



## Forced draught gas burners

Progressive two stage or modulating operation



CODE	MODEL
C9327400	RS 190/E
C9327410	RS 190/E
20094407	RS 190/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 is present. An explosive atmosphere is defined as a mixture of dangerous substances with air, under atmospheric conditions, 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.



#### **MOUNT CASING**

This symbol indicates that it is mandatory to mount casing again after maintenance, cleaning or checks.



#### **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

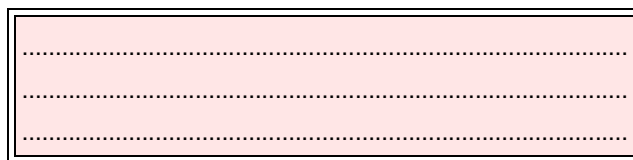
**Delivery of the system and the instruction manual**

When the system is delivered, it is important that:

- The instruction manual is supplied to the user by the system manufacturer, with the recommendation to keep it in the room where the heat generator is to be installed.
- The instruction manual shows:
  - the serial number of the burner;



- the address and telephone number of the nearest Assistance Centre;



- The system supplier carefully informs the user about:
  - the use of the system,
  - any further tests that may be necessary before the system is started up,
  - maintenance and the need to have the system checked at least once a year by the manufacturer or another specialised technician.

To ensure a periodic check, the manufacturer recommends the drawing up of a Maintenance Contract.

**1.2 Guarantee and responsibility**

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



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

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

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

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

**1.2.1 Owner's responsibility**

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

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

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

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



If you smell gas:

- Do not touch any electrical items.
- Open all windows.
- Close all gas supply valves.
- Contact your local gas authority immediately.
- Do not store flammable or hazardous materials in the vicinity of fuel burning appliances.
- Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death.
- Refer to this manual for instructional or additional information.
- Consult a certified installer, service representative or the gas supplier for further assistance.
- Burner shall be installed in accordance with manufacturers requirements as outlined in this manual, local codes and authorities having jurisdiction.

## 2 Safety and prevention

### 2.1 Introduction

The burners have been designed and built in compliance with current regulations and directives, applying the known technical rules of safety and envisaging all the potential danger situations.

It is necessary, however, to bear in mind that the imprudent and clumsy use of the equipment may lead to situations of death risk for the user or third parties, as well as the damaging of the burner or other items. Inattention, thoughtlessness and excessive confidence often cause accidents; the same applies to tiredness and sleepiness.

It is a good idea to remember the following:

- The burner must only be used as expressly described. Any other use should be considered improper and therefore dangerous.

In particular:

it can be applied to boilers operating with water, steam, diathermic oil, and to other users expressly named by the manufacturer;

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

- Modification of the burner to alter its performance and destinations is not allowed.
- The burner must be used in exemplary technical safety conditions. Any disturbances that could compromise safety must be quickly eliminated.
- Opening or tampering with the burner components is not allowed, apart from the parts requiring maintenance.
- Only those parts envisaged by the manufacturer can be replaced.



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:



- the user 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 Technical data

Model			RS 190/E
Output <sup>(1)</sup>	Maximum	kW MBtu/hr	1420 - 2542 4845 - 8673
	Minimum	kW MBtu/hr	522 1781
Fuel			Natural gas
- max. delivery		SCFH	8673
- pressure at max. delivery <sup>(2)</sup>		" WC	5.9
Operation			Low - high or modulating
Standard applications			Boilers: water, steam, thermal oil
Ambient temperature		°F	32 - 104 (0 - 40 °C)
Combustion air temperature		°F max	140 (60 °C)
Noise levels <sup>(3)</sup>		dB(A)	83.1

Tab. A

(1) Reference conditions: Ambient temperature 68 °F (20 °C) - Barometric pressure 39.4" WC - Altitude 329 ft.

(2) Pressure at test point 21)(Fig. 3), with zero pressure in the combustion chamber, with open gas ring 2)(Fig. 22) at maximum burner output

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

#### 3.2 Electrical data

Model		RS 190/E		
Control circuit power supply	V/Ph/Hz	120/1/60		
Main electrical supply	V/Ph/Hz	208-220/3/60	460/3/60	575/3/60
Fan motor IE2	rpm	3540	3540	3500
	HP	5.5	5.5	7.5
	V	208-230	460	575
	A	13.2	6.6	7.4
Ignition transformer	V1 - V2	120 V - 1 X 8 kV		
	I1 - I2	1.6 A - 20 mA		
Electrical power consumption	W max	4550		6350
Electrical control circuit cons.	W	750		750
Total electrical consumption	W	5300		7100
Electrical protection		NEMA 1		

Tab. B

#### 3.3 Burner models designation

Model	Code	Code RBNA	Voltage	Flame safeguard
RS 190/E	20051837	C9327400	208-230/3/60	Burner mounted
		C9327410	460/3/60	Burner mounted
RS 190/E	20090923	20094407	575/3/60	Burner mounted

Tab. C



## 3.4 Packaging - weight - Approximate measurements

- The packaging of the burner (Fig. 1) rests on a wooden platform that is particularly suitable for lift trucks.  
The overall dimensions of the packaging are shown in the table.
- The weight of the burner complete with its packaging is shown in table.

Inch	A	B	C	lbs
RS 190/E	59	30 <sup>29</sup> / <sub>32</sub>	39 <sup>3</sup> / <sub>8</sub>	245

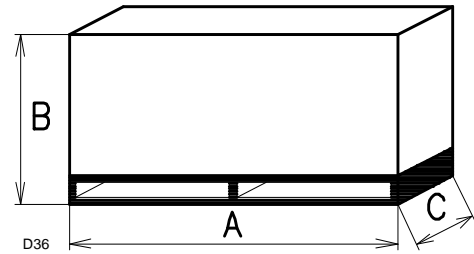


Fig. 1

## 3.5 Burner dimensions

The dimensions of the burner are shown in Fig. 2.

The dimensions of the open burner are indicated by position I.

Bear in mind that inspection of the combustion head requires the burner to be opened and the rear part drawn back on the sliding bars.

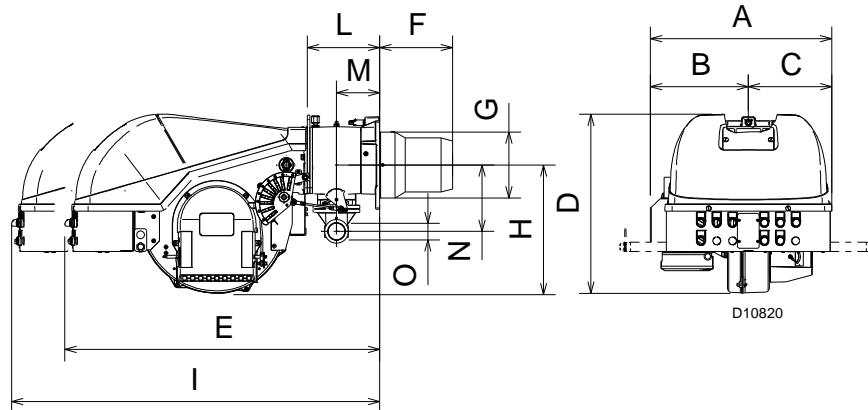


Fig. 2

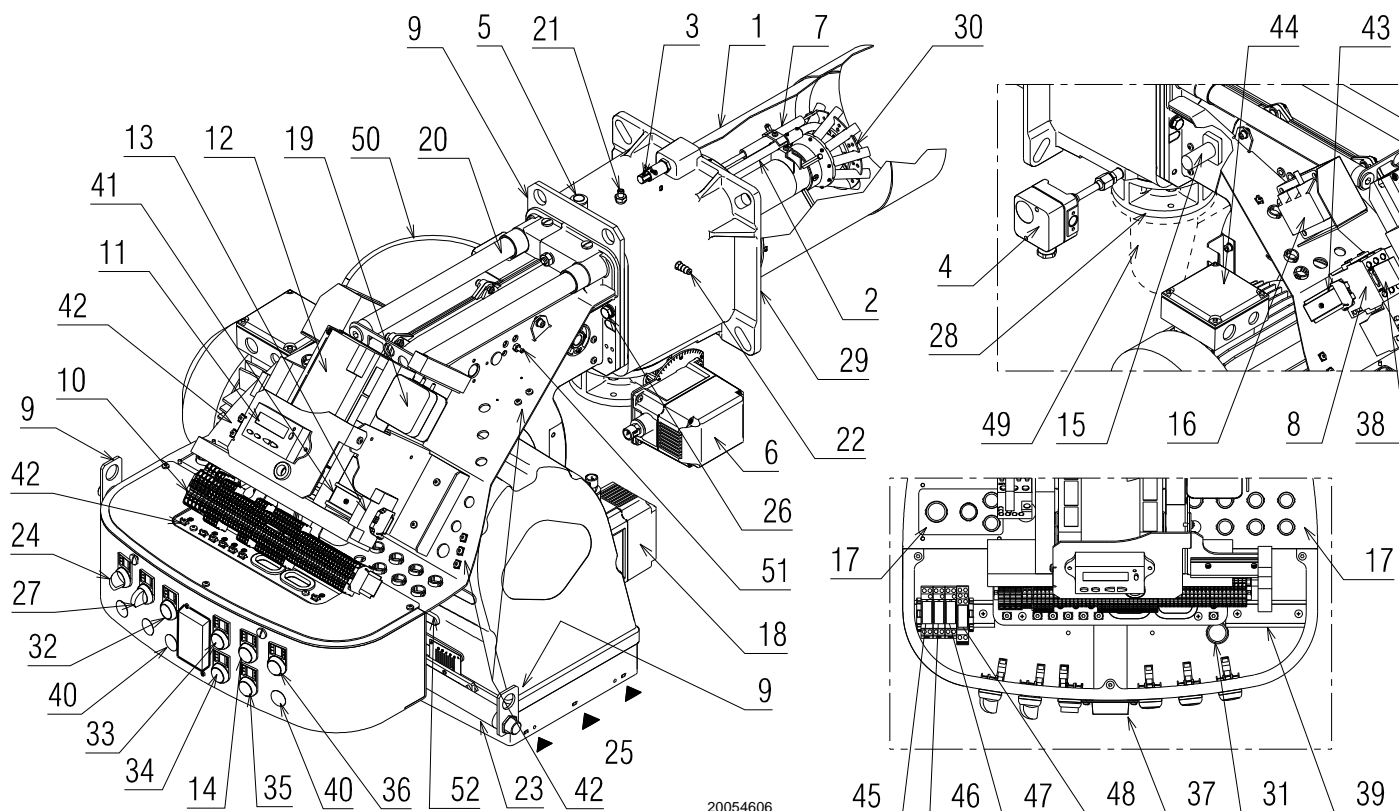
Inch	A	B	C	D	E	F	G	H	I	L	M	N	O
RS 190/E	28 <sup>47</sup> / <sub>64</sub>	16 <sup>47</sup> / <sub>64</sub>	12 <sup>13</sup> / <sub>64</sub>	23 <sup>53</sup> / <sub>64</sub>	40 <sup>3</sup> / <sub>4</sub>	14 <sup>31</sup> / <sub>32</sub>	8 <sup>3</sup> / <sub>4</sub>	17 <sup>21</sup> / <sub>64</sub>	65 <sup>15</sup> / <sub>32</sub>	8 <sup>25</sup> / <sub>32</sub>	5 <sup>5</sup> / <sub>8</sub>	8 <sup>3</sup> / <sub>4</sub>	2

