GB

Forced draught gas burners

Low-high-low or modulating operation

CODE	MODEL
20166044	RS 70/M
20166045	RS 70/M
20166046	RS 70/M
20166047	RS 100/M
20166048	RS 100/M
20166049	RS 100/M
20166101	RS 130/M
20166102	RS 130/M
20166103	RS 130/M

20160778 (6) - 03/2022

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.

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

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

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

1.1.3 Other symbols

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 HOOD AND ALL THE SAFETY AND PROTECTION DEVICES

This symbol signals the obligation to reassemble the hood 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 installation date, in accordance with the regulations in force and/or the sales contract. At the moment of the first start-up, check that the burner is integral and complete.

WARNING

Failure to observe the information given in this manual, operating negligence, incorrect installation and 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;
➤ 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 structurally established flame;
➤ insufficient and inappropriate surveillance and care of those burner components most likely to be subject to wear and tear;
➤ the 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 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 Burner models designation

Model	Riello Code	RBNA Code	Voltage	Flame safeguard
RS 70/M TC FS1	20160208	20166044	208-230/3/60	Burner mounted
		20166045	460/3/60	
	20160227	20166046	575/3/60	
RS 100/M TC FS1	20160233	20166047	208-230/3/60	Burner mounted
		20166048	460/3/60	
	20160238	20166049	575/3/60	
RS 130/M TC FS1	20160253	20166101	208-230/3/60	Burner mounted
		20166102	460/3/60	
	20160256	20166103	575/3/60	

Tab. A

3.2 Technical data

Model			RS 70/M	RS 100/M	RS 130/M
Output (1)	High	MBtu/hr kW	1761 - 3084 516 - 904	2644 - 4405 775 - 1291	3521 - 5545 1032 - 1625
	Low	MBtu/hr kW	512 150	570 167	607 178
Fuel			Natural or propane gas		
- Max. delivery		SCFH	3084	4405	5545
- Pressure at max. delivery (2)		"WC	4.06	3.66	3.20
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 (3)		dB(A)	75	77	78.5
Weight (complete with packaging)		lbs	154	161	168

Tab. B

(1) Reference conditions: ambient temperature 68 °F (20°C) - Barometric pressure 394" WC - Altitude 329 ft.
(2) Pressure at test point 16)(Fig. 4, page 12) with zero pressure in the combustion chamber and maximum burner output.
(3) Sound pressure measured in manufacturer's combustion laboratory, with burner operating on test boiler and at maximum rated output.

3.3 Electrical data

Model		RS 70/M	RS 100/M	RS 130/M
Control circuit power supply	V/Ph/Hz		120/1/60	
Main electrical supply (+/- 10%)	V/Ph/Hz		208-220/3/60	
Fan motor IE3/EPACT	rpm HP - kW V A	3500 1.5 - 1.1 208-230 4	3500 3 - 2.2 208-230 7.4	3500 3 - 2.2 208-230 7.4
Ignition transformer	V1 - V2 I1 - I2		120 V - 1 X 8 kV 1.6 A - 20 mA	
Electrical power consumption	W max	1291	2565	2565
Electrical control circuit coms.	W		750	
Total electrical consumption	W	2041	3315	3315
Electrical protection			NEMA 1	
Main electrical power supply				
Minimum Circuit Ampacity (MCA)	A	5	9.25	9.25
Maximum rating of overcurrent protective device (MOP)	A	9	16.65	16.65
Control circuit power supply				
Minimum Circuit Ampacity (MCA)	A		6.3	
Maximum rating of overcurrent protective device (MOP)				

Model		RS 70/M	RS 100/M	RS 130/M
Control circuit power supply	V/Ph/Hz		120/1/60	
Main electrical supply (+/- 10%)	V/Ph/Hz		460/3/60	
Fan motor IE3/EPACT	rpm HP - kW V A	3500 1.5 460 2	3500 3 460 3.7	3500 3 460 3.7
Ignition transformer	V1 - V2 I1 - I2		120 V - 1 X 8 kV 1.6 A - 20 mA	
Electrical power consumption	W max	1291	2565	2565
Electrical control circuit coms.	W		750	
Total electrical consumption	W	2041	3315	3315
Electrical protection			NEMA 1	
Main electrical power supply				
Minimum Circuit Ampacity (MCA)	A	2.5	4.6	4.6
Maximum rating of overcurrent protective device (MOP)	A	4.5	8.3	8.3
Control circuit power supply				
Minimum Circuit Ampacity (MCA)	A		6.3	
Maximum rating of overcurrent protective device (MOP)				

Model		RS 70/M	RS 100/M	RS 130/M
Control circuit power supply	V/Ph/Hz		120/1/60	
Main electrical supply (+/- 10%)	V/Ph/Hz		575/3/60	
Fan motor IE3/EPACT	rpm HP - kW V A	3500 1.5 - 1.1 575 1.6	3500 3 - 2.2 575 3	3500 3 - 2.2 575 3
Ignition transformer	V1 - V2 I1 - I2		120 V - 1 X 8 kV 1.6 A - 20 mA	
Electrical power consumption	W max	1275	2510	2510
Electrical control circuit coms.	W		750	
Total electrical consumption	W	2025	3260	3260
Electrical protection			NEMA 1	
Main electrical power supply				
Minimum Circuit Ampacity (MCA)	A	2	3.75	3.75
Maximum rating of overcurrent protective device (MOP)	A	3.60	6.75	6.75
Control circuit power supply				
Minimum Circuit Ampacity (MCA)	A		6.3	
Maximum rating of overcurrent protective device (MOP)				

Tab. C

3.4 Burner dimensions

The maximum dimensions of the burners are given in Tab. D.

Bear in mind that inspection of the combustion head requires the burner to be opened by withdrawing the rear part on the slide bars.

The maximum dimension of the burner, when open, is give by measurement I.

