

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

Progressive two stage or modulating operation



CODE	MODEL
20125045 - 20125046 - 20123531	RLS 280/E
20124918 - 20124919 - 20124927	RLS 280/EV
20125075 - 20125082	RLS 310/E
20125083 - 20125085	RLS 410/E
20125094 - 20125095	RLS 510/E



**Original instructions**

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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 Other symbols**



**DANGER**

**DANGER: LIVE COMPONENTS**  
This symbol indicates operations which, if not carried out correctly, lead to electric shocks with lethal consequences.



**DANGER: FLAMMABLE MATERIAL**  
This symbol indicates the presence of flammable materials.



**DANGER: BURNING**  
This symbol indicates the risks of burns due to high temperatures.



**DANGER: CRUSHING OF LIMBS**  
This symbol indicates the presence of moving parts: danger of crushing of limbs.



**WARNING: MOVING PARTS**

This symbol indicates that you must keep limbs away from moving mechanical parts; danger of crushing.



**DANGER: EXPLOSION**

This symbol signals places where an explosive atmosphere may be present. An explosive atmosphere is defined as a mixture - under atmospheric conditions - of air and flammable substances in the form of gases, vapours, mist or dust in which, after ignition has occurred, combustion spreads to the entire unburned mixture.



**PERSONAL PROTECTION EQUIPMENT**

These symbols indicate the equipment that must be worn and kept by the operator for protection against threats against safety and/or health while at work.



**OBLIGATION TO ASSEMBLE THE COVER AND ALL THE SAFETY AND PROTECTION DEVICES**

This symbol signals the obligation to reassemble the cover and all the safety and protection devices of the burner after any maintenance, cleaning or checking operations.



**ENVIRONMENTAL PROTECTION**

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



**IMPORTANT INFORMATION**

This symbol indicates important information that you must bear in mind.

- This symbol indicates a list.

**Abbreviations used**

Ch.	Chapter
Fig.	Figure
Page	Page
Sec.	Section
Tab.	Table

### 1.1.4 Delivery of the system and the instruction manual

When the system is delivered, it is important that:

- the instruction manual is delivered 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 must carefully inform the user about:
  - the use of the system;
  - any further tests that may be required before activating the system;
  - maintenance, and the need to have the system checked at least once a year by a representative of 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 date of installation, 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 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 unauthorised 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 supply system;
- continuation of use of the burner when a fault has occurred;
- repairs and/or overhauls incorrectly carried out;
- modification of the combustion chamber with inserts that prevent the regular development of the structurally established flame;
- insufficient and inappropriate surveillance and care of those burner components most likely to be subject to wear and tear;
- use of non-original components, including spare parts, kits, accessories and optional;
- force majeure.

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

## 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 uses expressly foreseen 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.



The manufacturer guarantees safety and proper functioning only if all burner components are intact and positioned correctly.

## 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;
- 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;
- personnel must observe 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 must 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 every responsibility for any damage that may be caused by the use of non-original parts.

In addition:



- must take all the measures necessary to prevent unauthorised people gaining access to the machine;
- the user 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.

**3**
**Technical description of the burner**
**3.1 Burner models designation**

Model	Code	Code RBNA	Voltage	Fan motor starting	Flame safeguard
RLS 280/E-EV	20104292	20125045/E	230/3/60	Direct	Burner mounted
		20124918/EV			
		20125046/E	460/3/60		
		20124919/EV			
	20122386	20123531/E	575/3/60		
		20124927/EV			
RLS 310/E	20112105	20125075	460/3/60	Star/Delta	Burner mounted
	20122387	20125082	575/3/60		
RLS 410/E	20113380	20125083	460/3/60	Star/Delta	Burner mounted
	20122389	20125085	575/3/60		
RLS 510/E	20113381	20125094	460/3/60	Star/Delta	Burner mounted
	20122396	20125095	575/3/60		

**Tab. A**
**3.2 Technical data**

Model	RLS 280/E				RLS 310/E			
Output delivery <sup>(1)</sup>	High	kW	762	3,077	2,770*	1,026	3,986	3,587*
		Mbtu/hr <sup>(3)</sup>	2,600	10,500	9,450*	3,500	13,600	12,240*
		GPH	18.6	75.0	67.5*	25.0	97.1	87.4*
	Low	kW	308	-	-	403	-	-
		Mbtu/hr <sup>(3)</sup>	1.050	-	-	1,375	-	-
		GPH	7.5	-	-	9.8	-	-
Fuel	Oil n°2							
	Natural gas							
Gas max. delivery	SCFH	10,396				13,465		
Operation	Low-high or modulating							
Nozzles	1							
Standard applications	Boilers: water, steam, therrmail oil							
Ambient temperature	°F	32-104 (0-40°C)						
Combustion air temperature	°F Max.	140 (60°C)						
Pump:								
- Delivery (at 300 PSI)	GPH	218						
- Pressure range	PSI	102 - 580						
- Fuel temperature	°F Max.	302 (150°C)						
Noise level (gas) <sup>(2)</sup>	dBA	82.7				78.7		
Noise level (oil) <sup>(2)</sup>		83.2				79.3		

**Tab. B**

Model		RLS 410/E			RLS 510/E			
Output delivery <sup>(1)</sup>	High	kW	1,172	4,719	4,247*	1,465	5,627	5,064*
		Mbtu/hr <sup>(3)</sup>	4,000	16,100	14,490*	5,000	19,200	17,280*
		GPH	28.6	115	103.5*	35.7	137.1	123.4*
	Low	kW	479	-	-	586	-	-
		Mbtu/hr <sup>(3)</sup>	1,635	-	-	2,000	-	-
		GPH	11.7	-	-	14.3	-	-
Fuel		Oil n°2						
		Natural gas						
Gas max. delivery	SCFH	15,941			19,010			
Operation		Low-high or modulating						
Nozzles		1						
Standard applications		Boilers: water, steam, thermail oil						
Ambient temperature	°F	32-104 (0-40°C)						
Combustion air temperature	°F Max.	140 (60°C)						
Pump								
- delivery (at 300 PSI)	GPH	290			403			
- pressure range	PSI	102 - 580			102 - 435			
- fuel temperature	°F Max.	302 (150°C)						
Noise level (gas) <sup>(2)</sup>	dBA	82.9			83.6			
Noise level (oil) <sup>(2)</sup>		83.4			84.1			

**Tab. C**

(\*) Firing Rate for C-ETL Canadian Listing

(1) Reference conditions: ambient temperature 68 °F (20°C) - Barometric pressure 394" WC - Altitude 329 ft.

(2) Sound pressure measured in manufacturer's combustion laboratory, with burner operating on test boiler and at maximum rated output.

(3) Equivalent Btu values based on 1 USGPH = 140,000 Btu/hr.

### 3.3 Electrical data

#### Fan motor and pump motor IE3/NEMA PREMIUM EFFICIENCY

Model		RLS 280/E		RLS 310/E	
Control circuit power supply	V/Ph/Hz	120/1/60			
Main power supply (+/- 10%)	V/Ph/Hz	230-460/3/60	575/3/60	460/3/60	575/3/60
Electrical power consumption	W	6250	6350	10060	10100
Electrical control circuit consumption	W max	750			
Total electrical consumption	W	7000	7100	10810	10850
Electrical protection		NEMA 3			

Model		RLS 410/E		RLS 510/E	
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
Electrical power consumption	W	11,910	11,950	13,870	13,950
Electrical control circuit consumption	W max	750			
Total electrical consumption	W	12,660	12,700	14,620	14,700
Electrical protection		NEMA 3			

Tab. D

**3.4 Packaging - weight - Approximate measurements**

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

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

inch	A	B	C	lbs
RLS 280/E	71 <sup>21</sup> / <sub>32</sub> "	41"	41 <sup>3</sup> / <sub>4</sub> "	620
RLS 310/E	94 <sup>1</sup> / <sub>2</sub> "	61 <sup>13</sup> / <sub>16</sub> "	51"	660
RLS 410/E	94 <sup>1</sup> / <sub>2</sub> "	61	59 <sup>1</sup> / <sub>2</sub> "	660
RLS 510/E	94 <sup>1</sup> / <sub>2</sub> "	61"	59 <sup>1</sup> / <sub>2</sub> "	660

Tab. E

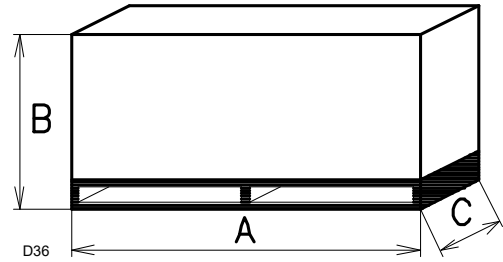


Fig. 1

**3.5 Standard equipment**

- Flange gasket. . . . . No. 1
- Flange fixing screws (M18 x 60). . . . . No. 4
- Gas train flange gasket . . . . . No. 1
- Gas train flange gasket . . . . . No. 2
- Gas train flange fixing screws (M16x70) . . . . . No. 8
- Instructions . . . . . No. 1



**WARNING**

It is recommended to tighten the screws of the gas flange with a tightening torque of **40 Nm ±10%**.



S10230

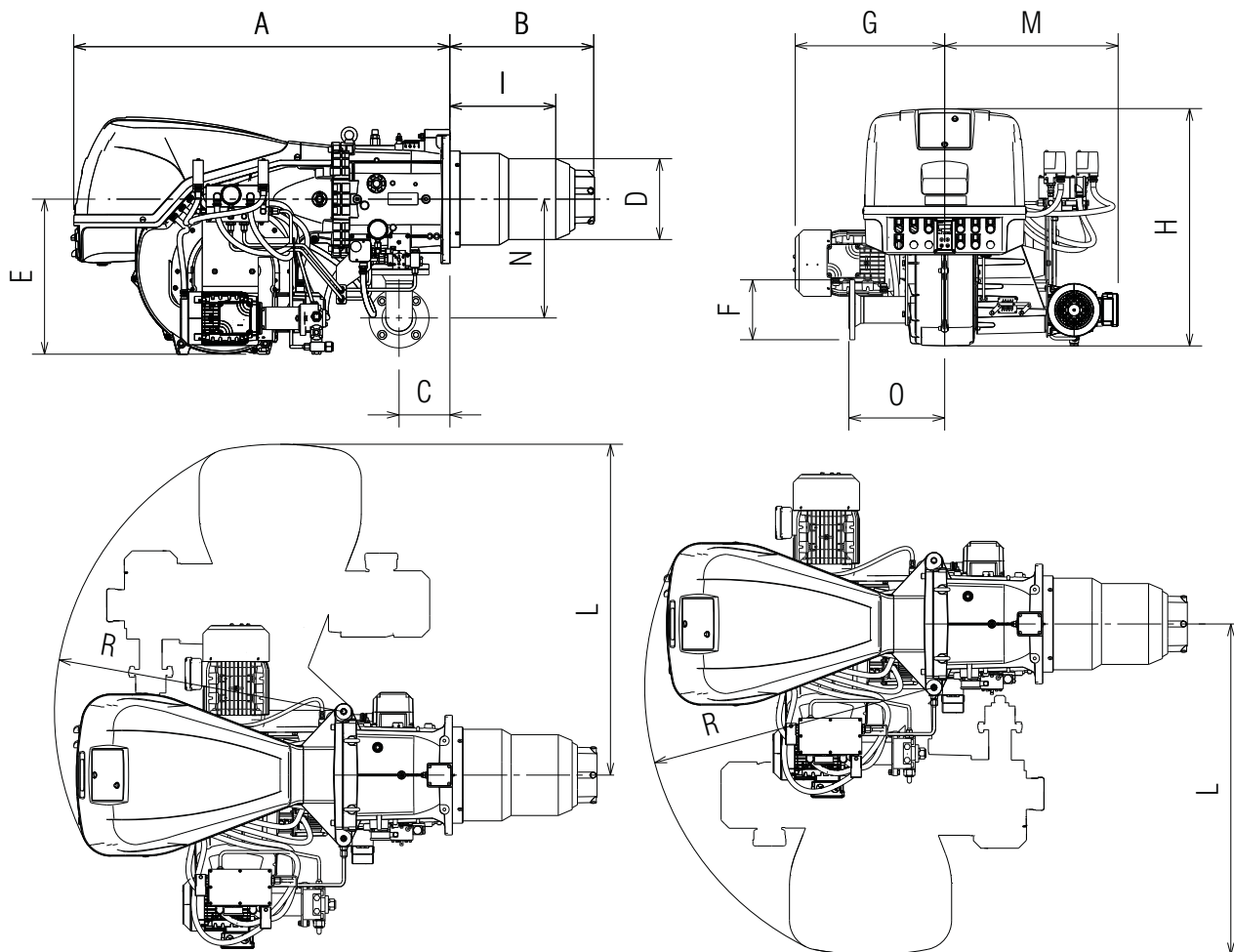
Tighten the nuts gradually (first to 30%, then to 60% up to 100%) according to the cross pattern shown in the figure.

**3.6 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.



20123199

**Fig. 2**

inch	A	B	C	D	E	F	G	H	I	L	M	N	O	R
RLS 280/E	49 3/4"	19 9/32"	6 11/16"	10 5/8"	20 1/2"	ANSI 3"	19 7/8"	31"	14"	43 25/32"	22 27/32"	15 5/8"	12 19/32"	38"
RLS 310/E	49 3/4"	20 23/64"	6 11/16"	12 21/64"	20 1/2"	ANSI 3"	20 1/4"	31"	14 11/16"	43 25/32"	25"	15 5/8"	12 19/32"	38"
RLS 410/E	49 3/4"	20 23/64"	6 11/16"	12 21/64"	20 1/2"	ANSI 3"	22 1/4"	31"	14 11/16"	43 25/32"	25"	15 5/8"	12 19/32"	38"
RLS 510/E	49 3/4"	20 23/64"	6 11/16"	12 21/64"	20 1/2"	ANSI 3"	22 1/4"	31"	14 11/16"	43 25/32"	25"	15 5/8"	12 19/32"	38"