## 3.6 Burner equipment

The burner is supplied complete with:

Gas train flange .....	No. 1
Flange gasket.....	No. 1
Connector for pilot line .....	No. 1
Screws (M10 x 40) to fix the flange .....	No. 4
Screws (M4 x 7) .....	No. 2
Disc .....	No. 1
Small disc .....	No. 1
Instruction manual .....	No. 1

### 3.7 Burner description



20054606

Fig. 3

- |  |   |
|--|---|
| 1 Combustion head  | 31 Horn   |
| 2 Burner pilot   | 32 Button "ALARM SILENCE"   |
| 3 Screw for combustion head adjustment   | 33 Signal "POWER ON"  |
| 4 Maximum gas pressure switch  | 34 Signal "IGNITION ON"   |
| 5 Burner pilot attachment  | 35 Signal "FUEL ON"   |
| 6 Gas actuator   | 36 Signal "ALARM ON"  |
| 7 Ignition electrode   | 37 RWF40 modulator (with analog output 4-20 mA)                                 |
| 8 Fan motor contactor and thermal relay with reset button  | 38 Auxiliary contact for fan motor contactor                                    |
| 9 Lifting ring   | 39 Din bar available for accessories  |
| 10 Terminal board for electrical wiring  | 40 Optional holes   |
| 11 Operator panel with LCD display   | 41 Din bar for fuse holder step-down transformer and OCI 412.10                 |
| 12 Control box for checking flame and air/fuel ratio   | 42 Ground terminals   |
| 13 Auxiliary fuse  | 43 Din bar for thermal relay, fan motor contactor and available for accessories |
| 14 Signal "CALL FOR HEAT"  | 44 Fan motor  |
| 15 UV flame sensor   | 45 $k_1$ relay  |
| 16 Ignition transformer  | 46 $k_5$ relay  |
| 17 Holes for cable grommets for electrical wiring for accessories (to be carried out by the installer) | 47 $k_3$ relay  |
| 18 Air actuator  | 48 $k_2$ relay  |
| 19 Air pressure switch (differential operating type)   | 49 Gas train flange   |
| 20 Sliding bars for opening the burner and inspecting the combustion head                              | 50 High voltage lead  |
| 21 Gas pressure test point and head fixing screw   | 51 Air pressure switch test point "+"   |
| 22 Air pressure test point   | 52 Air pressure switch test point "-"   |
| 23 Extension sliding bars  |   |
| 24 Switch "OFF - ON"   |   |
| 25 Fan air inlet   |   |
| 26 Screws to secure fan to pipe coupling   |   |
| 27 Switch "LOCAL REMOTE"   |   |
| 28 Gas butterfly valve   |   |
| 29 Boiler fixing flange  |   |
| 30 Flame stability disc  |   |
- Two types of burner failure may occur:
- Flame safeguard lock-out - if the flame safeguard alarm 36)(Fig. 3) lights up, it indicates that the burner is in lock-out. To reset, press the reset pushbutton.
  - Fan motor trip - release by pressing the pushbutton on thermal overload 8) (Fig. 3). See "Thermal relay Thermal relay calibration" on page 25.

The **maximum output** is chosen within area **A** of the diagram (Fig. 4).

The **minimum output** must not be lower than the minimum limit of the diagrams.



The firing rate was obtained considering a room temperature of 68 °F and an atmospheric pressure of 394 "WC (approx. 0 ft above sea level), with the combustion head adjusted.

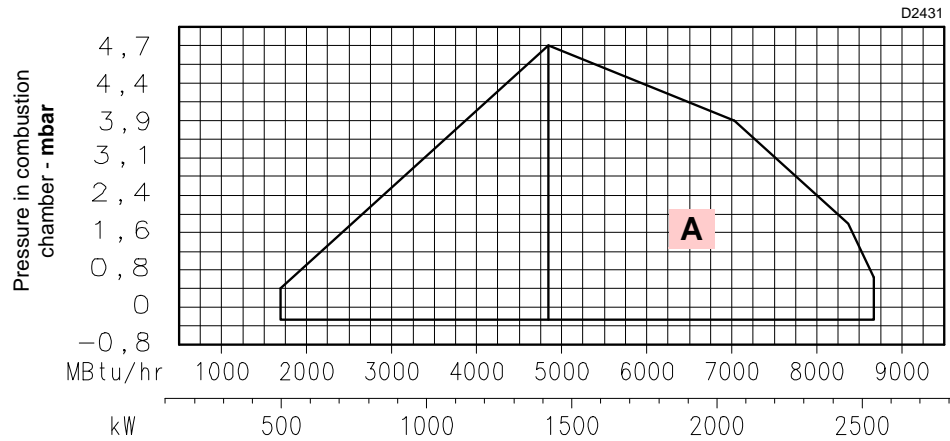


Fig. 4

### 3.7.1 Procedure to refer burner operating condition in high altitude plants

Find the **CORRECTED BURNER CAPACITY** for the plant's altitude in chart 1 and the **CORRECTED PRESSURE** in chart 2.

Check in the firing rate graph of the burner (Fig. 4), if the working point defined by the values above is within the range limits.

If not, higher burner size is needed.

#### Note

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

#### Example

Rated capacity = 3000 MBtu/hr - Rated air pressure = 1.5" WC  
 Real altitude = 5000 ft - Real temperature = 108°F  
 $\Delta$  = 108°F - 68°F (reference temp.) = 40°F  
 (equivalent 2000 ft variation)  
 $40 : 2 = 20 \times 100 = 2000$  ft

Proceeding as described above and considering a "virtual altitude" of (5000 + 2000) ft:

- 3000 MBtu/hr at 7000 ft, the corrected capacity is 3847 MBtu/hr
- 1.5" WC at 7000 ft, the corrected burner air pressure is 1.92

#### Reference conditions:

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

**1 CORRECTED BURNER CAPACITY ACCORDING TO ALTITUDE**

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

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

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

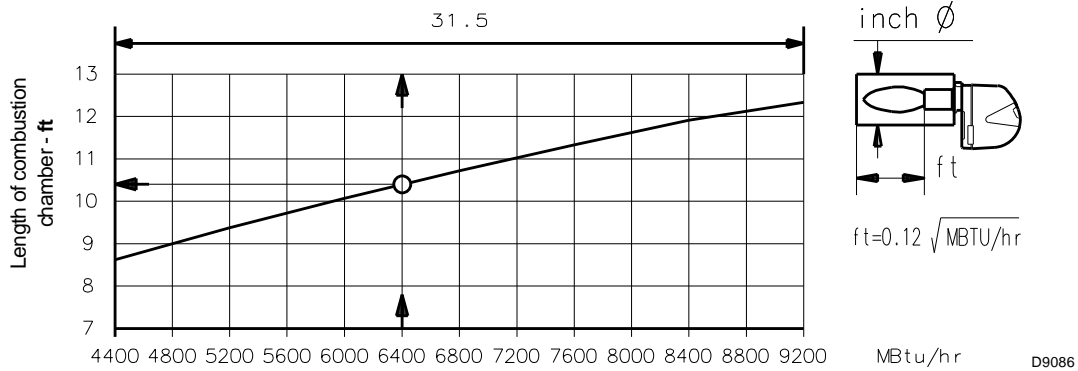
## 3.8 Minimum furnace dimensions

The firing rates were obtained in special test boilers.

Fig. 5 indicates the diameter and length of the test combustion chamber.

### Example

Output 6400 Mbtu/hr - diameter 31.5 inch - length 10.4 ft.



**Fig. 5**

### 3.9 Control box for the air/fuel ratio (LMV37.4...)

#### Warning notes



**WARNING**

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

**The LMV37.4... is a safety device!**

**Do not open, interfere with or modify the unit.**

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

- 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 control box for the air/fuel ratio (Fig. 6), (hereafter referred to simply as the control box), 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).

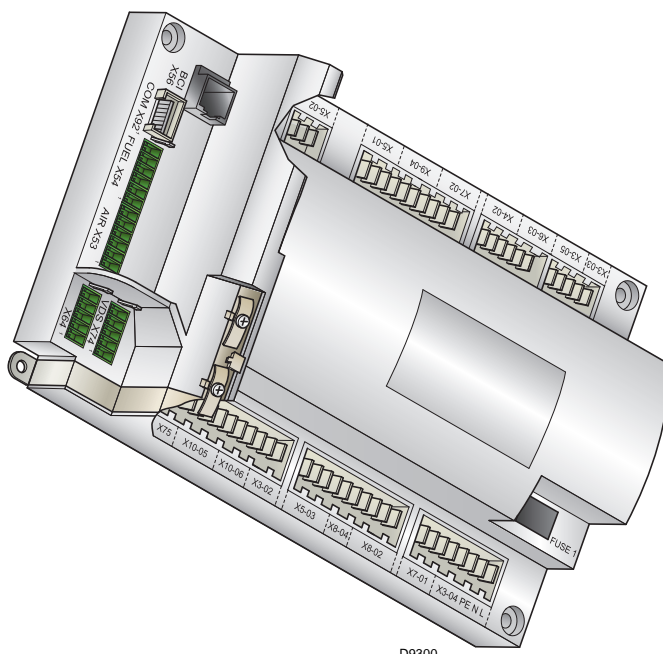
The basic functions carried out by the control box relate to:

- 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 LMV37.4... basic unit:

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



D9300

**Fig. 6**

#### 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 LMV37.4... to the AZL2... together with other cables.



**WARNING**

**The first start-up, like every further operation for the internal settings of the control box, 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

LMV37.4... 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 loading 'Inputs'	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 loading 'Outputs'	<b>Total contact loading:</b>	
	<ul style="list-style-type: none"> <li>Nominal voltage</li> <li>Unit input current (safety loop) from:</li> <li>- Fan motor contactor</li> <li>- Ignition transformer</li> <li>- Valves</li> <li>- Oil pump / magnetic clutch</li> </ul>	AC 120 V, 50 / 60 Hz Max. 5 A
	<b>Individual contact loading:</b>	
	Fan motor contactor	
	<ul style="list-style-type: none"> <li>Nominal voltage</li> <li>Nominal current</li> <li>Power factor</li> </ul>	AC 120 V, 50 / 60 Hz 1.6 A pilot duty load declaration to UL372 $\cos\phi > 0.4$
	Alarm output	
	<ul style="list-style-type: none"> <li>Nominal voltage</li> <li>Nominal current</li> <li>Power factor</li> </ul>	AC 120 V, 50 / 60 Hz 1 A $\cos\phi > 0.4$
	Ignition transformer	
	<ul style="list-style-type: none"> <li>Nominal voltage</li> <li>Nominal current</li> <li>Power factor</li> </ul>	AC 120 V, 50 / 60 Hz 1.6 A pilot duty load declaration to UL372 or 250 VA ignition load declaration to UL372 $\cos\phi > 0.2$
	Fuel valves	
	<ul style="list-style-type: none"> <li>Nominal voltage</li> <li>Nominal current</li> <li>Power factor</li> </ul>	AC 120 V, 50 / 60 Hz 1.6 A pilot duty load declaration to UL372 $\cos\phi > 0.4$
	Operation display	
	<ul style="list-style-type: none"> <li>Nominal voltage</li> <li>Nominal current</li> <li>Power factor</li> </ul>	AC 120 V, 50 / 60 Hz 0.5 A $\cos\phi > 0.4$
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.

