image4)
4.17 Motor connection at 208-230 or 460V only for RLS 300/E

**WARNING:**
the motors, manufactured for 208-230/460V **IE2/Epact** voltage, have a different connection than **IE1** motors, no more star/delta but star/double star.
Please, pay attention to the indications in case of modification of voltage, maintenance, or substitution.

![Diagram showing motor connections](image1.png)

4.18 Motor connection at 575V only for RLS 300/E

**WARNING:**
the motors, manufactured for 575V **IE2/Epact** voltage, have the same control box base of the **IE1** motors.
Please pay attention to the indications in case of maintenance or substitution.

![Diagram showing motor connection at 575V](image2.png)

4.19 Reversible direction

**WARNING:**
If it is necessary to reverse the direction then reverse the two main supply phases.
For example: L1 with L2, there is not difference between **IE1** and **IE2/Epact**.

![Diagram showing reversible direction](image3.png)
4.20 Motor connection at 208-230 or 460V only for RLS 400-500-650-800/E

WARNING:
the motors, manufactured for 208-230/460V IE2/Epact voltage, have a different connection than IE1 motors, no more star/delta but star/double star.
Please, pay attention to the indications in case of modification of voltage, maintenance, or substitution.

4.21 Motor connection at 575V only for RLS 400-500-650-800/E

WARNING:
the motors, manufactured for 575V IE2/Epact voltage, have the same control box base of the IE1 motors.
Please pay attention to the indications in case of maintenance or substitution.

4.22 Reversible direction

WARNING:
If it is necessary to reverse the direction then reverse the two main supply phases.
For example: L1 with L2, there is not difference between IE1 and IE2/Epact.
5 Start-up, calibration and operation of the burner

5.1 Notes on safety for the first start-up

- The first start-up of the burner must be carried out by qualified personnel, as indicated in this manual and in compliance with the standards and regulations of the laws in force.

- Check the correct working of the adjustment, command and safety devices.

5.2 Adjustments before first firing (light oil operation)

The optimum calibration of the burner requires an analysis of the flue gases at the boiler outlet and interventions on the following points.

5.2.1 Nozzles

See the information listed on page 26.

5.2.2 Combustion head

The adjustment of the combustion head already carried out (page 28) need not be altered unless the 2nd stage delivery of the burner is changed.

The setting of the combustion head depends exclusively on the maximum delivery of the burner. In case of high altitude site, head setting must refer to the “corrected capacity” according procedure described at page 14.

5.2.3 Pump pressure

- **300 psi**: this is the pressure calibrated in the factory which is usually sufficient for most purposes. Sometimes, this pressure must be adjusted to:
  - **145 psi** in order to reduce fuel delivery. This adjustment is possible only if the surrounding temperature remains above 0 °C;
  - In order to adjust pump pressure, use the screw 5)(Fig. 26).

5.2.4 Fan air gate valve

See adjustments at page 41.

5.3 Burner firing

Having completed the checks indicated in the previous heading, the ignition pilot of the burner should fire.

Set switch 1)(Fig. 42) to “LOCAL”.

Set switch 2)(Fig. 42) to “GAS”.

If the motor starts but the flame does not appear and the flame safeguard goes into lock-out, reset and wait for a new firing attempt.

Pilot adjustment has been illustrated on page 25.

Having adjusted the pilot, reconnect the main valve and ignite the main flame; it might require several attempts to purge the air from the gas lines or to adjust the valve with little gas.

Once the burner has fired, now proceed with calibration operations.

5.4 Fuel change

There are two possible options for changing fuel:

1. using switch 2)(Fig. 42);
2. using a remote selector connected to the main terminal board.

By setting switch 1)(Fig. 42), to “remote” you activate the remote fuel selection facility.

In this position, if no remote selector is fitted, the display shows the priority fuel.
5.5 Adjustments before first firing (gas operation)

Adjustment of the combustion head has been illustrated on page 28.