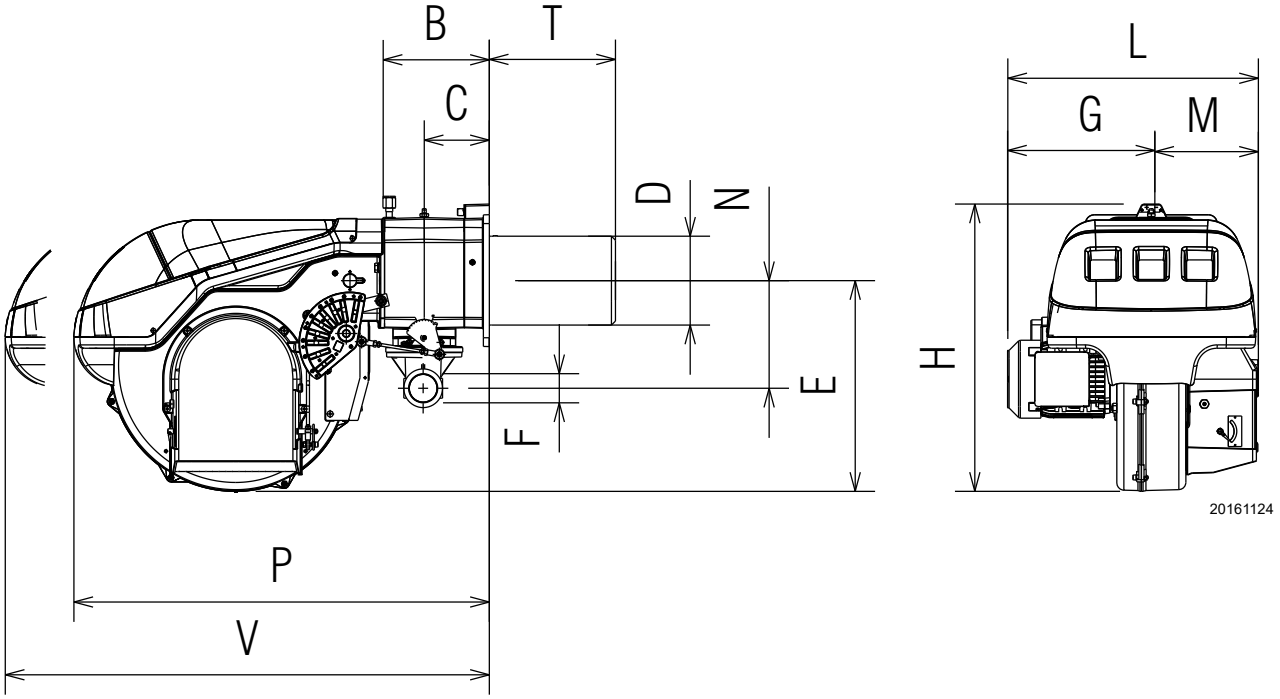

Fig. 1

inch	L	G	M	H	P	$T_{(1)}$	D	E	V (1)	B	C	N	F
RS 70/M	20”	11 11/32“	8 1/2“	23 11/32“	33”	10” - 15 1/4“	7”	16 3/4“	46 1/4“ - 51 1/2“	8 5/16“	5 5/8“	8 3/4“	2”
RS 100/M	21 1/4“	12 3/4“	8 1/2“	23 11/32“	33”	10” - 15 1/4“	7”	16 3/4“	46 1/4“ - 51 1/2“	8 5/16“	5 5/8“	8 3/4“	2”
RS 130/M	21 1/4“	12 3/4“	8 1/2“	23 11/32“	33”	11 1/4“ - 16 1/2“	7 7/16“	16 3/4“	46 1/4“ - 51 1/2“	8 5/16“	5 5/8“	8 3/4“	2”

Tab. D

(1) Blast tube: short - long (obtainable with the kit)

3.5 Standard equipment

Gas train flange . . . . . .No. 1
Flange fixing screws M10x40 . . . . . .No. 6
Connector for gas pilot . . . . . .No. 1
Instruction booklet . . . . . .No. 1

3.6 Firing rates

During operation, burner output varies between:

- **MAXIMUM OUTPUT** must be selected in area **A** (Fig. 2).
- **MINIMUM OUTPUT** which must not be lower than the minimum limit in the diagram.

Model	MBtu/hr	kW
RS 70/M	512	150
RS 100/M	570	167
RS 130/M	607	178

In order to utilize also area **B** (RS 130/M) it is necessary to perform the calibration of the combustion head as explained on page 17.
RS 50/M = 321 MBtu/hr 94 kW

NOTE:
The FIRING RATE areas given in figure (A) have been reduced by 10% with respect to the maximum range that can be reached. See "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)" to page 11 for operation at different ambient temperatures and/or altitudes.

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 at page 17.