### Operation sequence of the burner

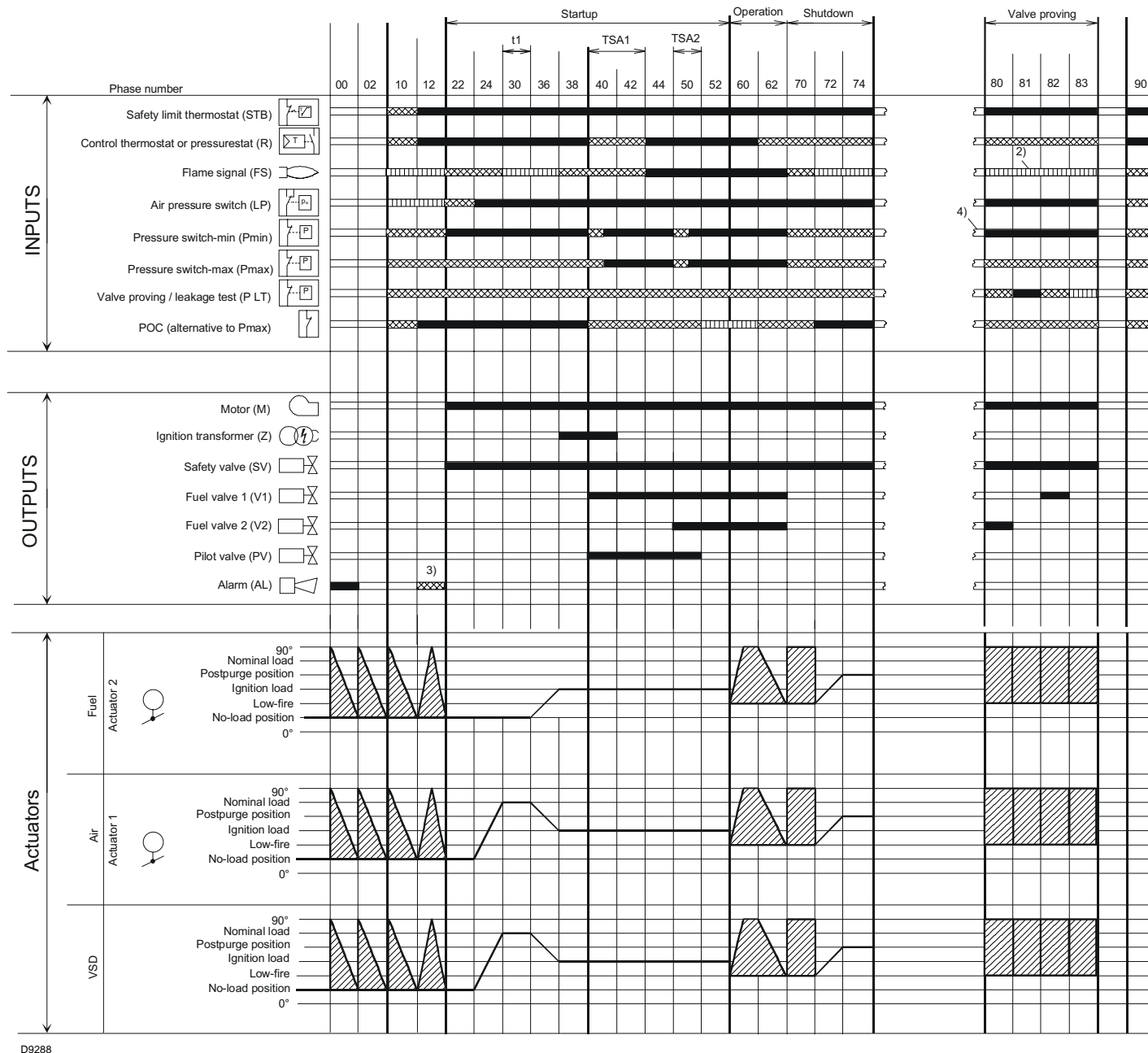


Fig. 7

#### Legend to the sequence diagrams:

Valve proving takes place depending on the parameter:

2) Only with valve proving on startup

3) Parameter: with/without alarm in the event of start prevention

4) In the event of an erroneous signal on startup, 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 Prepurge time

TSA1 Safety time 1 gas / oil

TSA2 Safety time 2 gas / oil



## 3.10 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. 8) 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 control box, 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.

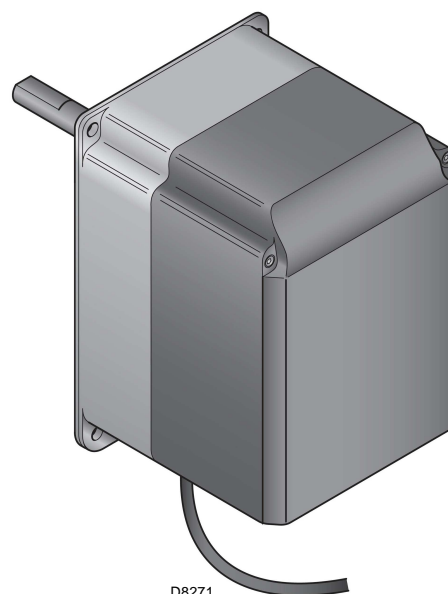
### Installation notes

- 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.**



D8271

**Fig. 8**

### Technical data

Operating voltage	AC / DC 24 V $\pm 20\%$ (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 control box)
Firing rate	0 - 90°
Cable connection	RAST2,5 connectors
Direction of rotation	Clockwise/anticlockwise (can be selected from the control box)
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 xC
Humidity	< 95 % r.h.

## 4 Installation

### 4.1 Notes on safety for the installation

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



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



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



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



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

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

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



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



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

### 4.3 Preliminary checks

#### Checking the consignment



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



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



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



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

## 4.4 Operating position



- The burner is designed to operate only in positions 1, 2, 3 and 4 (Fig. 9).
- 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.

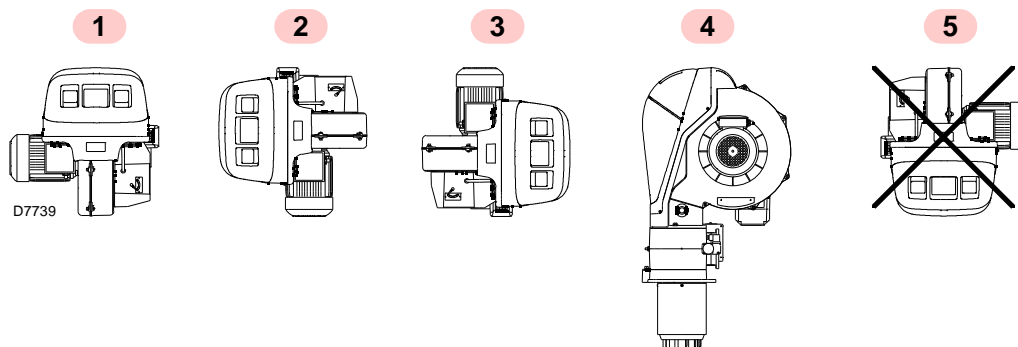


Fig. 9

## 4.5 Preparing the boiler

### 4.5.1 Boring the boiler plate

Make holes in the plate shutting off the combustion chamber, as illustrated in Fig. 10.

The position of the threaded holes can be marked using the thermal insulation screen supplied with the burner.

- For boilers with front flue passes 13)(Fig. 11) or flame inversion chambers, a protection in refractory material 11) must be inserted between the boiler refractory 12) and the blast tube 10). This protection must not compromise the extraction of the blast tube.
- For boilers with a water-cooled frontal, a refractory lining is not necessary 11)-12)(Fig. 11) unless expressly requested by the boiler manufacturer.

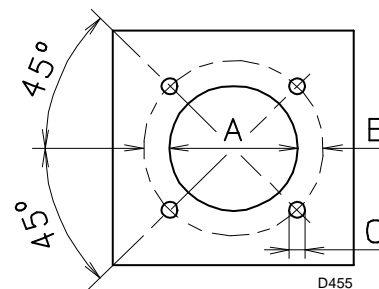


Fig. 10

inch	A	B	C
RS 190/E	9 1/16	12 25/32 - 14 1/2	5/8 W

Tab. D

### 4.6 Securing the burner to the boiler



Provide an adequate lifting system of the burner.

- Secure the burner to the boiler, fixing the flange 9 (Fig. 11) to the boiler plate and interposing the insulating gasket 8).
- Use the 4 screws supplied, with a tightening torque of 26-29 Lbf. ft, after protecting their thread with anti-seize products.

- The seal between burner and boiler must be airtight.
- After the start-up, check there is no leakage of flue gases into the external environment.



The seal between burner and boiler must be airtight; after the start-up, check there is no leakage of flue gases into the external environment.