**Tab. F**

3.7 Burner description

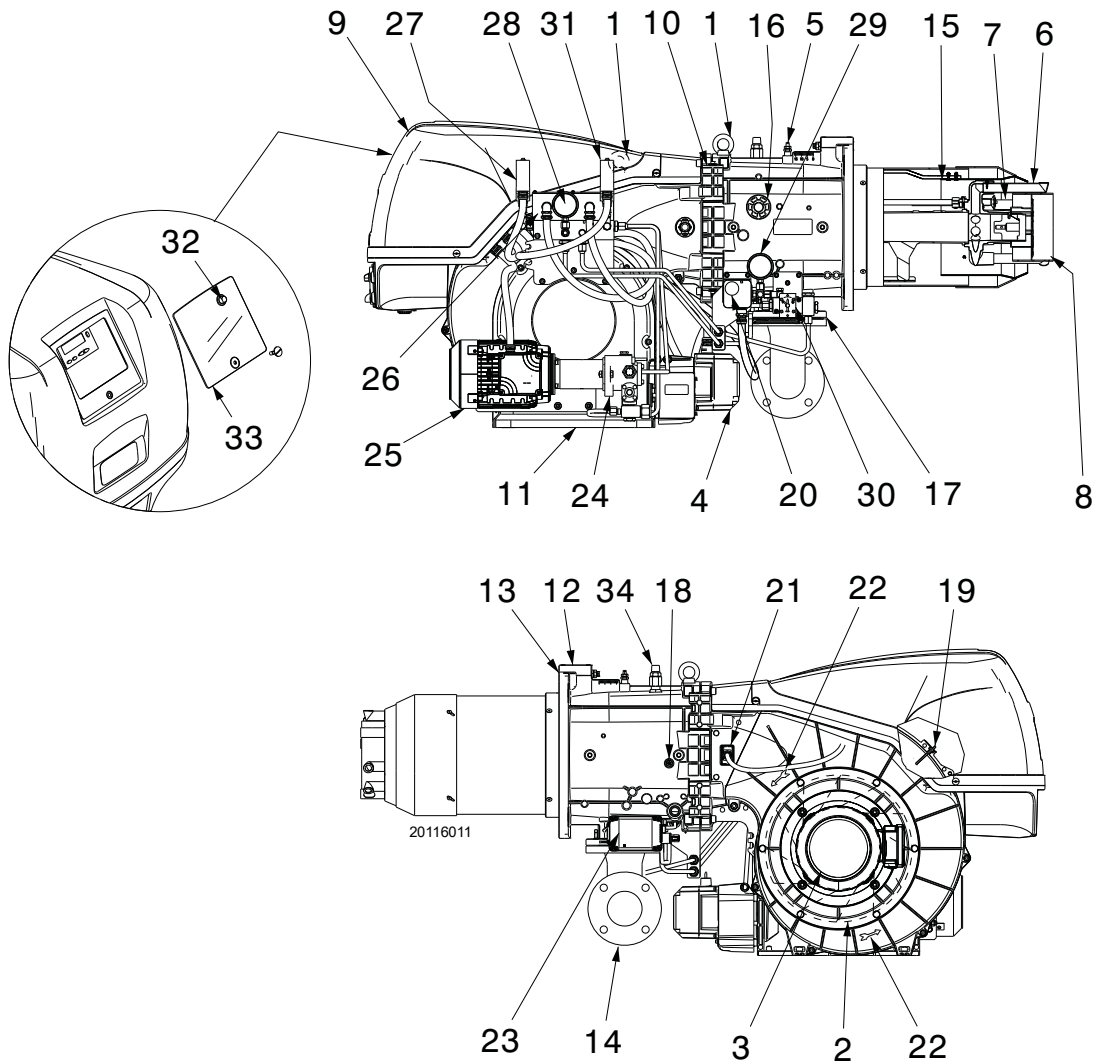


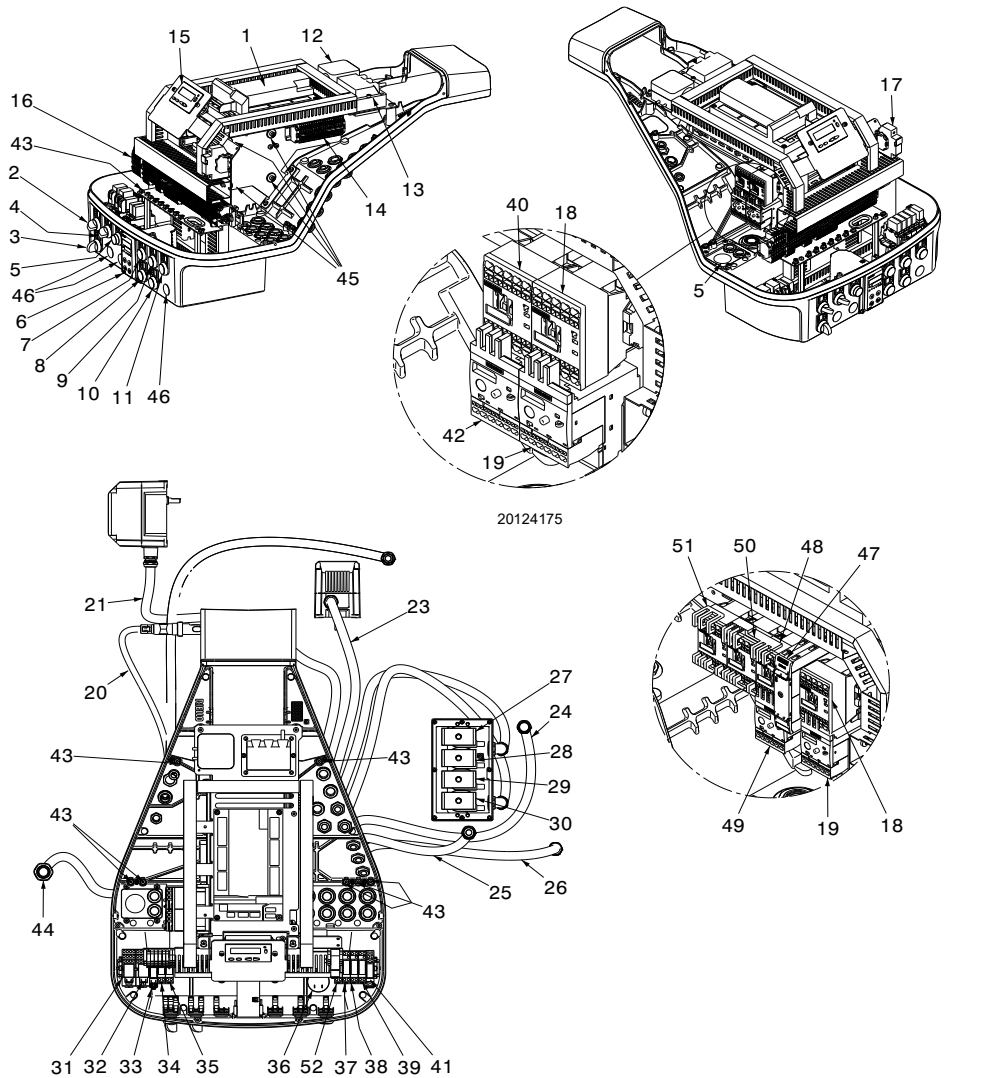
Fig. 3

- |  |  |
|--|--|
| 1 Lifting eyebolts   | 24 Pump                                |
| 2 Fan  | 25 Pump motor                          |
| 3 Fan motor  | 26 Valve group (see Fig. 4 on page 12) |
| 4 Air gate valve servomotor                                | 27 Minimum oil pressure switch         |
| 5 Gas pressure test point                                  | 28 Nozzle delivery pressure gauge      |
| 6 Combustion head  | 29 Nozzle return pressure gauge        |
| 7 Ignition pilot   | 30 Oil modulator                       |
| 8 Flame stability disk                                     | 31 Maximum oil pressure switch         |
| 9 Electric panel board - cover                             | 32 Reset button                        |
| 10 Hinge for opening burner                                | 33 Transparent protection              |
| 11 Air inlet to fan  | 34 Pilot gas train attachment          |
| 12 Manifold  |  |
| 13 Thermal insulation screen for securing burner to boiler |  |
| 14 Gas train flange  |  |
| 15 Shutter   |  |
| 16 Flame inspection window                                 |  |
| 17 Gas butterfly valve                                     |  |
| 18 Combustion head air pressure test point                 |  |
| 19 Air pressure test point "+"                             |  |
| 20 Max gas pressure switch with pressure test point        |  |
| 21 Flame sensor  |  |
| 22 Indication for checking the fan motor rotation          |  |
| 23 Oil modulator and gas butterfly valve servomotor        |  |



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



- |    |  |    |  |
|----|--|----|--|
| 1  | Electrical flame control                     | 27 | VS1Oil return safety solenoid valve          |
| 2  | ON/OFF selector                              | 28 | VROil return solenoid valve                  |
| 3  | OIL/OFF/GAS selector                         | 29 | UFOil delivery safety solenoid valve         |
| 4  | LOCAL/REMOTE selector                        | 30 | UFOil solenoid valve                         |
| 5  | ALARM SILENCE push-button                    | 31 | KO1 oil timer module and relay               |
| 6  | Output power regulator                       | 32 | KG1 gas timer module and relay               |
| 7  | POWER ON light signal                        | 33 | KP oil pump timer module and relay           |
| 8  | IGNITION ON light signal                     | 34 | KG2 auxiliary gas relay                      |
| 9  | CALL FOR HEAT light signal                   | 35 | KVP auxiliary fan/oil pump relay             |
| 10 | FUEL ON light signal                         | 36 | AH horn                                      |
| 11 | ALARM light signal                           | 37 | K1 auxiliary flame alight relay              |
| 12 | Air pressure switch                          | 38 | K3 auxiliary alarm relay                     |
| 13 | Ignition transformer                         | 39 | K5 auxiliary burner lock out relay           |
| 14 | Valve group terminal board                   | 40 | Fan motor direct start-up contactor          |
| 15 | Operator panel with LCD display              | 41 | K2 auxiliary remote position relay           |
| 16 | Main terminal supply board                   | 42 | Fan motor thermal relay (with reset button)  |
| 17 | Auxiliary circuits fuse                      | 43 | Earth terminal                               |
| 18 | Pump motor contact maker                     | 44 | Fan motor sheath                             |
| 19 | Pump motor thermal relay (with reset button) | 45 | Available for step down transformer          |
| 20 | Flame sensor sheath                          | 46 | Available                                    |
| 21 | Fuel servomotor sheath                       | 47 | Timer for Star/Triangle Start-up             |
| 22 | Maximum gas pressure switch sheath           | 48 | Star/Triangle Start-up line contactor        |
| 23 | Air servomotor sheath                        | 49 | Fan motor thermal relay (with reset button)  |
| 24 | Maximum oil pressure switch sheath           | 50 | Triangle contactor (Start/Triangle Start-Up) |
| 25 | Minimum oil pressure switch sheath           | 51 | Star contactor (Star/Triangle Start-Up)      |
| 26 | Pump motor cables sheath                     | 52 | KVOil oil relay                              |

Fig. 4

Three types of burner failure may occur:

- **Flame safeguard lock-out**  
If the flame safeguard alarm 11)(Fig. 4 on page 12) lights up, it indicates that the burner is in lock-out. To reset, press the reset pushbutton.
- **Pump motor trip**  
release by pressing the push-button on thermal overload 19)(Fig. 4 on page 12). See "Thermal relay calibration" on page 34

### 3.8 Firing rate

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

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



The firing rate area values have been obtained considering an ambient temperature of 68 °F, and an atmospheric pressure of 394" WC and with the combustion head adjusted as shown on page 23.

Model	MBtu/hr
RLS 280/E	2.600
RLS 310/E	3.500
RLS 410/E	4.000
RLS 510/E	5.000

Tab. G

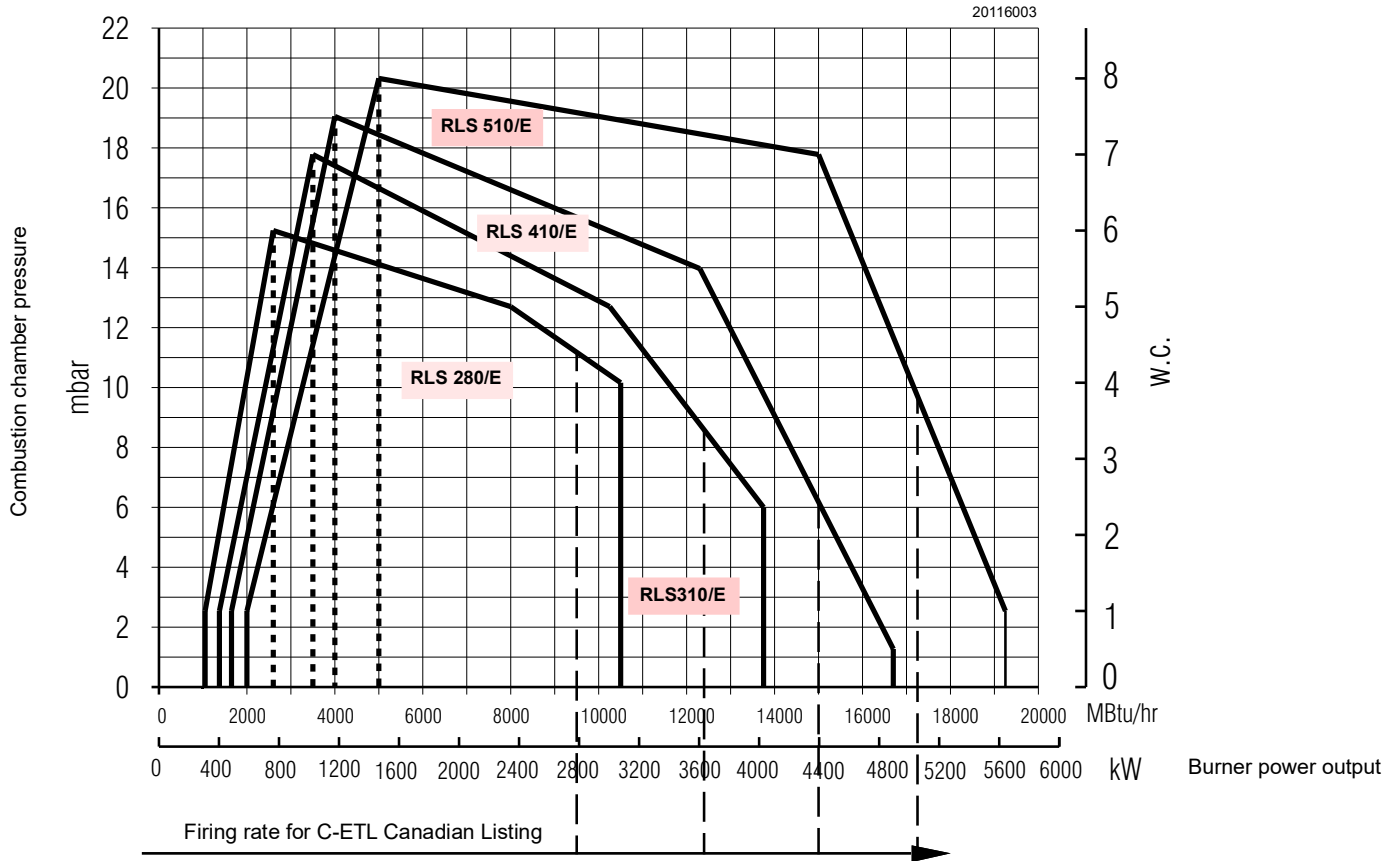


Fig. 5

**3.8.1 Procedure to refer burner operating condition at an altitude and/or at a combustion supporter air temperature different to the standard values (328 ft above sea level, 68 °F).**

**AIR TEMPERATURE**

Altitude	Altitude	bar. press.	bar. press.	0	5	10	15	20	25	30	40	°C
ft a.s.l.	m a.s.l.	"w.c.	mbar	32	41	50	59	68	77	86	104	°F
0	0	399	1013,00	1,087	1,068	1,049	1,031	1,013	0,996	0,980	0,948	
328	100	394	1000,00	1,073	1,054	1,035	1,017	<b>1,000</b>	0,983	0,967	0,936	
1.000	305	385	977,40	1,049	1,030	1,012	0,994	0,977	0,961	0,945	0,915	
2.000	610	371	942,80	1,012	0,994	0,976	0,959	0,943	0,927	0,912	0,883	
3.000	915	358	908,20	0,975	0,957	0,940	0,924	0,908	0,893	0,878	0,850	
4.000	1.220	345	875,80	0,940	0,923	0,907	0,891	0,876	0,861	0,847	0,820	
5.000	1.525	332	843,50	0,905	0,889	0,873	0,858	0,844	0,829	0,816	0,790	
6.000	1.830	320	811,85	0,871	0,856	0,841	0,826	0,812	0,798	0,785	0,760	
7.000	2.135	307	779,80	0,837	0,822	0,807	0,793	0,780	0,767	0,754	0,730	
8.000	2.440	294	747,80	0,803	0,788	0,774	0,761	0,748	0,735	0,723	0,700	

**Tab. H**

F - correction factor of discharge head and delivery in relation to temperature and altitude.

**Reference conditions:**

- Air temperature 68 °F (20 °C)
- Barometric pressure 394 "w.c. (1000 mbar)
- Altitude 328 ft a.s.l. (100 m a.s.l.)