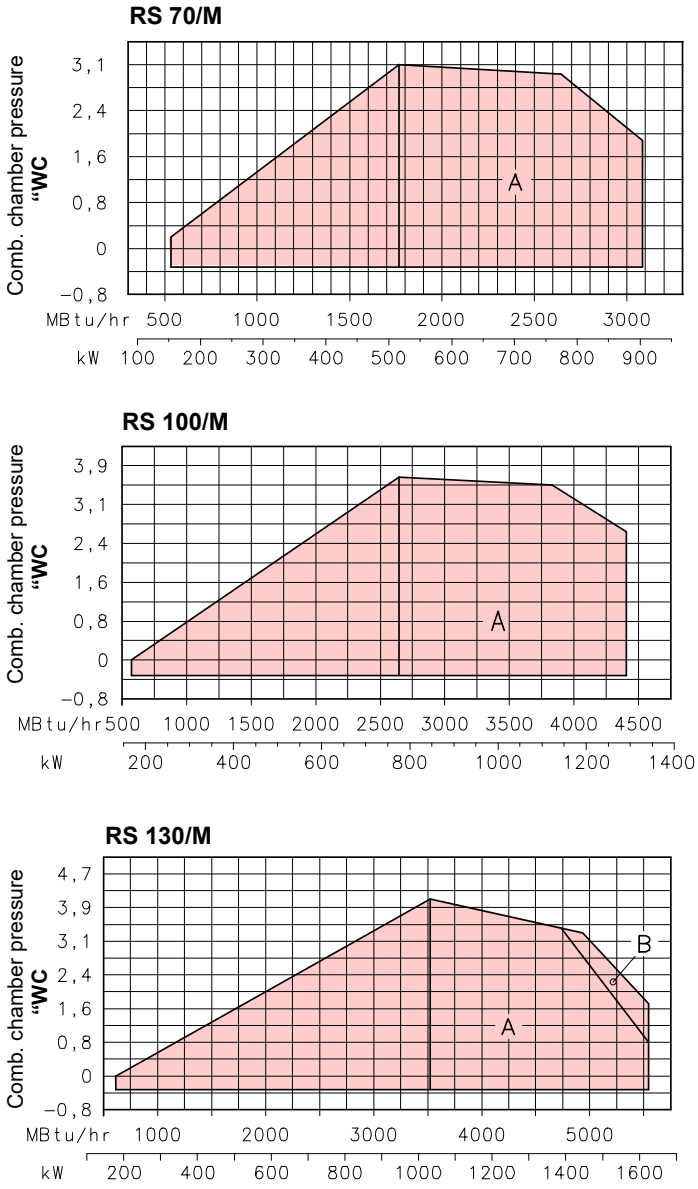

Fig. 2

3.6.1 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	**1.000**	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. E

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. E, 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 Qfoc = 4,500 Mbtu/h, the correct output will be equal to:

Qburner = Qfoc / F = 4,500 / 0.908 = 4,956 Mbtu/h

3.7 Minimum furnace dimensions

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

Fig. 3 indicates the diameter and length of the test combustion chamber.