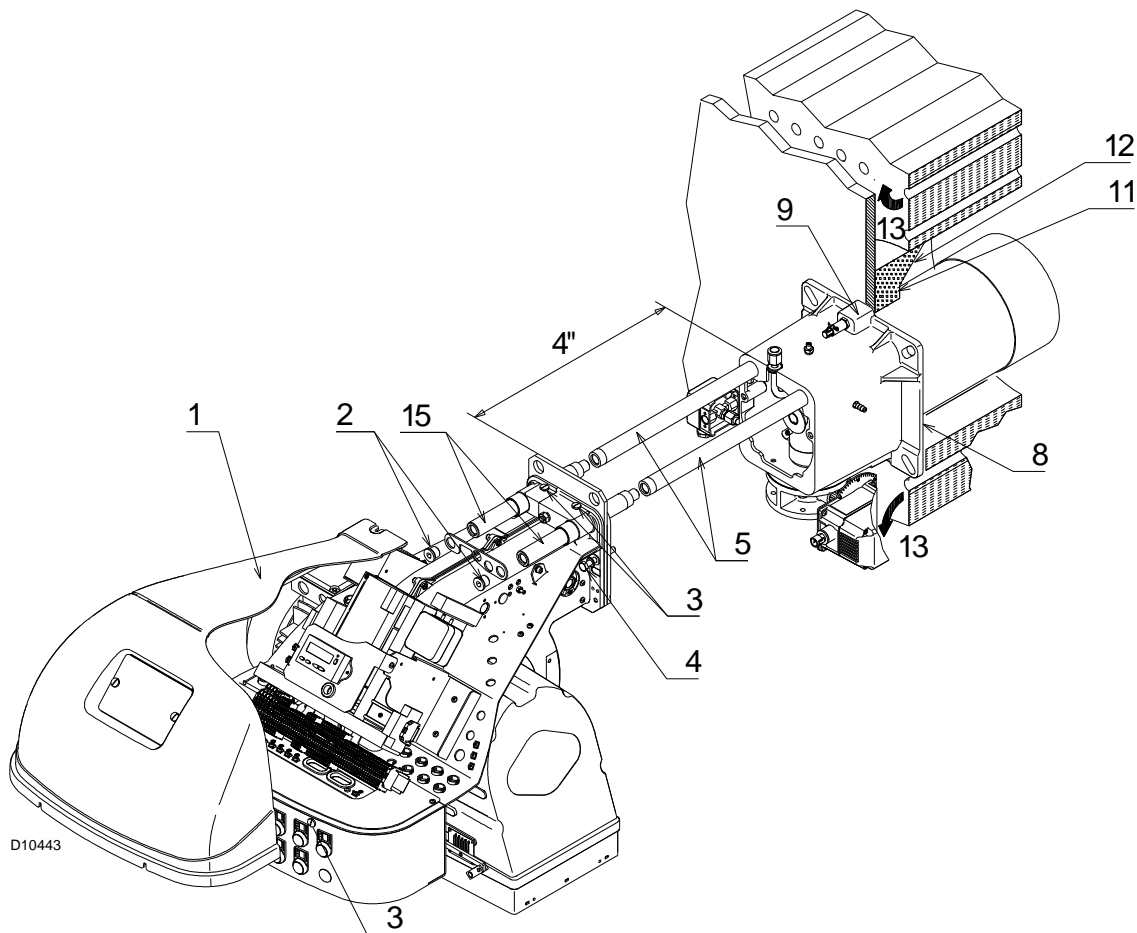


Fig. 11

## 4.7 Electrode positioning

To verify the correct position of the ignition electrode (Fig. 12), you need to separate the combustion head from the rest of the burner.

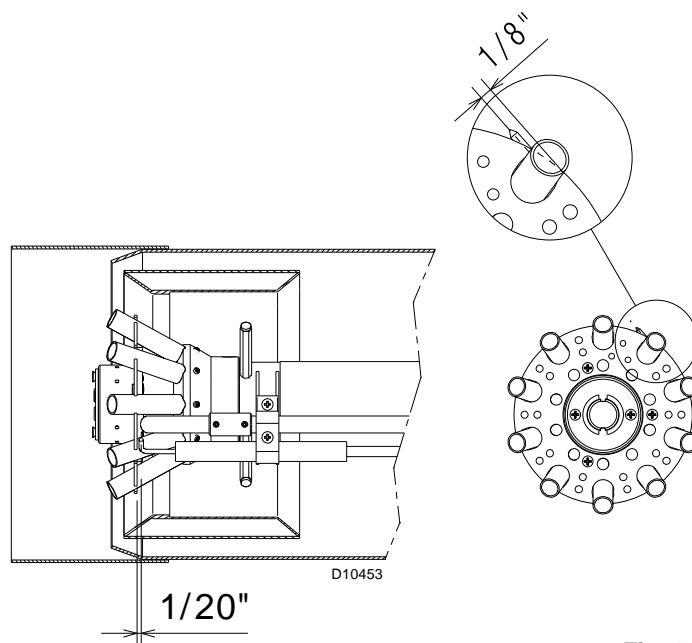
Proceed as follows:

- loosen the 4 screws 3)(Fig. 11) and remove the cover 1);
- remove the screws 2) from the two sliding bars 5);
- install the extensions 15) and re-screw the screws 2);
- remove the two screws 4);
- pull back the burner on the sliding bars 5) of about 4";
- disconnect the electrode lead, then unthread the burner completely from the sliding bars;
- remove the screw 1)(Fig. 13) and extract the inner part 2) of the head;
- check the correct position of ignition electrode, as shown in Fig. 12.

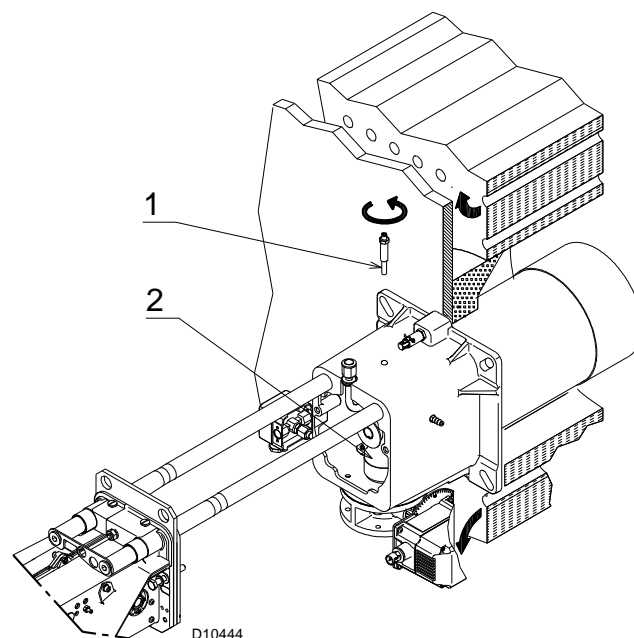


**Measures must be respected.**

- Re-install all components with reverse procedure.



**Fig. 12**



**Fig. 13**

### 4.8 Combustion head adjustment

At this point of the installation, the combustion head is fixed to the boiler as shown in Fig. 13.

It is therefore especially easy to adjust, and this adjustment depends only on the maximum output of the burner.

Two adjustments of the head are foreseen:

- air adjustment
- gas adjustment

In the diagram of Fig. 14, find the notch at which to adjust both air and central gas/air.

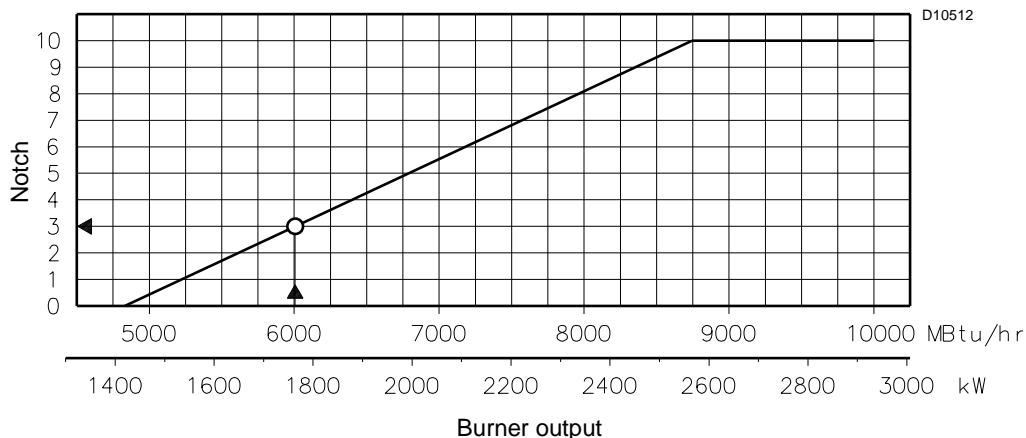


Fig. 14

#### 4.8.1 Air adjustment

Rotate the screw 2) (Fig. 15) until the notch you have found corresponds with the front surface 1) of the flange.



To facilitate adjustment, loosen the screw 3) (Fig. 15), adjust and then lock.

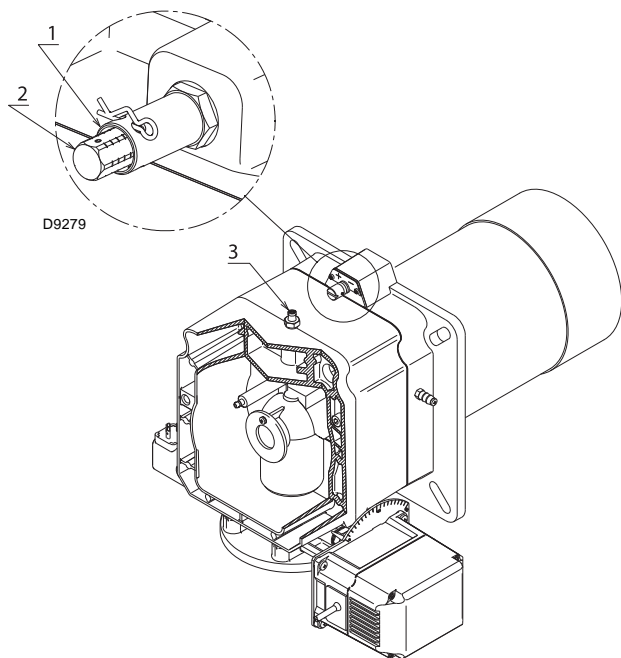


Fig. 15

#### 4.8.2 Gas adjustment

When the burner is working at the maximum output  $\leq 5680$  MBtu/hr fit the discs 1) and 2) (Fig. 16), supplied as part of the standard equipment, removing the internal tube 3) (Fig. 16).

If the mains gas pressure is low, the head can be left in the standard set-up, limiting the modulation minimum to 1970 MBtu/hr.

##### Example:

Burner output = 6000 MBtu/hr

The diagram of Fig. 14 shows that the adjustments for this potential is external air R1 = notch 3.

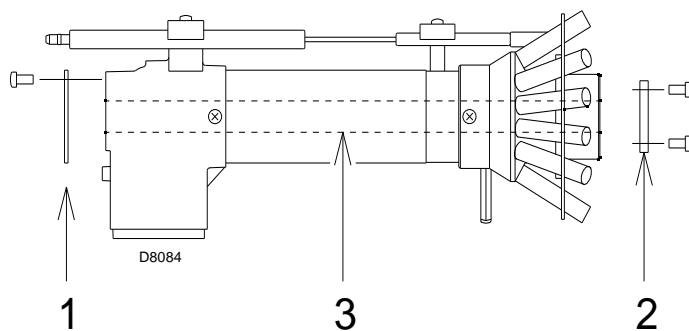


Fig. 16

##### NOTE:

The diagram indicates the optimum adjustment for a type of boiler according to Fig. 5.

The adjustments indicated can be modified during the initial start-up.

## 4.9 Burner closing

Once the combustion head adjustment is completed:

- push the burner on the sliding bars 3) at approximately 4" from the pipe coupling 4) - burner in the position shown in Fig. 17;
- insert the electrode cable, then slide the burner as far as the pipe coupling - burner in the position shown in Fig. 18;
- unscrew the 2 screws 2) from the extension 5) and reposition them as previously Fig. 18.
- refit the screws 2) on the sliding bars 3);
- fix the burner to the pipe coupling with the screws 1).

