

## **GB** Dual fuel light oil/ gas burners

Progressive two stage or modulating operation



CODE	MODEL
C9131010 C9131001	RLS 300/E
C9132010 C9132001	RLS 400/E
C9133001	RLS 500/E



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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.



**DANGER**

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



**WARNING**

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



**CAUTION**

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.



**WARNING**

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**



**DANGER**

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.



**WARNING**

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.



**WARNING**

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

## Safety and prevention

**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;

the type and pressure of the fuel, the voltage and frequency of the electrical power supply, the minimum and maximum deliveries for which the burner has been regulated, the pressurisation of the combustion chamber, the dimensions of the combustion chamber and the room temperature must all be within the values indicated in the instruction manual.

- 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.

**3 Technical description of the burner**

**3.1 Technical data**

Model		RLS 300/E		RLS 400/E		RLS 500/E	
Output <sup>(1)</sup> Delivery <sup>(1)</sup>	High	kW	1387 – 4220 (3834*)	1998 – 4995 (4541*)	2775 – 5740 (5217*)		
		MBtu/hr <sup>(4)</sup> GPH	4732 – 14390 (13082*) 33.6 – 102.7 (93.4*)	6817 – 17042 (15494*) 47.8 – 121.7 (110.6*)	9468 – 19692 (17800*) 67.6 – 140.6 (127.1*)		
	Low	kW	666	888	1243		
		MBtu/hr <sup>(4)</sup> GPH	2272 16.0	3030 21.8	4241 30.4		
Fuel			# 2 Fuel oil - Natural gas				
Gas maximum delivery		SCFH	14,390	17,042	19,692		
Gas pressure at maximum delivery <sup>(2)</sup>		"WC	9.0	13.0	15.0		
Operation			Low-high or modulating				
Nozzle		number	1				
Standard applications			Boilers: water, steam, thermal oil				
Ambient temperature		°F	32 - 104 (0 - 40 °C)				
Combustion air temperature		°F max	140 (60 °C)				
Pump delivery (at 300 PSI) pressure range fuel temperature		GPH	218	218	290		
		PSI	102 - 580	102 - 580	102 - 580		
		° F max	302 (150 °C)	302 (150 °C)	302 (150 °C)		
Noise levels <sup>(3)</sup>		dB(A)	82	85	86		

Model		RLS 650/E		RLS 800/E		
Output <sup>(1)</sup> Delivery <sup>(1)</sup>	High	kW	3330 – 7270 (6543*)	3885 – 8990 (8172*)		
		MBtu/hr <sup>(4)</sup> GPH	11362 – 24807 (22325*) 81.1 – 177.1 (159.4*)	13256 – 30670 (27882*) 94.5 – 219 (199.1*)		
	Low	kW	1587	1942		
		MBtu/hr <sup>(4)</sup> GPH	5415 38.7	6626 47.1		
Fuel			# 2 Fuel oil - Natural gas			
Gas maximum delivery		SCFH	24,807	30,299		
Gas pressure at maximum delivery <sup>(2)</sup>		"WC	13.1	19.9		
Operation			Low-high or modulating			
Nozzle		number	1			
Standard applications			Boilers: water, steam, thermal oil			
Ambient temperature		°F	32 - 104 (0 - 40 °C)			
Combustion air temperature		°F max	140 (60 °C)			
Pump delivery (at 300 PSI) pressure range fuel temperature		GPH	403			
		PSI	102 - 435			
		° F max	302 (150 °C)			
Noise levels <sup>(3)</sup>		dB(A)	80	89.6		

**Tab. A**

- (\*) 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 IE2/EPACT**

Model		RLS 300/E	
RBNA Code		C9131010	C9131001
Control circuit power supply	V/Ph/Hz	120/1/60	
Main power supply (+/- 10%)	V/Ph/Hz	460/3/60	575/3/60
Fan motor	rpm	3500	3500
	HP	7.5	7.5
	V	460	575
	A	9.3	7.4
Pump motor	rpm	3470	3470
	HP	2	2
	V	460	575
	A	2.7	2.2
Ignition transformer	Oil	V1 - V2 I1 - I2	120 V - 2 x 5 kV 2.7 A - 30 mA
	Gas	V1 - V2 I1 - I2	120 V - 1 x 8 kV 1.6 A - 20 mA
Electrical power consumption	W	8200	
Electrical control circuit consumption	W max	750	
Total electrical consumption	W	8950	
Electrical protection		NEMA 1	

**Fan motor and pump motor IE2/EPACT**

Model		RLS 400/E		RLS 500/E	
RBNA Code		C9132010	C9132001	C9133010	C9133001
Control circuit power supply	V/Ph/Hz	120/1/60			
Main power supply (+/- 10%)	V/Ph/Hz	460/3/60	575/3/60	460/3/60	575/3/60
Fan motor	rpm	3510	3510	3545	3545
	HP	10	10	20	20
	V	460	575	460	575
	A	11.5	8.8	23.5	18.8
Pump motor	rpm	3470	3470	3470	3470
	HP	2	2	2	2
	V	460	575	460	575
	A	2.7	2.2	2.7	2.2
Ignition transformer	Oil	V1 - V2 I1 - I2	120 V - 2 x 5 kV 2.7 A - 30 mA		
	Gas	V1 - V2 I1 - I2	120 V - 1 x 8 kV 1.6 A - 20 mA		
Electrical power consumption	W	10200	9900	18350	18400
Electrical control circuit consumption	W max	750			
Total electrical consumption	W	10950	10650	19100	19150
Electrical protection		NEMA 1			

### Fan motor and pump motor IE2/EPACT

Model		RLS 650/E		RLS 800/E	
RBNA Code		C9134010	C9134001	C9135010	C9135001
Control circuit power supply	V/Ph/Hz	120/1/60			
Main power supply (+/- 10%)	V/Ph/Hz	460/3/60	575/3/60	460/3/60	575/3/60
Fan motor	rpm	3550	3550	3540	3540
	HP	25	25	30	30
	V	460	575	460	575
	A	28.8	23	35.7	28.6
Pump motor	rpm	3470	3470	3470	3470
	HP	2	2	2	2
	V	460	575	460	575
	A	2.7	2.2	2.7	2.2
Ignition transformer	Oil	V1 - V2 I1 - I2	120 V - 2 x 5 kV 2.7 A - 30 mA		
	Gas	V1 - V2 I1 - I2	120 V - 1 x 8 kV 1.6 A - 20 mA		
Electrical power consumption	W	21850	21850	25750	25800
Electrical control circuit consumption	W max	750			
Total electrical consumption	W	22600	22600	26500	26550
Electrical protection		NEMA 1			

Tab. B

### 3.3 Burner models designation

Model	Code	Code RBNA	Voltage	Fan motor starting	Flame safeguard
RLS 300/E	20041484	C9131010	460/3/60	Direct	Burner mounted
	20061830	C9131001	575/3/60		
RLS 400/E	20055002	C9132010	460/3/60	Star/Delta	Burner mounted
	20057986	C9132001	575/3/60		
RLS 500/E	tbd	C9133010	460/3/60	Star/Delta	Burner mounted
	20095539	C9133001	575/3/60		
RLS 650/E	tbd	C9134010	460/3/60	Star/Delta	Burner mounted
		C9134001	575/3/60		
RLS 800/E	tbd	C9135010	460/3/60	Star/Delta	Burner mounted
		C9135001	575/3/60		

Tab. C

### 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. D.

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

inch	A	B	C	lbs
RLS 300/E	77 <sup>11</sup> / <sub>64</sub> "	37 <sup>1</sup> / <sub>64</sub> "	38 <sup>3</sup> / <sub>16</sub> "	496
RLS 400/E	77 <sup>11</sup> / <sub>64</sub> "	37 <sup>1</sup> / <sub>64</sub> "	38 <sup>3</sup> / <sub>16</sub> "	520
RLS 500/E	77 <sup>11</sup> / <sub>64</sub> "	37 <sup>1</sup> / <sub>64</sub> "	38 <sup>3</sup> / <sub>16</sub> "	551
RLS 650/E	80 <sup>7</sup> / <sub>64</sub> "	42 <sup>29</sup> / <sub>32</sub> "	47 <sup>3</sup> / <sub>64</sub> "	661
RLS 800/E	80 <sup>7</sup> / <sub>64</sub> "	42 <sup>29</sup> / <sub>32</sub> "	47 <sup>3</sup> / <sub>64</sub> "	661

Tab. D

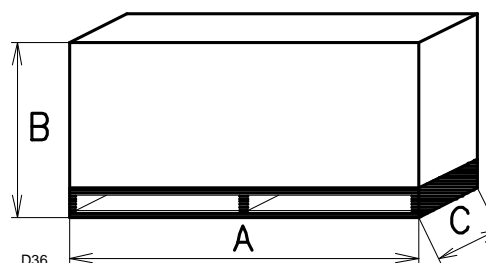


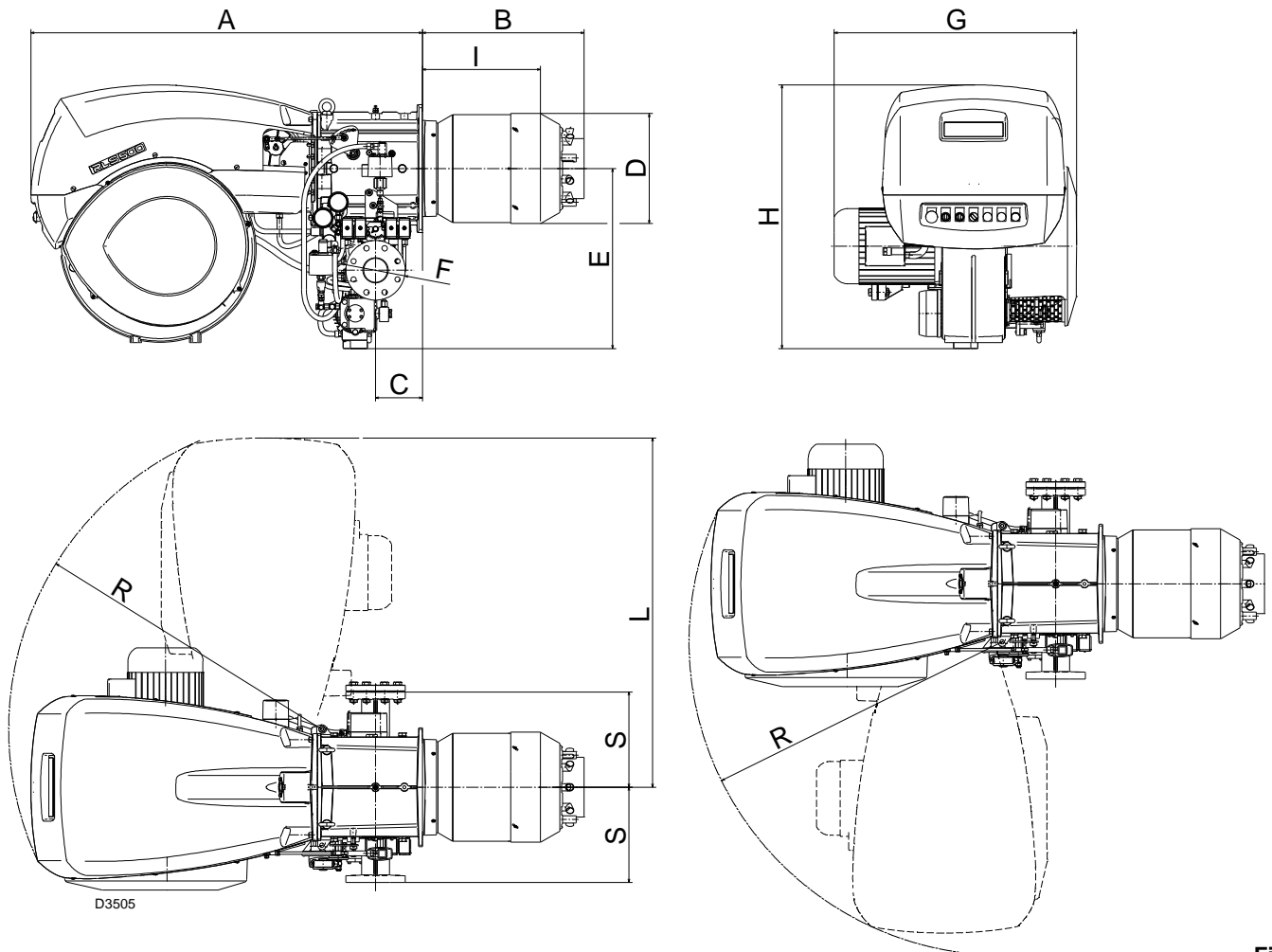
Fig. 1

**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.



**Fig. 2**

inch	A	B	C	D	E	F	G	H	I	L	R	S
RLS 300/E	52 3/16"	20 1/2"	6 7/16"	12 5/16"	23 5/32"	ANSI 3"	31 5/32"	34 9/64"	14 1/32"	46 1/4"	41 17/32"	12 19/32"
RLS 400/E	52 3/16"	20 1/2"	6 7/16"	12 5/16"	23 5/32"	ANSI 3"	30 1/2"	34 9/64"	14 1/32"	46 1/4"	41 17/32"	12 19/32"
RLS 500/E	52 3/16"	20 1/2"	6 7/16"	14 17/32"	23 5/32"	ANSI 3"	30 1/2"	34 9/64"	14	46 1/4"	41 17/32"	12 19/32"
RLS 650/E	52 3/16"	22 29/32"	6 7/16"	16 9/64"	23 5/32"	ANSI 3"	34 21/32"	34 9/64"	14 3/16"	46 1/4"	41 17/32"	12 19/32"
RLS 800/E	52 3/16"	22 29/32"	6 7/16"	16 27/32"	23 5/32"	ANSI 3"	37	34 9/64"	16 15/32"	46 1/4"	41 17/32"	12 19/32"