Example:
Output 2579 MBtu/hr:
diameter 24 inch - length 6.6 ft

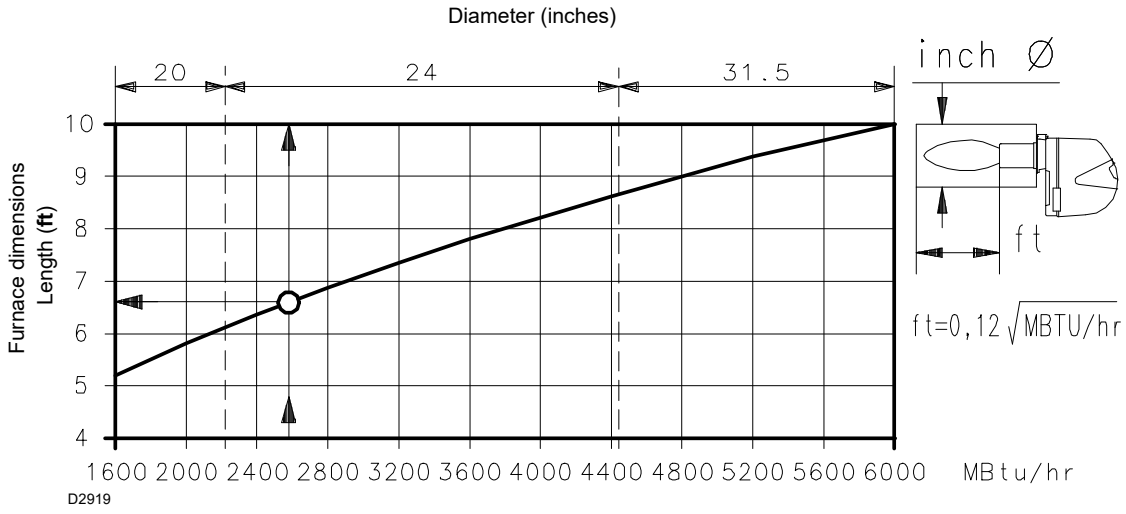

Fig. 3

3.8 Burner description

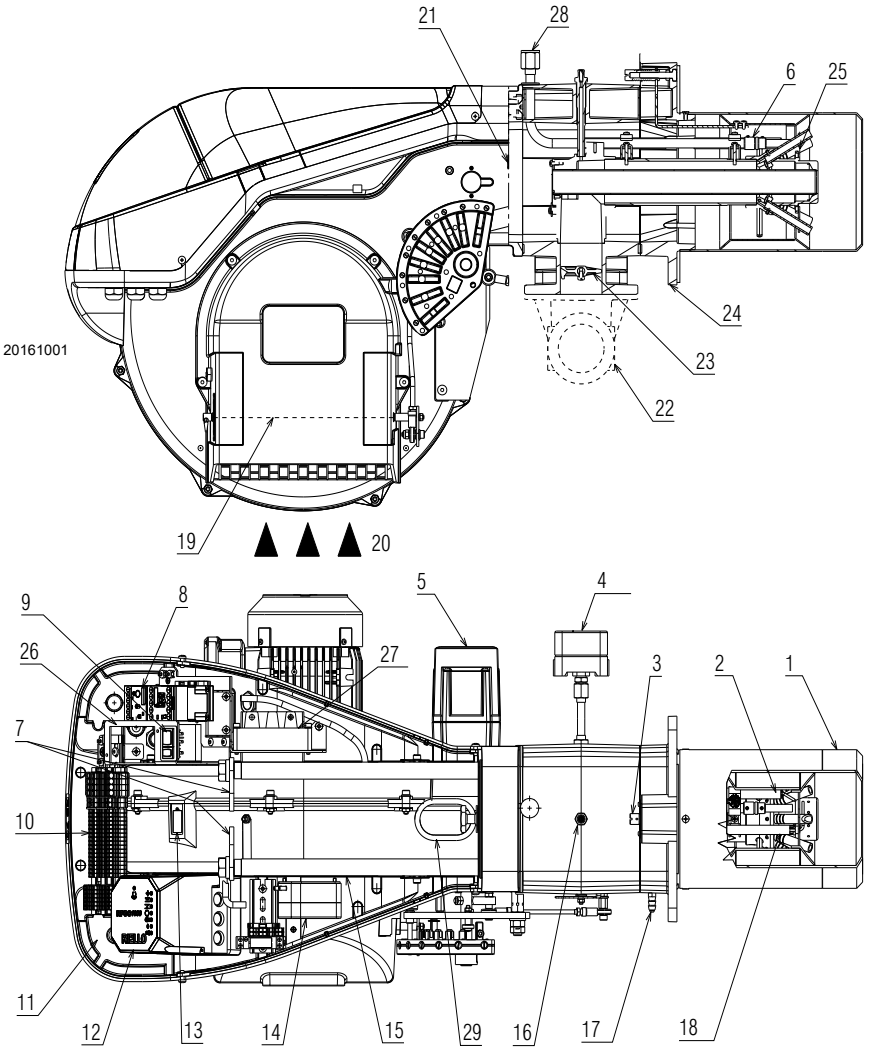

Fig. 4

1 Combustion head
2 Ignition electrode
3 Screw for combustion head adjustment
4 High gas pressure switch
5 Servomotor controlling the gas butterfly valve and the air damper (by means of a variable profile cam mechanism). When the burner is stopped the air damper will be completely closed to reduce heat loss due to the draft of the chimney that draws the air from the air intake of the fan
6 Plug-socket on the cable of the ionisation probe
7 Lifting rings
8 Motor contactor and thermal relay with reset button
9 Switch for:
- Automatic-manual-OFF operation
- Power increase / power reduction button
10 Terminal board for electrical connection
11 Cable grommets for electrical connection to be carried out by the installer
12 Control box with light signalling lockout and reset button
13 Flame inspection window
14 Low air pressure switch (differential operating type)
15 Slide bars for opening the burner and inspecting the combustion head
16 Gas pressure test point and head fixing screw
17 Combustion head air pressure test point
18 Flame sensor
19 Air damper
20 Air inlet to fan
21 Screws securing fan to sleeve
22 Gas input pipework
23 Gas butterfly valve
24 Boiler mounting flange
25 Flame stability disk
26 Bracket for output power regulator RWF (foreseen as kit)
27 Ignition transformer
28 Connection for ignition gas pilot
29 Lifting ring

Two types of burner failure may occur:

➤ **Flame safeguard lock-out**
If the flame safeguard alarm lights up, it indicates that the burner is in lock-out. To reset, press the reset push-button.

➤ **Motor trip**
release by pressing the push-button on thermal overload 8)(Fig. 4). Refer to paragraph “Thermal relay calibration” on page 24.

3.9 RFGO-A13 control box

Warnings

WARNING

To avoid accidents, material or environmental damage, observe the following instructions!

The control box is a safety device! Avoid opening or modifying it, or forcing its operation. Riello S.p.A. cannot assume any responsibility for damage resulting from unauthorised interventions!

- ➤ All interventions (assembly and installation operations, assistance, etc.) must be carried out by qualified personnel.
- ➤ Before modifying the wiring in the control box connection area, fully disconnect the system from the power supply (omnipolar separation). Check the system is not powered and cannot be accidentally reconnected. Failure to do this will lead to the risk of electrocution.
- ➤ Protection against electrocution from the control box and all connected electric components is obtained with the correct assembly.
- ➤ Before any intervention (assembly and installation operations, assistance, etc.), ensure the wiring is in order and that the parameters are correctly set, then make the safety checks.
- ➤ Falls and collisions can negatively affect the safety functions. In this case, the control box must not be operated, even if it displays no evident damage.

For the safety and reliability of the control box, comply with the following instructions:

– avoid conditions that can favour the development of condensate and humidity. Otherwise, before switching on again, make sure that the entire control box is perfectly dry!
– Static charges must be avoided since they can damage the control box's electronic components when touched.

Fig. 5

Technical data

Mains voltage	110 Vac +20 % / +15 %
Mains frequency	50 / 60 Hz
Primary fuse (external)	max. 10 A
Weight	approx. 2.5 lbs.
Power absorption	approx. AC 7 VA
Protection level	IP40
Safety class	II
Environmental conditions:	
Operation	DIN EN 60721-3-3
Mechanical conditions	Class 3M3
Temperature range	Class 3K3
Humidity	-104 to 140°F
	< 90 % r.h. (without condensing)

Tab. F

Mechanical structure

The control box is made of plastic to resist knocks, heat and flame propagation.

3.10 Servomotor SQM41 ...

Warnings

WARNING

To avoid accidents, material or environmental damage, observe the following instructions!

Avoid opening, modifying or forcing the servomotor.

- ➤ All interventions (assembly and installation operations, assistance, etc.) must be carried out by qualified personnel.
- ➤ Falls and collisions can negatively affect the safety functions. In this case, the servomotor must not be operated, even if it displays no evident damage.
- ➤ Fully disconnect the burner from the mains when working near terminals and servomotor connections.
- ➤ Condensation and exposure to water are not allowed.
- ➤ For safety reasons, the servomotor must be checked after long periods of non-use.

S8907

Fig. 6

Technical data

Mains voltage	120 V -15% +10%
Mains frequency	50 / 60 Hz
Power absorption	10 VA
Motor	Synchronous
Drive angle	Varying between 0° and 135°

WARNING

Absolutely do not adjust the red cam No. 1 more than 135° to prevent serious or irreversible damage to the mechanical adjustment parts.

Protection level	Max. IP 66, with appropriate cable entry
Cable entry	2 x 1/2” NPT
Cable connection	terminal board for 0.5mm^2 (min.) and 2.5mm^2 (max.)
Rotation direction	Anticlockwise
Rated torque (max.)	10 Nm
Holding torque	5 Nm
Operation time	30 s. at 90° (60Hz - 17%)
Weight	approx. 2 kg
Environmental conditions:	
Operation Transport and storage	-20....+60° C -20...+60°C

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.