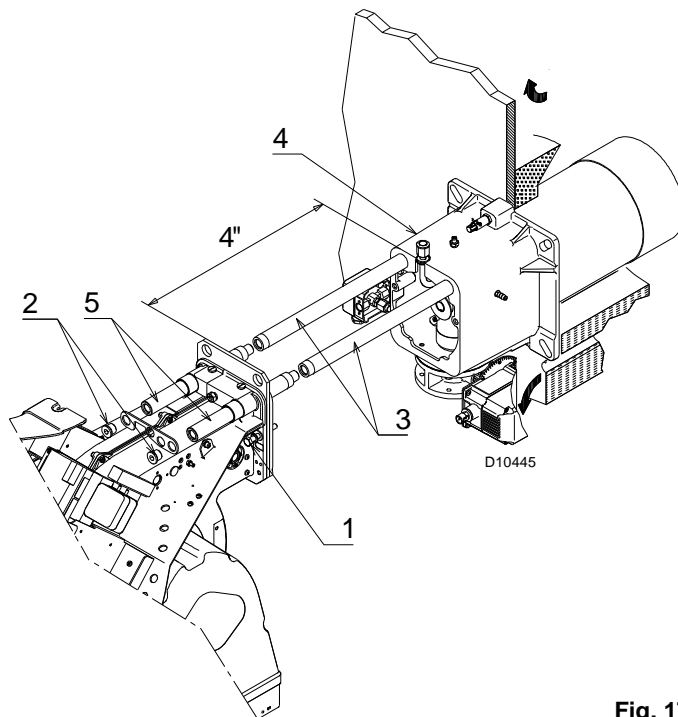


**WARNING**

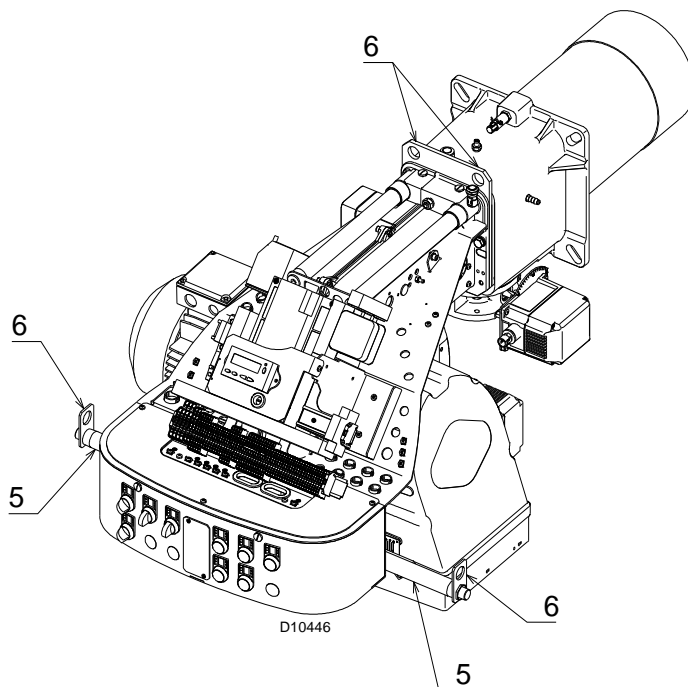
**When fitting the burner on the two sliding bars, it is advisable to gently draw out the high voltage cable until it is slightly taut.**

Key (Fig. 17 and Fig. 18)

- 1 Screws
- 2 Screws
- 3 Sliding bars
- 4 Pipe coupling
- 5 Extension sliding bars
- 6 Lifting rings



**Fig. 17**



**Fig. 18**

### 4.10 Gas supply



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

Precautions: avoid knocking, attrition, sparks and heat.

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



**WARNING**

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

#### 4.10.1 Gas train



**DANGER**

Disconnect the electrical power using the main system switch.



Check that there are no gas leaks.



Beware of train movements: danger of crushing of limbs.



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



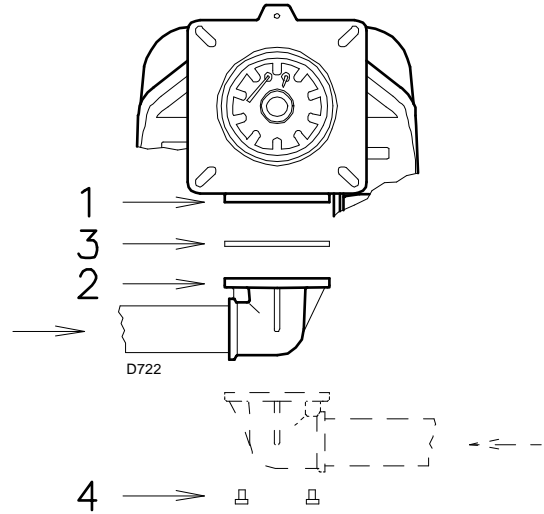
The operator must use appropriate tools for installation.

- The gas train is type-approved according to standard UL 795 and is supplied separately from the burner.
- The gas train can enter the burner from the right or left side, depending on which is the most convenient.
- The gas train must be connected to the gas attachment 1) (Fig. 19) with the flange 2), the gasket 3) and the screws 4) supplied with the burner.
- The gas solenoids must be as close as possible to the burner, to ensure that the gas reaches the combustion head within the safety time of 3s.
- Ensure that the maximum pressure necessary for the burner is included in the calibration field of the pressure regulator (colour of the spring).



**WARNING**

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



**Fig. 19**

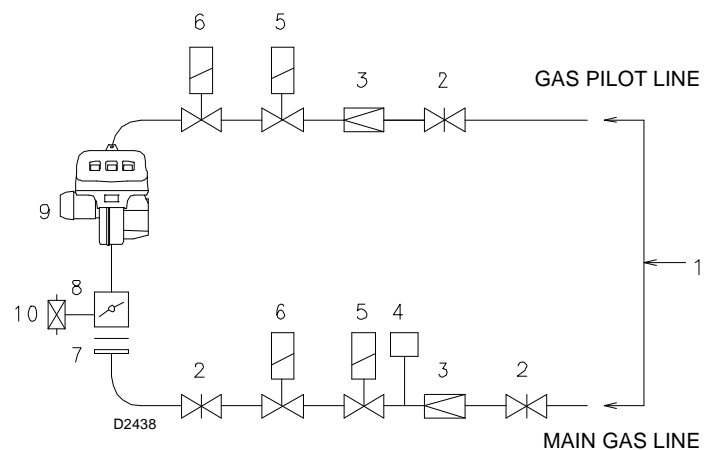
#### 4.10.2 Gas feeding line

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

Key (Fig. 20)

- 1 Gas input pipe
- 2 Manual valve
- 3 Pressure regulator
- 4 Minimum gas pressure switch
- 5 1st safety shut off valve
- 6 2nd safety shut off valve
- 7 Standard issue burner with flange gasket
- 8 Gas adjustment butterfly valve (\*)
- 9 Burner
- 10 Maximum gas pressure switch (\*)

(\*) On the burner



**Fig. 20**



### 4.10.3 Gas pressure

The diagram (Fig. 21) shows minimum load losses at combustion head depending on the maximum burner output operation with natural gas (G 20).

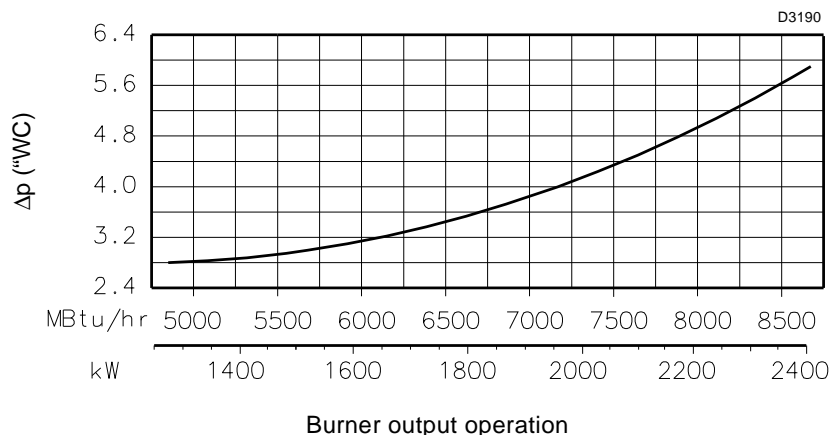


Fig. 21

Gas pressure is measured at the test point 1)(Fig. 22), with:

- Combustion chamber at 0 mbar
- Burner working at maximum output
- Ring nut 2)(Fig. 15) adjusted as in the diagram of Fig. 14

#### NOTE

To know the approximate output at which the burner is operating at its maximum:

- subtract the combustion chamber pressure from the gas pressure measured at test point 1)(Fig. 22);
- find, in the diagram (Fig. 21) the pressure value closest to the result you want;
- read the corresponding output on the left.

#### Example RS 190/E

- Maximum output operation
- Ring nut 2)(Fig. 15) adjusted as in the diagram of Fig. 14
- Gas pressure at test point 1)(Fig. 22) = 6 "wc
- Pressure in combustion chamber = 1.2 "wc
- $6.0 - 1.2 = 4.8$  "wc

A maximum output of 7800 MBtu/hr corresponds to 4.8 "wc pressure. This value serves as a rough guide; the effective output must be measured at the gas meter.

#### NOTE

To know the required gas pressure at test point 1)(Fig. 22), set the maximum output required from the burner operation, then:

- find the nearest output value in the table for the burner in question.
- read, on the diagram (Fig. 21), the pressure test point 1) (Fig. 22);
- add this value to the estimated pressure in the combustion chamber.

#### Example RS 190/E

- Maximum output required: 7800 MBtu/hr
  - Ring nut 2)(Fig. 15) adjusted as in the diagram of Fig. 14
  - Gas pressure at output of 7800 MBtu/hr = 4.8 "wc
  - Pressure in combustion chamber = 1.2 "wc
  - $4.8 + 1.2 = 6.0$  "wc
- pressure required at pressure test point 1)(Fig. 22).

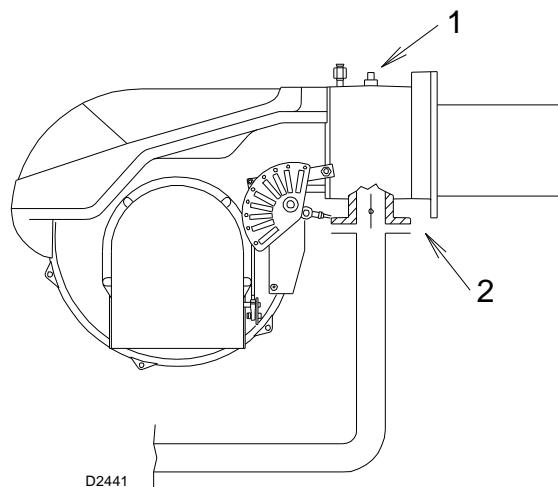


Fig. 22

MBtu/hr	kW	$\Delta p$ "WC
4848	1421	0.5
5302	1554	0.6
5681	1665	0.7
6060	1776	0.8
6438	1887	0.9
6817	1998	1.1
7196	2109	1.2
7575	2220	1.3
7953	2331	1.4
8673	2542	1.7

$\Delta p$  "WC gas butterfly 2)(Fig. 22)

Tab. E

### 4.11 Electrical wiring

#### Notes on safety for the electrical wiring



**WARNING**

- 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  $\frac{1}{8}$  inch (overvoltage category) between the contacts, as indicated by the current safety standards.
- Do not touch the device with wet or damp body parts and/or in bare feet.
- Do not pull the electric cables.