In addition, the following adjustments must also be made:

- Open manual valves up-stream from the gas train.
- Purge the air from the gas line.
- Adjust the min gas pressure switch (Fig. 48) to the start of the scale.
- Adjust the max gas pressure switch (Fig. 47) to the upper limit of the scale.
- Adjust the air pressure switch (Fig. 46) to the zero position of the scale.
- Fit a U-type manometer (Fig. 43) to the gas pressure test point on the sleeve. The manometer readings are used to calculate MAX. burner power using the Tab. J on page 34.

Before starting up the burner it is good practice to adjust the gas train so that ignition takes place in conditions of maximum safety, i.e. with gas delivery at the minimum.

5.6 Burner start-up

Feed electricity to the burner via the disconnecting switch on the boiler panel.

Close the thermostats/pressure switches.

Turn the switch to position “LOCAL” and turn the switch to position “OIL” for oil operation and “GAS” for gas operation (Fig. 44).

Make sure that the lamps or testers connected to the solenoids, or indicator lights on the solenoids themselves, show that no voltage is present.

If voltage is present, stop the burner immediately and check the electrical wiring.

When the burner starts, check the direction of the motor rotation, as indicated in Fig. 44.

As soon as the burner starts up, look at the cooling fan of the fan motor and check it is rotating anti-clockwise.

If this is not the case:

- place the switch of Fig. 44 in position “OFF” and wait for the control box to carry out the switch-off phase;
- disconnect the electrical supply from the burner;
- invert the phases on the three-phase power supply.

NOTE:

for further information, please refer to the specific instruction of the control box.
5.6.1 Combustion air adjustment
Fuel/combustion air must be synchronized with the relevant servomotors (air and gas) by storing a setting curve by means of the electronic cam.
To reduce pressure loss and to have a wider adjustment range, it is best to set the servomotor to the maximum output used, as near to maximum opening (90°) as possible.
On the gas butterfly valve, the fuel’s partial setting adjustment based on required output, with the servomotor fully open, is made by using the pressure stabilizer on the gas train.

5.6.2 Air adjustment for maximum output
Set the servomotor to maximum opening (near 90°) so that the air butterfly valves are fully open.
**Not for RLS 800/E model**
- Loosen screw 2) (Fig. 45) under the burner’s intake and close grille 1) progressively until you achieve the required output.
The only time reducing intake to a partial setting is not necessary is when the burner is working at the top of the operating range given in Fig. 21.

**WARNING**
We recommend you achieve the maximum output required manually, and adjust intake to the partial setting, define gas pressure and adjust the combustion head before completing the setting and storing the fuel/combustion air synchronization curves.

5.6.3 Adjusting gas/air delivery
- Move slowly towards the maximum output (butterfly gas valve completely open);
- adjust the required maximum output with the gas pressure stabilizer;
- adjust the combustion parameters with the air servomotor and store the maximum combustion point;
- complete the procedure slowly, synchronizing the combustion with the two servomotors and storing the different setting points.

5.6.4 Adjusting oil/air delivery
- Switch to the light oil operation.
- During the ignition, move slowly with an approximate adjustment to the oil servomotor at maximum 90°.
- Adjust the combustion parameter with the air servomotor and store the maximum combustion point.
- Complete the procedure slowly, synchronizing the combustion with the two servomotors.
- Store the different setting points.

5.6.5 Air/fuel control and power modulation system
The air/fuel and power modulation system installed on RLS burner series provides, a set of integrated functions ensuring top level energy and operational performance from the burner, both for single and grouped burners (e.g. boiler with a double combustion chamber or several generators in parallel).
The system includes the following basic functions:
- air and fuels are supplied in correct quantities by positioning the valves by direct servo-control, thus avoiding the possibility of play typical of systems used for traditional modulating burners, in which settings are obtained by levers and a mechanical cam;
- burner power is modulated according to the load required by the system, while boiler pressure or temperature is maintained at set operating values;

Further interfaces and computer communication functions for remote control or integration in centrally supervised systems are available according to the system’s configuration.