**Example**

Using the Tab. H , for an altitude of 3,000 ft and an air temperature of 68 °F, an **F** factor value is obtained equal to 0.908; if the capacity at the boiler furnace is  $Q_{foc} = 4,500$  Mbtu/h, the correct output will be equal to:

$$Q_{burner} = Q_{foc} / F = 4,500 / 0.908 = 4,956 \text{ Mbtu/h}$$

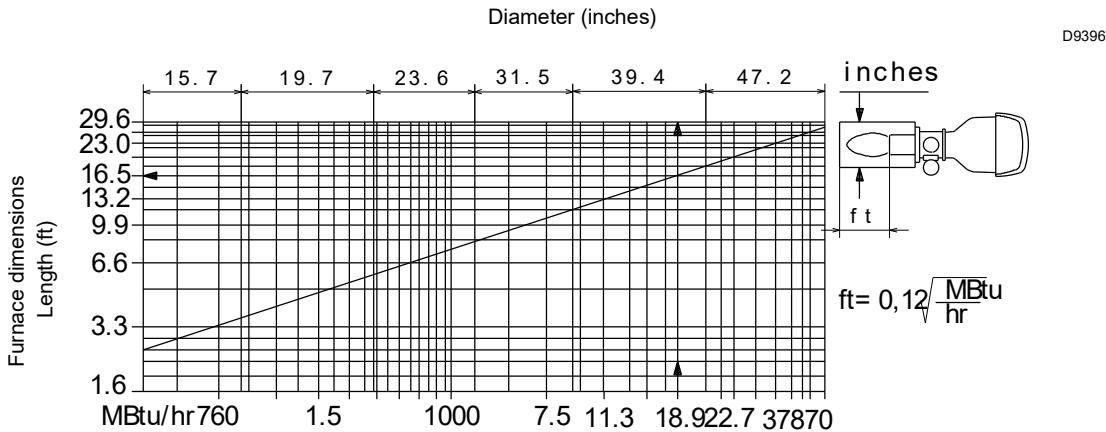
**3.9 Minimum furnace dimensions**

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

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

**Example RLS 510/E:**

Output 19200 MBtu/hr: diameter 39.4 inch - length 16.5 ft.



**Fig. 6**

### 3.10 Flame control (LMV36...)

#### Warning notes



**WARNING**

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

The LMV36... is a safety device! Do not open, interfere with or modify the unit.

The manufacturer will not assume responsibility for any damage resulting from unauthorized interference!

- All activities (mounting, installation and service work, etc.) must be performed by qualified staff.
- Before making any wiring changes in the connection area, 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.
- Ensure protection against electric shock hazard by providing adequate protection for the burner control's connection terminals.
- Each time work has been carried out (mounting, installation, service work, etc.), check to ensure that wiring and parameters 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.

#### Introduction

The flame control for the air/fuel ratio (Fig. 7), (hereafter referred to simply as the flame control), that equips the burners, carries out a series of integrated functions in order to optimise burner functioning, both for single operation and together with other units (e.g. double furnace boiler or more than one generator at the same time).

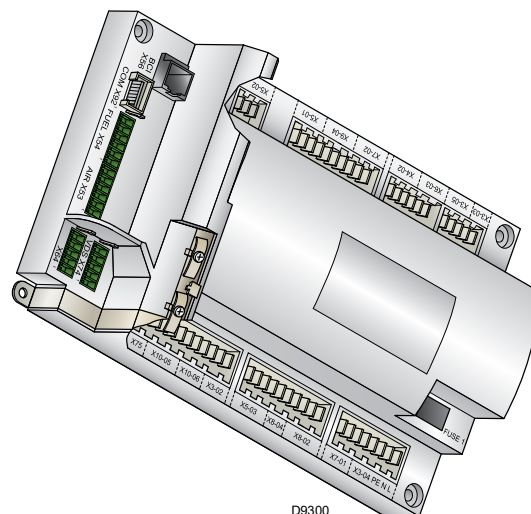
The basic functions carried out by the flame control relate to:

- flame control;
- the dosage of air and fuel via the positioning (with direct servo-control) of the relative valves, excluding the possible play in the mechanical cam calibration systems;
- the modulation of burner output, on the basis of the load requested by the system, maintaining the pressure or temperature of the boiler at the working values set;
- the safety diagnostic of the air and fuel circuits, via which it is possible to easily identify any causes of malfunctioning.

#### Mechanical design

The following system components are integrated in the LMV36... basic unit:

- Burner control with gas valve proving system
- Electronic air / fuel ratio control
- Control frequency converter air fan
- Modbus interface



**Fig. 7**

#### Installation notes

- Always run high-voltage ignition cables separately while observing the greatest possible distance to the unit and to other cables.
- Do not mix up live and neutral conductors (fire hazard, dangerous failures, loss of protection against electric shock hazard, etc.).
- Do not lay the connecting cable from the LMV36... to the AZL2... together with other cables.



**WARNING**

The first start-up, like every further operation for the internal settings of the flame control, requires access by means of a password and is only to be carried out by personnel of the Technical Assistance Service who have been specifically trained in the internal programming of the tool.

#### Electrical connection of the flame detectors

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

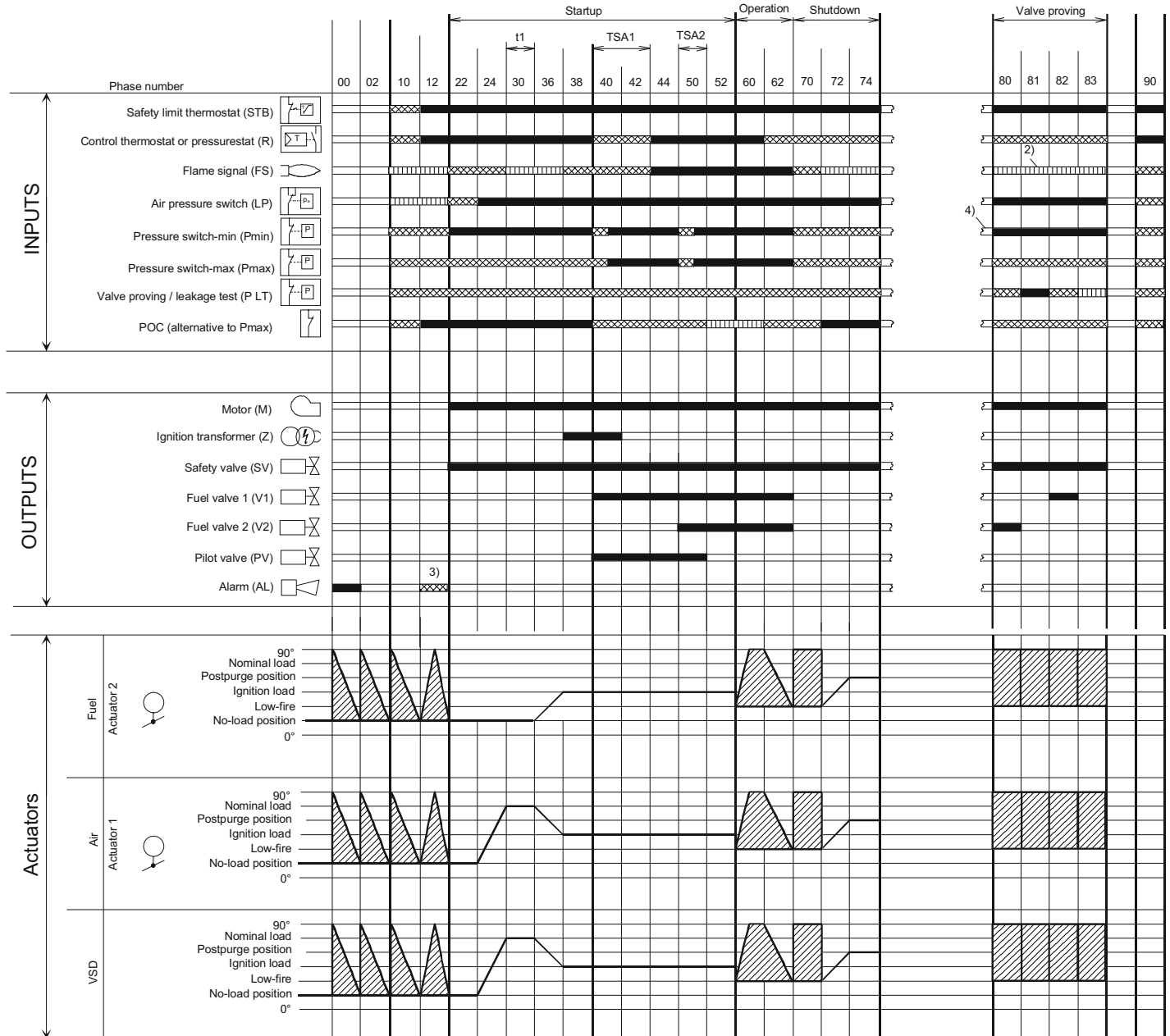
- Never run the detector cable together with other cables.
  - Line capacitance reduces the magnitude of the flame signal.
  - Use a separate cable.
- Observe the maximum permissible detector cable lengths.
- The ionization probe is not protected against electric shock hazard. It is mainspowered and 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

LMV36... basic unit	Mains voltage	AC 120 V -15 % / +10 %
	Mains frequency	50 / 60 Hz $\pm$ 6 %
	Power consumption	< 30 W (typically)
	Safety class	I, with parts according to II and III to DIN EN 60730-1
Terminal 'Inputs'	loading Unit fuse F1 (internally)	6.3 AT
	Perm. mains primary fuse (externally)	Max. 16 AT
	Undervoltage	
	<ul style="list-style-type: none"> <li>• Safety shutdown from operating position at mains voltage</li> <li>• Restart on rise in mains voltage</li> </ul>	Approx. AC 93 V Approx. AC 96 V
Terminal 'Outputs'	loading <b>Total contact loading:</b>	
	• Nominal voltage	AC 120 V, 50 / 60 Hz
	• Unit input current (safety loop) from:	Max. 5 A
	- Fan motor contactor	
	- Ignition transformer	
	- Valves	
	- Oil pump / magnetic clutch	
	<b>Individual contact loading:</b>	
	Fan motor contactor	
	• Nominal voltage	AC 120 V, 50 / 60 Hz
	• Nominal current	1.6 A pilot duty load declaration to UL372
	• Power factor	$\cos\phi > 0.4$
	Alarm output	
• Nominal voltage	AC 120 V, 50 / 60 Hz	
• Nominal current	1 A	
• Power factor	$\cos\phi > 0.4$	
Ignition transformer		
• Nominal voltage	AC 120 V, 50 / 60 Hz	
• Nominal current	1.6 A pilot duty load declaration to UL372 or 250 VA ignition load declaration to UL372	
• Power factor	$\cos\phi > 0.2$	
Fuel valves		
• Nominal voltage	AC 120 V, 50 / 60 Hz	
• Nominal current	1.6 A pilot duty load declaration to UL372	
• Power factor	$\cos\phi > 0.4$	
Operation display		
• Nominal voltage	AC 120 V, 50 / 60 Hz	
• Nominal current	0.5 A	
• Power factor	$\cos\phi > 0.4$	
Cable lengths	Mains line	Max. 100 m (100 pF/m)
	Display,	BCI For used outside the burner cover or the control panel: Max. 3 m (100 pF/m)
	External lockout reset button	Max. 20 m (100 pF/m)
Environmental conditions	Operation	DIN EN 60721-3-3
	Climatic conditions	Class 3K3
	Mechanical conditions	Class 3M3
	Temperature range	-20...+60 °C
	Humidity	< 95 % r.h.

Tab. I

## Operation sequence of the burner



D9288

Fig. 8

### Legend to the sequence diagrams:

Valve proving takes place depending on the parameter:

- 2) Only with valve proving on start-up
- 3) Parameter: with/without alarm in the event of start prevention
- 4) In the event of an erroneous signal on start-up, followed by phase 10, otherwise phase 70
- 0° Position as supplied (0°)
- 90° Actuator fully open (90°)

- Signal ON
- Signal OFF
- Any signal is allowed



In standby: after referencing, the actuator is driven to the no-load position

Assignment of times:

- t1 Pre-purge time
- TSA1 Safety time 1 gas / oil
- TSA2 Safety time 2 gas / oil

### 3.11 Actuators (SQM33.5...)

#### 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 units, completely isolate the equipment from mains supply (all-polar disconnection). If not observed, there is a risk of electric shock hazard.
- Ensure protection against electric shock hazard by providing adequate protection for the connection terminals and by securing the housing cover.
- After any kind of activity (mounting, installation and service work, etc.), check wiring. Also ensure that the parameters are correctly set.
- 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 actuator's housing must not be opened. The actuator contains an optical feedback system.**

#### 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.

They are commanded by the flame control, which constantly checks their position by means of a return signal from the optic sensor inside the actuator.

The position (in degrees) of the actuators can be seen on the display of the Operator Panel.

Index "0" for fuel actuator, index "1" for air actuator.

#### Installation notes

- Always run the high-voltage ignition cables separate from the unit and other cables while observing the greatest possible distance.
- The holding torque is reduced when the actuator is disconnected from power.



WARNING

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

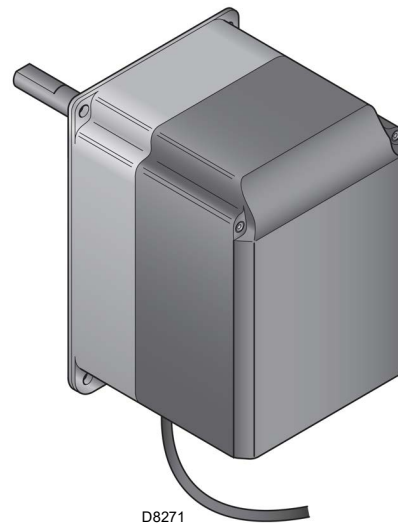


Fig. 9

#### Technical data

Operating voltage	AC / DC 24 V ±20 % (load on interface)
Safety class	2 to EN 60 730 part 1 and parts 2...14
Power consumption	max. 10 W
Degree of protection	IP54 to EN 60 529-1
Opening time 0 - 90°	min: 5s, max.: 120s (depending on the type of flame control)
Firing rate	0 - 90°
Cable connection	RAST2,5 connectors
Direction of rotation	Clockwise/anticlockwise (can be selected from the flame control)
Nominal output torque	3 Nm
Holding torque (when live)	3 Nm
Holding torque (when dead)	2.6 Nm
Weight	approx. 1 kg
Environmental conditions:	
Operation	DIN EN 60 721-3-3
Climatic conditions	class 3K5
Mechanical conditions	class 3M4
Temperature range	-20...+ 60 °C
Humidity	< 95 % r.h.

Tab. J

**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.



Combustion air inside the boiler must be free from hazardous mixes (e.g.: chloride, fluoride, halogen); if present, it is highly recommended to carry out cleaning and maintenance more frequently.

**4.2 Handling**

The burner packaging includes a wooden platform, it is therefore 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).

When handling, keep the load at not more than 20-25cm 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.



Release the burner from the wooden platform by removing the bolts/nuts/screws that secure the burner to the platform.

Handle the burner following the safety standards and regulations of the laws in force and using the eyebolts supplied as equipment.

**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**

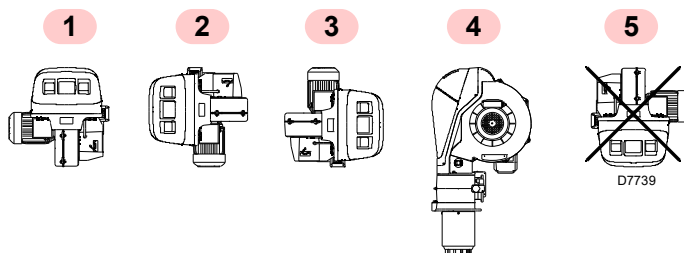
The burner is designed to operate only in the positions 1, 2, 3 and 4 (Fig. 10).

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 Preparing the boiler

#### 4.5.1 Boring the boiler plate

Drill the combustion chamber locking plate as shown in Fig. 11. The position of the threaded holes can be marked using the thermal screen supplied with the burner.

#### 4.5.2 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.

For boilers with front flue passes 1)(Fig. 18 on page 23) or flame inversion chamber, a protection in refractory material 5) must be inserted between the boiler fettling 2) and the blast tube 4).

The refractory can have a conical shape (minimum 60°).

This protective fettling must not compromise the extraction of the blast tube.

For boilers with a water-cooled front piece, a refractory lining 2)-5)(Fig. 18 on page 23) is not necessary, unless expressly requested by the boiler manufacturer.