**Tab. E**

**3.6 Standard equipment**

- 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

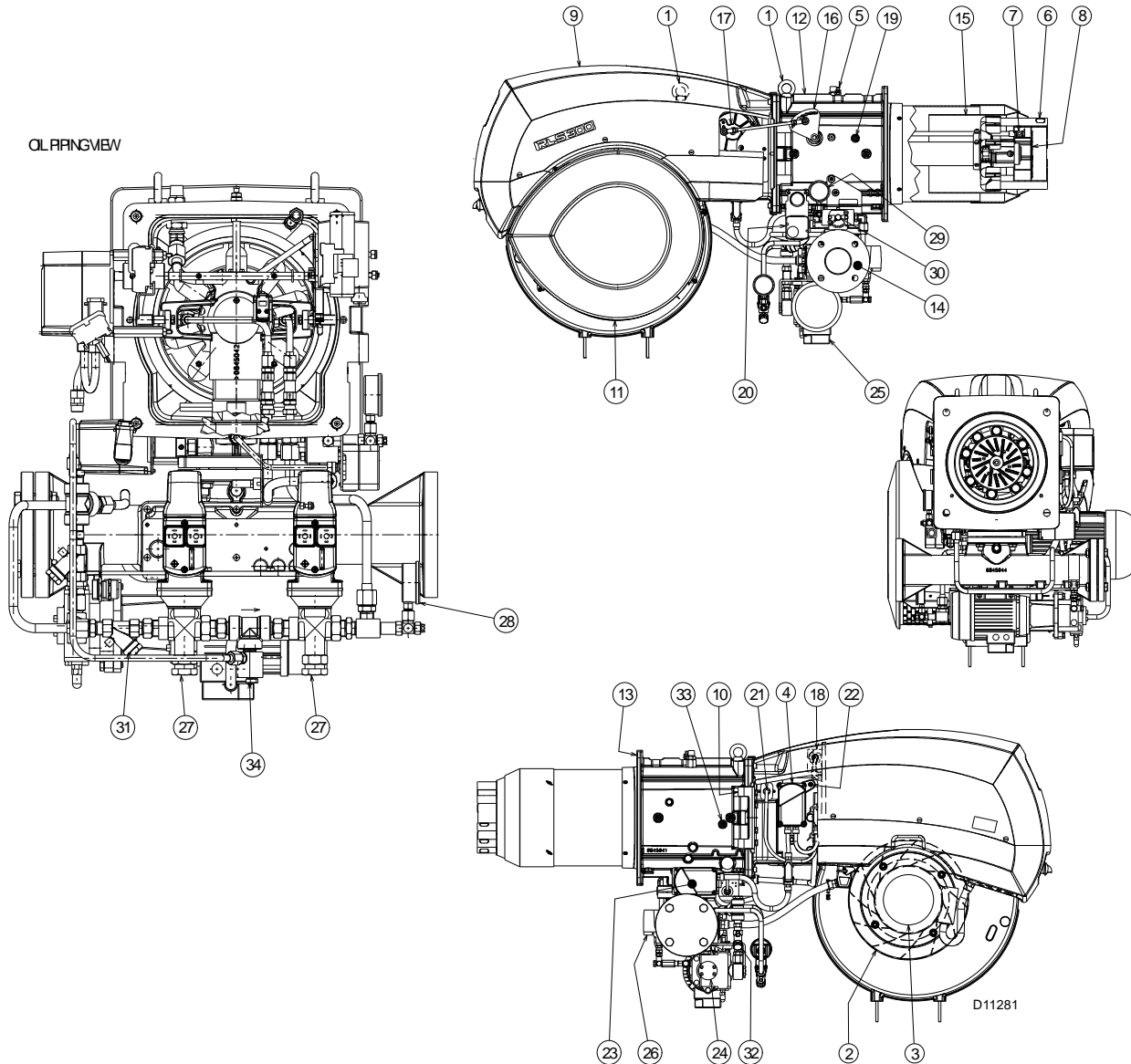


Fig. 3

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>1 Lifting eyebolts</li> <li>2 Fan</li> <li>3 Fan motor</li> <li>4 Air gate valve servomotor</li> <li>5 Gas pressure test point</li> <li>6 Combustion head</li> <li>7 Ignition pilot</li> <li>8 Flame stability disk</li> <li>9 Electric panel board - cover</li> <li>10 Hinge for opening burner</li> <li>11 Air inlet to fan</li> <li>12 Manifold</li> <li>13 Thermal insulation screen for securing burner to boiler</li> <li>14 Gas train flange</li> <li>15 Shutter</li> <li>16 Lever for movement of combustion head</li> <li>17 Gears for movement of air damper</li> <li>18 Air pressure switch (differential operating type)</li> <li>19 Air pressure test point</li> <li>20 Max gas pressure switch with pressure test point</li> </ul> | <ul style="list-style-type: none"> <li>21 QRI flame detector</li> <li>22 Air pressure test point "+"</li> <li>23 Oil modulator and gas butterfly valve servomotor</li> <li>24 Pump</li> <li>25 Pump motor</li> <li>26 Min oil pressure switch</li> <li>27 Oil shutoff VOG valve</li> <li>28 Nozzle delivery pressure gauge</li> <li>29 Nozzle return pressure gauge</li> <li>30 Oil modulator</li> <li>31 Strainer</li> <li>32 Check valve</li> <li>33 Air pressure test point "-"</li> </ul> |
|---|---|

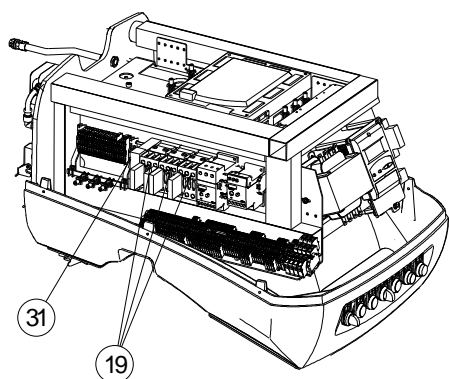


**WARNING**

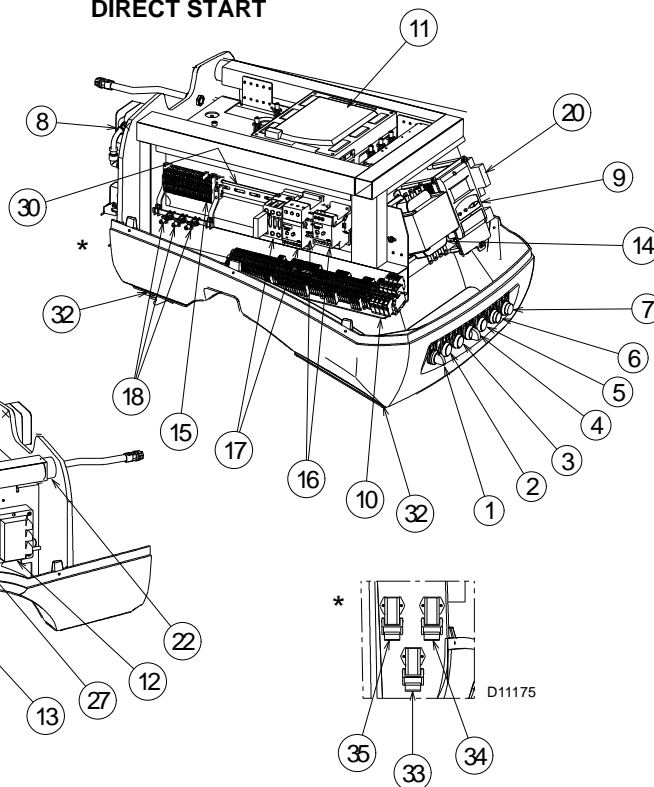
The burner can be opened either on the right or left sides, irrespective of the side from which fuel is supplied. When the burner is closed, the hinge can be re-positioned on the opposite side.

3.7.1 Panel board description

STAR/DELTA START



DIRECT START



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

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 push-button.
- ▶ **Fan motor trip**  
 release by pressing the push-button on thermal overload 16)(Fig. 4). See "Thermal relay calibration" on page 35.
- ▶ **Pump motor trip**  
 release by pressing the push-button on thermal overload 17)(Fig. 4). See "Thermal relay calibration" on page 35.



The connection of the inverter and O<sub>2</sub> kits must be carried out by the client / installer following the instructions (electrical drawing) provided with the burner and the kits.

Fig. 4

**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.

Model	MBtu/hr
RLS 300/E	4,732
RLS 400/E	6,817
RLS 500/E	9,468
RLS 650/E	11,362
RLS 800/E	13,256



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 27.

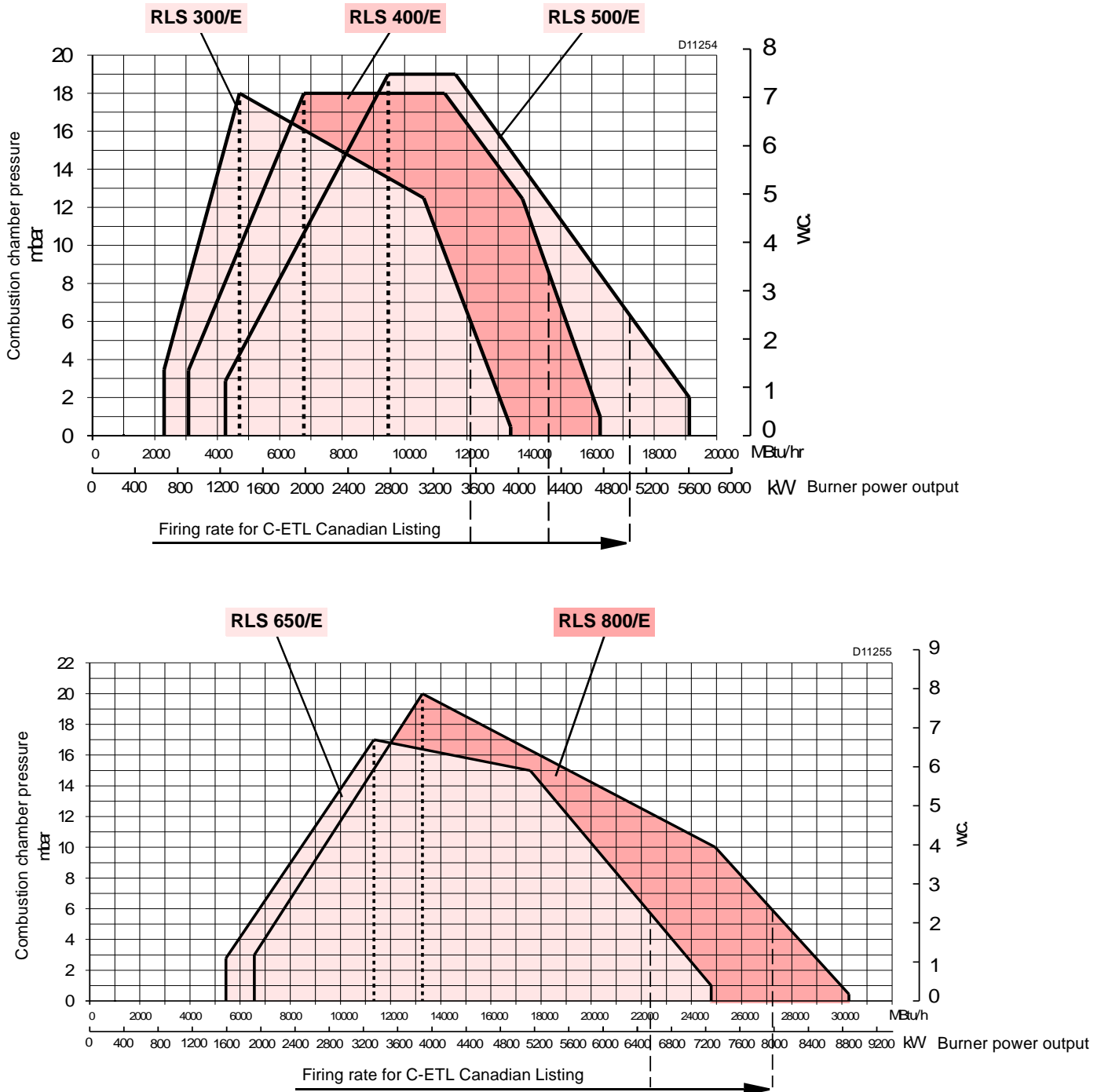


Fig. 5

### 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 (reference temp.) = 40°F  
 (equivalent 2000 ft variation)  
 $40 : 2 = 20 \times 100 = 2000$  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.).

## 1 CORRECTED BURNER CAPACITY ACCORDING TO ALTITUDE

Rated Capacity	Altitude										
	m a.s.l.	0	100	305	610	915	1220	1525	1830	2135	2440
	ft a.s.l	0	328	1000	2000	3000	4000	5000	6000	7000	8000
500		494	500	512	530	551	571	593	616	641	669
1000		987	1000	1023	1061	1101	1142	1186	1232	1282	1337
1500		1481	1500	1535	1591	1652	1713	1778	1848	1924	2006
2000		1974	2000	2046	2121	2202	2284	2371	2464	2565	2675
2500		2468	2500	2558	2652	2753	2855	2964	3079	3206	3343
3000		2962	3000	3069	3182	3303	3425	3557	3695	3847	4012
3500		3455	3500	3581	3712	3854	3996	4149	4311	4488	4680
4000		3949	4000	4092	4243	4404	4567	4742	4927	5130	5349
4500		4442	4500	4604	4773	4955	5138	5335	5543	5771	6018
5000		4936	5000	5116	5303	5505	5709	5928	6159	6412	6686
5500		5429	5500	5627	5834	6056	6280	6520	6775	7053	7355
6000		5923	6000	6139	6364	6606	6851	7113	7391	7694	8024
6500		6417	6500	6650	6894	7157	7422	7706	8006	8335	8692
7000		6910	7000	7162	7425	7708	7993	8299	8622	8977	9361
7500		7404	7500	7673	7955	8258	8564	8892	9238	9618	10029
8000		7897	8000	8185	8485	8809	9135	9484	9854	10259	10698
8500		8391	8500	8697	9016	9359	9705	10077	10470	10900	11367
9000		8885	9000	9208	9546	9910	10276	10670	11086	11541	12035
9500		9378	9500	9720	10076	10460	10847	11263	11702	12183	12704
10000		9872	10000	10231	10607	11011	11418	11855	12318	12824	13373
Average barometric pressure (20°C)	mbar	1013	1000	977.4	942.8	908.2	875.8	843.5	811.85	779.8	747.8
Average barometric pressure (68°F)	"w.c.	399	394	385	371	358	345	332	320	307	294



**2 CORRECTED BURNER AIR PRESSURE ACCORDING TO ALTITUDE**

Rated Pressure	Altitude										
	m a.s.l.	0	100	305	610	915	1220	1525	1830	2135	2440
	ft a.s.l.	0	328	1000	2000	3000	4000	5000	6000	7000	8000
0.50		0.49	0.50	0.51	0.53	0.55	0.57	0.59	0.62	0.64	0.67
1.00		0.99	1.00	1.02	1.06	1.10	1.14	1.19	1.23	1.28	1.34
1.50		1.48	1.50	1.53	1.59	1.65	1.71	1.78	1.85	1.92	2.01
2.00		1.97	2.00	2.05	2.12	2.20	2.28	2.37	2.46	2.56	2.67
2.50		2.47	2.50	2.56	2.65	2.75	2.85	2.96	3.08	3.21	3.34
3.00		2.96	3.00	3.07	3.18	3.30	3.43	3.56	3.70	3.85	4.01
3.50		3.46	3.50	3.58	3.71	3.85	4.00	4.15	4.31	4.49	4.68
4.00		3.95	4.00	4.09	4.24	4.40	4.57	4.74	4.93	5.13	5.35
4.50		4.44	4.50	4.60	4.77	4.95	5.14	5.33	5.54	5.77	6.02
5.00		4.94	5.00	5.12	5.30	5.51	5.71	5.93	6.16	6.41	6.69
5.50		5.43	5.50	5.63	5.83	6.06	6.28	6.52	6.77	7.05	7.35
6.00		5.92	6.00	6.14	6.36	6.61	6.85	7.11	7.39	7.69	8.02
6.50		6.42	6.50	6.65	6.89	7.16	7.42	7.71	8.01	8.34	8.69
7.00		6.91	7.00	7.16	7.42	7.71	7.99	8.30	8.62	8.98	9.36
7.50		7.40	7.50	7.67	7.96	8.26	8.56	8.89	9.24	9.62	10.03
8.00		7.90	8.00	8.18	8.49	8.81	9.13	9.48	9.85	10.26	10.70
8.50		8.39	8.50	8.70	9.02	9.36	9.71	10.08	10.47	10.90	11.37
9.00		8.88	9.00	9.21	9.55	9.91	10.28	10.67	11.09	11.54	12.04
9.50		9.38	9.50	9.72	10.08	10.46	10.85	11.26	11.70	12.18	12.70
10.00		9.87	10.00	10.23	10.61	11.01	11.42	11.86	12.32	12.82	13.37
Average barometric pressure (20°C)	mbar	1013	1000	977.4	942.8	908.2	875.8	843.5	811.85	779.8	747.8
Average barometric pressure (68°F)	"w.c.	399	394	385	371	358	345	332	320	307	294

**3.9 Minimum furnace dimensions**

The firing rates were set in relation to certified test boilers.