**NOTE**
The first start-up and all further operations concerning internal settings of the control system or expansion of basic functions, are accessed with a password and are reserved for technical service personnel specifically trained for internal programming of the instrument and for the specific application obtained with this burner.
The first start-up and curve synchronization manual is supplied with the burner.
The complete manual for checking and setting all parameters will be provided on application.
5.7 Final calibration of the pressure switches

5.7.1 Air pressure switch
Adjust the air pressure switch (Fig. 46) after having performed all other burner adjustments with the air pressure switch set to the start of the scale.

With the burner operating at min. output, increase adjustment pressure by slowly turning the relative dial clockwise until the burner locks out.

Then turn the dial anti-clockwise by about 20% of the set point and repeat burner starting to ensure it is correct.

If the burner locks out again, turn the dial anti-clockwise a little bit more.

As a rule, the air pressure switch must prevent the formation of CO. To check this, insert a combustion analyser into the chimney, slowly close the fan suction inlet (for example with cardboard) and check that the burner locks out, before the CO in the fumes exceeds 400 ppm.

To check this, insert a combustion analyser into the chimney, slowly close the fan suction inlet (for example with cardboard) and check that the burner locks out, before the CO in the fumes exceeds 1%.

On RLS 300-400-500/E burners the air pressure switch is fitted in a "differential" mode, that is, with two pipes connected to the specific pressure test points "+" and "-" (Fig. 3 on page 11).

5.7.2 Maximum gas pressure switch
Adjust the maximum gas pressure switch (Fig. 47) after having performed all other burner adjustments with the maximum gas pressure switch set to the end of the scale.

With the burner operating at MAX output, reduce the adjustment pressure by slowly turning the adjustment dial anticlockwise until the burner locks out.

Then turn the dial clockwise by 0.8" WC and repeat burner firing.

If the burner locks out again, turn the dial again clockwise by 0.4" WC.

5.7.3 Minimum gas pressure switch
Adjust the minimum gas pressure switch (Fig. 48) after having performed all the other burner adjustments with the pressure switch set at the start of the scale.

With the burner operating at MAX output, increase adjustment pressure by slowly turning the relative dial clockwise until the burner locks out.

Then turn the dial anti-clockwise by 0.8" WC and repeat burner starting to ensure it is uniform.

If the burner locks out again, turn the dial anti-clockwise again by 0.4" WC.
5.7.4 Low oil pressure switch

The low oil pressure switch (Fig. 49) is factory set to 261 PSI (18 bar).

If the oil pressure goes down this value in the delivery piping, the pressure switch stops the burner.
Burner starts again automatically if the pressure goes above 261 PSI (18 bar) after burner start up.
5.8 Burner starting

- Operating control closes, the motor starts.
- The pump 18) (Fig. 50) draws the fuel from the tank through the piping 1) and pumps it under pressure for delivery.
  The pump pressure governor 4) rises and the fuel returns to the tank through the piping 2).
  The screw 3) closes the by-pass heading towards suction and the de-energized solenoid valves 5) - 6) close the passage to the nozzle.
- Air damper and pressure regulator are positioned on MIN output.

- The ignition pilot starts.
- Solenoid valves 5) - 6) open; the fuel passes through the piping 19) and filter 12), and enters the nozzle.
  A part of the fuel is then sprayed out through the nozzle, igniting when it comes into contact with the pilot flame: flame at a low output level; the rest of the fuel passes through piping 20 at the pressure adjusted by the regulator 10), then, through piping 2), it goes back into the tank.
- The pilot flame goes out.
- The starting cycle ends.