Before carrying out any maintenance, cleaning or checking operations:



**DANGER**

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



**DANGER**

close the fuel interception tap;



**DANGER**

avoid condensate, ice and water leaks from forming.

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

#### 4.11.1 Supply cables and external connections passage

All the cables to be connected to the burner are fed through the grommets. The use of the cable grommets can take various forms.

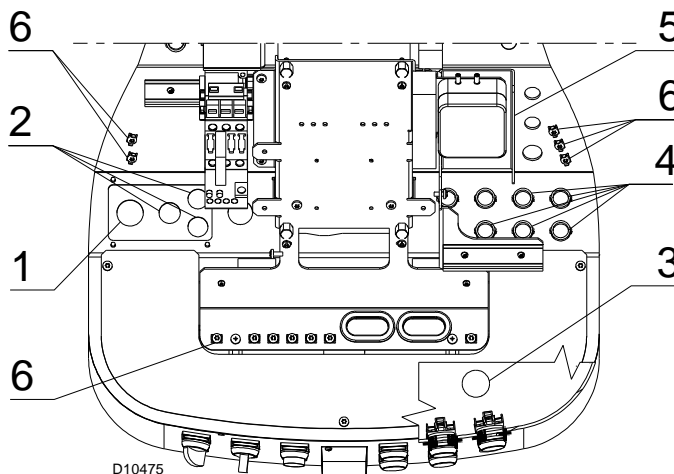
By way of example we indicate the following mode (according to **UL795**):

- 1 Three phase power supply with  $\frac{3}{4}$  inch cable grommet.
- 2 Available: single phase power supply and other devices with  $\frac{1}{2}$  inch cable grommet.
- 3 Horn
- 4 Available: consents/safety, minimum gas pressure switch, gas valves and other devices with  $\frac{3}{8}$  inch cable grommet.
- 5 Anchor plate for installation of step down transformer.
- 6 Available for ground terminals



**WARNING**

The control panel is in compliance with UL508A.



**Fig. 23**



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

## 4.12 Thermal relay calibration

Depending on the burner type, there are two different thermal relays:

- Electro-mechanical thermal relay (used for single phase motors)
- Electronic thermal relay (used for three phase motors)

### 4.12.1 Electro-mechanical thermal relay

The electro-mechanical thermal relay (Fig. 24) is used to avoid damage to the motor owing to a strong increase in absorption or the lack of a phase.

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

This arises when the power supply of the motor is a nominal value.

- To reset, in the case of an intervention of the thermal relay, press the button “RESET” (Fig. 24).
- The button “STOP” (Fig. 24) opens the NC (95-96) contact and stops the motor.

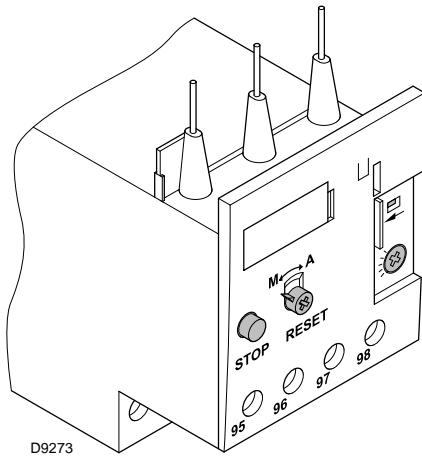


Fig. 24

- To test the thermal relay, insert a screwdriver in the window “TEST” (Fig. 28) and move it in the sense of the arrow (towards right).



WARNING

**Automatic resetting can be dangerous.**

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

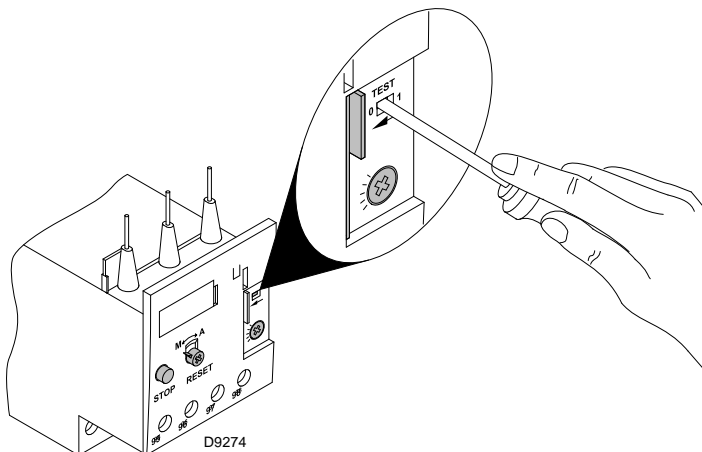


Fig. 25

### 4.12.2 Electronic thermal relay

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

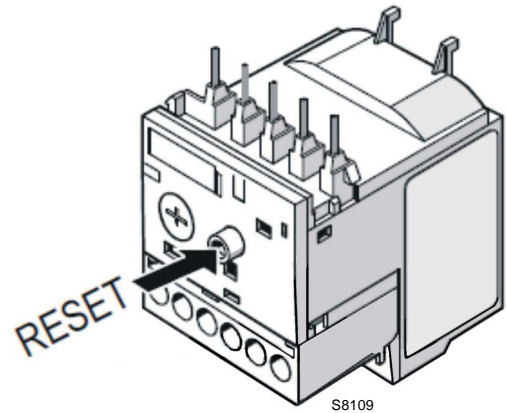


Fig. 26

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

- **Device test (Fig. 27)**

Push slowly the button in the window with a little screwdriver.

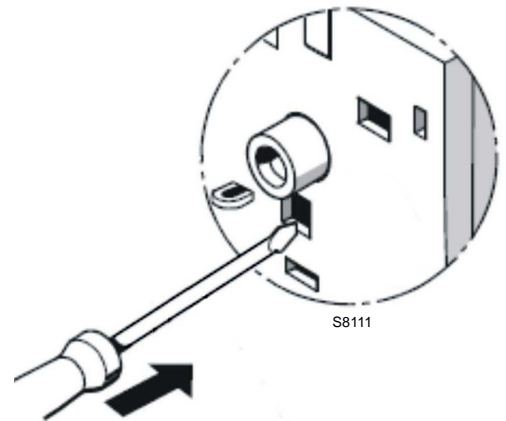


Fig. 27

- **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.

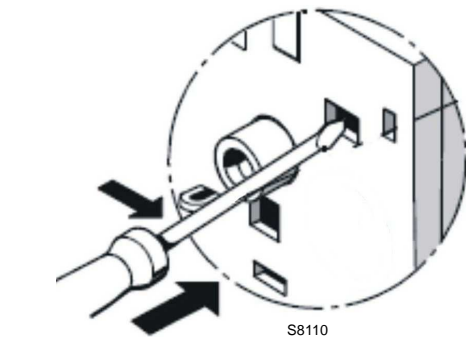


Fig. 28

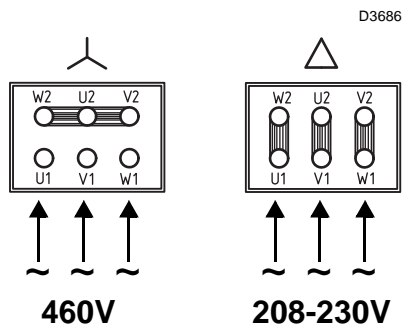
### 4.13 Motor connection at 208-230 or 460V

#### WARNING:

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

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

#### IE1



#### IE2/Epact

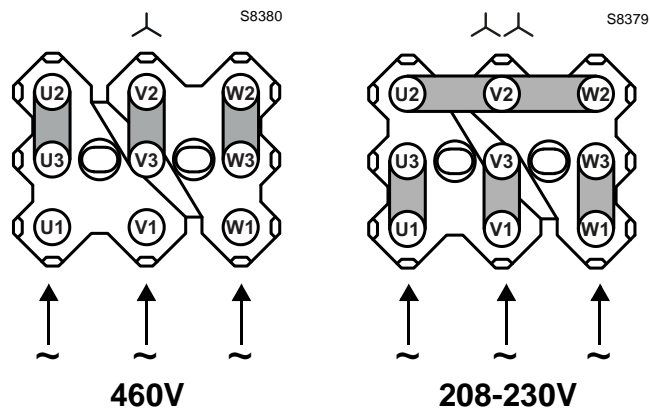


Fig. 29

### 4.14 Motor connection at 575V

#### WARNING:

the motors, manufactured for 575V **IE2/Epact** voltage, have the same control box base of the IE1 motors.

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

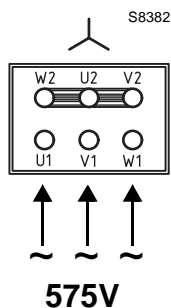


Fig. 30

### 4.15 Reversible direction

#### WARNING:

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

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

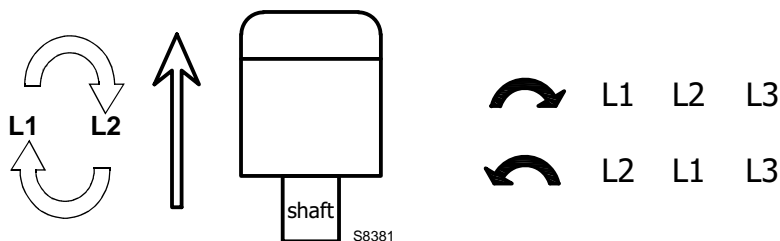


Fig. 31

**5 Start-up, calibration and operation of the burner****5.1 Notes on safety for the first start-up****WARNING**

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.

**WARNING**

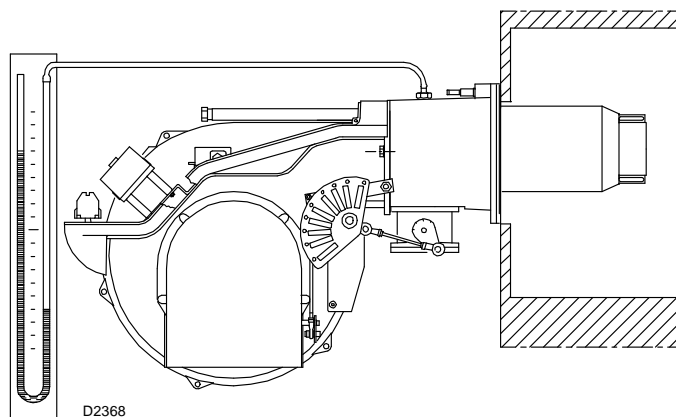
Check the correct working of the adjustment, command and safety devices.