**Example RLS 500/E:**

Fig. 6 indicates the diameter and length of the test combustion chamber.

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

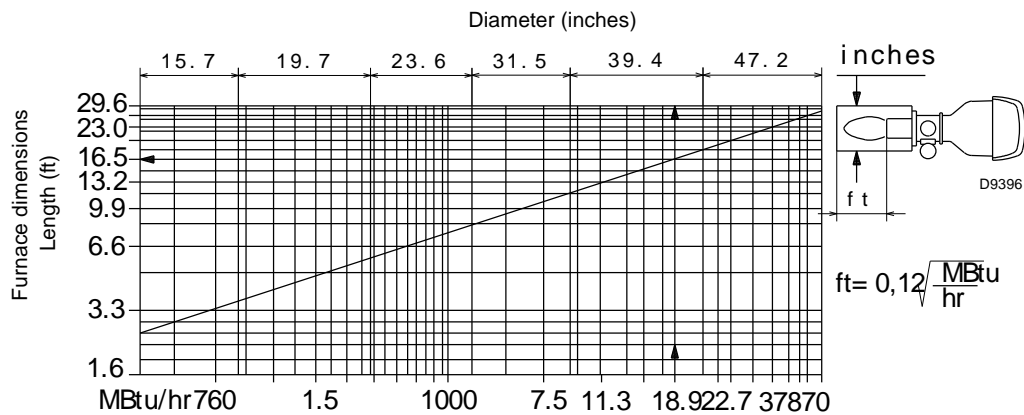


Fig. 6



**3.10 Control box for the air/fuel ratio (LMV51...)**

**Warning notes**



**WARNING**

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.



D9301

**Fig. 7**

**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:

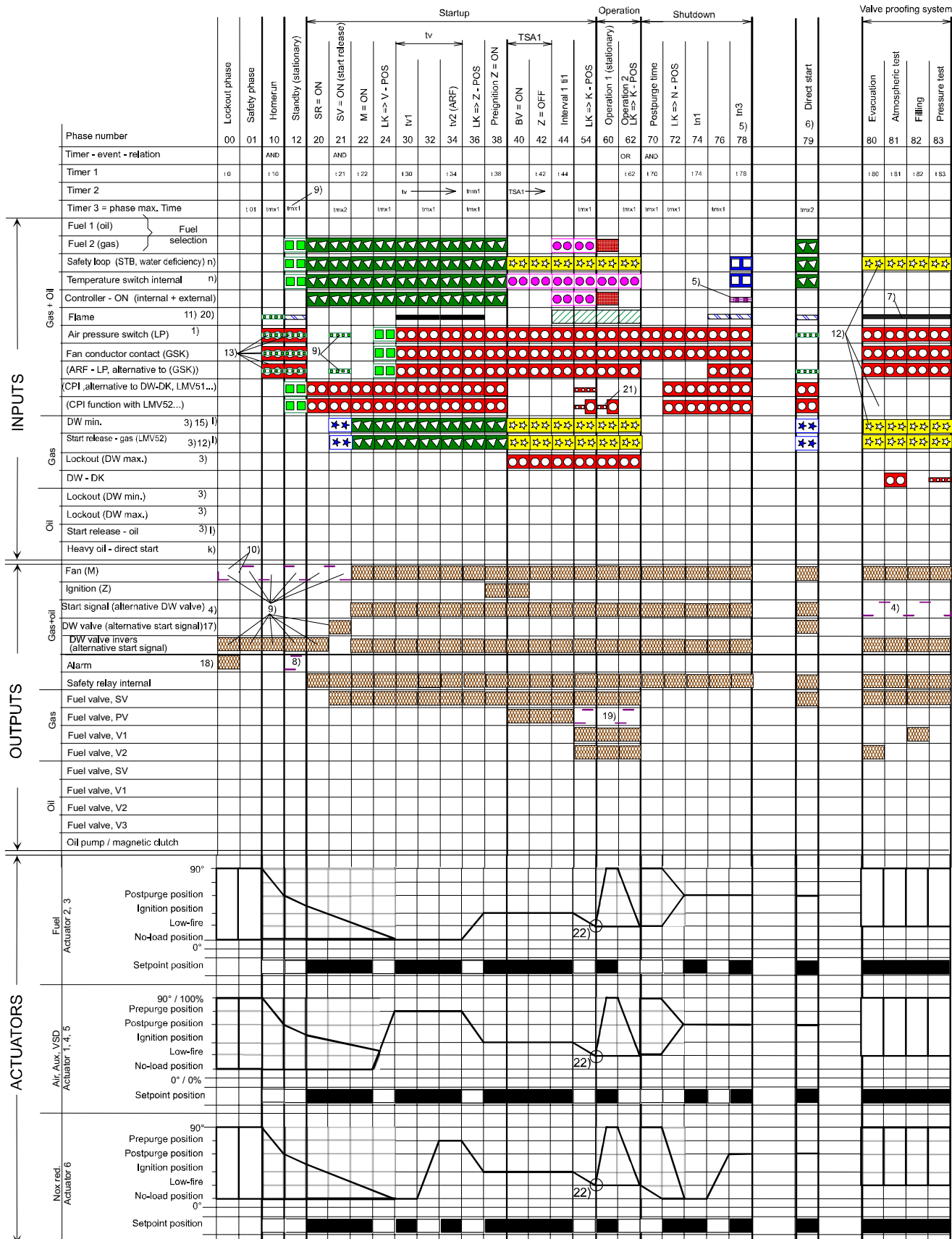
- Never run the detector cables together with other cables:
  - Line capacitance reduces the magnitude of the flame signal.
  - Use a separate cable.

- Observe the permissible cable lengths.
- The ionization probe is not protected against electrical shock hazard. The mainspowered 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

LMV51... basic unit	Mains voltage	AC 120 V -15 % / +10 %
	Mains frequency	50 / 60 Hz ±6 %
	Power consumption	< 30 W (typically)
	Safety class	I, with parts according to II and III to DIN EN 60730-1
Terminal loading 'Inputs'	Unit fuse F1 (internally)	6.3 AT
	Perm. mains primary fuse (externally)	Max. 16 AT
	Undervoltage	
	• Safety shutdown from operating position at mains voltage	< AC 96 V
	• Restart on rise in mains voltage	> AC 100 V
	Oil pump / magnetic clutch (nominal voltage)	
	• Nominal current • Power factor	1.6A cosφ > 0.4
Terminal loading 'Outputs'	Air pressure switch test valve (nominal voltage)	
	• Nominal current • Power factor	0.5A cosφ > 0.4
	<b>Total contact loading:</b>	
	• Mains voltage • Input current of unit (safety loop) total load on contacts resulting from: - Fan motor contactor - Ignition transformer - Valve - Oil pump / magnetic clutch	AC 120 V -15 % / +10 % Max. 5 A
Cable lengths	<b>Single contact loading:</b>	
	Fan motor contactor (nominal voltage)	
	• Nominal current • Power factor	1A cosφ > 0.4
	Alarm output (nominal voltage)	
	• Nominal current • Power factor	1 A cosφ > 0.4
	Ignition transformer (nominal voltage)	
	• Nominal current • Power factor	1.6 A cosφ > 0.2
	Fuel valve gas (nominal voltage)	
	• Nominal current • Power factor	1.6 A cosφ > 0.4
	Fuel valve oil (nominal voltage)	
• Nominal current • Power factor	1.6 A cosφ > 0.4	
Environmental conditions	Main line	Max. 100 m (100 pF/m)
	Operation	DIN EN 60721-3-3
	Climatic conditions	Class 3K3
	Mechanical conditions	Class 3M3
	Temperature range Humidity	-20...+60 °C < 95 % r.h.

## Operation sequence of the burner



D9507

Fig. 8

### 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.

Signal ON	Signal OFF	Next phase
		01 $\begin{cases} \rightarrow 00, \text{Rep} = 0 \\ \rightarrow 12, \text{Rep} > 0 \end{cases}$ Parameter direct start Checking with controller on Deviation $\rightarrow 10$ No Rep. decrement
		10
		70
		Without VP70 with VP80
		62
		Stop, up to Ph – max. time $\rightarrow 01$
		Stop, up to Ph – max. time $\rightarrow 10$
		01 $\begin{cases} \rightarrow 00, \text{Rep} = 0 \\ \rightarrow 12, \text{Rep} > 0 \end{cases}$ 0-3 s.
		01 $\begin{cases} \rightarrow 00, \text{Rep} = 0 \\ \rightarrow 12, \text{Rep} > 0 \end{cases}$ 0-30 s.
		01 $\begin{cases} \rightarrow 00, \text{Rep} = 0 \\ \rightarrow 12, \text{Rep} > 0 \end{cases}$ 0-3 s.
		Param. $\begin{cases} \rightarrow 79 \\ \rightarrow 10 \end{cases}$
		Input: don't care
		Output: OFF
		Output: ON

### 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

## Key to the sequence diagrams:

- 1) Parameter: With / without pressure switch
- 2) Parameter: Short / long preignition time for oil only Short / long oil pump – ON – time
- 3) Delayed shutdown within TSA1 + TSA2
- 4) Parameter: Output as startup signal / pressure switch relief valve
- 5) Parameter: Normal / direct startup  
 Normal startup → sequential phase = 10  
 Direct startup → sequential phase = 79  
 (when R = ON)
- 6) Sequential phase = 24
- 7) Only with valve proving during startup
- 8) Parameter: With / without alarm on prevention of startup
- 9) Parameter: With continuous purging the shown output signals are inverted
- 10) Fan controlled as before  
 Running time when LOCK OUT = T\_FanLockout LF
- 11) Parameter: With / without extraneous light test in STANDBY
- 12) With valve proving during startup phase 10
- 13) Parameter: Normal / continuous purging  
 Normal purging: Checking for off in 10, stop to Ph-max time → 01  
 Continuous purging: Checking for on in 10 and 12, Stop up to phase-max time → 01
- 14) Parameter: "OilPressureMin", "akt\_from\_ts" → no check before TSA1 (LO, HO) or TSA2 (LOgp, HOgp)
- 15) Parameter: "GasPressureMin", "deakt\_xOGP" → pressure switch-min can be deactivated for oil programs with gas pilot
- 16) Parameter: "OilPumpCoupling", "direct\_coupl" → shutoff valve oil has to be connected to output "Oil pump / magnetic clutch".  
 Output is active when fan is on and for another 15 s after fan is switched off
- 17) Parameter: "Start / pressure switch valve", "PS\_Reli\_Inv" → Output pressure switch valve will be logically inverted
- 18) Parameter: "Alarm act / deact", "deactivated" → The alarm output can temporarily be deactivated (for current error only)
- 19) Parameter: Only with LMV52...: Continuous pilot gas / oil: Activated → Pilot valve is also activated in operation
- 20) Parameter: Only with LMV52...: Extraneous light, pilot phase, operating phase gas / oil → Separate flame supervision possible
- 21) Parameter: Only with LMV52...: pressure switch valve proving / CPI or StartReleaseGas → Parameter-dependent ON / OFF test  
 CPI Gas: OFF test for gas trains only  
 CPI Oil: OFF test for oil trains only  
 CPI Gas+Oil: OFF test for gas and oil trains
- 22) Parameter: After LMV52... software version 04.50 and AZL5... software version 04.40, dependent on parameter *StartPktOperation*



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

### 3.11 Actuators

#### Warning notes



WARNING

**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.



WARNING

**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.



WARNING

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

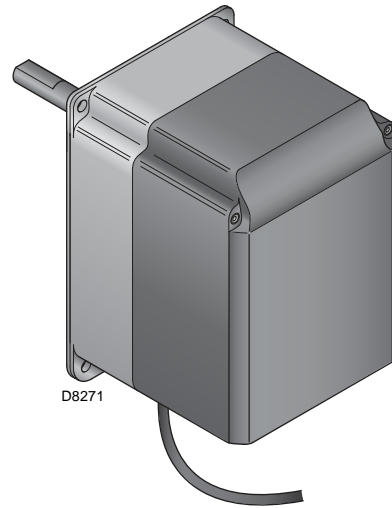


Fig. 9

#### Technical data

Model	SQM45.295A9	SQM48.497A9
Operating voltage	AC 2 x 12 V via bus cable from the basic unit or via a separate transformer	
Safety class	Extra low-voltage with safe isolation from mains voltage	
Power consumption	9...15 VA	
Degree of protection	To EN 60 529, IP 54, provided adequate cable entries are used	
On time	50 %, max. 3 min. continuously	
Electrical connections	RAST3.5 terminals	
Direction of rotation (when facing the shaft)	- Standard: counterclockwise - Reverse: clockwise	
Running time (min.) for 90°	10 s.	30s.
Holding torque (max.)	1.5 Nm	20 Nm
Nominal torque (max.)	3 Nm	20 Nm
Weight	approx. 1 kg	approx. 1.6 kg
Environmental conditions:		
Operation	DIN EN 60721-3-1	
Climatic conditions	class 1K3	
Mechanical conditions	class 1M2	
Temperature range	-20...+60 °C	
Humidity	< 95 % r.h.	



**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 suitability 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 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.



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



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**

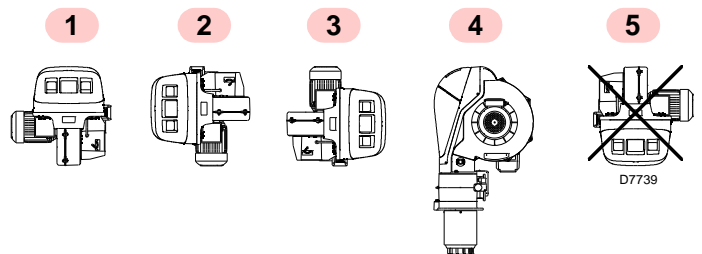
The burner is designed to operate only in the positions **1, 2, 3** and **4** (Fig. 10).