5.8.1 Steady state operation

At the end of the starting cycle, the servomotor control then passes to load control for boiler pressure or temperature.
- If the temperature or pressure is low (and the load control is consequently closed), the burner progressively increases output up to MAX.
- If subsequently the temperature or pressure increases until the load control opens, the burner progressively decreases output down to MIN.
- The burner shuts off when demand for heat is less than the heat supplied by the burner in the MIN output.
- The servomotor returns to the 0° angle. The air damper closes completely to reduce thermal dispersion to a minimum.

Every time output is changed, the servomotor automatically modifies oil delivery (pressure regulator) and air delivery (fan damper).

5.8.2 Firing failure

- If the burner does not fire, it goes into lock-out within 5 sec. of the opening of the light oil valve.
- If the flame should go out for accidental reasons during operation, the burner will lock out in 1 s.
### 5.9 Final checks (with the burner working)

<table>
<thead>
<tr>
<th>Step</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>➤ Open the control limit operation</td>
<td>➡ The burner must stop</td>
</tr>
<tr>
<td>➤ Open the high limit operation</td>
<td></td>
</tr>
<tr>
<td>➤ Rotate the maximum gas pressure switch knob to the minimum end-of-scale position</td>
<td>➡ The burner must stop in lockout</td>
</tr>
<tr>
<td>➤ Rotate the air pressure switch knob to the maximum end of scale position</td>
<td></td>
</tr>
<tr>
<td>➤ Rotate the maximum oil pressure switch at the minimum of the scale</td>
<td></td>
</tr>
<tr>
<td>➤ Switch off the burner and disconnect the voltage</td>
<td>➡ The burner must not start</td>
</tr>
<tr>
<td>➤ Disconnect the minimum gas pressure switch</td>
<td></td>
</tr>
<tr>
<td>➤ Rotate the minimum low oil pressure switch at the maximum of the scale</td>
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<tr>
<td>➤ Cover the QRI flame detector</td>
<td>➡ The burner must stop in lockout due to firing failure</td>
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</table>

**WARNING**

Make sure that the mechanical locking systems on the different adjustment devices are fully tightened.
6.1 Notes on safety for the maintenance

The periodic maintenance is essential for the good operation, safety, yield and duration of the burner.

It allows you to reduce consumption and polluting emissions and to keep the product in a reliable state over time.

![DANGER]

The maintenance interventions and the calibration of the burner must only be carried out by qualified, authorised personnel, in accordance with the contents of this manual and in compliance with the standards and regulations of current laws.

Before carrying out any maintenance, cleaning or checking operations:

- Disconnect the electricity supply from the burner by means of the main switch of the system.
- Close the fuel interception tap.

6.2 Maintenance programme

6.2.1 Maintenance frequency

The combustion system should be checked at least once a year by a representative of the manufacturer or another specialised technician.

6.2.2 Checking and cleaning

Combustion

The optimum calibration of the burner requires an analysis of the flue gases. Significant differences with respect to the previous measurements indicate the points where more care should be exercised during maintenance.

Combustion head

Open the burner and make sure that all components of the combustion head are in good condition, not deformed by the high temperatures, free of impurities from the surroundings and correctly positioned.

Measurement of detector current

Measurement of the detector’s signal (Fig. 50) with a Voltmeter is not normally required since the flame signal’s intensity is shown on the AZL_Display and operating unit.

Min. value for a good work: 3.5 Vdc (AZL display flame approx. 50%).

If the value is lower, it can depend on:
- photocell positioned incorrectly;
- low current (lower than 96V);
- bad regulation of the burner.

To measure power, use a voltmeter with a 10 Vdc scale, connected as illustrated in Fig. 50.

Fan

Check to make sure that no dust has accumulated inside the fan or on its blades, as this condition will cause a reduction in the air flow rate and provoke polluting combustion.

Burner

Clean the outside of the burner.
Clean and grease the cam variable profile.

Boiler

Clean the boiler as indicated in its accompanying instructions in order to maintain all the original combustion characteristics intact, especially the flue gas temperature and combustion chamber pressure.

Pump

Delivery pressure must correspond with the Tab. G on page 26. The depression must be less than 0.45 bar.