**5.2 Adjustments before first firing**

- Ensure that the gas supply company has carried out the supply line vent operations, eliminating air or inert gases from the piping.
- Slowly open the manual valves situated upstream of the gas train.
- Adjust the minimum gas pressure (Fig. 36) switch to the start of the scale.
- Adjust the maximum gas pressure switch (Fig. 35) to the end of the scale.
- Adjust the air pressure switch (Fig. 34) to the start of the scale.
- Purge the air from the gas line.  
Fit a U-type manometer (Fig. 32) to the gas pressure test point on the sleeve.  
The manometer readings are used to calculate the MAX. burner power using the diagram on page 23.

**CAUTION**

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 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 RWF 40 regulator. Please refer to the specific manual for this operation. Turn the switch of Fig. 33 to position “ON” and turn the switch of Fig. 33 to position “LOCAL”.



Make sure that the lamps or testers connected to the solenoids, or indicator lights on the solenoids themselves, show that no voltage is present. If voltage is present, stop the burner **immediately** and check the electrical wiring. When the burner starts, check the direction of the motor rotation, as indicated in Fig. 33.

As the burner is not fitted with a device to check the sequence of the phases, the motor rotation may be incorrect. As soon as the burner starts up, go in front of the cooling fan of the fan motor and check it is rotating anticlockwise.

If this is not the case:

- place the switch of Fig. 33 in position “0” and wait for the control box to carry out the switch-off phase;
- disconnect the electrical supply from the burner;
- invert the phases on the three-phase power supply.

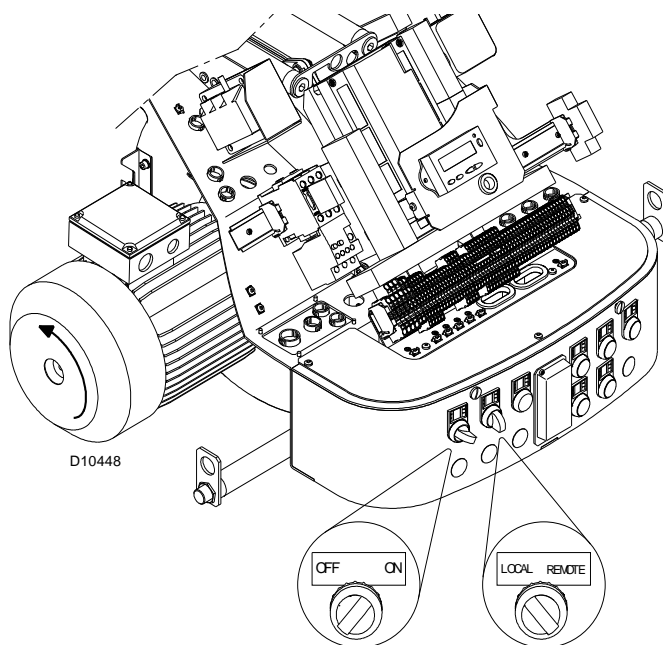


Fig. 33



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

### 5.4 Combustion air adjustment

Fuel/combustion air must be synchronized with the relevant servomotors (air and gas) by storing a setting curve by means of the electronic cam.

To reduce pressure loss and to have a wider adjustment range, it is best to set the servomotor to the maximum output used, as near to maximum opening (90°) as possible.

On the gas butterfly valve, the fuel's partial setting adjustment based on required output, with the servomotor fully open, is made by using the pressure stabilizer on the gas train.

With O<sub>2</sub> control via the relative kit, follow the instructions about commissioning in the specific handbook for the LMV52.... instrument provided at the Technical Service Training.

#### 5.4.1 Adjusting gas/air delivery

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

#### 5.4.2 Air/fuel control and power modulation system

The air/fuel and power modulation system installed on **RS** burner series provides, a set of integrated functions ensuring top level energy and operational performance from the burner, both for single and grouped burners (e.g. boiler with a double combustion chamber or several generators in parallel).

The system includes the following basic functions:

- air and fuels are supplied in correct quantities by positioning the valves by direct servo-control, thus avoiding the possibility of play typical of systems used for traditional modulating burners, in which settings are obtained by levers and a mechanical cam;
- burner power is modulated according to the load required by the system, while boiler pressure or temperature is maintained at set operating values;
- fine, continuous correction of the airflow according to the analysis of the flue gases at the stack (O<sub>2</sub>); this function is associated with the O<sub>2</sub> kit containing the PLL module and the QGO2 sensor;
- measurement of the combustion efficiency; this function is associated with the O<sub>2</sub> kit;
- a sequence (cascade control) of several boilers by suitably connecting different units.

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

## NOTE

The first start-up and all further operations concerning internal settings of the control system or expansion of basic functions, are accessed with a password and are reserved for technical service personnel specifically trained for internal programming of the instrument and for the specific application obtained with this burner.

The first start-up and curve synchronization manual is supplied with the burner.

The complete manual for checking and setting all parameters will be provided on application.

## 5.5 Final calibration of the pressure switches

### 5.5.1 Air pressure switch

The air pressure switch is connected in differential (see Fig. 34) and is activated by both the negative pressure of the air intake and the air pressure from the fan.

Adjust the air pressure switch 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.

### 5.5.2 Maximum gas pressure switch

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

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

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

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

### 5.5.3 Minimum gas pressure switch

Adjust the minimum gas pressure switch (Fig. 36) after having performed all the other burner adjustments with the pressure switch set at the start of the scale.

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

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

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

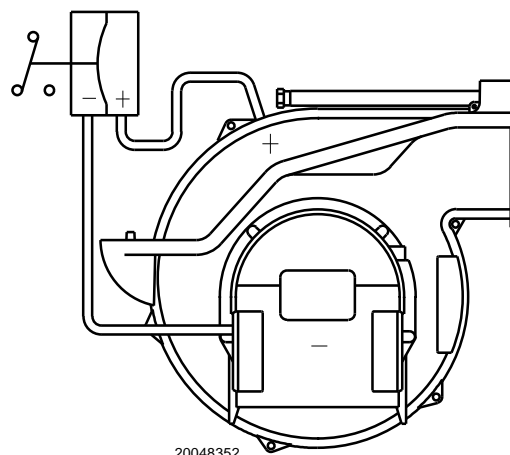


Fig. 34

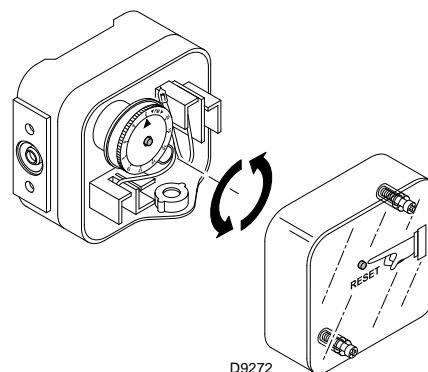


Fig. 35

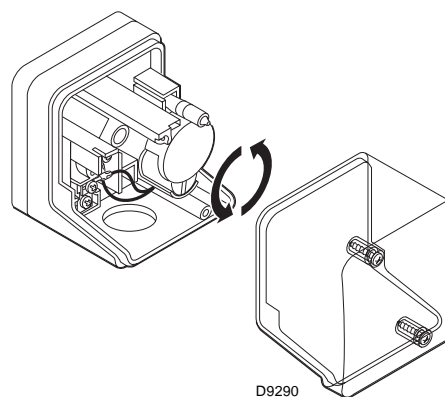


Fig. 36



5.6 Flame signal measurement

Check the flame signal through the parameter 954, as indicated in Fig. 37. 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. 37) shows parameter **954**: flashing on the left.

On the right, the flame's intensity is displayed as a percentage.  
Example: **954: 0.0**

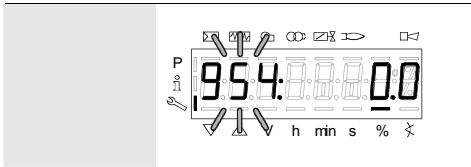


Fig. 37

5.7 Final checks (with the burner working)

➤ Open the control limit operation	➡	The burner must stop
➤ Open the high limit operation	➡	
➤ Rotate the maximum gas pressure switch knob to the minimum end-of-scale position	➡	The burner must stop in lockout
➤ Rotate the air pressure switch knob to the maximum end of scale position	➡	
➤ Switch off the burner and disconnect the voltage	➡	The burner must not start
➤ Disconnect the minimum gas pressure switch	➡	
➤ Cover the UV flame sensor	➡	The burner must stop in lockout due to firing failure



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



## 6 Maintenance

### 6.1 Notes on safety for the maintenance

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

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



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

Before carrying out any maintenance, cleaning or checking operations:



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



Close 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 Checking and cleaning



The operator must use the required equipment during maintenance.

#### Combustion

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

#### Combustion head

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

#### Fan

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

#### Burner

Clean the outside of the burner.

Clean and grease the cam variable profile.

#### Boiler

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

#### 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.

#### UV scanner

In order to reach the UV scanner (Fig. 38), proceed as follows:

- extract the UV scanner 2;
- clean the glass cover from any dust that may have accumulated.



- Be extremely careful while troubleshooting the detector; line voltage is present on some of the terminals when power is on.
- Open the master switch to disconnect power before removing or installing the detector.

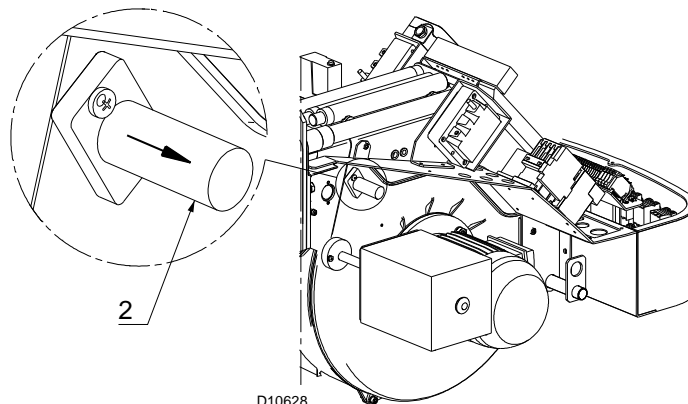


Fig. 38

### Combustion

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

### 6.3 Opening the burner



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



Close the fuel interception tap.



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

In order to open the burner, proceed as follows:

- loosen the 4 screws 1) (Fig. 39) and remove the cover 2);
- install the 2 extensions 9) on the sliding bars 4) and re-screw the screws 8);
- remove the screws 3) and pull back the burner on the sliding bars 4) of about 4";
- disconnect the electrode lead, then unthread the burner completely from the sliding bars;
- remove the screw 6) and extract the inner part 5) of the head.