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.



**Fig. 10**

### 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.

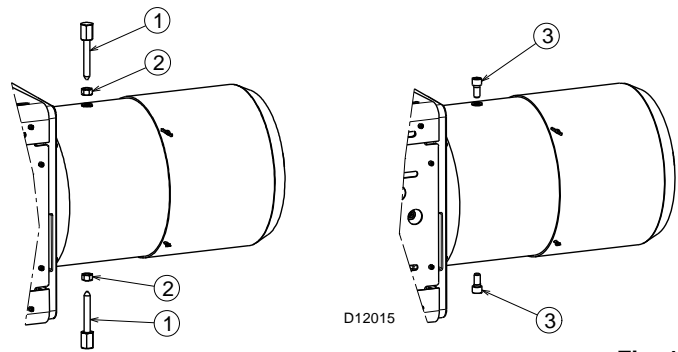


Fig. 11

### 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.

inch	A	B	C
RLS 300/E	13 <sup>25</sup> / <sub>32</sub> "	17 <sup>51</sup> / <sub>64</sub> "	3/4" coarse
RLS 400/E	13 <sup>25</sup> / <sub>32</sub> "	17 <sup>51</sup> / <sub>64</sub> "	3/4" coarse
RLS 500/E	15 <sup>11</sup> / <sub>32</sub> "	17 <sup>51</sup> / <sub>64</sub> "	3/4" coarse
RLS 650/E	17 <sup>5</sup> / <sub>16</sub> "	19 <sup>31</sup> / <sub>64</sub> "	3/4" coarse
RLS 800/E	17 <sup>5</sup> / <sub>16</sub> "	19 <sup>31</sup> / <sub>64</sub> "	3/4" coarse

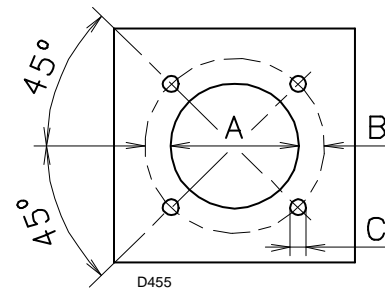


Fig. 12

### 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.

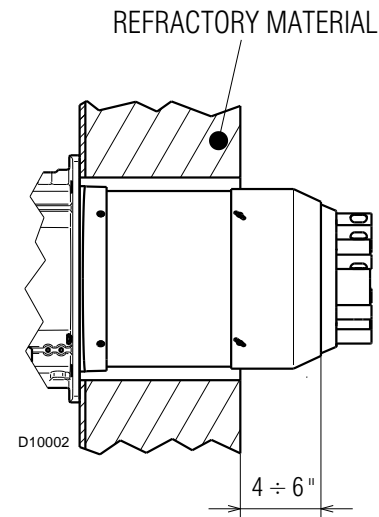


Fig. 13



### 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.



While unscrewing, some fuel may leak out.

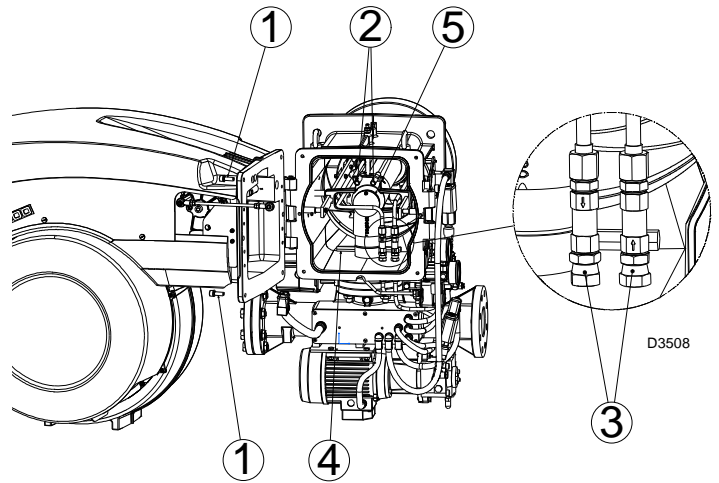


Fig. 14

#### 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).



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.

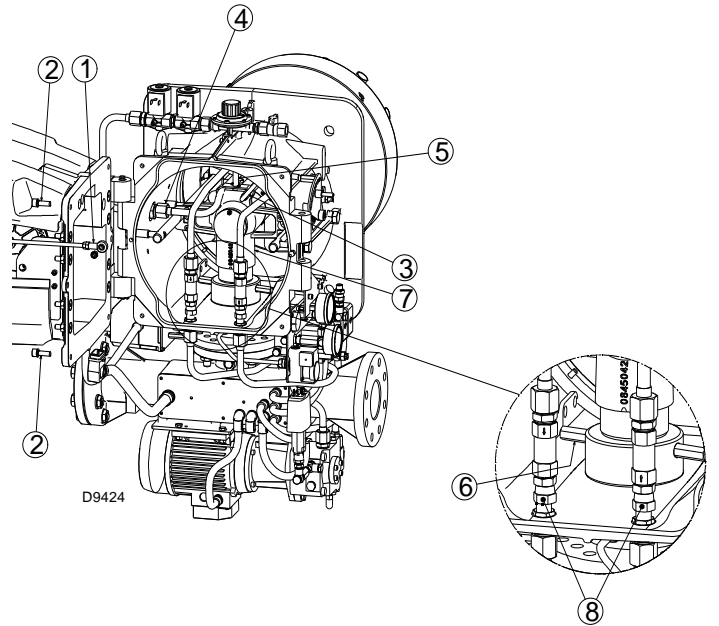
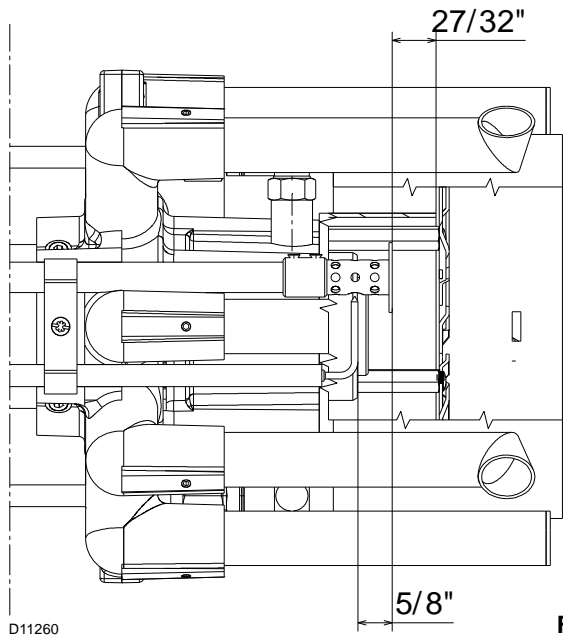
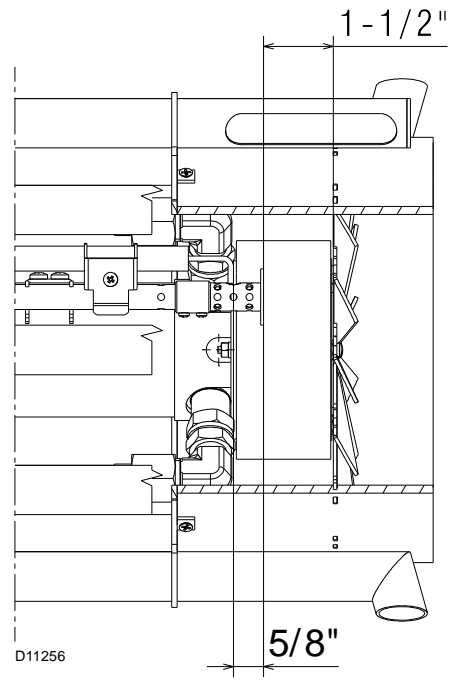


Fig. 15

**4.8 Electrode and ignition pilot adjustment**

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

**RLS 650 - 800/E model (Fig. 17)****RLS 300 - 400 - 500/E model (Fig. 16)****Fig. 16****Fig. 17**

**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.



**WARNING**

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



**CAUTION**

The use of nozzles other than those specified by the Manufacturer and inadequate regular maintenance may result into emission limits non-conforming to the values set forth by the regulations in force, and in extremely serious cases, into potential hazards to people and objects.

The manufacturing company shall not be liable for any such damage arising from non observance of the requirements contained in this manual.

**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.

MODULATING PRESSURE BURNER MODEL					NOZZLE		HIGH FIRE			LOW FIRE		
RLS 300	RLS 400	RLS 500	RLS 650	RLS 800	Nominal size	Fluidics N2 45°	By-pass pressure	Flow rate		By-pass pressure	Flow rate	Supply pressure
					kg/h	Code	PSI	kg/h	GPH	PSI	GPH	PSI
X					130	3045477	270	105,0	33,6	100	8,3	300
X					150	3045479	264	125,0	40,0	100	11,8	300
X	X				175	3045481	258	149,4	47,8	100	13,8	300
X	X				175	3045481	260	156,3	50,0	100	13,8	300
X	X				200	3045483	267	187,5	60,0	100	15,0	300
X	X	X			250	3045487	260	211,3	67,6	100	16,6	300
X	X	X			250	3045487	262	218,8	70,0	100	16,6	300
X	X	X			275	3045489	268	250,0	80,0	100	19,2	300
X	X	X	X		300	3045491	257	256,3	82,0	100	21,4	300
X	X	X	X		325	3045493	257	281,3	90,0	100	23,0	300
X	X	X	X	X	325	3045493	261	295,3	94,5	100	23,0	300
X	X	X	X	X	350	3045495	258	304,7	97,5	100	25,6	300
	X	X	X	X	350	3045495	260	312,5	100,0	100	25,6	300
	X	X	X	X	400	3045499	232	343,8	110,0	100	33,6	300
	X	X	X	X	400	3045499	239	368,8	118,0	100	33,6	300
		X	X	X	500	3045503	249	406,3	130,0	100	38,4	300
		X	X	X	500	3045503	254	425,0	136,0	100	38,4	300
			X	X	525	3045504	247	437,5	140,0	100	41,6	300
			X	X	525	3045504	251	468,8	150,0	100	41,6	300
			X	X	575	3045506	245	500,0	160,0	100	42,2	300
			X	X	600	3045507	245	531,3	170,0	100	46,4	300
			X	X	650	3045508	233	552,5	176,8	100	51,2	300
				X	650	3045508	236	562,5	180,0	100	51,2	300
				X	700	3045509	226	593,8	190,0	100	57,6	300
				X	700	3045509	230	625,0	200,0	100	57,6	300
				X	750	3045510	244	656,3	210,0	100	64,0	300
				X	750	3045510	247	674,4	215,8	100	64,0	300

**Tab. F**

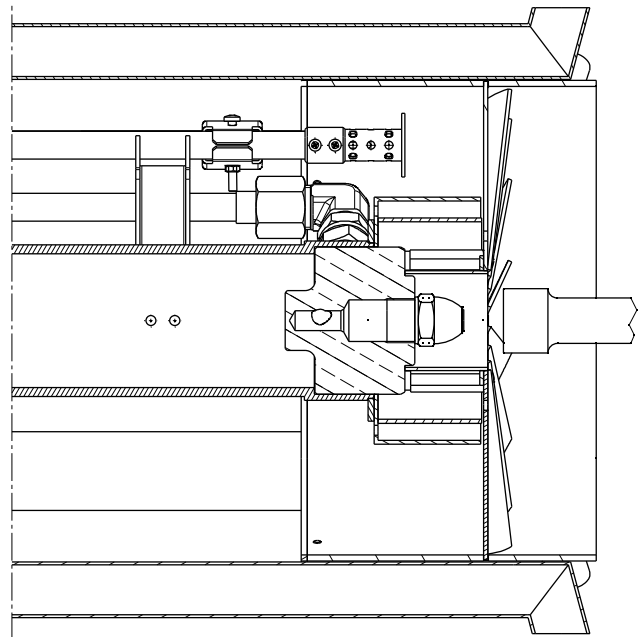
#### 4.9.2 Nozzle installation

- 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. F.



WARNING

- 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.



D11257

Fig. 18

**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.

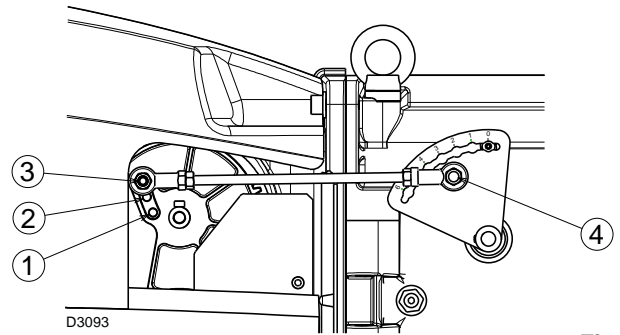
Setting is pre-arranged in the plant for the maximum run (hole 3) (Fig. 19).

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.

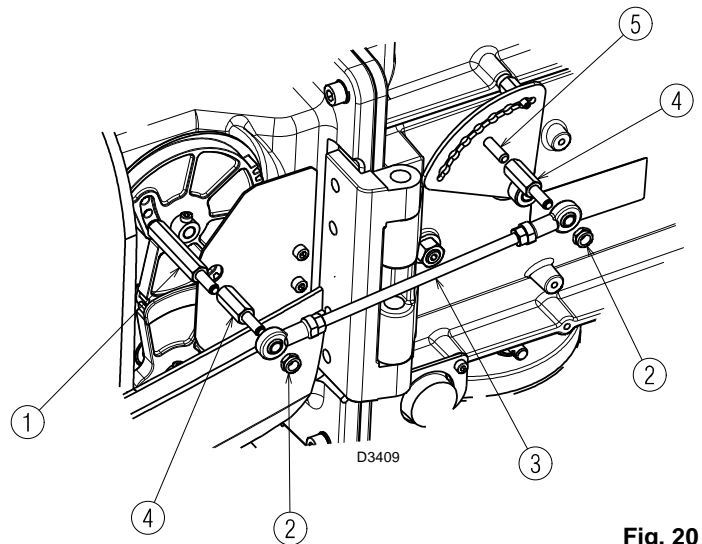
If combustion requirements require you to move spacer 1)(Fig. 20) onto the 1<sup>st</sup> or 2<sup>nd</sup> hole of the gear and, at the same time, the hinge is on the right, you need to fit the spacers 4)(Fig. 20) supplied with the burner.