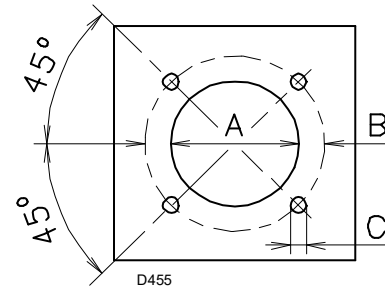


Fig. 11

inch	A	B	C
RLS 280/E	13 1/4"	17 13/16"	3/4" coarse
RLS 310/E	13 1/4"	17 13/16"	3/4" coarse
RLS 410/E	13 1/4"	17 13/16"	3/4" coarse
RLS 510/E	13 1/4"	17 13/16"	3/4" coarse

Tab. K

### 4.6 Securing the burner to the boiler



Prepare a suitable lifting system using the rings 3)(Fig. 12), after removing the fixing screws 7) of the casing 8).

- Fit the heat insulation supplied onto the blast tube 4)(Fig. 12).
- Fit the entire burner onto the boiler hole prepared previously, and fasten with the screws supplied.



**The seal between burner and boiler must be airtight.**



The manufacturer declines **any and every responsibility** for any possible lifting movements, different from those indicated in **this manual**.

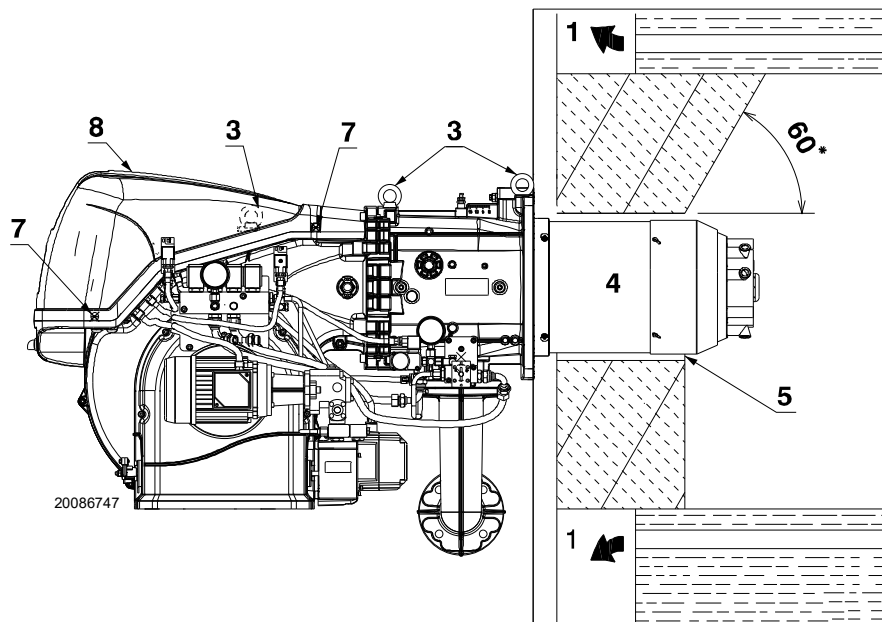


Fig. 12

### 4.6.1 Accessibility to the interior of the combustion head

The burner leaves the factory set for opening to the right, therefore maintaining the pin 1)(Fig. 13) in its housing.

To open the burner towards the right, proceed as follows:

- A remove the screws 2);
- B disconnect the two oil pipes by unscrewing the two nuts 3);
- C open the burner to a maximum of 100-150 mm by rotating around the hinge and release the cables of the electrodes 4);
- D fully open the burner as in Fig. 13;
- E disconnect the light oil pipes by unscrewing the two swivel fittings 5);
- F undo the screw 6) with pressure test point;
- G release the ignition pilot retainer;
- H release the head by lifting it from its housing 7), then take out the combustion head.



**WARNING**

To open the burner from the opposite side, before removing the pin 1)(Fig. 13), make sure that the 4 screws 2) are tight.

Then shift the pin 1) to the opposite side, only then is it possible to remove the screws 2).

Disconnect the socket 8)(Fig. 13) of the maximum gas pressure switch, then proceed as described above at point C).

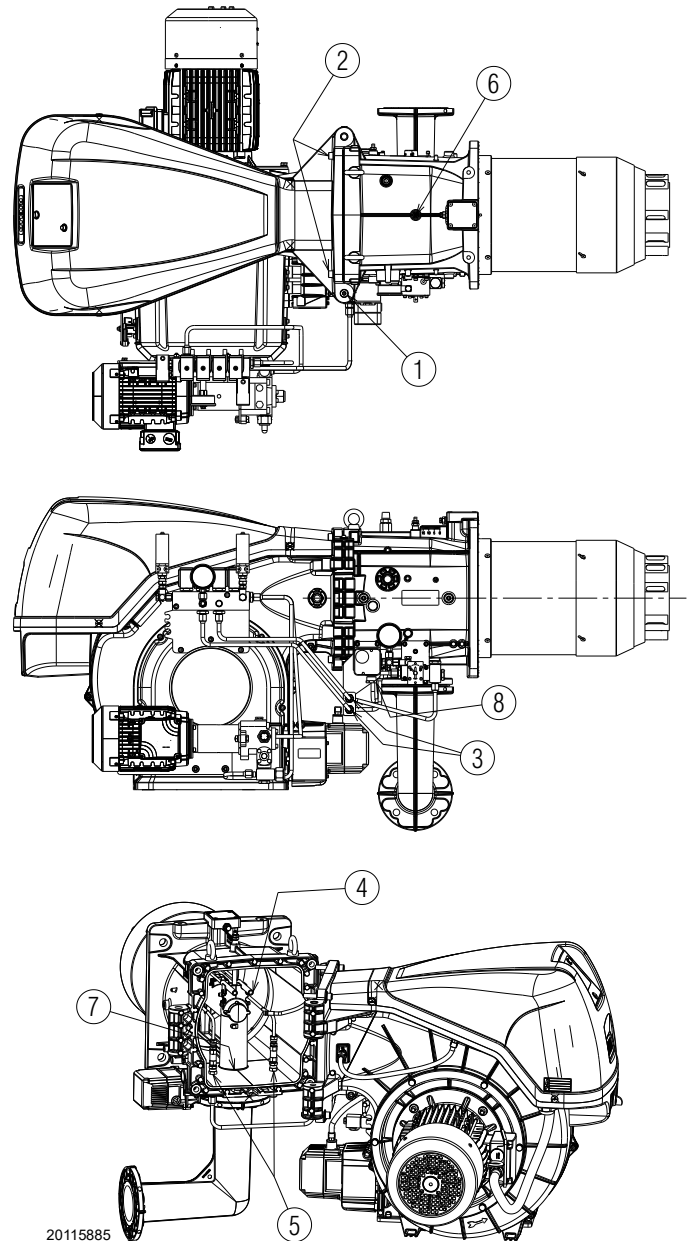


Fig. 13

### 4.7 Electrode and ignition pilot adjustment (RLS 280/E model)

Place the pilot and electrodes as shown in Fig. 14.

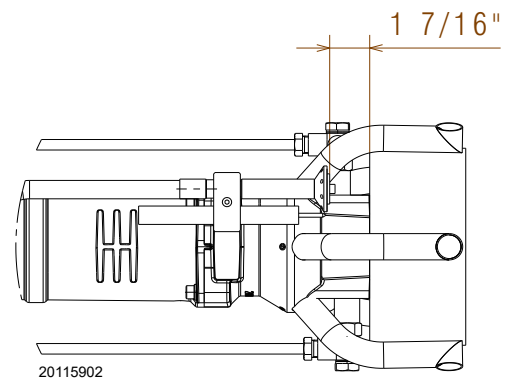
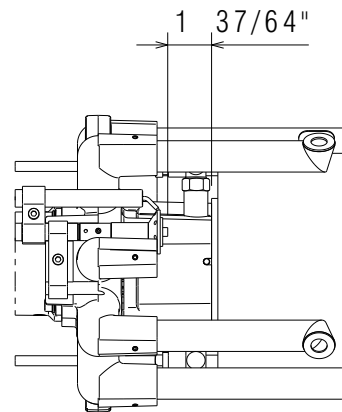


Fig. 14

**4.8 Electrode and ignition pilot adjustment (RLS 310 - 410 - 510/E model)**

Place the electrode and the ignition pilot observing the dimensions in Fig. 15.



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**Fig. 15****4.9 Gas butterfly valve**

If necessary, replace the gas butterfly valve.  
The correct position is shown in Fig. 17 on page 23.

**4.10 Combustion head setting**

Rotate the screw 1)(Fig. 18) until the notch you have found corresponds with the front surface of the screw itself.

The combustion head is opened by turning the screw 1) anticlockwise.

The combustion head is closed by turning the screw 1) clockwise (Fig. 18).



The burner leaves the factory with the combustion head adjusted to notch 0 (Fig. 18).

This adjustment allows you to secure the moving parts when the burner is being transported.

Before starting the burner, carry out the adjustments for the output required.

**NOTE:**

Depending on the specific application, the adjustment can be modified.



The combustion head can be adjusted within the following fields:

RLS 280/E: 0 - 12;

RLS 310/E: 0 - 11;

RLS 410/E: 0 - 8;

RLS 510/E: 0 - 11.

No adjustment can be made outside these intervals.

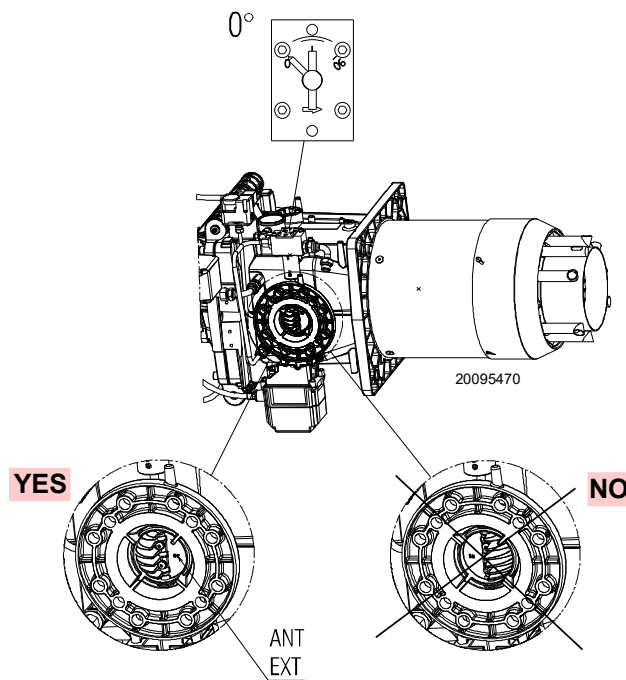


Fig. 17

No. Notches

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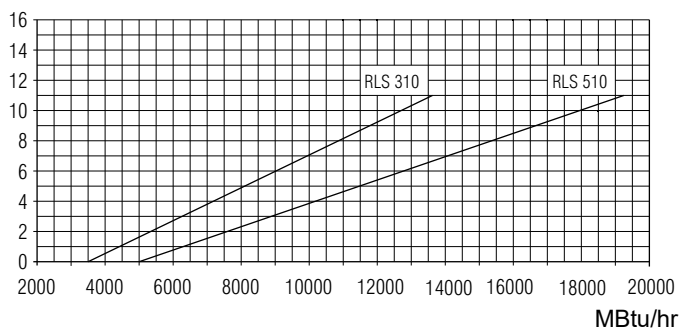
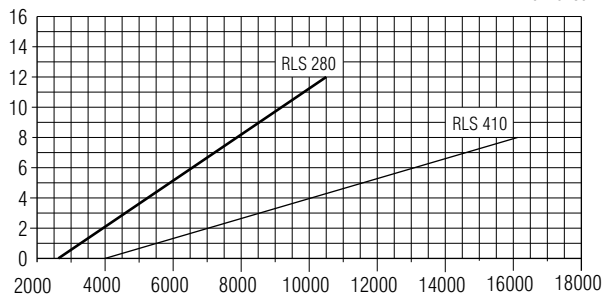
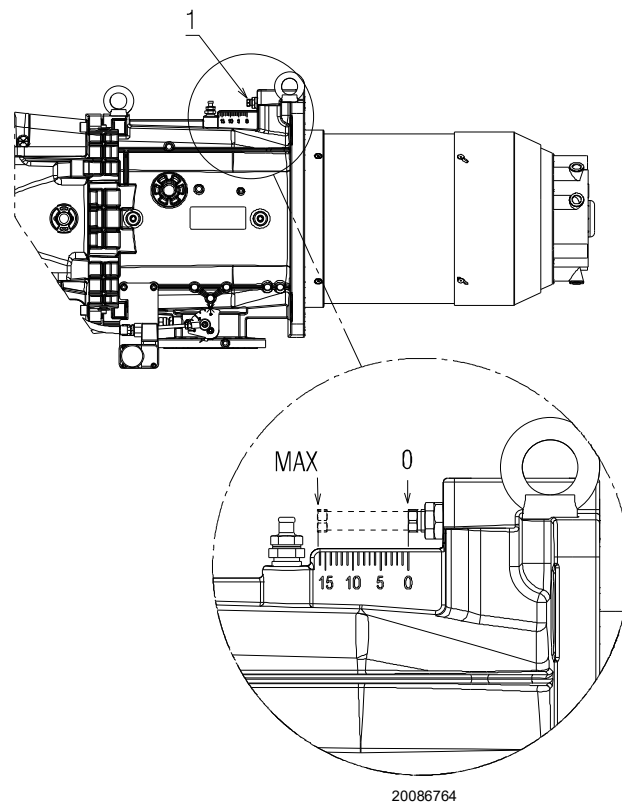


Fig. 16



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Fig. 18

## 4.11 Nozzle

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



**WARNING**

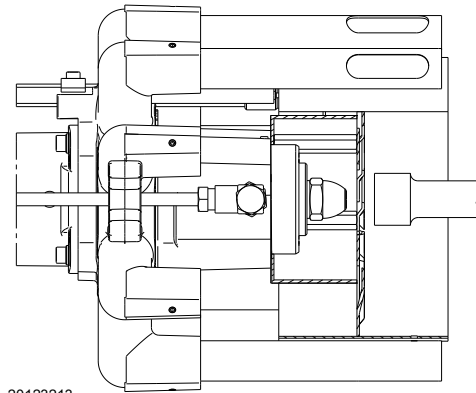
It is advisable to replace nozzles every year during regular maintenance operations.



**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.



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**Fig. 19**

### 4.11.1 Nozzle installation

- Fit the nozzle with the box spanner, fitting the spanner through the central hole in the flame stability disk (Fig. 19).
- Nozzles with no fuel shut-off 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. L.