DANGER

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

WARNING

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

4.2 Handling

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

WARNING

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

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

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

CAUTION

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

CAUTION

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.

WARNING

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

WARNING

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 Preparing the boiler

4.4.1 Boiler plate

Drill the combustion chamber mounting plate as shown in Fig. 7. The position of the threaded holes can be marked using the head gasket supplied with the burner.

inch	A	DF	∅
RS 70/M	7 11/16"	10 7/8" - 12 51/64"	1/2 W
RS 100/M	7 11/16"	10 7/8" - 12 51/64"	1/2 W
RS 130/M	7 11/16"	10 7/8" - 12 51/64"	1/2 W

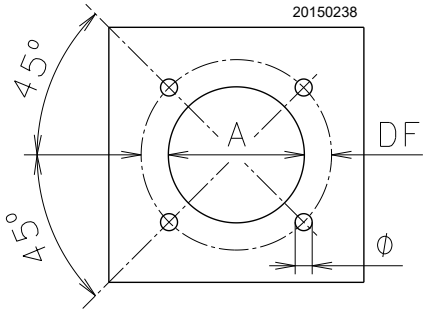

Fig. 7

4.4.2 Blast tube length

The length of the blast tube must be selected according to the indications provided by the manufacturer of the boiler, it must be greater than the thickness of the boiler door complete with its insulation.

The length available, L (inches), is as follows:

Model	L (short blast tube)
RS 70/M	10“
RS 100/M	10“
RS 130/M	11“

➤ For boilers with front flue passes 15)(Fig. 8) or flame inversion chambers, protective insulation material 13), must be inserted between the boiler refractory 14) and the blast tube 12).

➤ This protective insulation must not compromise the extraction of the blast tube.

➤ For boilers having a water-cooled front, the insulation 13)-14) is not required unless it is required by the boiler manufacturer.

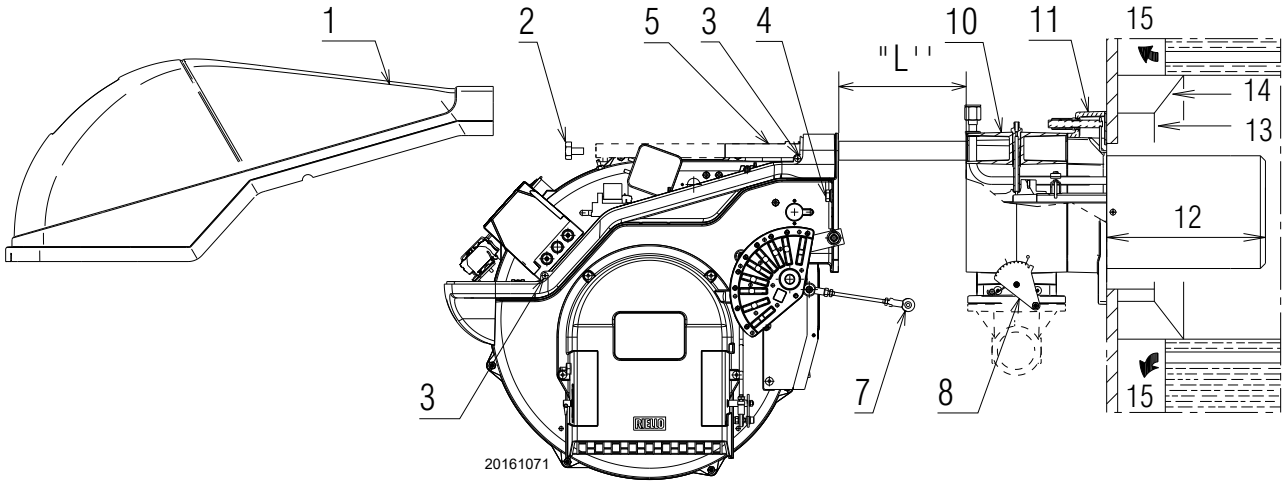

Fig. 8

4.5 Combustion head calibration

At this point check, for model RS 130/M, whether the maximum delivery of the burner at high fire operation is contained in area A or in area B of the firing rate. See Fig. 2, page 10.

If it is in area A then no operation is required.

If, on the other hand, it is in area B:

➤ unscrew the screws 1)(Fig. 9) and disassemble the blast tube 2);

➤ move the fixing of the rod 3) from position A to position B, thereby causing the shutter 4) to retract;

➤ now refit the blast tube 2) and the screws 1).

Once this operation has been carried out (if it was required), secure the flange 11)(Fig. 8) to the boiler plate, inserting the gasket 9).

Use the 4 screws, after first protecting the thread with an anti-locking product.

The seal between burner and boiler must be airtight.

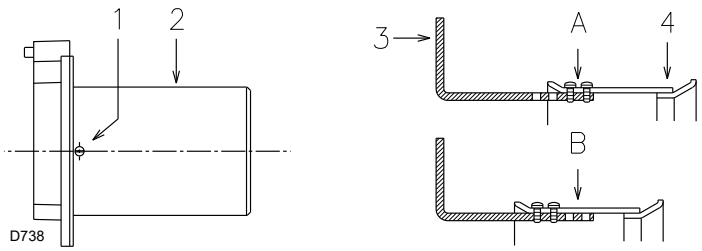

Fig. 9

If you noticed any irregularities in the positions of the flame rod or ignition electrode during the check mentioned above, remove screw 1)(Fig. 10), extract the internal part 2) of the head and set up the two components correctly.