Proceed as follows:

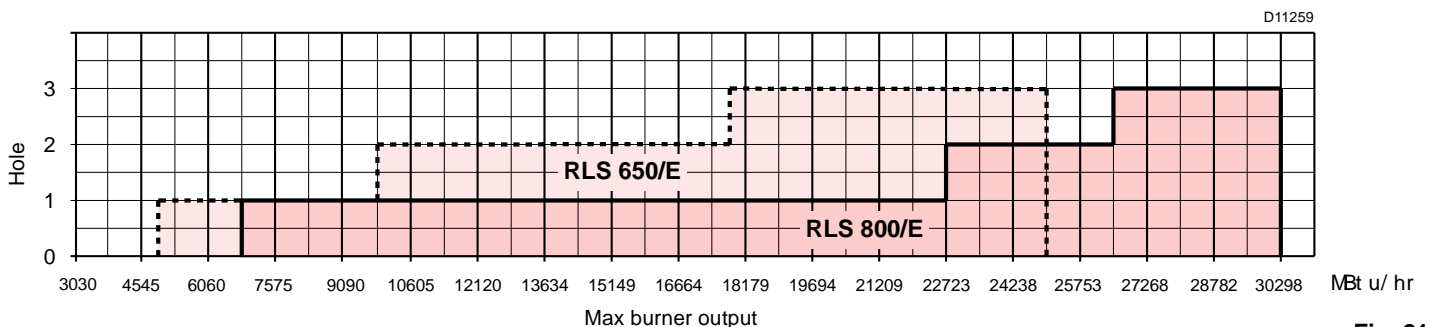
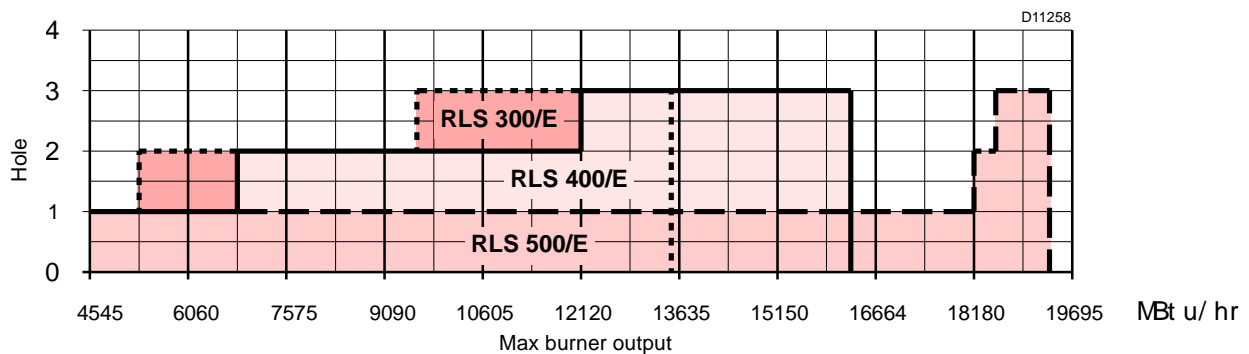
- first unscrew nuts 2), remove tie rod 3), unscrew spacer 1) and position it on the hole you want,
- screw the spacers 4) onto spacer 1) and screw 5) respectively,
- once done, refit the tie rod and nuts.



**Fig. 19**



**Fig. 20**

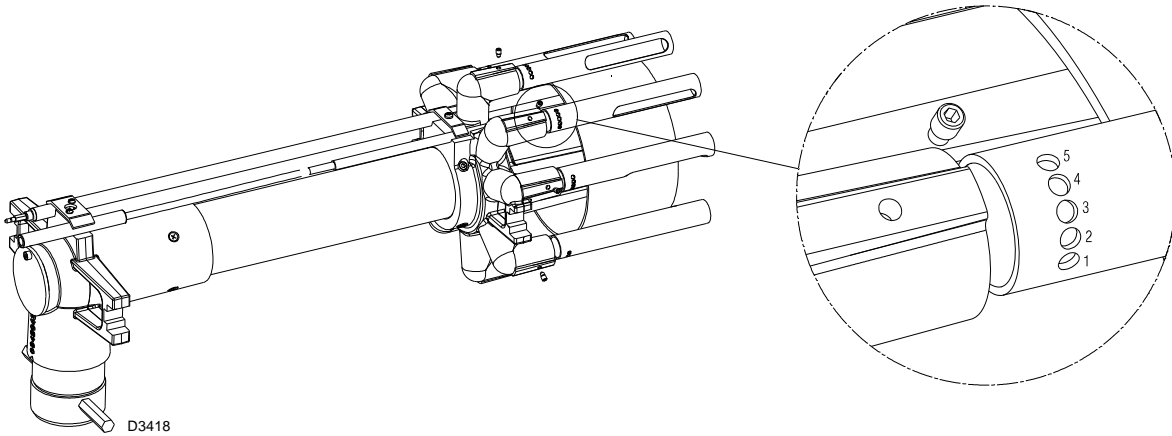


**Fig. 21**

**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**

**4.10.1 Adjustment at the maximum output (for gas)**

**Only for RLS 650/E model**

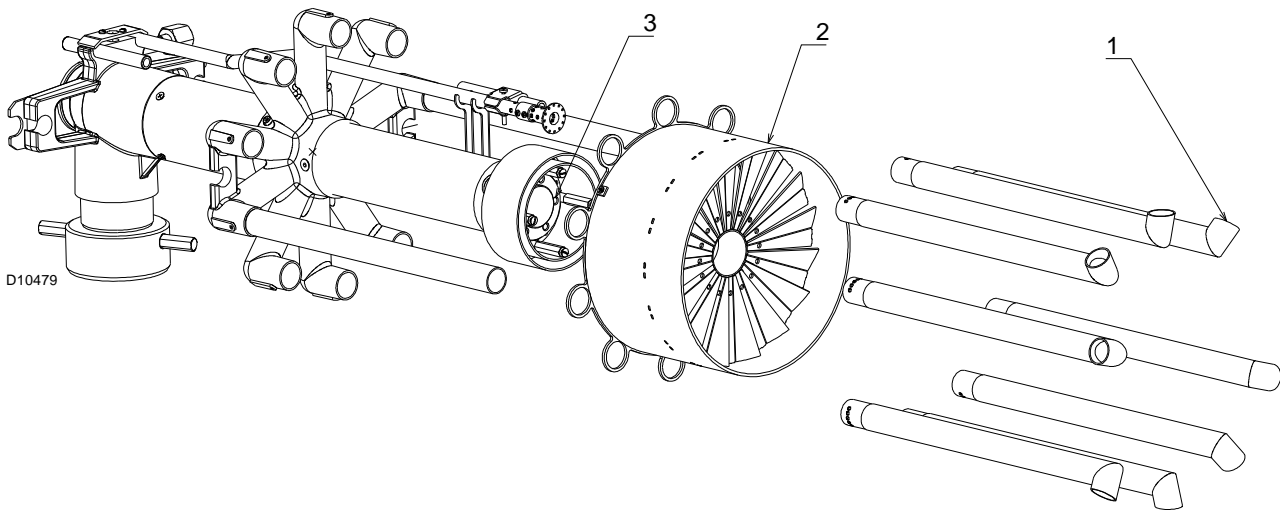
The adjustment at the maximum output requires the disassembly of the 6 nozzles as indicated in Fig. 23.

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**

**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. G.

**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. G.

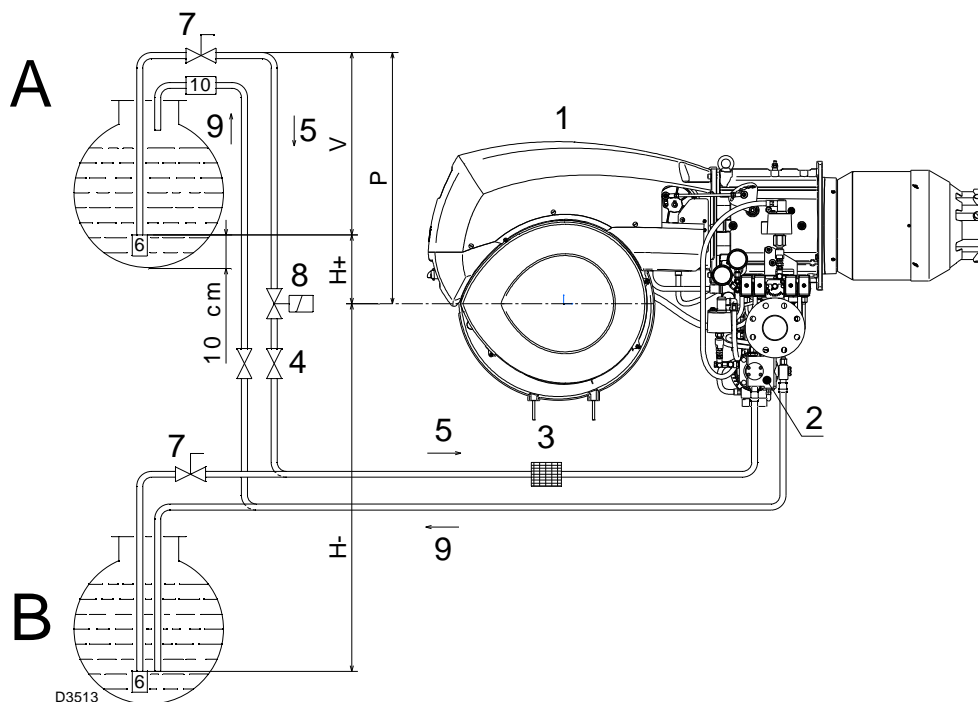


Fig. 24

+/- H (ft)	L (ft)	
	Ø 1/2"	Ø 5/8"
+ 13	197	263
+ 10	164	230
+ 6.6	132	197
+ 4.8	115	181
+ 3.3	99	164
+ 1.6	82	148
0	66	132
- 1.6	59	115
- 3.3	49	99
- 4.8	43	82
- 6.6	33	66
- 10	16	33
- 13	-	20

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

Tab. G

**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.



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.



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**

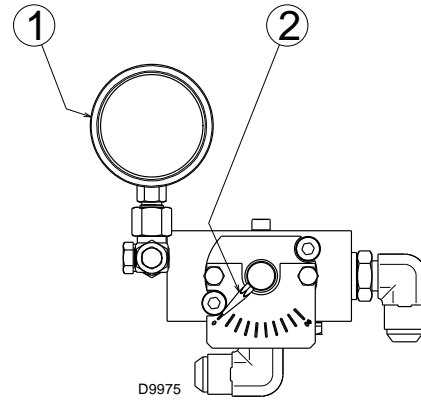
The pressure variator (Fig. 25) of the oil circuit makes it possible to vary the pressure on return of the nozzle depending on the flow rate required.

Governing of the pressure on return is obtained with the variation of a section by rotating the servomotor 23)(Fig. 3 on page 10) 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 11); 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 10) 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.



**Fig. 25**

Key (Fig. 25)

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



**4.13 Pump**

**4.13.1 Technical data**

Pump model		TA3	TA4	TA5
		(RLS 300-400/E)	(RLS 500/E)	(RLS 650-800/E)
Min. delivery rate at 300 PSI pressure	GPH	218	290	403
Delivery pressure range	PSI	102 - 580		102 - 435
Max. suction pressure	PSI	7.0		
Viscosity range	cSt	3 - 75		
Max. oil temperature	°F	302 (150 °C)		
Max. return pressure	PSI	73.0		
Pressure calibration in the factory	PSI	300		

Tab. H

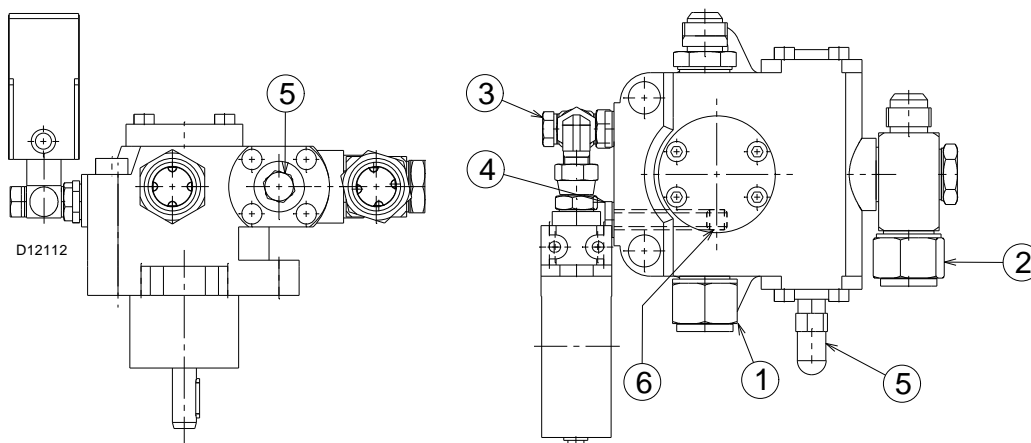


Fig. 26

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              |          |

**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.

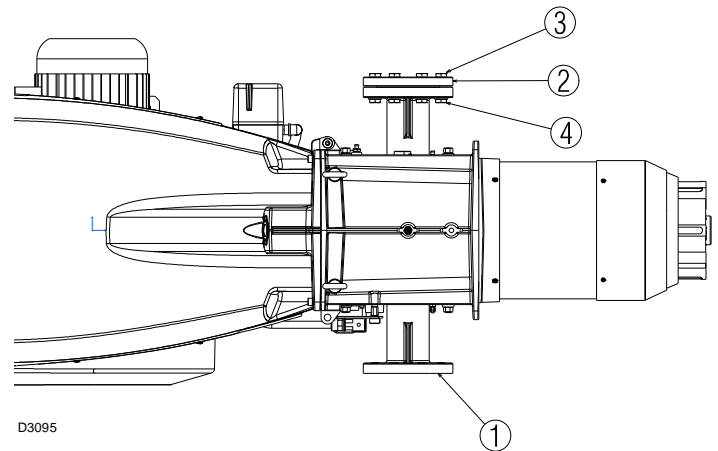


**WARNING**

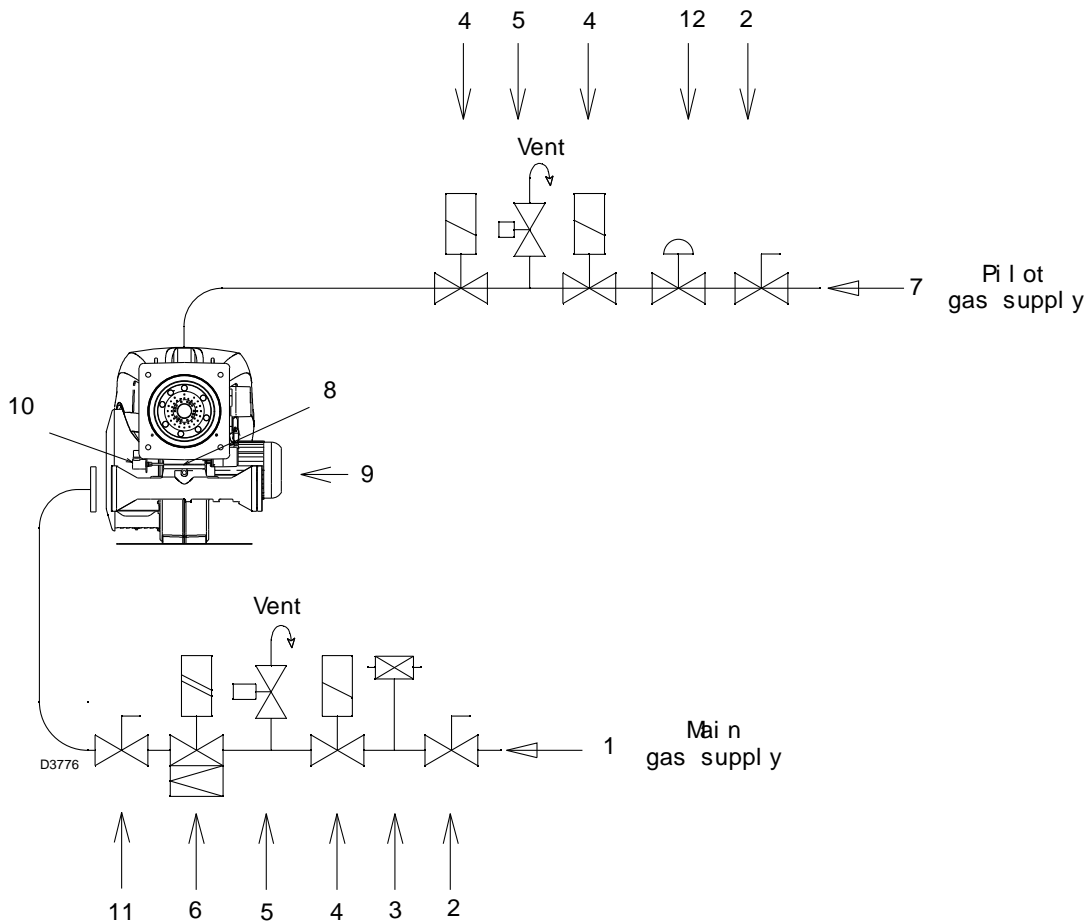
Once assembled the gas train, check for leaks.