**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.

4.11.2 Recommended nozzles

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

	MBtu/hr ( GCV )	Nozzle			Supply Pressure	High Fire		Low Fire	
		Type	GPH	kg/h	PSI	By-pass Pressure	Flow rate GPH	By-pass Pressure	Flow rate GPH
RLS280	2.600	Delavan Variflo (30°-45°-60°)	12		300	172	18,6	110	6,7
	3.500		16			195	25,0	110	8,7
	4.500		24			169	32,1	130	11,9
	5.500		26			150	39,3	70	16
	6.500		28			150	46,4	75	18,3
	7.500		35			160	53,6	70	21,5
	8.500		40			155	60,7	70	24,7
	9.500		40			160	67,9	75	28,8
	10.500		45			160	75,0	80	30,4
	2.600		Bergonzo A4 Fluidics KC2 (30°-45°-60°)			60	300	246	18,6
	3.500			80	229	25,0		90	8,7
	4.500			100	225	32,1		90	11,9
	5.500			130	218	39,3		80	16,0
	6.500			150	215	46,4		80	18,3
	7.500			170	210	53,6		80	21,5
	8.500			190	203	60,7		80	24,7
	9.500			220	185	67,9		80	28,8
	10.500			240	185	75,0		80	30,4
RLS310	3.500	Fluidics N2 & N4 (45° - 60°)			90	300		245	25,0
	4.500			125	160		32,1	100	8,6
	5.500			150	268		39,3	100	11,8
	6.500			175	253		46,4	100	13,4
	7.500			200	253		53,6	100	14,7
	8.500			200	267		60,7	100	14,7
	9.500			225	268		67,9	100	15
	10.500			275	263		75,0	100	18,6
	11.500			300	258		82,1	100	20,8
	12.500			325	258		89,3	100	21,8
	13.600			350	258		98,2	100	23,4
RLS410	4.000	Fluidics N2 & N4 (45° - 60°)		100	300	275	28,6	100	8,3
	5.500			150		268	39,3	100	11,8
	6.500			175		253	46,4	100	13,4
	7.500			200		253	53,6	100	14,7
	8.500			200		267	60,7	100	14,7
	9.500			225		268	67,9	100	15
	10.500			275		263	75,0	100	18,6
	11.500			300		258	82,1	100	20,8
	12.500			325		258	89,3	100	21,8
	13.500			350		255	96,4	100	23,4
	14.500			350		261	103,6	100	23,4
	15.500			375		255	110,7	100	29,5
	16.100			400		240	119,3	100	35,2

	MBtu/hr ( GCV )	Nozzle			Supply Pressure	High Fire		Low Fire	
		Type	GPH	kg/h	PSI	By-pass Pressure	Flow rate GPH	By-pass Pressure	Flow rate GPH
<b>RLS510</b>	5.000	Fluidics N2 & N4 45° - 60°		125	300	268	35,7	100	8,6
	6.500			175		253	46,4	100	13,4
	7.500			200		253	53,6	100	14,7
	8.500			200		267	60,7	100	14,7
	9.500			225		268	67,9	100	15,0
	10.500			275		263	75,0	100	18,6
	11.500			300		258	82,1	100	20,8
	12.500			325		258	89,3	100	21,8
	13.500			350		255	96,4	100	23,4
	14.500			350		261	103,6	100	23,4
	15.500			375		255	110,7	100	29,5
	16.500			400		236	117,9	100	35,2
	17.500			450		261	125,0	100	36,8
	18.500			500		253	132,1	100	38,1
	19.500			500		260	139,3	100	38,1
19.200		525	253	137,1	100	39,1			

**Tab. L**

**4.12 Hydraulic system**

**4.12.1 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. M.

**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**

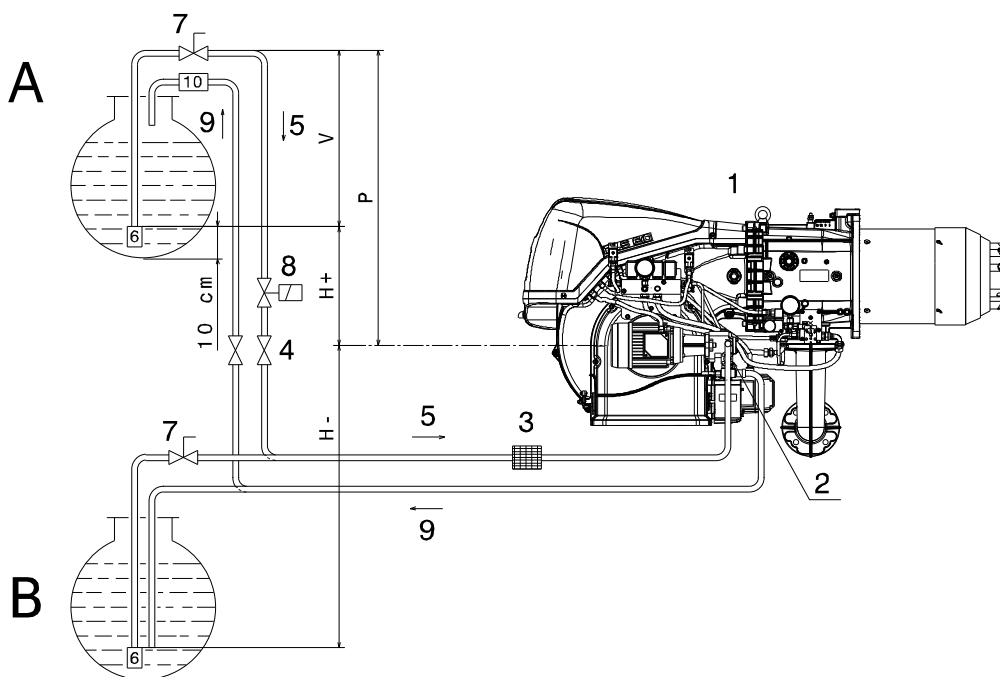
Pump depression values higher than 0.45 bar (35 cm Hg) must not be exceeded because at higher levels gas is released from the fuel, the pump starts making noise and its working life-span decreases. It is good practice to ensure that the return and suction lines enter the burner from the same height; in this way it will be more improbable that the suction line fails to prime or stops priming.

**4.12.2 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. M.



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**Fig. 20**

+/- 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. 20)**

- 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. M**

### 4.13 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. 21). 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.

#### 4.13.1 Pump

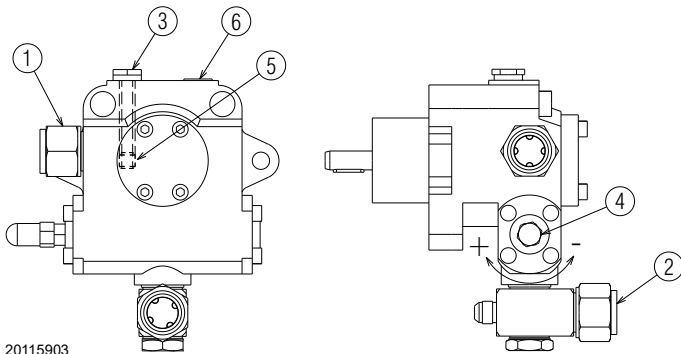


Fig. 21

- 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.

#### Key (Fig. 21)

1	Suction line	G 3/4" NPT
2	Return line	G 3/4" NPT
3	Vacuometer connection	G 1/4"
4	Pressure adjuster	
5	By-pass screws	
6	Gauge connection	G 1/4"

#### Technical data

Pump model		TA3	TA4	TA5
		(RLS 280-310/E)	(RLS 410/E)	(RLS 510/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. N

#### 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.

- In order for the pump (Fig. 21) to self-prime, it is vital that the screw 4) of the pump be loosened to vent the air contained in the suction line.
- Start the burner by closing the remote controls. As soon as the burner starts, check the direction of rotation of the fan blade.
- The pump can be considered to be primed when the light oil starts coming out of the screw 4). Close the burner and undo the screws 4).

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

If the pump fails to prime at first start-up and the burner locks out, wait approx. 15 seconds, reset the burner, and then repeat the start-up operation.

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

Do not light the flame sensor or the burner will lock out; the burner should lock out anyway about 10 seconds after it starts.

### 4.13.2 Pressure variator

The pressure variator (Fig. 22), allows the pressure on the return line of the nozzle to be varied according to the required output.

The pressure on the return line is adjusted by varying a section by means of the rotation of the servomotor 23 (Fig. 3 on page 11), which also controls the gas butterfly valve at the same time.

- Regulator at 0° (maximum opening) = minimum pressure on the nozzle return line.
- Regulator at 90° (minimum opening) = maximum pressure on the nozzle return line.

The servomotor is controlled by the electronic cam; thanks to this device, it is possible to set different curves for oil and gas on the same servomotor (also for the air damper servomotor 4) (Fig. 3 on page 11).

- In the **oil regulation** the regulation is carried out on the basis of the nozzle that has been mounted and the modulation required.

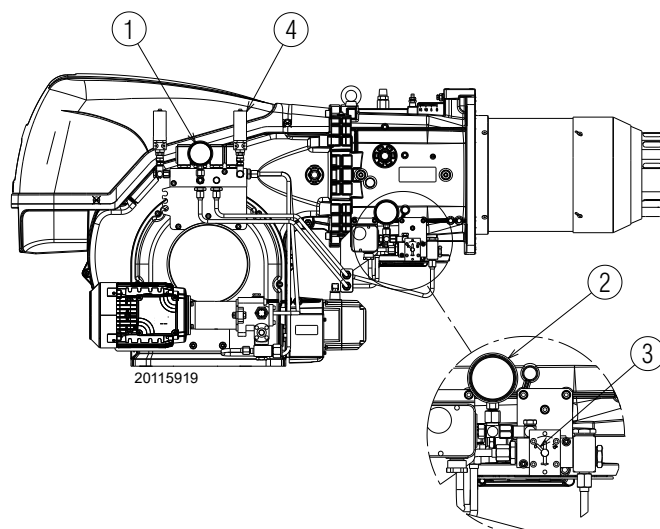


Fig. 22

#### Key (Fig. 22)

- 1 Nozzle delivery pressure gauge
- 2 Nozzle return pressure gauge
- 3 Position indicator (0 ÷ 90) of the pressure variator
- 4 Maximum oil pressure switch on return circuit

### 4.14 Gas feeding



Explosion danger due to fuel leaks in the presence of a flammable source.

Precautions: avoid knocking, attrition, sparks and heat.

Make sure the fuel interception tap is closed before performing any operation on the burner.



The fuel supply line must be installed by qualified personnel, in compliance with current standards and laws.

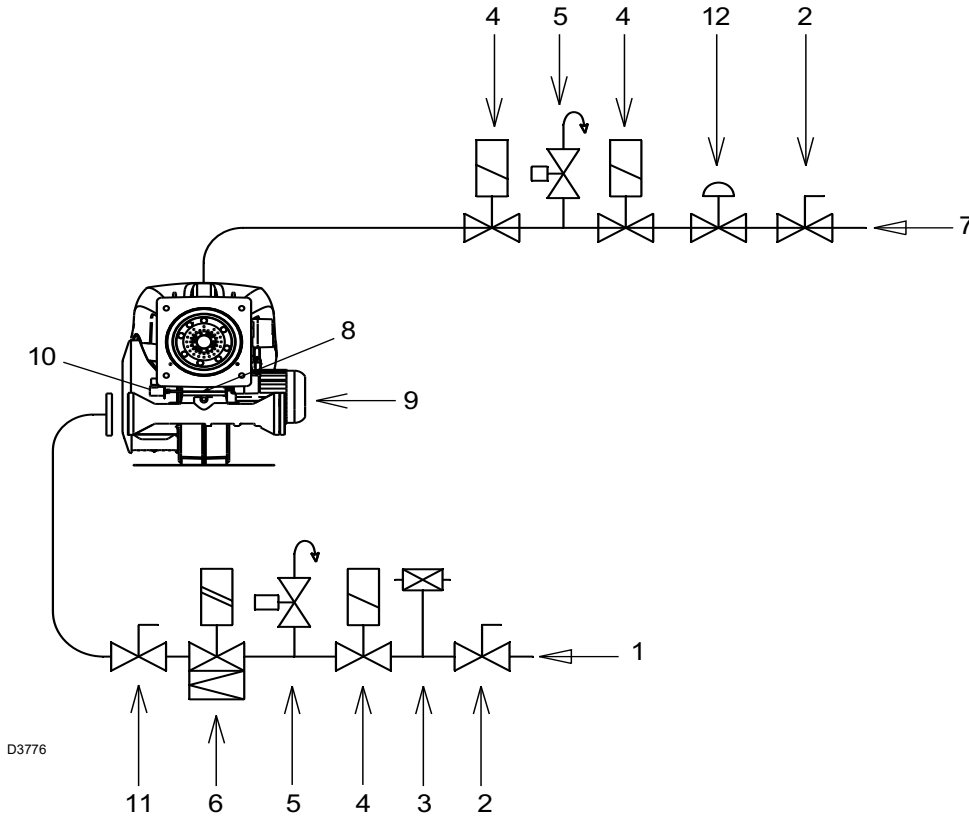


Fig. 23

#### Key (Fig. 23)

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



Check that there are no gas leaks.



Pay attention when handling the train: danger of crushing of limbs.



Make sure that the gas train is properly installed by checking for any fuel leaks.

#### 4.14.1 Gas train

It must be type-approved according to UL Standards and is supplied separately from the burner.



WARNING

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



The operator must use the required equipment during installation.

**4.14.2 Gas pressure**

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

The values shown in the Tab. O refer to natural gas (GCV).

Column 1

Pressure loss at combustion head.

Gas pressure measured at the test point 1)(Fig. 24), with:

- combustion chamber at 0" WC;
- burner working at maximum output;
- combustion head adjusted as in the diagram of Fig. 16 on page 23.

Column 2

Pressure loss at gas butterfly valve 17)(Fig. 3 on page 11) 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. 24);
- find, in the Tab. O 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 510/E:**

- Maximum output operation
  - Gas pressure at test point 1)(Fig. 24) = 11.7 "WC
  - Pressure in combustion chamber = 2 "WC
- 11.7 - 2 = 9.7 "WC

An output of 10500 MBtu/hr shown in Tab. O 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.

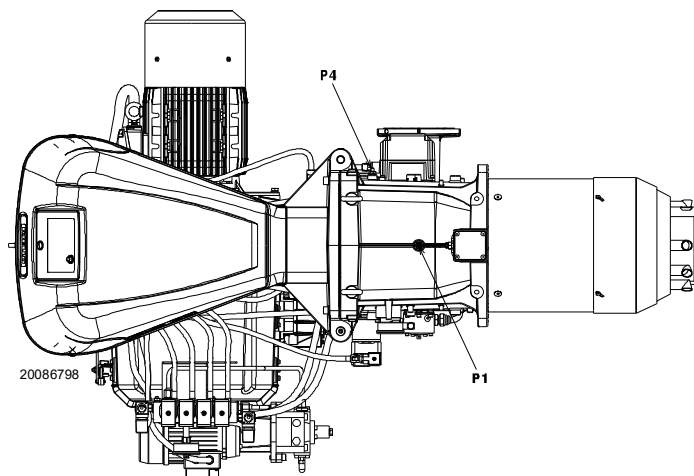


Fig. 24



**The data of thermal output and combustion head gas pressure are related to full open (90°) gas butterfly valve.**

	MBtu/hr ( GCV )	1 Δp ("WC)	2 Δp ("WC)
RLS280	2.600	1.2	0.01
	3.500	2.2	0.02
	4.500	3.6	0.03
	5.500	6.5	0.07
	6.500	9.1	0.15
	7.500	12.2	0.20
	8.500	14.0	0.40
	9.500	15.6	0.50
	10.500	19.1	0.60
	RLS310	3.500	1.2
4.500		2.0	0.03
5.500		3.0	0.07
6.500		4.2	0.15
7.500		5.9	0.20
8.500		7.6	0.40
9.500		9.5	0.50
10.500		11.8	0.60
11.500		14.0	0.80
12.500		16.5	1.00
RLS410	4.000	1.5	0
	5.500	2.8	0
	6.500	3.9	0.07
	7.500	5.2	0.17
	8.500	8.1	0.22
	9.500	10.1	0.34
	10.500	12.3	0.50
	11.500	14.8	0.60
	12.500	16.5	0.90
	13.500	18.3	1.10
RLS510	14.500	21.0	1.40
	15.500	24.1	1.73
	16.100	26.0	2.00
	5.000	2.2	0.00
	6.500	3.7	0.07
	7.500	5.0	0.17
	8.500	6.4	0.22
	9.500	8.0	0.34
	10.500	9.7	0.50
	11.500	11.7	0.60
12.500	13.8	0.90	
13.500	16.1	1.10	
14.500	18.6	1.40	
15.500	21.2	1.73	
17.500	27.0	2.60	
18.500	30.2	3.00	
19.200	33.8	3.50	

Tab. O

## 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:

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



DANGER

Disconnect the electrical supply from the burner by means of the main system switch.



DANGER

Turn off the fuel interception tap.



DANGER

Avoid condensate, ice and water leaks from forming.

**4.15.1 Supply cables and external connections passage**

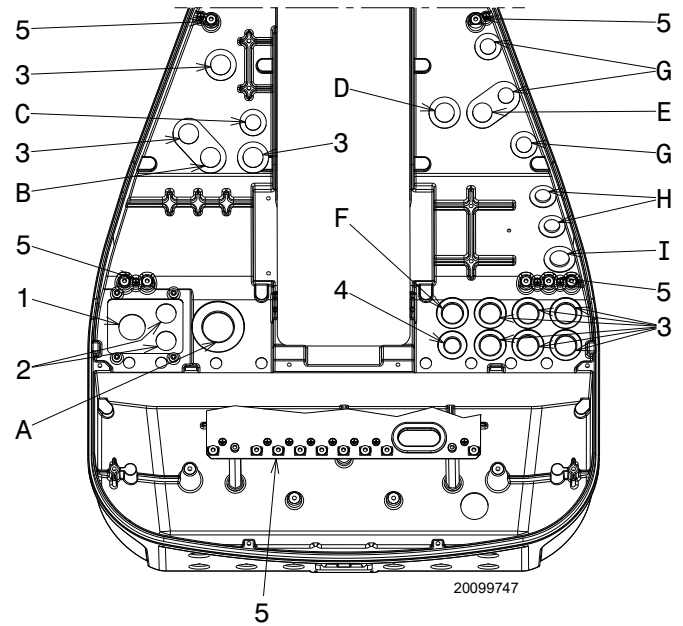
If the cover is still present, remove it and proceed with the electrical wiring.