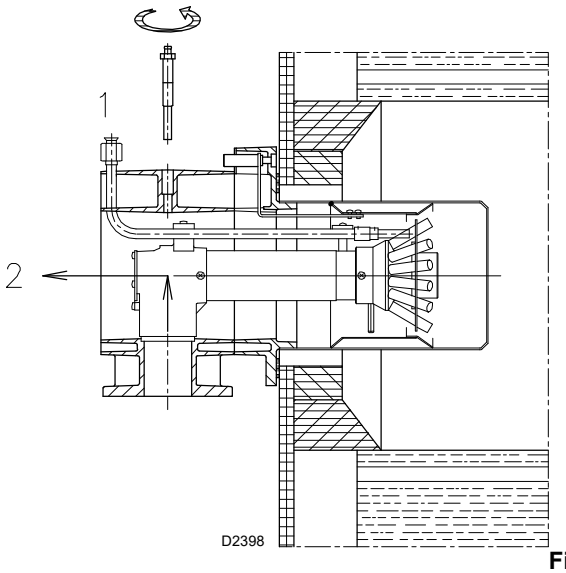

Fig. 10

4.6 Securing the burner to the boiler

Prepare a suitable lifting system.

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

Detach the combustion head from the burner (Fig. 8, page 16):

- ➤ loosen the four screws 3) and remove the cover 1);
- ➤ disengage the swivel joint 7) from the graduated sector 8);
- ➤ remove the screws 2) from the slide bars 5);
- ➤ remove the two screws 4) and pull the burner back on slide bars 5) by about 4";
- ➤ disconnect the wires from the flame rod and the electrode and then pull the burner completely off the slide bars.

WARNING

The seal between burner and boiler must be airtight.

4.7 Combustion head setting

Installation operations are now at the stage where the blast tube and sleeve are secured to the boiler as shown in Fig. 11.

It is now a very simple matter to set up the combustion head, as this depends solely on the MAX output developed by the burner.

It is therefore essential to establish this value before proceeding to set up the combustion head.

There are two adjustments to make on the head:
air and gas deliveries.

In diagram (Fig. 12) find the notch to use for adjusting the air and the gas.

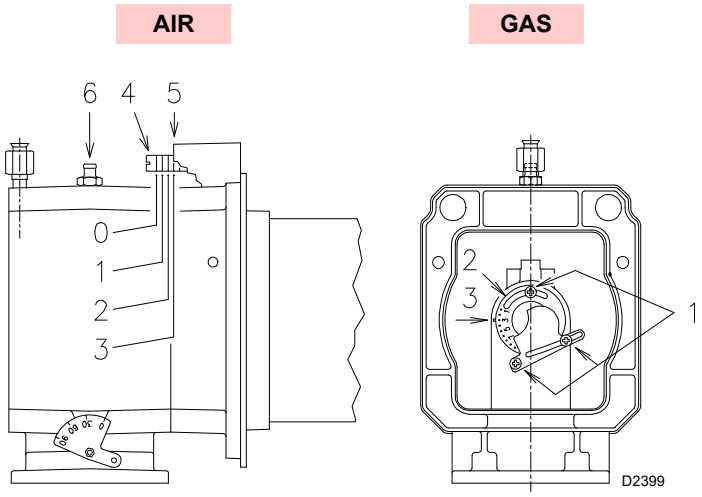

Fig. 11

4.7.1 Air adjustment

Turn screw 4)(Fig. 11) until the notch identified is aligned with the front surface 5) of the flange.

4.7.2 Gas adjustment

Loosen the 3 screws 1)(Fig. 11) and turn ring 2) until the notch identified is aligned with index 3).

Tighten the 3 screws 1) fully down.

Example RS 70/M

MAX output = 2200 MBtu/hr

If we consult diagram (Fig. 12) we find that for this output, air must be adjusted using notch 3)(Fig. 11).

NOTE

Diagram (Fig. 12) shows the ideal settings for the ring 2)(Fig. 11).

If the gas main pressure is too low to reach the maximum output operation pressure indicated on page 21, and if the ring 2)(Fig. 11) is not fully open, it can be opened wider by 1 or 2 notches.

Continuing with the previous example, page 21 indicates that for burner RS 70/M with output of 2200 MBtu/hr a pressure of approximately 2.36 "WC is necessary at test point 6)(Fig. 11).

If the pressure cannot be reached, open the ring 2)(Fig. 12) to notch 4 or 5.

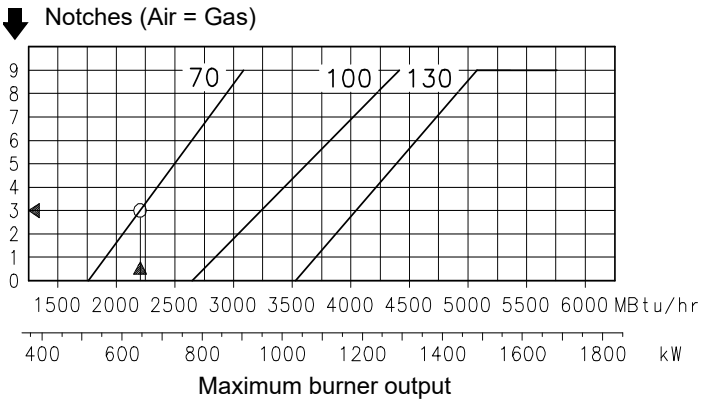

Fig. 12

Make sure that the combustion characteristics are satisfactory and free of pulsations.

Once you have finished setting up the head:

- ➤ refit the burner to the slide bars 3)(Fig. 13) at approximately 4" from the sleeve 4) - burner positioned as shown in Fig. 8, page 16 - insert the flame rod cable and the ignition electrode cable and then slide the burner up to the sleeve so that it is positioned as shown in Fig. 13.
- ➤ Refit screws 2) on slide bars 3).
- ➤ Secure the burner to the sleeve by tightening screw 1).
- ➤ Reconnect the swivel joint 7) to the graduated sector 6).
- ➤ Connect gas train and pilot train as shown in Fig. 17, page 20.

WARNING

When fitting the burner on the two slide bars, it is advisable to gently draw out the high tension cable and flame detection probe cable until they are slightly stretched.