#### 4.14.2 Gas feeding line

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



**Fig. 27**



**Fig. 28**

Key (Fig. 28)

- |                                  |                                    |
|----------------------------------|------------------------------------|
| 1 Gas input pipe for main burner | 11 Manual valve (for seal control) |
| 2 Manual valve                   | 12 Pilot regulator                 |
| 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       |                                    |

**4.14.3 Gas pressure**

The Tab. I shows minimum pressure losses along the gas supply line depending on the maximum burner output operation.

The values shown in the Tab. I 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 27.

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:

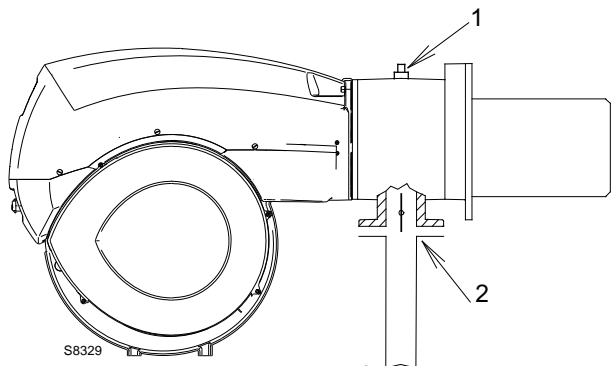
- subtract the combustion chamber pressure from the gas pressure measured at test point 1)(Fig. 29);
- find, in the Tab. I relating to the burner concerned, the pressure value closest to the result of the subtraction;
- read off the corresponding output on the left.

**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
- 11.7 - 2 = 9.7 "WC

An output of 15148 MBtu/hr shown in Tab. I 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.



**Fig. 29**

**Note**

See the accompanying instructions for the adjustment of the gas train.

	MBtu/hr (GCV)	1 Δp ("WC)	2 Δp ("WC)
RLS 300/E	5112	3.3	0.63
	5680	3.7	0.79
	7574	4.9	1.38
	9467	5.4	2.13
	11361	5.9	3
	13254	7.9	4.2
	14390	9	5.1
RLS 400/E	6816	2.3	1.1
	7574	3	1.38
	9467	4.7	2.13
	11361	6.4	3
	12307	7.3	3.62
	13254	8.3	5.17
	15148	10.8	5.47
RLS 500/E	17042	13	7
	9467	4.4	1.81
	11361	6	2.64
	13254	7.7	3
	15148	9.7	3.82
	17042	11.8	4.64
	18935	14.1	5.55
RLS 650/E	19692	15	5.9
	11362	2.8	1
	13255	4	1.4
	15149	5.1	1.8
	17043	6.2	2.2
	18936	7.7	2.8
	20830	9.3	3.3
RLS 800/E	22724	10.9	4
	24617	12.6	4.7
	24805	13.1	4.9
	13255	4.5	1.1
	15149	6	1.4
	17043	7.5	1.8
	18936	8.9	2.2
RLS 800/E	20830	10.4	2.6
	22724	11.9	3.1
	24617	13.9	3.7
	26511	15.3	4.3
	28405	17.6	4.9
	30299	19.9	5.6

**Tab. I**

### 4.15 Electrical wiring

#### Notes on safety for the electrical wiring



**DANGER**

- 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:



**DANGER**

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



**DANGER**

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).

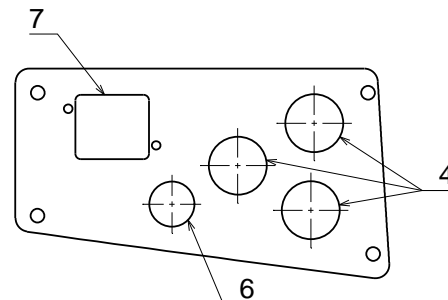
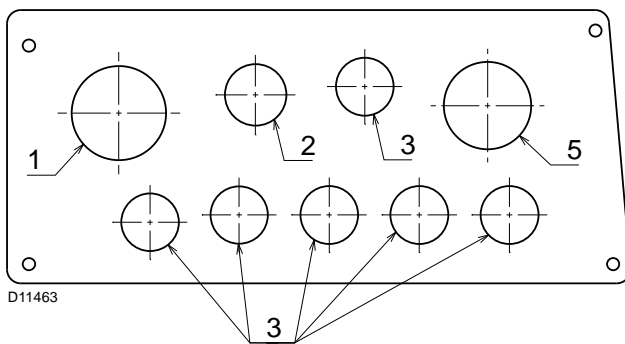
The use of the cable grommets can take various forms. By way of example we indicate the following mode (according to **UL795**):

- 1 Three phase power supply with 1 inch cable grommet
- 1 Single phase power supply with 1/2 inch cable grommet
- 2 Available: single phase power supply and other devices with 1/2 inch cable grommet
- 3 Available: consents/safety, minimum gas pressure switch, gas valves and other devices with 3/8 inch cable grommet
- 4 Available: variable speed driver, pressure and temperature probe sensor with 3/8 inch cable grommet
- 5 Motor earth cable
- 6 Available
- 7 Entry plug-socket branch unit



**WARNING**

**The control panel is in compliance with UL508A.**



**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.

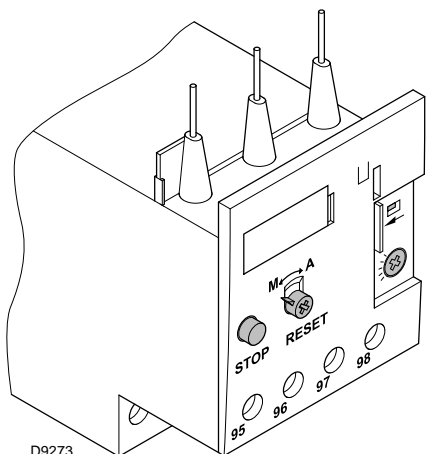


Fig. 31

- To test the thermal relay, insert a screwdriver in the window "TEST" (Fig. 32) and move it in the sense of the arrow (towards right).



**Automatic resetting can be dangerous.**

**This action is not provided for the burner operation.**

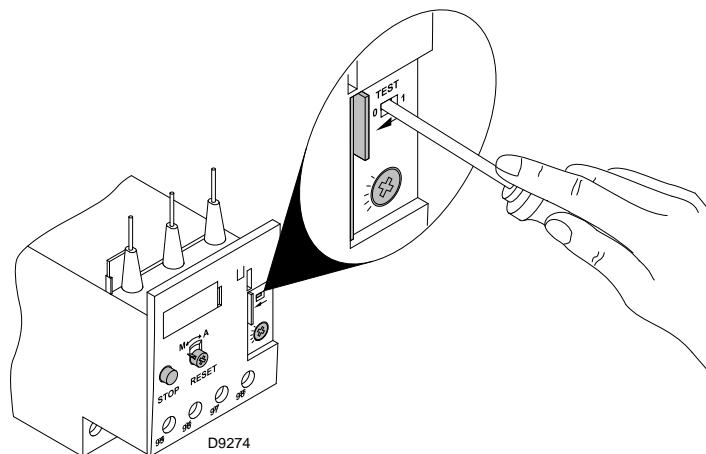


Fig. 32

**4.16.2 Electronic thermal relay**

- To reset, in the case of an intervention of the thermal relay, press the button "RESET" (Fig. 33).

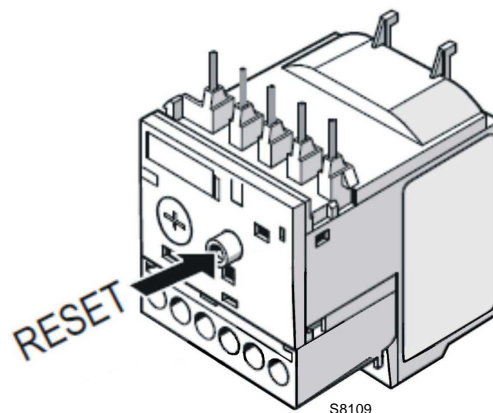


Fig. 33

There are two different solution to test the electronic thermal relay:

- **Device test (Fig. 34)**  
Push slowly the button in the window with a little screwdriver.

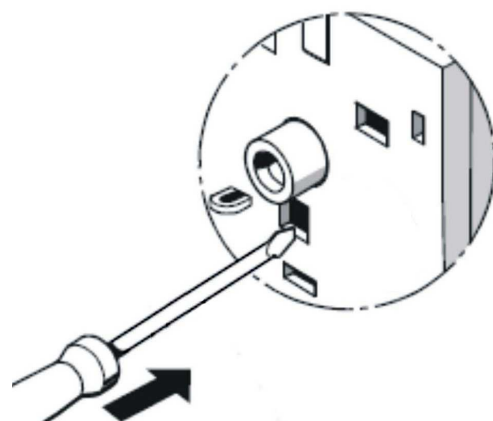


Fig. 34

- **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.

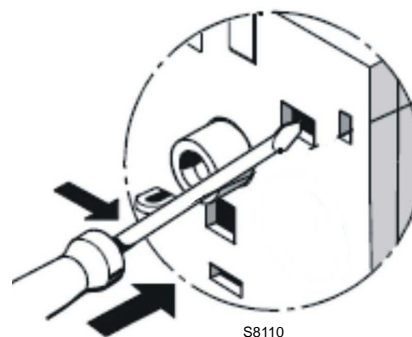
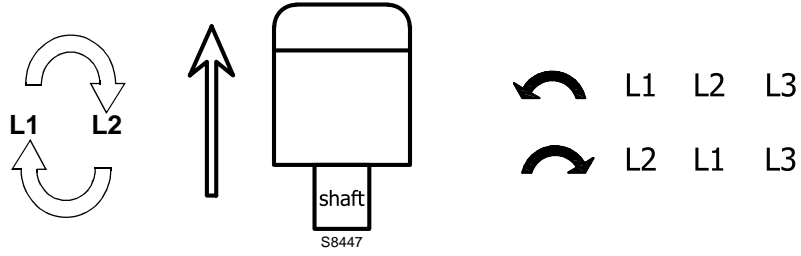


Fig. 35

**4.17 Reversible direction**



If it is necessary to reverse the direction then reverse the two main supply phases.



**Fig. 36**

**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 25.

**5.2.2 Combustion head**

The adjustment of the combustion head already carried out (page 27) 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 13.

**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 39.

**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. 37) to "LOCAL".

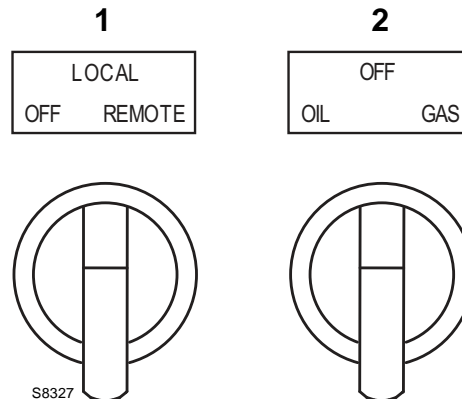
Set switch 2)(Fig. 37) to "GAS".

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 24.

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.



**Fig. 37**

**5.4 Fuel change**

There are two possible options for changing fuel:

- 1 using switch 2)(Fig. 37);
- 2 using a remote selector connected to the main terminal board.

By setting switch 1)(Fig. 37), 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 27.

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. 43) to the start of the scale.
- Adjust the max gas pressure switch (Fig. 42) to the upper limit of the scale.
- Adjust the air pressure switch (Fig. 41) to the zero position of the scale.
- Fit a U-type manometer (Fig. 38) to the gas pressure test point on the sleeve. The manometer readings are used to calculate MAX. burner power using the Tab. I on page 33.



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.

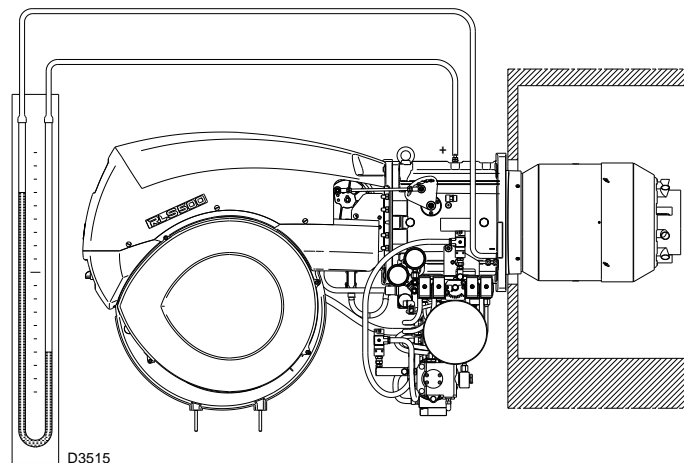


Fig. 38

### 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. 39).



DANGER

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.



WARNING

When the burner starts, check the direction of the motor rotation, as indicated in Fig. 39.

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. 39 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.