All the cables to be connected to the burner are fed through the grommets. See figure on the right.

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 3/4 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: hole for M16
- 5 Available for ground terminals

- A Fan motor
- B Maximum gas pressure switch
- C UV sensor
- D Air servomotor
- E Fuel servomotor
- F Air pressure switch
- G Oil valve
- H Oil pressure switch
- I Pump motor



**Fig. 25**



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

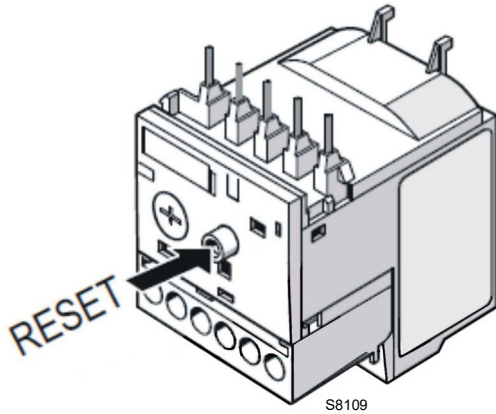


After carrying out maintenance, cleaning or checking operations, reassemble the cover and all the safety and protection devices of the burner.

**4.16 Thermal relay calibration**

**4.16.1 Electronic thermal relay**

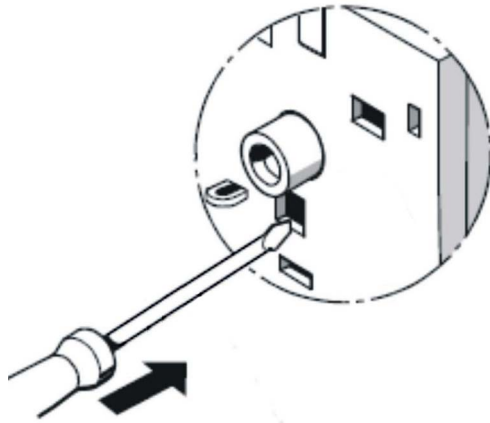
- To reset, in the case of an intervention of the thermal relay, press the button "RESET" (Fig. 26).



**Fig. 26**

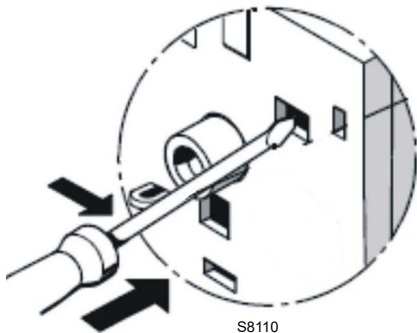
There are two different solution to test the electronic thermal relay:

- **Device test (Fig. 22)**  
Push slowly the button in the window with a little screwdriver.



**Fig. 27**

- **Contact test NC (95-96) and NO (97-98)(Fig. 28)**  
Insert in the window a little screwdriver and move it in the sense of the arrow.



**Fig. 28**

**4.17 Motor connection at 208-230 or 460V**



the motors, manufactured for 208-230/460 **IE3 NEMA Premium Efficiency** voltage, have the same connection than **IE2/Epact** motors, but different connection than **IE1** motors no more star/delta but star/double star.

Please, pay attention to the indications in case of modification of voltage, maintenance, or substitution.

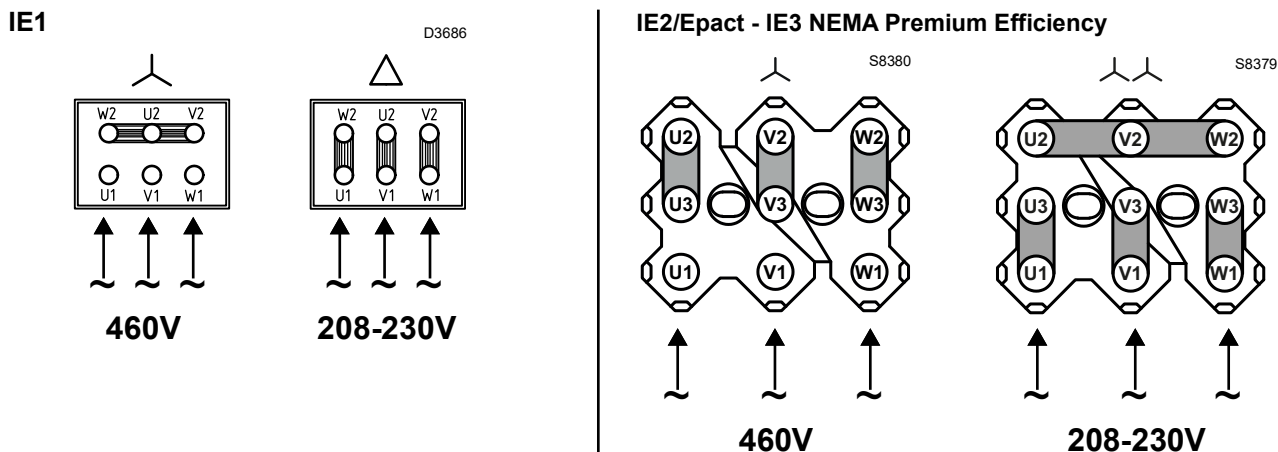


Fig. 29

**4.18 Motor connection at 575V**



the motors, manufactured for 575V **IE3 NEMA Premium Efficiency** voltage, have the same frame control base of the **IE1** and **IE2/Epact** motors.

Please pay attention to the indications in case of maintenance or substitution.

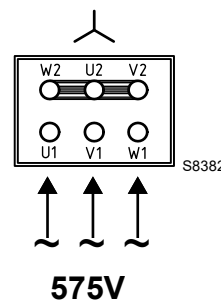


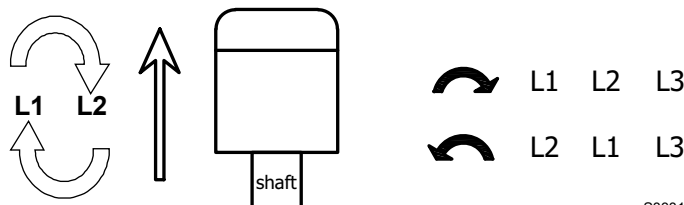
Fig. 30

**4.19 Reversible direction**



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

For example: L1 with L2, there is not difference between **IE1**, **IE2/Epact** and **IE3 NEMA Premium Efficiency**.



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Fig. 31

## 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.



Refer to paragraph “Safety test - with gas ball valve closed” on page 42 before the first start-up.

## 5.2 Adjustments before first firing

Adjustment of the combustion head has been illustrated on page 23.

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 low gas pressure switch to the start of the scale (Fig. 36 on page 39).
- Adjust the high gas pressure switch to the upper limit of the scale (Fig. 35 on page 38).
- Adjust the air pressure switch to the zero position of the scale (Fig. 34 on page 38).
- Fit a U-type manometer (Fig. 32) to the gas pressure test point on the sleeve. The manometer readings are used to calculate MAX. burner power using the Tab. O on page 31.

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.

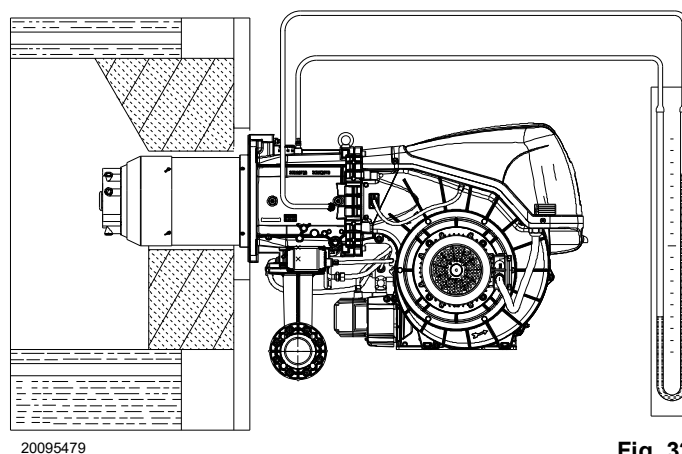


Fig. 32

## 5.3 Burner firing

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

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 Fig. 15 on page 22.

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

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

## 5.4 Burner calibration

The optimum calibration of the burner requires an analysis of the flue gases at the boiler outlet.

Adjust successively:

- Firing output
- Maximum burner output
- Minimum burner output
- Intermediate outputs between low and high fire
- Air pressure switch
- Minimum gas pressure switch

### 5.5 Burner start-up

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

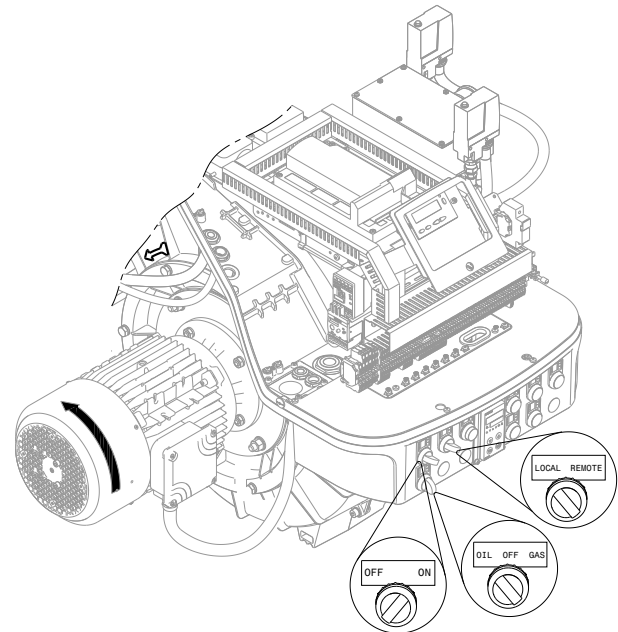
Close the thermostats/pressure switches, set the parameters on the RWF55 regulator.

Please refer to the specific manual for this operation.

Turn the switch to position “**ON**” (Fig. 33) and turn the switch of to position “**LOCAL**” and turn the switch to position “**OIL**” for oil operation and “**GAS**” for gas operation.



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.



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Fig. 33

### 5.6 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.



**For the start-up procedure and the parameters calibration, refer to the specific instruction manual of the LMV37... electronic cam supplied with the burner.**

### 5.7 Adjusting oil/air delivery

- Switch to the light oil operation;
- during the ignition, move slowly with an approximate adjustment to the oil servomotor at maximum 90°;
- adjust the combustion parameter with the air servomotor and store the maximum combustion point;
- complete the procedure slowly, synchronizing the combustion with the two servomotors;
- store the different setting points.

**5.8 Final calibration of the pressure switches**

**5.8.1 Air pressure switch**

For the **RLS 280**, model the air pressure switch is connected in differential mode and is activated by both the negative pressure of the air intake and the positive pressure from the fan.

For the **RLS 310-410-510**, models the air pressure switch is connected in absolute mode and is activated by the positive pressure from the fan (Fig. 34).

Adjust the air pressure switch (Fig. 34) after having performed all other burner adjustments with the air pressure switch set to the min. of the scale.

With the burner operating at low fire, adjust the pressure switch by slowly turning the relative knob clockwise until the burner locks out.

Then turn the knob counter-clockwise about 20% of the set point and start-up the burner again to ensure the set point is correct.

If the burner locks out again, turn the knob counter-clockwise a little bit more.

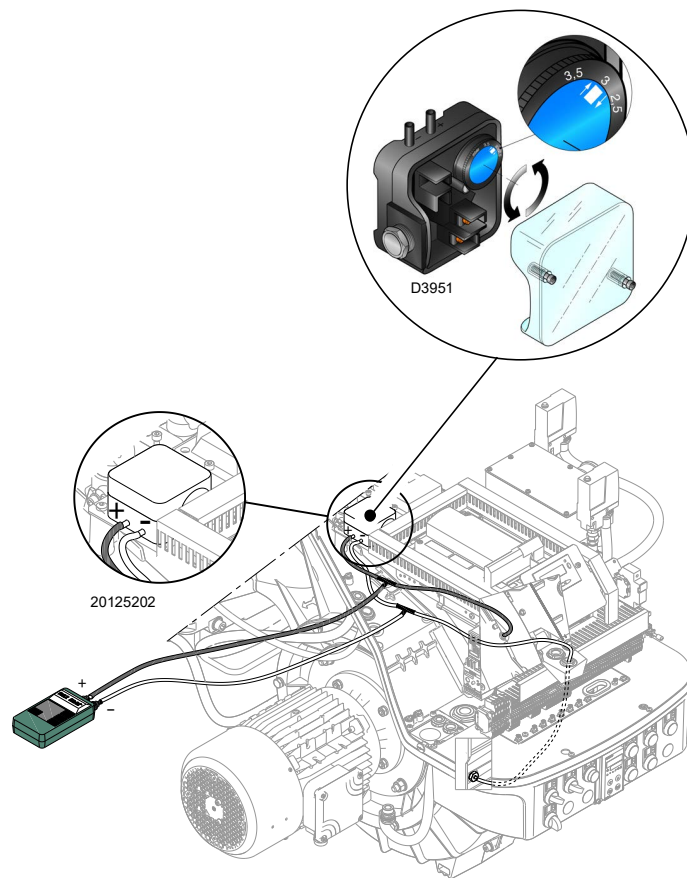
**5.8.2 Maximum gas pressure switch**

Adjust the maximum gas pressure switch (Fig. 35) after making all other burner adjustments with the maximum gas pressure switch set to the end of the scale.

To calibrate the maximum gas pressure switch, open the tap and then connect a pressure gauge to its pressure test point.

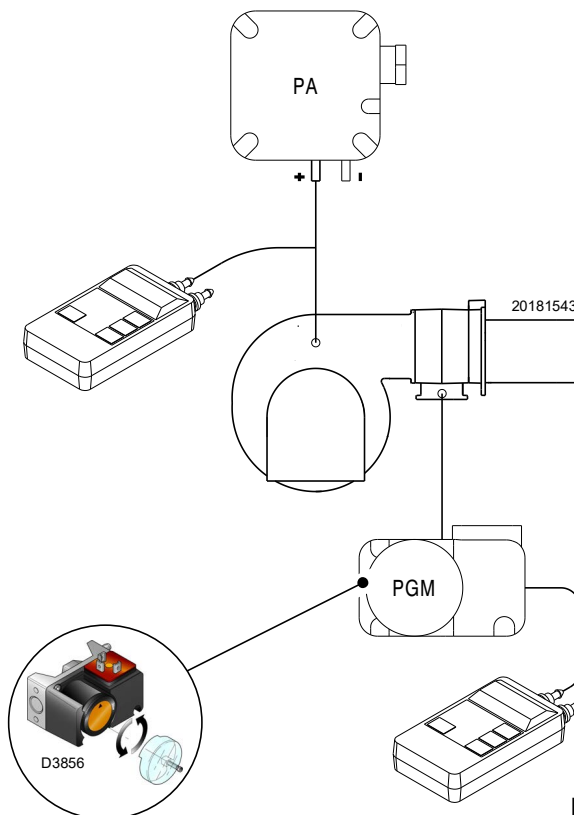
The maximum gas pressure switch must be regulated to a value no higher than 30% of the measurement read on the gauge when the burner is working at maximum output.

After making the adjustment, remove the pressure gauge and close the tap.