Unusual noise must not be evident during pump operation. If the pressure is found to be unstable or if the pump runs noisily, the flexible hose must be detached from the line filter and the fuel must be sucked from a tank located near the burner. This measure permits the cause of the anomaly to be traced to either the suction line or the pump.

If the pressure is found to be unstable or if the pump runs noisily, the flexible hose must be detached from the line filter and the fuel must be sucked from a tank located near the burner. This measure permits the cause of the anomaly to be traced to either the suction line or the pump. If the problem lies in the suction line, check to make sure that the filter is clean and that air is not entering the piping.

Filters

Check the filtering baskets on line and at nozzle present in the system. Clean or replace if necessary. If rust or other impurities are observed inside the pump, use a separate pump to lift any water and other impurities that may have deposited on the bottom of the tank.

Nozzles

It is advisable to replace nozzles every year during regular maintenance operations. Do not clean the nozzle openings; do not even open them.
Flexible hoses
Check to make sure that the flexible hoses are still in good condition.

Fuel tank
Approximately every 5 years, or whenever necessary, suck any water or other impurities present on the bottom of the tank using a separate pump.

Combustion
In case the combustion values found at the beginning of the intervention do not respect the standards in force or, in any case, do not correspond to a proper combustion, contact the Technical Assistant and have him carry out the necessary adjustments.

6.3 Opening the burner

DANGER
Disconnect the electrical supply from the burner.

► Remove the tie rod 1)(Fig. 51) of the head movement lever, loosening nut 2).
► Disconnect the gas servomotor test point 3).
► Disconnect the gas pressure switch test point 4).
► Remove screws 5).
► At this point it is possible to open the burner at the hinge.

Fig. 51

6.4 Closing the burner

► Close the burner at the hinge.
► Apply screw 5)(Fig. 51).
► Connect the gas pressure switch test point 4).
► Connect the gas servomotor test point 3).
► Apply the tire rod 1) of the head movement lever, loosening nut 2).
► Connect the electrical supply from the burner.

Gas leaks
Make sure that there are no gas leaks on the pipework between the gas meter and the burner.

Gas filter
Change the gas filter when it is dirty.

Combustion
In case the combustion values found at the beginning of the intervention do not respect the standards in force or, in any case, do not correspond to a proper combustion, contact the Technical Assistant and have him carry out the necessary adjustments.
## Appendix - Spare parts

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**ADVISER PARTS**

- A = Spare parts for minimum fittings
- A+B = Spare parts for basic safety fittings
- A+B+C = Spare parts for extended safety fittings
Appendix - Accessories

Gas train according to UL Standards

WARNING

The installer is responsible for the supply and installation of any required safety device(s) not indicated in this manual.
## Appendix - Burner start up report

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### GAS OPERATION

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### OIL OPERATION

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<thead>
<tr>
<th>Oil supply pressure:</th>
<th>CO₂: Low Fire</th>
<th>High Fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil suction pressure:</td>
<td>O₂: Low Fire</td>
<td>High Fire</td>
</tr>
<tr>
<td>Control Power Supply:</td>
<td>CO: Low Fire</td>
<td>High Fire</td>
</tr>
<tr>
<td>Burner Firing Rate:</td>
<td>NOₓ: Low Fire</td>
<td>High Fire</td>
</tr>
<tr>
<td>Low Fire Flame Signal:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Fire Flame Signal:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Fire Nozzle Size:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Fire Nozzle Size:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CONTROL SETTINGS

<table>
<thead>
<tr>
<th>Operating Setpoint:</th>
<th>Low Oil Pressure:</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Limit Setpoint:</td>
<td>High Oil Pressure:</td>
</tr>
<tr>
<td>Low Gas Pressure:</td>
<td>Flame Safeguard Model Number:</td>
</tr>
<tr>
<td>High Gas Pressure:</td>
<td>Modulating Signal Type:</td>
</tr>
</tbody>
</table>

### NOTES

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