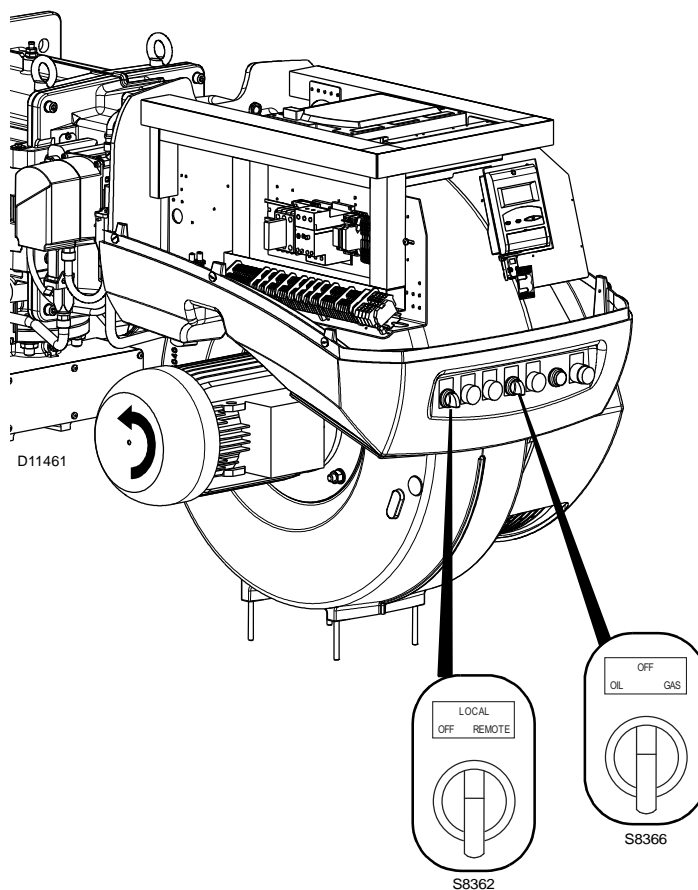


Fig. 39



### 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. 40) 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.



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.

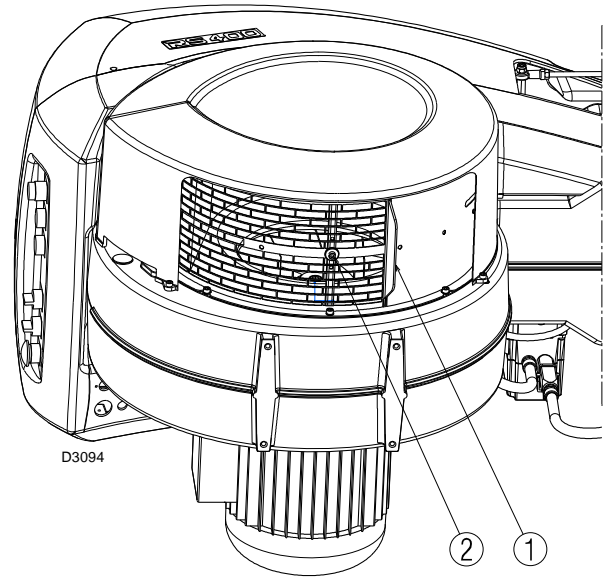


Fig. 40

### 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. 41) 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.

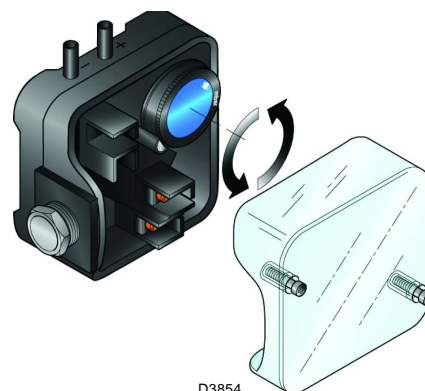


**WARNING**

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.

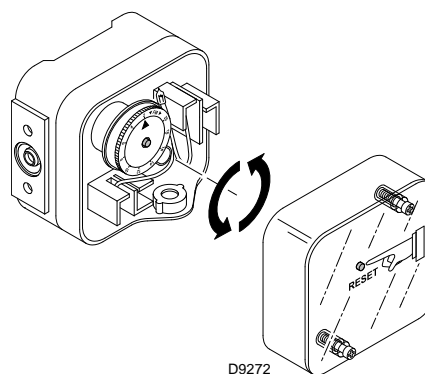
To check this, insert a combustion analyser into the chimney, slowly close the fan suction inlet (for example with cardboard) and check that the burner locks out, before the CO in the fumes exceeds 1%.

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 "-" 22) and 33)(Fig. 3 on page 10).



D3854

**Fig. 41**



D9272

**Fig. 42**

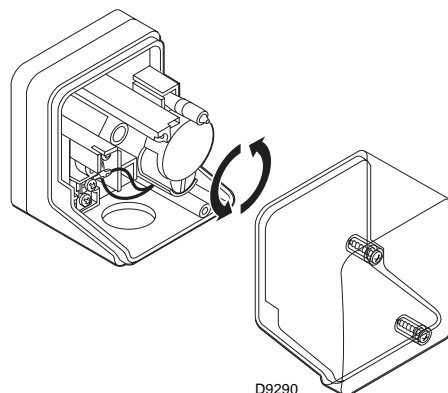
**5.7.2 Maximum gas pressure switch**

Adjust the maximum gas pressure switch (Fig. 42) 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.



D9290

**Fig. 43**

**5.7.3 Minimum gas pressure switch**

Adjust the minimum gas pressure switch (Fig. 43) 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.

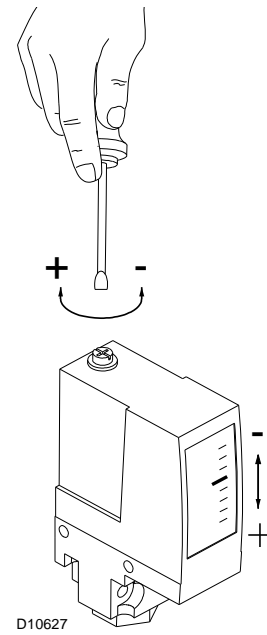
If the burner locks out again, turn the dial anti-clockwise again by 0.4" WC.

**5.7.4 Low oil pressure switch**

The low oil pressure switch (Fig. 44) 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.



**Fig. 44**

### 5.8 Burner starting

- Operating control closes, the motor starts.
- The pump 18)(Fig. 45) 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.

#### Key (Fig. 45)

- 1 Pump suction
- 2 Pump and nozzle return
- 3 By-pass screw in pump
- 4 Pump pressure governor
- 5 Safety valve
- 6 Safety valve
- 7 Nozzle delivery
- 8 Nozzle without interception pin
- 9 Nozzle return
- 10 Pressure variator on nozzle return
- 11 Servomotor for pressure variator
- 12 Check valve (no dripping function)
- 13 Check valve (no dripping function)
- 14 Check valve
- 15 Pressure switch on pump delivery
- 16 Strainer
- 17 Security relief valve
- 18 Pump
- 19 Piping
- 20 Piping
- M Pressure gauge
- V Vacuumeter

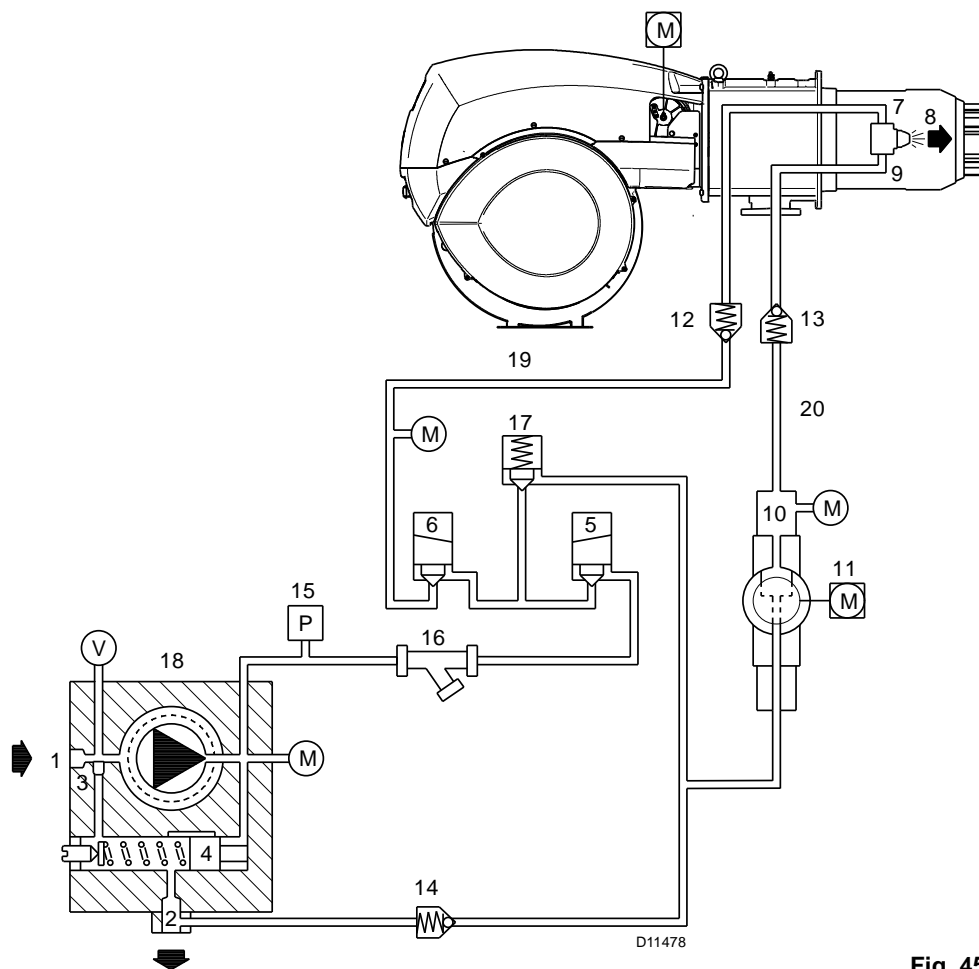


Fig. 45

#### 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)**

<ul style="list-style-type: none"> <li>➤ Open the control limit operation</li> <li>➤ Open the high limit operation</li> </ul>		<p>The burner must stop</p>
<ul style="list-style-type: none"> <li>➤ Rotate the maximum gas pressure switch knob to the minimum end-of-scale position</li> <li>➤ Rotate the air pressure switch knob to the maximum end of scale position</li> <li>➤ Rotate the maximum oil pressure switch at the minimum of the scale</li> </ul>		<p>The burner must stop in lockout</p>
<ul style="list-style-type: none"> <li>➤ Switch off the burner and disconnect the voltage</li> <li>➤ Disconnect the minimum gas pressure switch</li> <li>➤ Rotate the minimum low oil pressure switch at the maximum of the scale</li> </ul>		<p>The burner must not start</p>
<ul style="list-style-type: none"> <li>➤ Cover the QRI flame detector</li> </ul>		<p>The burner must stop in lockout due to firing failure</p>



Make sure that the mechanical locking systems on the different adjustment devices are fully tightened.

**6**

**Maintenance**

**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.



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. 45) 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 dosplay 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, connect as illustrated in Fig. 45.

**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.

**LIGHT OIL OPERATION**

**Pump**

Delivery pressure must correspond with the Tab. F on page 25.

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 problem lies in the suction line, check to make sure that the filter is clean and that air is not entering the piping.

**Filters**

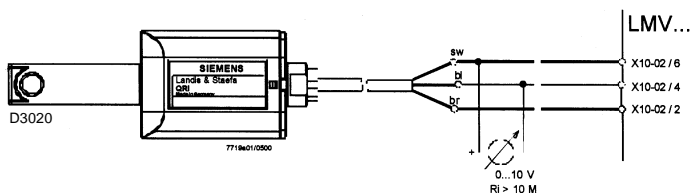
Check the filtering baskets on line and at nozzle present in the system. Clean or replace if necessary.

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.



**Fig. 45**

**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.

**GAS OPERATION****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**

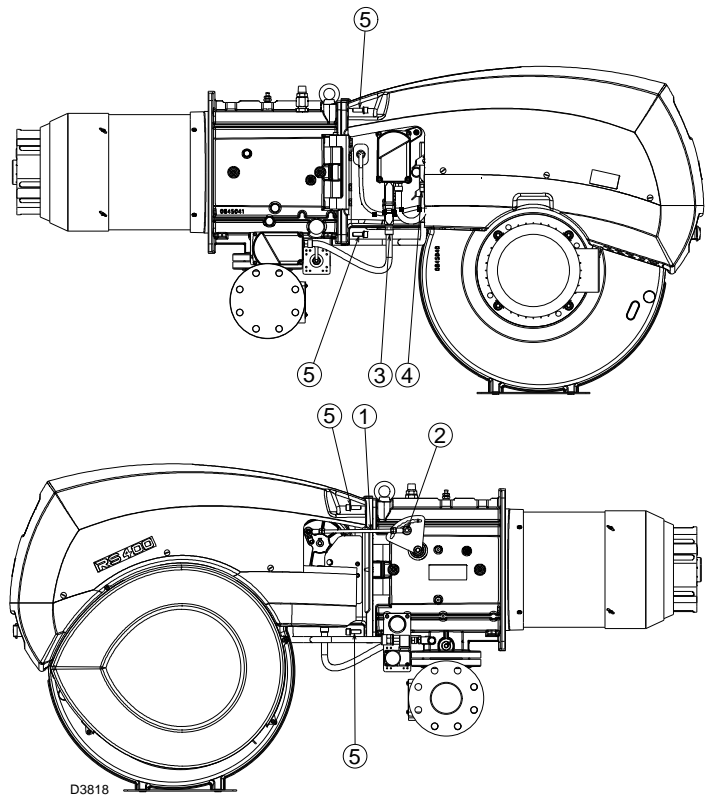
In case the combustion values found at the beginning of the intervention do not respect the standards in force or, in any case, do not correspond to a proper combustion, contact the Technical Assistant and have him carry out the necessary adjustments.