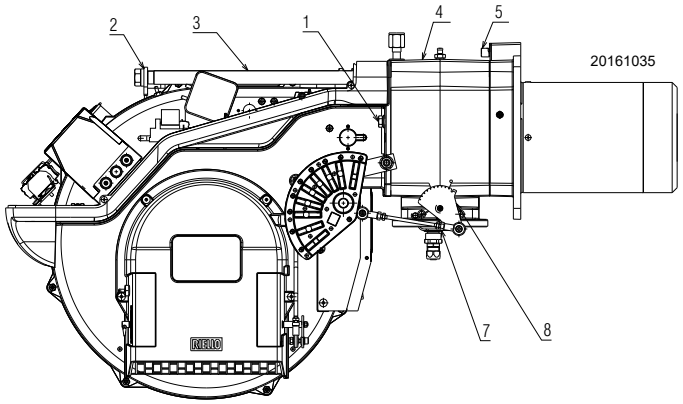

Fig. 13

4.8 Ignition pilot adjustment

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

The pilot works correctly at pressures ranging from 5 - 12" WC.

IMPORTANT

To set the pilot without main burner operation, proceed as follows:

– disconnect all wires of the main valves V1 and V2 **A** (Fig. 15);
– carry out a jumper between; VP1-2 and V1-V2 **B** (Fig. 15).

At the end of the pilot adjustment, restore the valves connection **D** (Fig. 15).

WARNING

Measures must be respected.

Pay attention to the terminals during the connection of the valves.

The correct terminals are the orange ones, as shown in **E** (Fig. 15).