Connection of the pressure gauge with the pressure switch in absolute mode or differential mode for RLS 280

**Fig. 34**



**Fig. 35**

### 5.8.3 Minimum gas pressure switch

Adjust the minimum gas pressure switch (Fig. 36) after having adjusted the burner, the gas valves and the gas train stabiliser. With the burner operating at maximum output:

- install a pressure gauge downstream of the gas train stabiliser (for example at the gas pressure test point on the burner combustion head);
- choke slowly the manual gas cock until the pressure gauge detects a decrease in the pressure read of about 0.1 kPa (1 mbar). In this phase, verify the CO value which must always be less than 100 mg/kWh (93 ppm).
- Increase the adjustment of the gas pressure switch until it intervenes, causing the burner shutdown;
- remove the pressure gauge and close the cock of the gas pressure test point used for the measurement;
- open completely the manual gas cock.



1 kPa = 10 mbar

**WARNING**

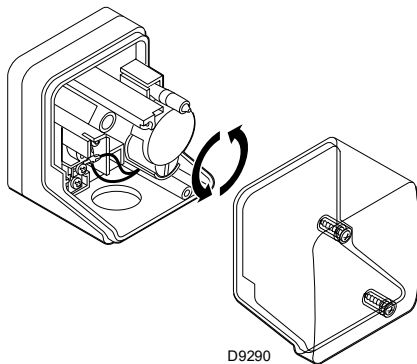


Fig. 36

### 5.8.4 Low oil pressure switch

The low oil pressure switch is factory set to 261 PSI (18 bar) (Fig. 37).

If the oil pressure goes down this value in the delivery piping, the pressure switch stops the burner.

Burner starts again automatically if the pressure goes above 261 PSI (18 bar) after burner start up.

### 5.8.5 High oil pressure switch

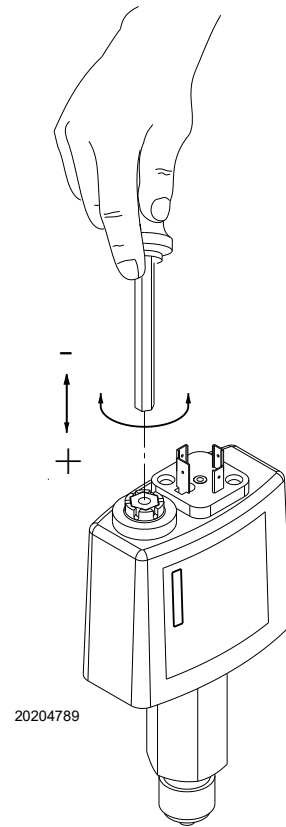
The high oil pressure switch is factory set to 43.5 PSI (3 bar).

If the oil pressure goes above this value in the return piping, the pressure switch stops the burner.

Burner starts again automatically if the pressure goes down under 43.5 PSI (3 bar) after burner shut down.

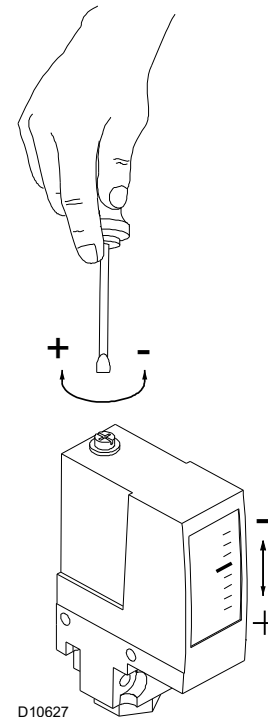
If a loop circuit with Px pressure feeds the burner, the pressure switch should be adjusted to Px + 43.5 PSI.

For the adjustment see Fig. 38.



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Fig. 37



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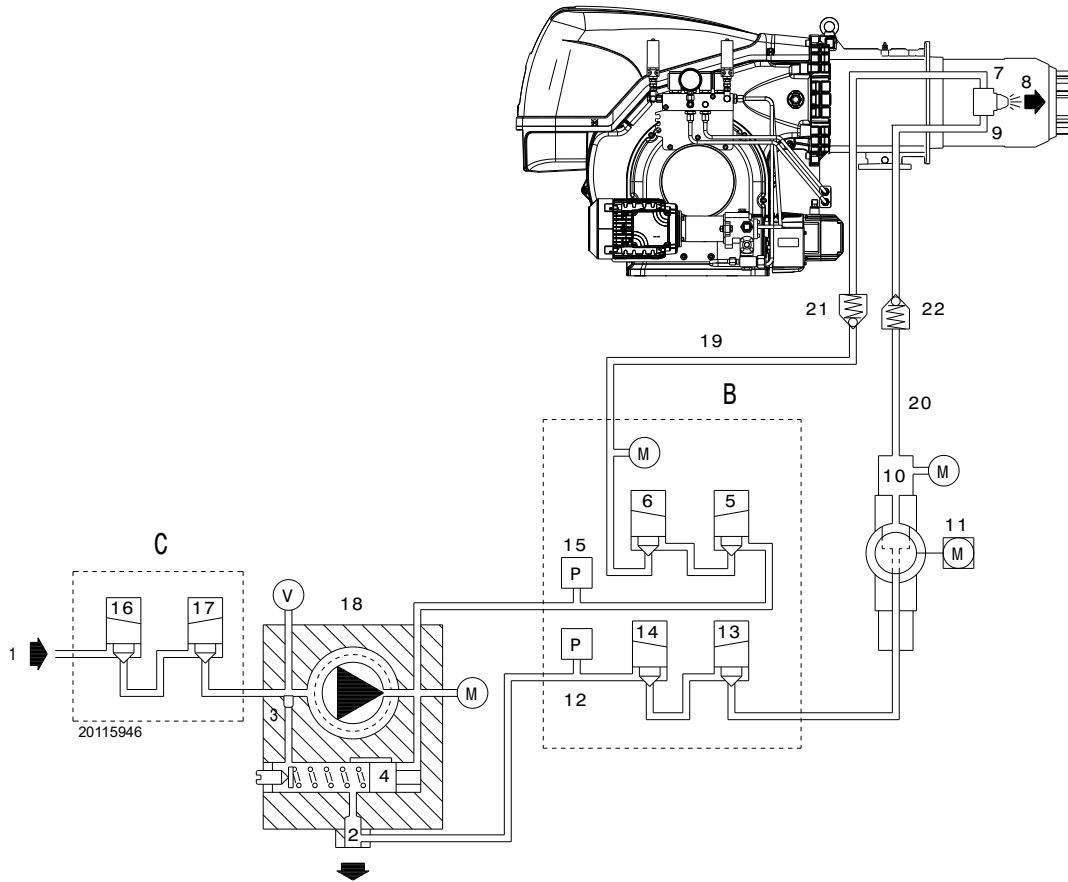
Fig. 38

**5.9 Burner starting**

- Operating control closes, the ignition pilot starts and the P.O.C. solenoid valves 16)-17) open (available as accessory), if required.
- The pump 18)(Fig. 39) 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.
- Solenoid valves 5) - 6) -13) -14) open; the fuel passes through

the piping 19), 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.



**Fig. 39**

**Key (Fig. 39)**

- 1 Pump suction
- 2 Pump return line and nozzle return line
- 3 Pump by-pass screw
- 4 Pump pressure regulator
- 5 Safety valve
- 6 Safety valve
- 7 Nozzle delivery line
- 8 Nozzle without interception rod
- 9 Nozzle return line
- 10 Pressure variator on nozzle return line
- 11 Pressure variator servomotor
- 12 Pressure switch on nozzle return line
- 13 Safety valve on nozzle return line
- 14 Safety valve on nozzle return line
- 15 Pressure switch on pump delivery line
- 16 POC safety valve
- 17 POC safety valve

- 18 Oil pump
- 19 Delivery piping
- 20 Return piping
- 21 Check valve (no dripping function)
- 22 Check valve (no dripping function)
- B Oil valve group and pressure variator
- C POC Oil valve group (available as accessory)
- M Pressure gauges
- V Vacuumeter connection

**NOTE:**

**The POC (Proof of Closure) valves are required by the NFPA 8501 standard for burners having an output of 12.500 Mbtu/hr or greater (RLS 310-410-510).**

**5.9.1 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).

**5.10 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.

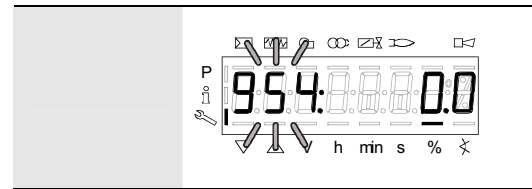
**5.11 Flame signal measurement**

Check the flame signal through the parameter 954, as indicated in Fig. 40. The displayed value is expressed in percentage.

The value during the operation must be higher than 24%. If at the burner start-up the value is higher or equal of 18%, the burner locks out due to the extraneous light.

For further and specific information, please refer to the specific instruction manual.

The display (Fig. 40) shows parameter **954**: flashing on the left. On the right, the flame's intensity is displayed as a percentage. Example: **954: 0.0**



S8171

**Fig. 40**

**5.12 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>	➡	The burner must stop
<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>	➡	The burner must stop in lockout
<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>	➡	The burner must not start
<ul style="list-style-type: none"> <li>➤ Cover the flame sensor</li> </ul>	➡	The burner must stop in lockout due to firing failure

**Tab. P**



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

#### 6.1 Notes on safety for the maintenance

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

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



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 electrical supply from the burner by means of the main system switch.



Turn off the fuel interception tap.



Wait for the components in contact with heat sources to cool down completely.

#### 6.2 Maintenance programme

##### 6.2.1 Maintenance frequency



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

##### 6.2.2 Safety test - with gas ball valve closed

It is fundamental to ensure the correct execution of the electrical connections between the gas solenoid valves and the burner to perform safely the commissioning.

For this purpose, after checking that the connections have been carried out in accordance with the burner's electrical diagrams, an ignition cycle with closed gas ball valve -dry test- must be performed.

- 1 The manual ball gas valve must be closed
- 2 The electrical contacts of the burner limit switch need to be closed
- 3 Ensures closed the contact of the low gas pressure switch
- 4 Make a trial for burner ignition

The start-up cycle must be as follows:

- Starting the fan for pre-ventilation
- Performing the gas valve seal control, if provided
- Completion of pre-ventilation
- Arrival of the ignition point
- Power supply of the ignition transformer
- Electrical Supply of solenoid gas valves

Since the manual gas ball valve is closed, the burner will not light up and its flame control will go to a safety lockout condition.

The actual electrical supply of the solenoid gas valves can be verified by inserting a tester. Some valves are equipped with light signals (or close/open position indicator) that turn on at the same time as their power supply.



**IF THE ELECTRICAL SUPPLY OF THE GAS VALVES OCCURS AT UNEXPECTED TIMES, DO NOT OPEN MANUAL GAS BALL VALVE, SWITCH OFF POWER LINE; CHECK THE WIRES; CORRECT THE ERRORS AND REPEAT THE COMPLETE TEST.**

##### 6.2.3 Checking and cleaning



The operator must use the required equipment 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.

##### Burner

Check for excess wear or loose screws. Also make sure that the screws securing the electrical leads in the burner connections are fully tightened.

Clean the outside of the burner.

##### Flame sensor

In order to reach the flame sensor, proceed as follows:

- extract the sensor 2)(Fig. 42 on page 43);
- clean the glass cover from any dust that may have accumulated.

**Flame inspection window**

Clean the flame inspection window 1)(Fig. 41).

**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.

**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.

**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.

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.

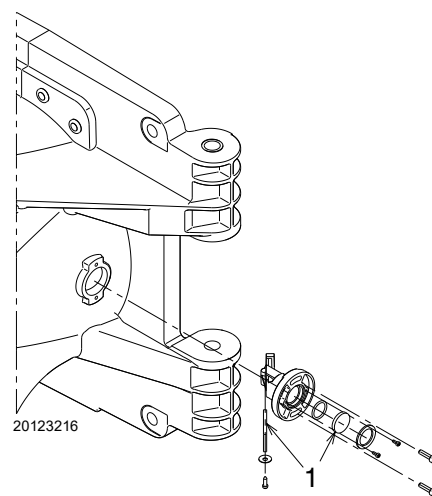


Fig. 41

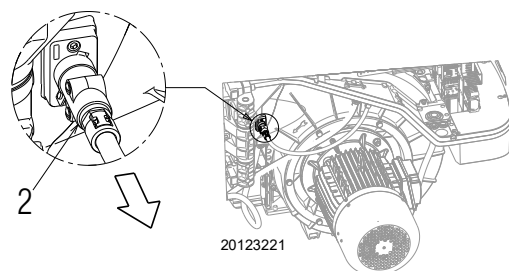


Fig. 42

### LIGHT OIL OPERATION

**Pump**

Delivery pressure must correspond with the Tab. L on page 26.

The depression must be less than 0.45 bar.

Unusual noise must not be evident during pump operation.

If the pressure is found to be unstable or if the pump runs noisily, the flexible hose must be detached from the line filter and the fuel must be sucked from a tank located near the burner. This measure permits the cause of the anomaly to be traced to either the suction line or the pump.

If the 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.

Combustion must be checked after the nozzles have been changed.

**Flexible hoses**

Check to make sure that the flexible hoses are still in good condition and that they are not crushed or otherwise deformed.

**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.

### 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.

### 6.2.4 Safety components

The safety components must be replaced at the end of their life cycle indicated in Tab. Q. The specified life cycles do not refer to the warranty terms indicated in the delivery or payment conditions.

Safety component	Life cycle
Flame control	10 years or 250,000 operation cycles
Flame sensor	10 years or 250,000 operation cycles
Gas valves (solenoid)	10 years or 250,000 operation cycles
Pressure switches	10 years or 250,000 operation cycles
Pressure adjuster	15 years
Servomotor (electronic cam) (if present)	10 years or 250,000 operation cycles
Oil valve (solenoid) (if present)	10 years or 250,000 operation cycles
Oil regulator (if present)	10 years or 250,000 operation cycles
Oil pipes/ couplings (metallic) (if present)	10 years
Fan impeller	10 years or 500,000 start-ups

Tab. Q

### 6.3 Opening the burner



DANGER

Disconnect the electrical supply from the burner by means of the main system switch.



Wait for the components in contact with heat sources to cool down completely.



DANGER

Close the fuel interception tap.

See "Accessibility to the interior of the combustion head" on page 21.

### 6.4 Closing the burner

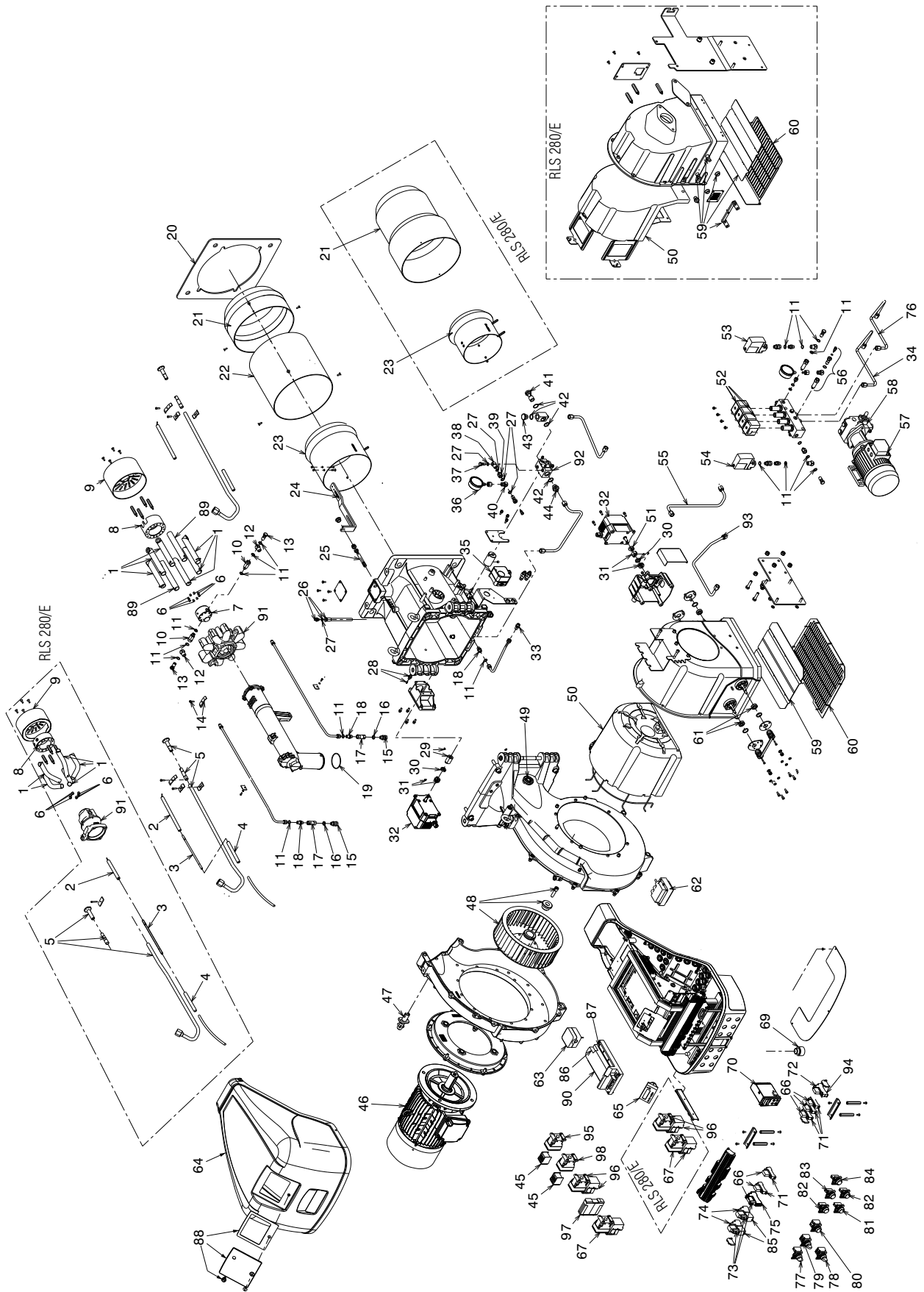
Refit following the steps described but in reverse order; refit all burner components as they were originally assembled.