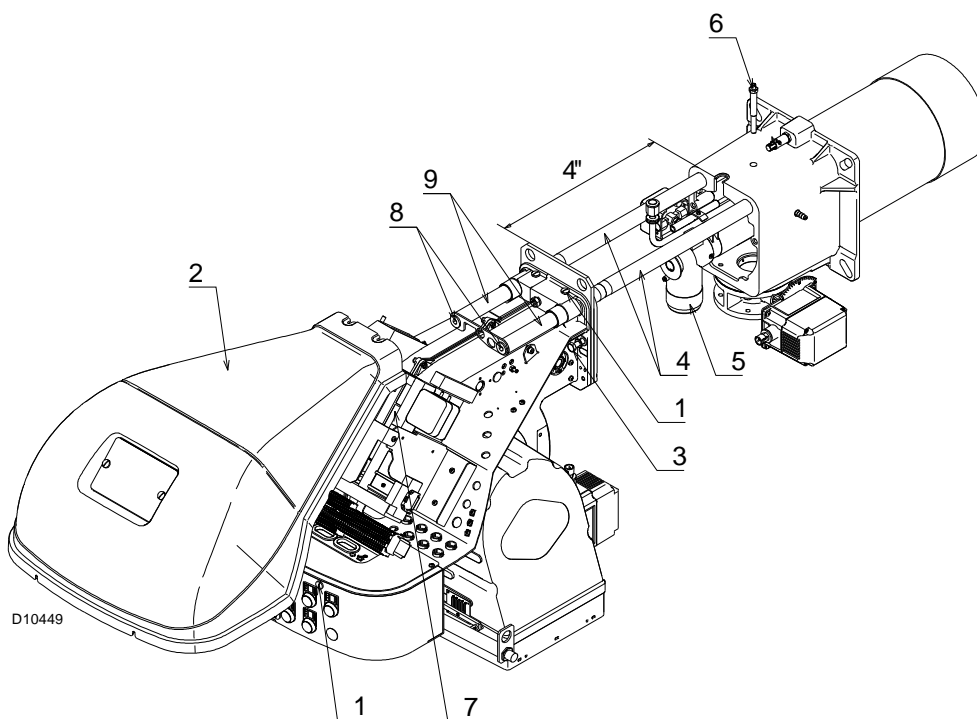


Fig. 39

### 6.4 Closing the burner

In order to close the burner, re-install all components with reverse procedure:

- remove the 2 extensions 9) and re-screw the screws 8) on the sliding bars 4);
- push the burner up to approximately 4" from the pipe coupling;
- reinsert the electrode lead and slide the burner as far as the stop.
- Fix the screws 3) to secure the burner to the combustion head;
- fix the 4 screws 1) to install the cover 2).



Connect the electrical supply from the burner.



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

## 7 Faults - Probable causes - Solutions

If faults arise in ignition or operations, the burner performs a “safety stop”, which is signalled by the red burner lockout LED.

The display visualises alternately the lockout code and the relative diagnostic. To reset the start-up conditions, refer to the “Reset procedure” indicated in the control box manual supplied.

When the burner starts again, the red LED goes out and the control box is reset.



**WARNING**

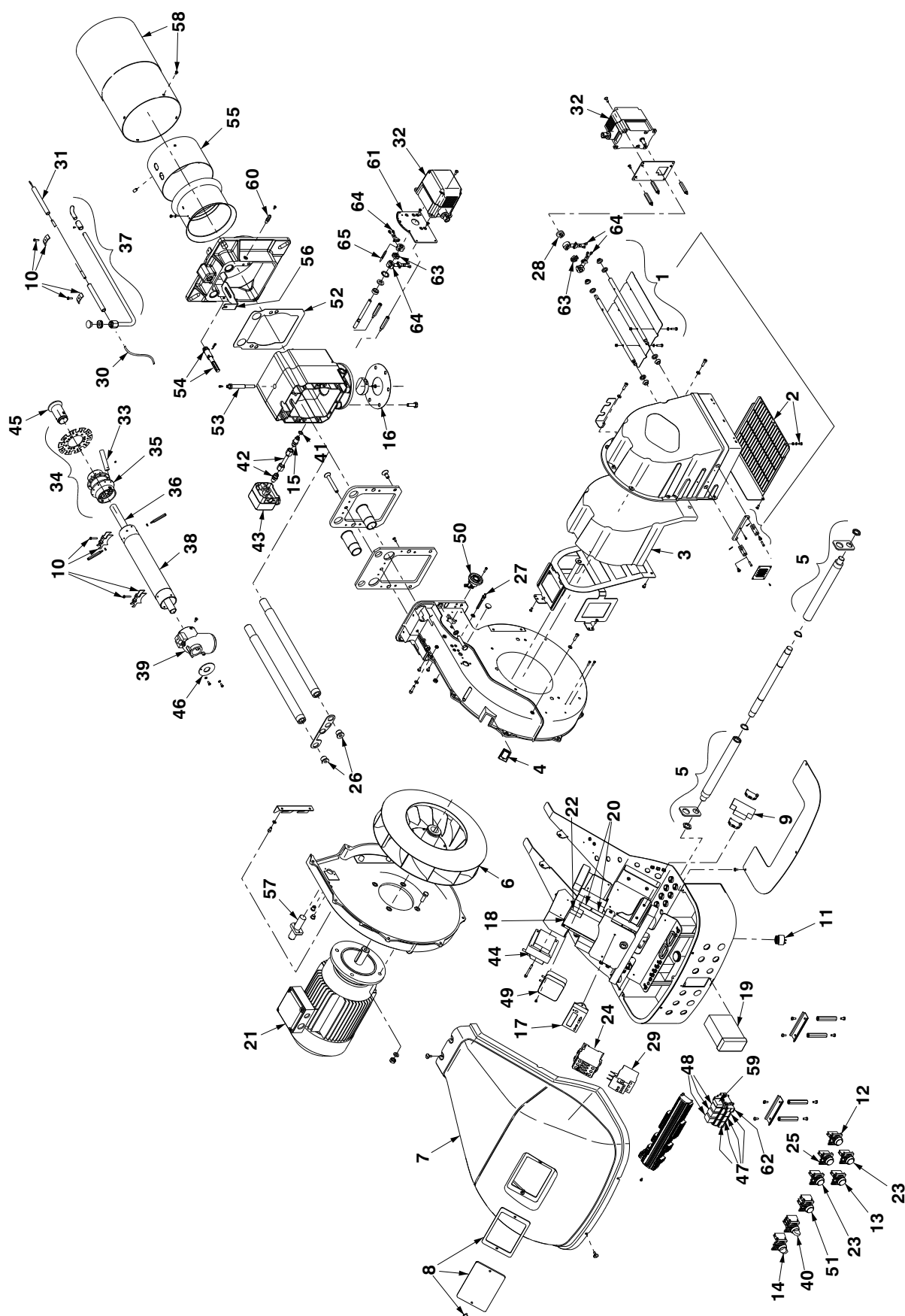
In the event of a burner lockout, more than two consecutive burner reset operations could cause damage to the installation. On the third lockout, contact the Aftersales Service.



**DANGER**

If further lockouts or burner faults occur, interventions must only be made by qualified, authorised personnel (as indicated in this manual, and in compliance with the laws and regulations currently in force).

### A Appendix - Spare parts



N.	CODE	20051837	20090923	DESCRIPTION	BURNER SERIAL NUMBER	*
1	3014083	•		AIR DAMPER ASSEMBLY	≤ 02413xxxxxx	
1	20073258	•		AIR DAMPER ASSEMBLY	≥ 02423xxxxxx	
1	20073258	•	•	AIR DAMPER ASSEMBLY		
2	3013683	•	•	PROTECTION GRATE		
3	3013682	•	•	SOUND DAMPING		
4	3003763	•	•	INSPECTION WINDOW		
5	3013686	•	•	BAR EXTENSION		
6	3012976	•	•	FAN		C
7	20027230	•	•	COVER		B
8	20026784	•	•	INSPECTION WINDOW		
9	20014366	•	•	FUSE HOLDER		
10	3012966	•	•	BRACKET		
11	20031413	•	•	HORN		
12	20027018	•	•	SIGNAL BUTTON		C
13	20027020	•	•	SIGNAL BUTTON		C
14	20027021	•	•	SELECTOR SWITCH		
15	3013095	•	•	CONNECTOR		C
16	3005482	•	•	SEAL		B
17	20010967	•	•	AZL DISPLAY		
18	20010968	•	•	ELECTRONIC CAM		C
19	20031411	•	•	POWER REGULATOR		
20	3013940	•	•	CONNECTORS ASSEMBLY		B
21	20031014	•		MOTOR		C
21	3014152	•	•	MOTOR		C
22	3006211	•	•	FUSE 6.3 A		A
23	20036017	•	•	GREEN SIGNAL LIGHT		A
24	20013973	•		CONTACTOR		C
24	20028310	•	•	CONTACTOR		C
25	20027014	•	•	WHITE SIGNAL LIGHT		A
26	3013681	•	•	SCREW		
27	3003891	•	•	CONNECTOR		C
28	3014079	•	•	SPACER		
29	20027917	•		OVERLOAD		C
29	20028312	•	•	OVERLOAD		C
30	3012393	•	•	ELECTRODE CONNECTION		A
31	3012980	•	•	ELECTRODE		A
32	20008601	•	•	SERVOMOTOR		B
33	3012025	•	•	TUBE		
34	3012981	•	•	DIFFUSER DISC		A
35	20038257	•	•	DISTRIBUTOR		
36	3012590	•	•	INTERIOR TUBE		
37	3012983	•	•	IGNITION PILOT TUBE		C
38	3012984	•	•	EXTERIOR TUBE		
39	3012042	•	•	ELBOW		
40	20027422	•	•	SELECTOR SWITCH		

N.	CODE	20051837	20090923	DESCRIPTION	BURNER SERIAL NUMBER	*
41	3007891	•	•	SEAL		B
42	3013055	•	•	TUBE		
43	3012969	•	•	GAS PRESSURE SWITCH		A
44	3012956	•	•	TRANSFORMER 1.7A 120V		
45	3012971	•	•	GAS DIFFUSER		
46	3012588	•	•	DISC		A
49	3012948	•	•	AIR PRESSURE SWITCH		A
50	3013933	•	•	INSPECTION WINDOW		
51	20010962	•	•	BUTTON		
52	3013856	•	•	SEAL		B
53	3012049	•	•	SCREW		
54	3012639	•	•	CONTROL DEVICE		C
55	3012560	•	•	SHUTTER		C
56	3013698	•	•	BRACKET		
57	3003396	•	•	UV SENSOR		
58	3013699	•	•	END CONE		B
59	3020068	•	•	RELAY		C
60	3003322	•	•	CONNECTOR		C
61	3014081	•	•	BRACKET		
62	3020071	•	•	BASE		
63	3013938	•	•	DISC		A
64	3013937	•	•	HUB		
65	3013939	•	•	INDEX		

\*

**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:

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

<b>GAS OPERATION</b>			
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:			

<b>CONTROL SETTINGS</b>			
Operating Setpoint:	Low Oil Pressure:		
High Limit Setpoint:	High Oil Pressure:		
Low Gas Pressure:	Flame Safeguard Model Number:		
High Gas Pressure:	Modulating Signal Type:		

<b>NOTES</b>









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