**6.3 Opening the burner**

**DANGER**

**Disconnect the electrical supply from the burner.**

- Remove the tie rod 1)(Fig. 46) 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. 46**

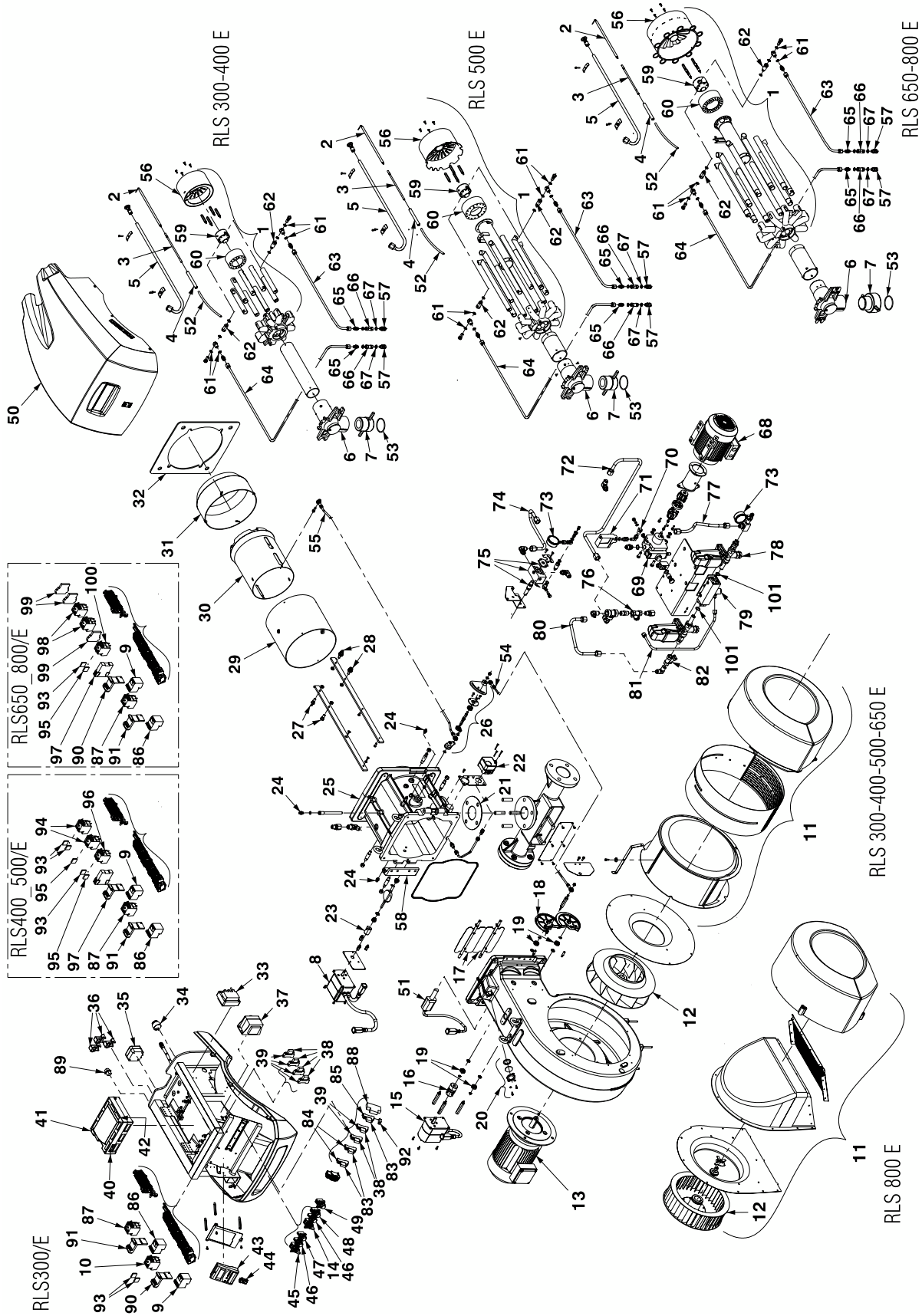
**6.4 Closing the burner**

- Close the burner at the hinge.
- Apply screw 5)(Fig. 46).
- 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.



**A**

**Appendix - Spare parts**





N.	CODE	RLS 300/E	RLS 400/E	RLS 500/E	RLS 650/E	RLS 800/E	DESCRIPTION	*
1	20042722	•					OIL/GAS HEAD	
1	20042723		•				OIL/GAS HEAD	
1	20042725			•			OIL/GAS HEAD	
1	20042726				•		OIL/GAS HEAD	
1	20042727					•	OIL/GAS HEAD	
2	3013106	•	•				ELECTRODE	A
2	20042714			•			ELECTRODE	A
2	20011338				•	•	ELECTRODE	A
3	20013159	•	•				ELECTRODE CONNECTION	A
3	3012995			•			ELECTRODE CONNECTION	A
3	3013794				•	•	ELECTRODE CONNECTION	A
4	20013160	•	•	•	•	•	INSULATOR	A
5	20013157	•	•				IGNITION PILOT TUBE	C
5	20042716			•			IGNITION PILOT TUBE	C
5	20042718				•	•	IGNITION PILOT TUBE	C
6	3013945	•	•				ELBOW	
6	3014118			•	•	•	ELBOW	
7	3014117	•	•	•			CONTROL WHEEL	
7	3014116				•	•	CONTROL WHEEL	
8	3013541	•	•	•	•	•	SERVOMOTOR	B
9	20027917	•	•	•	•	•	THERMAL RELAY	C
10	20027247	•					CONTACTOR	
11	3013326	•	•	•	•		AIR INTAKE ASSEMBLY	
11	3013961					•	AIR INTAKE ASSEMBLY	
12	20006192	•					FAN	C
12	20006205		•				FAN	C
12	3013317			•			FAN	C
12	20041011				•		FAN	C
12	20037158					•	FAN	C
13	20008598	•					MOTOR 7.5HP 460V	C
13	3014152	•					MOTOR 7.5HP 575V	C
13	20013155		•				MOTOR 10HP 460V	C
13	20042608		•				MOTOR 10HP 575V	C
13	20043145			•			MOTOR 20HP 460V	C
13	20043004			•			MOTOR 20HP 575V	C
13	20043144				•		MOTOR 25HP 460V	C
13	20042612				•		MOTOR 25HP 575V	C
13	20014024					•	MOTOR 30HP 460V	C
13	20042615					•	MOTOR 30HP 575V	C
14	20031873	•	•	•	•	•	SELECTOR SWITCH	
15	3013304	•	•	•	•	•	SERVOMOTOR	B
16	3013307	•	•	•	•	•	JOINT	A
17	3013319	•	•	•	•	•	AIR DAMPER	

N.	CODE	RLS 300/E	RLS 400/E	RLS 500/E	RLS 650/E	RLS 800/E	DESCRIPTION	*
18	3013320	•	•	•	•	•	GEAR	
19	3012795	•	•	•	•	•	BEARING	C
20	3008663	•	•	•	•	•	VIEWING PORT	
21	3000858	•	•	•	•	•	SEAL	B
22	20014103	•	•	•	•	•	PRESSURE SWITCH	A
23	3013308	•	•	•	•	•	JOINT	A
24	3005447	•	•	•	•	•	PRESSURE GAUGE	C
25	20013114	•	•	•			MANIFOLD ASSEMBLY	
25	20014022				•	•	MANIFOLD ASSEMBLY	
26	20040697	•	•	•	•	•	LEVER ASSEMBLY	
27	20040688	•	•	•	•	•	BAR	C
28	20040700	•	•	•	•	•	BAR	C
29	3013313	•	•				CYLINDER	C
29	3013641			•			CYLINDER	C
29	20026703				•		CYLINDER	C
29	3013959				•		CYLINDER	C
30	20041800	•					SHUTTER	C
30	20041776		•				SHUTTER	C
30	20041804			•			SHUTTER	C
30	20038374				•		SHUTTER	C
30	20011089				•		SHUTTER	C
31	3013314	•	•				END CONE	B
31	3013642			•			END CONE	B
31	20026702				•		END CONE	B
31	3013957				•		END CONE	B
32	3013328	•	•	•			GASKET	
32	20011117				•		GASKET	
32	3013956				•		GASKET	
33	3012956	•	•	•	•	•	TRANSFORMER	
34	20031413	•	•	•	•	•	HORN	
35	3012948	•	•	•			AIR PRESSURE SWITCH	A
35	20013975				•	•	AIR PRESSURE SWITCH	A
36	3013363	•	•	•	•	•	CONNECTOR	C
37	3013284	•	•	•	•	•	TRANSFORMER	
38	20010969	•	•	•	•	•	RELAY	C
39	3012841	•	•	•	•	•	BASE	C
40	3013282	•	•	•	•	•	CONTROL BOX	B
41	3006211	•	•	•	•	•	FUSE 6.3A	A
42	20013932	•	•	•	•	•	CONNECTORS ASSEMBLY	
43	3013283	•	•	•	•	•	DISPLAY	
44	3014113	•	•	•	•	•	9 PIN PLUG	C
45	20010963	•	•	•	•	•	SWITCH	
46	20036020	•	•	•	•	•	GREEN SIGNAL LIGHT	A

N.	CODE	RLS 300/E	RLS 400/E	RLS 500/E	RLS 650/E	RLS 800/E	DESCRIPTION	*
47	20036019	•	•	•	•	•	WHITE SIGNAL LIGHT	A
48	20010962	•	•	•	•	•	BUTTON	C
49	3013354	•	•	•	•	•	SIGNAL BUTTON	C
50	20013115	•	•	•	•	•	COVER	
51	20006151	•	•	•	•	•	QRI PROBE	A
52	20014102	•	•	•	•	•	ELECTRODE CONNECTION	A
53	3007170	•	•	•	•	•	O-RING	B
54	3013327	•	•	•	•	•	EXTERNAL TIE ROD	C
55	3013324	•	•	•	•	•	INTERNAL TIE ROD	C
56	20041673	•					AIR DIFFUSER	
56	3013548		•				AIR DIFFUSER	
56	3014171R			•			AIR DIFFUSER	
56	20011119				•	•	AIR DIFFUSER	
57	3013462	•	•	•			SWIVEL FITTING	C
57	20011190				•	•	SWIVEL FITTING	C
58	3013323	•	•	•			HINGE	
58	3013960				•	•	HINGE	
59	3013549	•	•				SPRAY NOZZLE	
59	3014228R			•			SPRAY NOZZLE	
59	20011191				•	•	SPRAY NOZZLE	
60	20041674	•	•				SHUTTER	
60	20042719			•			SHUTTER	
60	20011151				•	•	SHUTTER	
61	3007079	•	•	•			SEAL	B
61	3007166				•	•	SEAL	B
62	3013460	•	•	•			CONNECTOR	C
62	20011120				•	•	CONNECTOR	C
63	3013553	•	•				TUBE	
63	3014202			•			TUBE	
63	20011196				•	•	TUBE	
64	3013554	•	•				TUBE	
64	3014203			•			TUBE	
64	20011197				•	•	TUBE	
65	3012549	•	•	•			CONNECTOR	C
65	20011192				•	•	CONNECTOR	C
66	3013461	•	•	•			VALVE NOT RETURN	
66	20011122				•	•	VALVE NOT RETURN	
67	20041969	•	•	•			SEAL	B
67	20042959				•	•	SEAL	B
68	20042836	•	•	•	•	•	PUMP MOTOR 2HP 460V	
68	20041732	•	•	•	•	•	PUMP MOTOR 2HP 575V	
69	3006158	•	•				PUMP	C
69	3006236			•			PUMP	C

N.	CODE	RLS 300/E	RLS 400/E	RLS 500/E	RLS 650/E	RLS 800/E	DESCRIPTION	*
69	3006410				•	•	PUMP	C
70	3006896	•	•	•	•	•	CONNECTOR	C
71	3012384	•	•	•	•	•	OIL PRESSURE SWITCH	A
72	20042844	•	•	•	•	•	TUBE	
73	3006140	•	•	•	•	•	PRESSURE GAUGE	
74	20042842	•	•	•			TUBE	
74	20042846				•	•	TUBE	
75	20041353	•	•	•			MODULATOR	B
75	20042840				•	•	MODULATOR	B
76	20029257	•	•	•	•	•	VALVE NOT RETURN	
77	20042847	•	•	•			TUBE	
77	20042848				•	•	TUBE	
78	20029212	•	•	•	•	•	VALVE	
79	20029248	•	•	•	•	•	VALVE	
80	20042849	•	•	•	•	•	TUBE	
81	20042850	•	•	•	•	•	TUBE	
82	20029233	•	•	•	•	•	FILTER	
83	3020068	•	•	•	•	•	RELAY	
84	3020071	•	•	•	•	•	BASE	
85	20043289	•	•	•	•	•	BASE	
86	20028312	•					OVERLOAD 460V	
86	20043275	•	•	•	•	•	OVERLOAD 460/575V	
87	20030705	•	•	•	•	•	CONTACTOR	
88	20014366	•	•	•	•	•	FUSE HOLDER	A
89	20043271	•	•	•	•	•	CONNECTOR	
90	20043328	•	•	•	•	•	RELAY SUPPORT	
91	20043307	•	•	•	•	•	RELAY SUPPORT	
92	20043329	•	•	•	•	•	TIMER	
93	20013967	•	•	•	•	•	AUXILIARY CONTACT	
94	20013973		•	•			CONTACTOR	
95	20013969		•	•	•	•	AUXILIARY CONTACT	
96	20043297		•	•			CONTACTOR	
97	20013936		•	•	•	•	TIMER	
98	20043330				•	•	CONTACTOR	
99	20010958				•	•	AUXILIARY CONTACT	
100	20027916				•	•	CONTACTOR	
101	3013195	•					O-RING	B

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**ADVISED PARTS**

A = Spare parts for minimum fittings

A+B = Spare parts for basic safety fittings

A+B+C = Spare parts for extended safety fittings

**B**

**Appendix - Accessories**

**Gas train according to UL Standards**



The installer is responsible for the supply and installation of any required safety device(s) not indicated in this manual.

**C****Appendix - Burner start up report**

Model number:	_____	Serial number:	_____
Project name:	_____	Start-up date:	_____
Installing contractor:	_____	Phone number:	_____

**GAS OPERATION**

Gas Supply Pressure:	_____	CO <sub>2</sub> : Low Fire	_____	High Fire	_____
Main Power Supply:	_____	O <sub>2</sub> : Low Fire	_____	High Fire	_____
Control Power Supply:	_____	CO: Low Fire	_____	High Fire	_____
Burner Firing Rate:	_____	NO <sub>x</sub> : Low Fire	_____	High Fire	_____
Manifold Pressure:	_____	Net Stack Temp - Low Fire:	_____	High Fire	_____
Pilot Flame Signal:	_____	Comb. Efficiency - Low Fire:	_____	High Fire	_____
Low Fire Flame Signal:	_____	Overfire Draft:	_____		
High Fire Flame Signal:	_____				

**OIL OPERATION**

Oil supply pressure:	_____	CO <sub>2</sub> : Low Fire	_____	High Fire	_____
Oil suction pressure:	_____	O <sub>2</sub> : Low Fire	_____	High Fire	_____
Control Power Supply:	_____	CO: Low Fire	_____	High Fire	_____
Burner Firing Rate:	_____	NO <sub>x</sub> : Low Fire	_____	High Fire	_____
Low Fire Flame Signal:	_____	Net Stack Temp - Low Fire:	_____	High Fire	_____
High Fire Flame Signal:	_____	Comb. Efficiency - Low Fire:	_____	High Fire	_____
Low Fire Nozzle Size:	_____	Overfire Draft:	_____		
High Fire Nozzle Size:	_____	Smoke number:	_____		

**CONTROL SETTINGS**

Operating Setpoint:	_____	Low Oil Pressure:	_____
High Limit Setpoint:	_____	High Oil Pressure:	_____
Low Gas Pressure:	_____	Flame Safeguard Model Number:	_____
High Gas Pressure:	_____	Modulating Signal Type:	_____

**NOTES**