After carrying out maintenance, cleaning or checking operations, reassemble the cover and all the safety and protection devices of the burner.

**A**

**Appendix - Spare parts**



N.	CODE	20125045 - RLS 280/E	20125046 - RLS 280/E	20123531 - RLS 280/E	20124918 - RLS 280/EV	20124919 - RLS 280/EV	20124927 - RLS 280/EV	DESCRIPTION	*
1	20205003	•	•					TUBE	
1	20075046			•	•	•	•	TUBE	
2	20118164	•	•	•	•	•	•	ELECTRODE	A
3	3012282	•	•	•	•	•	•	ELECTRODE CONNECTION	A
4	3012258	•	•	•	•	•	•	INSULATOR	A
5	20123895	•	•	•	•	•	•	IGNITION PILOT TUBE	C
6	20123908	•	•	•	•	•	•	NOZZLE	
8	20123937	•	•	•	•	•	•	AIR DIFFUSER	
9	20123947	•	•	•	•	•	•	DIFFUSER DISC	
10	3013460	•	•	•	•	•	•	CONNECTOR	C
11	3007079	•	•	•	•	•	•	SEAL	B
12	3012455	•	•	•	•	•	•	CONNECTOR	C
13	3003006	•	•	•	•	•	•	CONNECTOR	C
14	3012626	•	•	•	•	•	•	U BOLT	
15	3013462	•	•	•	•	•	•	CONNECTOR	C
16	20041969	•	•	•	•	•	•	SEAL	B
17	3013461	•	•	•	•	•	•	VALVE NOT RETURN	B
18	3006723	•	•	•	•	•	•	CONNECTOR	C
19	3020191	•	•	•	•	•	•	O-RING SEAL	B
20	3013328	•	•	•	•	•	•	FLANGE GASKET	A
21	20075037	•	•	•	•	•	•	END CONE	B
23	20075041	•	•	•	•	•	•	SHUTTER	C
24	20075043	•	•	•	•	•	•	SQUARE	
25	20075916	•	•	•	•	•	•	SCREW	
26	20052434	•	•	•	•	•	•	CONNECTOR	C
27	3007077	•	•	•	•	•	•	SEAL	B
28	3005447	•	•	•	•	•	•	CONNECTOR	C
29	20075022	•	•	•	•	•	•	JOINT	C
30	20090029	•	•			•		DISC	A
30	20073817			•	•			HUB	
31	3013937	•	•	•	•	•	•	HUB	
32	20008601	•	•	•	•	•	•	SERVOMOTOR	B
33	20124024	•	•	•	•	•	•	CONNECTOR	C
34	20124453	•	•	•	•	•	•	OIL TUBE	C
35	20014103	•	•	•	•	•	•	PRESSURE SWITCH	A
36	3006140	•	•	•	•	•	•	PRESSURE GAUGE	
37	3003592	•	•	•	•	•	•	BAR	C
38	3012123	•	•	•	•	•	•	CONNECTOR	B
39	3012909	•	•	•	•	•	•	CONNECTOR	B
40	3013998	•	•	•	•	•	•	CONNECTOR	B
41	3003055	•	•	•	•	•	•	CONNECTOR	B
42	3007164	•	•	•	•	•	•	SEAL	B
43	3013635	•	•	•	•	•	•	PLUG	
44	3013559	•	•	•	•	•	•	CONNECTOR	B
46	20201364	•	•					MOTOR	C
46	20201353			•	•			MOTOR	C
46	20207183					•		MOTOR	C
46	20124265					•		MOTOR	C
47	20086579	•	•	•	•	•	•	FLAME SENSOR	
48	20006192	•	•	•	•	•	•	FAN	C
49	3013933	•	•	•	•	•	•	INSPECTION WINDOW	
49	3012794			•	•			INSPECTION WINDOW	
50	3013682	•	•	•	•	•	•	SOUND DAMPING	
51	3014079	•	•	•	•	•	•	SPACER	

N.	CODE							DESCRIPTION	*
		20125045 - RLS 280/E	20125046 - RLS 280/E	20123531 - RLS 280/E	20124918 - RLS 280/EV	20124919 - RLS 280/EV	20124927 - RLS 280/EV		
52	3003287	•	•	•	•	•	•	COIL	B
53	3012384	•	•	•	•	•	•	OIL PRESSURE SWITCH	A
54	3013674	•	•	•	•	•	•	OIL PRESSURE SWITCH	A
55	20124466	•	•	•	•	•	•	OIL TUBE	C
56	20075584	•	•	•	•	•	•	CONNECTOR	B
57	20042836	•	•	•	•	•	•	MOTOR	C
58	3006158	•	•	•	•	•	•	PUMP	C
59	20056809	•	•	•	•	•	•	AIR DAMPER	
60	3013683	•	•	•	•	•	•	PROTECTION	
62	3012956	•	•	•	•	•	•	TRANSFORMER	B
63	3012948	•	•	•	•	•	•	AIR PRESSURE SWITCH	A
64	20086561	•	•	•	•	•	•	COVER	B
65	3013926	•	•	•	•	•	•	DISPLAY	
66	20010969	•	•	•	•	•	•	RELAY	C
67	20207647	•	•	•	•	•	•	CONTACTOR	C
69	20031413	•	•	•	•	•	•	HORN	
70	20096592	•	•	•	•	•	•	POWER REGULATOR	C
71	3012841	•	•	•	•	•	•	BASE	C
72	3020068	•	•	•	•	•	•	RELAY	C
73	20043329	•	•	•	•	•	•	TIMER	B
74	20030708	•	•	•	•	•	•	RELAY	C
75	20125077	•	•	•	•	•	•	BASE	C
76	20124463	•	•	•	•	•	•	OIL TUBE	C
77	20027021	•	•	•	•	•	•	SELECTOR SWITCH	
78	20028411	•	•	•	•	•	•	SELECTOR SWITCH	
79	20027422	•	•	•	•	•	•	SELECTOR SWITCH	
80	20010962	•	•	•	•	•	•	SELECTOR SWITCH	
81	20027020	•	•	•	•	•	•	YELLOW SIGNAL LIGHT	A
82	20036017	•	•	•	•	•	•	GREEN SIGNAL LIGHT	A
83	20036019	•	•	•	•	•	•	WHITE SIGNAL LIGHT	A
84	20027018	•	•	•	•	•	•	RED SIGNAL LIGHT	A
85	20028400	•	•	•	•	•	•	BASE	
86	3014106	•	•	•	•	•	•	FUSE	
87	3013940	•	•	•	•	•	•	CONNECTORS ASSEMBLY	
88	20075921	•	•	•	•	•	•	VIEWING PORT	
90	20028329	•	•	•	•	•	•	ELECTRONIC CAM	C
91	20123269	•	•	•	•	•	•	DIFFUSER	
92	20124484	•	•	•	•	•	•	MODULATOR	B
93	20124390	•	•	•	•	•	•	OIL TUBE	C
94	3020071	•	•	•	•	•	•	BASE	
96	20207653	•	•	•	•	•	•	CONTACTOR	C

## \*

## 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

N.	CODE							DESCRIPTION	*
		20125075 - RLS 310/E	20125082 - RLS 310/E	20125083 - RLS 410/E	20122385 - RLS 410/E	20125094 - RLS 510/E	20125095 - RLS 510/E		
1	20109355	•	•	•	•	•	•	TUBE	
2	20032433	•	•	•	•	•	•	ELECTRODE	A
3	3012722	•	•	•	•	•	•	ELECTRODE CONNECTION	A
5	20123901	•	•	•	•	•	•	IGNITION PILOT TUBE	C
6	20123916	•	•	•	•	•	•	NOZZLE	
7	20123921	•	•	•	•	•	•	SPRAY NOZZLE	
8	20123941	•	•	•	•	•	•	AIR DIFFUSER	
9	20123955	•	•	•	•	•	•	DIFFUSER DISC	
10	3013460	•	•	•	•	•	•	CONNECTOR	C
11	3007079	•	•	•	•	•	•	SEAL	B
12	3012455	•	•	•	•	•	•	CONNECTOR	C
13	3003006	•	•	•	•	•	•	CONNECTOR	C
14	20138121	•	•	•	•	•	•	U BOLT	
15	3013462	•	•	•	•	•	•	CONNECTOR	C
16	20041969	•	•	•	•	•	•	SEAL	B
17	3013461	•	•	•	•	•	•	VALVE NOT RETURN	B
18	3006723	•	•	•	•	•	•	CONNECTOR	C
19	3020191	•	•	•	•	•	•	O-RING SEAL	B
20	3013328	•	•	•	•	•	•	FLANGE GASKET	A
21	3013314	•	•	•	•	•	•	END CONE	B
22	20073781	•	•	•	•	•	•	CYLINDER	C
23	20074988	•	•	•	•	•	•	SHUTTER	C
24	20073784	•	•	•	•	•	•	SQUARE	
25	20075916	•	•	•	•	•	•	SCREW	
26	20052434	•	•	•	•	•	•	CONNECTOR	C
27	3007077	•	•	•	•	•	•	SEAL	B
28	3005447	•	•	•	•	•	•	CONNECTOR	C
29	20075022	•	•	•	•	•	•	COUPLING	A
30	20090029	•	•	•	•	•	•	DISC	A
31	3013937	•	•	•	•	•	•	HUB	
32	20008601	•	•	•	•	•	•	SERVOMOTOR	B
34	20124498	•	•	•	•	•	•	OIL TUBE	C
35	20014103	•	•	•	•	•	•	PRESSURE SWITCH	A
36	3006140	•	•	•	•	•	•	PRESSURE GAUGE	
37	3003592	•	•	•	•	•	•	BAR	C
38	3012123	•	•	•	•	•	•	CONNECTOR	B
39	3012909	•	•	•	•	•	•	CONNECTOR	B
40	3013998	•	•	•	•	•	•	CONNECTOR	B
41	3003055	•	•	•	•	•	•	CONNECTOR	B
42	3007164	•	•	•	•	•	•	SEAL	B
43	3013635	•	•	•	•	•	•	PLUG	
44	3013559	•	•	•	•	•	•	CONNECTOR	B
45	20124632	•	•	•	•	•	•	AUXILIARY CONTACT	C
46	20013155	•						MOTOR	C
46	20042608		•					MOTOR	C
46	20013156			•				MOTOR	C
46	20124287				•			MOTOR	C
46	20124588					•		MOTOR	C
46	20124359						•	MOTOR	C
47	20086579	•	•	•	•	•	•	FLAME SENSOR	
48	3003614	•	•					FAN	C
48	20124069			•	•	•		FAN	C
49	3013933	•	•	•	•	•	•	INSPECTION WINDOW	
50	20073811	•	•	•	•	•	•	SOUND DAMPING	
51	3014079	•	•	•	•	•	•	SPACER	

N.	CODE							DESCRIPTION	*
		20125075 - RLS 310/E	20125082 - RLS 310/E	20125083 - RLS 410/E	20122385 - RLS 410/E	20125094 - RLS 510/E	20125095 - RLS 510/E		
52	3003287	•	•	•	•	•	•	COIL	B
53	3012384	•	•	•	•	•	•	OIL PRESSURE SWITCH	A
54	3013674	•	•	•	•	•	•	OIL PRESSURE SWITCH	A
55	20124499	•	•	•	•	•	•	OIL TUBE	C
56	20075584	•	•	•	•	•	•	CONNECTOR	B
57	20042836	•	•	•	•	•	•	MOTOR	C
57	20124363	•	•	•	•	•	•	MOTOR	C
58	3006158	•	•	•	•	•	•	PUMP	C
58	3006236	•	•	•	•	•	•	PUMP	C
58	3006410	•	•	•	•	•	•	PUMP	C
59	20126622	•	•	•	•	•	•	AIR DAMPER	
60	20073814	•	•	•	•	•	•	PROTECTION	
61	3012795	•	•	•	•	•	•	BEARING	C
62	3012956	•	•	•	•	•	•	TRANSFORMER	B
63	3012948	•	•	•	•	•	•	AIR PRESSURE SWITCH	A
64	20086561	•	•	•	•	•	•	COVER	B
65	3013926	•	•	•	•	•	•	DISPLAY	
66	20010969	•	•	•	•	•	•	RELAY	C
67	20125063	•	•	•	•	•	•	STARTER	
69	20031413	•	•	•	•	•	•	HORN	
70	20096592	•	•	•	•	•	•	POWER REGULATOR	C
71	3012841	•	•	•	•	•	•	BASE	C
72	3020068	•	•	•	•	•	•	RELAY	C
73	20043329	•	•	•	•	•	•	TIMER	B
74	20030708	•	•	•	•	•	•	RELAY	C
75	20125077	•	•	•	•	•	•	BASE	C
76	20124500	•	•	•	•	•	•	OIL TUBE	C
77	20027021	•	•	•	•	•	•	SELECTOR SWITCH	
78	20028411	•	•	•	•	•	•	SELECTOR SWITCH	
79	20027422	•	•	•	•	•	•	SELECTOR SWITCH	
80	20010962	•	•	•	•	•	•	SELECTOR SWITCH	
81	20027020	•	•	•	•	•	•	YELLOW SIGNAL LIGHT	A
82	20036017	•	•	•	•	•	•	GREEN SIGNAL LIGHT	A
83	20036019	•	•	•	•	•	•	WHITE SIGNAL LIGHT	A
84	20027018	•	•	•	•	•	•	RED SIGNAL LIGHT	A
85	20028400	•	•	•	•	•	•	BASE	
86	3014106	•	•	•	•	•	•	FUSE	
87	3013940	•	•	•	•	•	•	CONNECTORS ASSEMBLY	
88	20075921	•	•	•	•	•	•	VIEWING PORT	
89	3013493	•	•	•	•	•	•	TUBE	
90	20028329	•	•	•	•	•	•	ELECTRONIC CAM	C
91	20124446	•	•	•	•	•	•	DIFFUSER	
92	20124484	•	•	•	•	•	•	MODULATOR	B
93	20124501	•	•	•	•	•	•	OIL TUBE	C
94	3020071	•	•	•	•	•	•	BASE	
95	20124411	•	•	•	•	•	•	CONTACTOR	C
96	20125234	•	•	•	•	•	•	STARTER	C
97	20122022	•	•	•	•	•	•	TIMER	B
98	20124630	•	•	•	•	•	•	CONTACTOR	C

## \*

## 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**

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