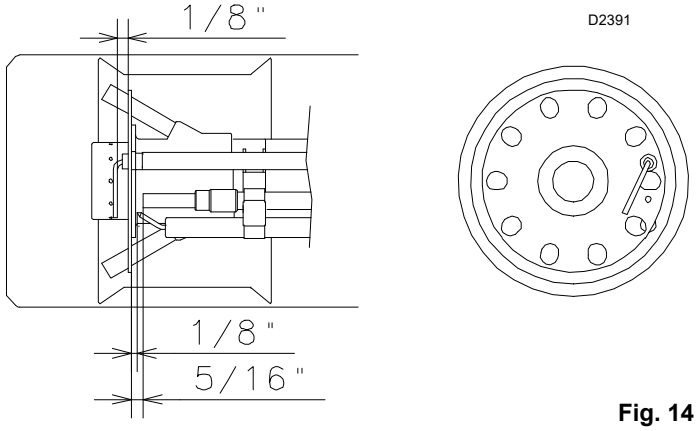

Fig. 14

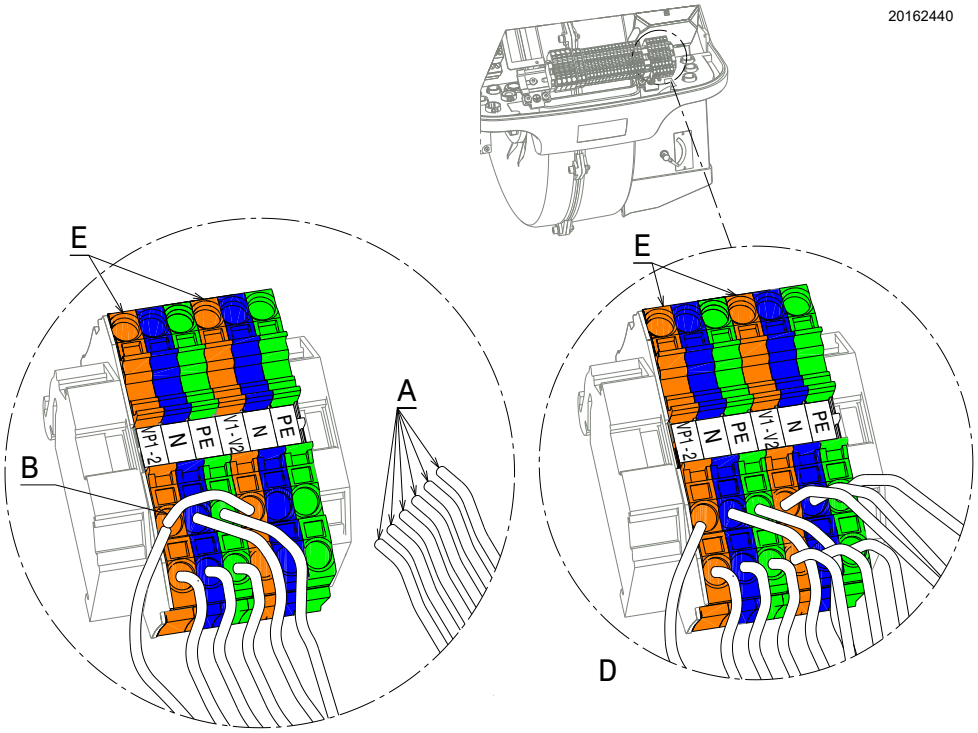

Fig. 15

4.8.1 Electrical connections

S9810

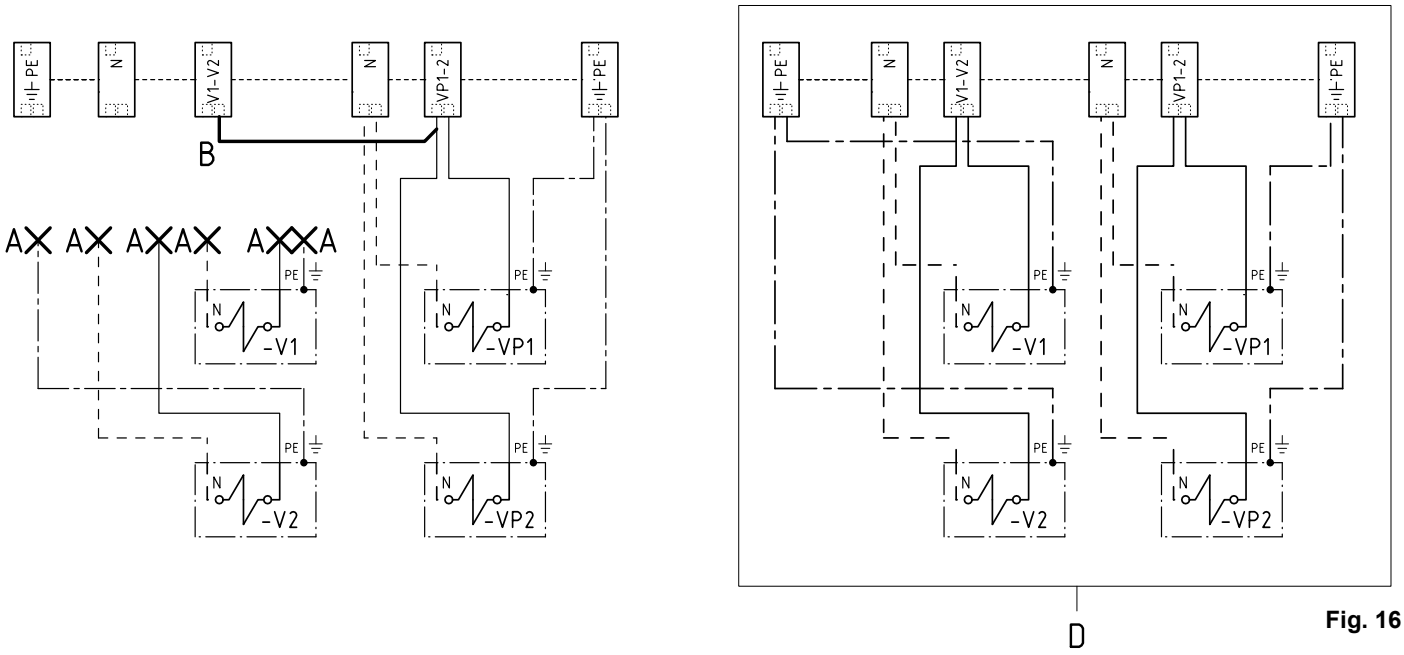

Fig. 16

4.9 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.

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

4.9.1 Gas piping

The main gas train must be connected to the gas attachment 1)(Fig. 17), using flange 2), gasket 3) and screws 4) supplied with the burner.

The gas train can enter the burner from the right or left side, depending on which is the most convenient.

The gas safety shut-off valves 5)-6) must be as close as possible to the burner to ensure gas reaches the combustion head within the safety time range.

The pilot gas train must be connected to the gas attachment 5) and can enter the burner from the right or left side.

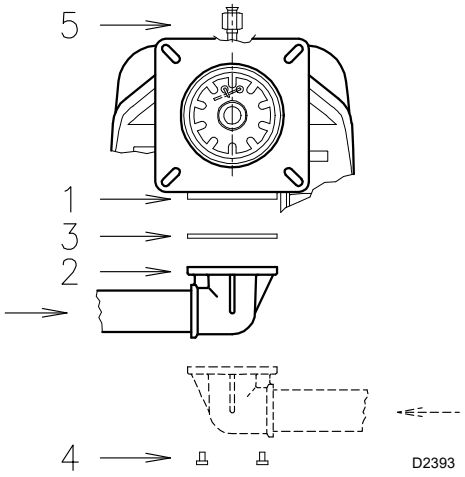

Fig. 17

4.9.2 Gas train

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

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.

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

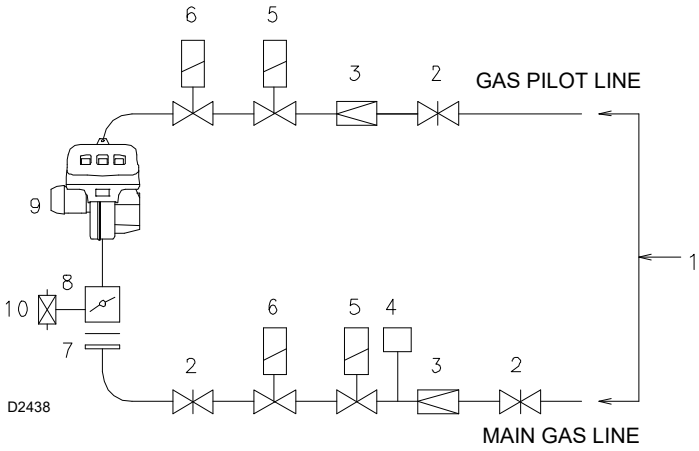

Fig. 18

Key to layout (Fig. 18)

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

4.9.3 Gas pressure

The Tab. G is used to calculate manifold pressure taking into account combustion chamber pressure.

Column 1

Gas manifold pressure measured at test point 1)(Fig. 19), with:
- Combustion chamber at 0 “WC
- Burner operating at maximum output
- Gas ring 2)(Fig. 11, page 17) adjusted as indicated in diagram (Fig. 12, page 17).

Column 2
- pressure loss at gas butterfly valve

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. 19).

➤ Find the nearest pressure value to your result in column 1 of the table for the burner in question.

➤ Read off the corresponding output on the left.

Example - RS 100/M:
- Maximum output operation
- Natural gas
- Gas ring Fig. 11, page 17 adjusted as indicated in diagram (Fig. 12)
- Gas pressure at test point 1)(Fig. 19) = 3.15 “WC
- Pressure in combustion chamber = 1.18 “WC

3.15 - 1.18 = 1.97 “WC

A maximum output of 3125 MBtu/hr shown in Tab. G corresponds to 1.97 “WC pressure, column 1.

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

WARNING

The heat output and gas pressure data in the head refer to operation with gas butterfly valve fully open (90°).

Model	MBtu/hr	kW	Δp (“ WC)	
			1	2
RS 70/M	1761	516	1.65	0.2
	1952	572	1.89	0.3
	2139	627	2.20	0.4
	2330	683	2.52	0.4
	2518	738	2.87	0.5
	2709	794	3.27	0.5
	2897	849	3.66	0.5
	3084	904	4.06	0.6
RS 100/M	2631	771	1.46	0.3
	2880	844	1.65	0.4
	3125	916	1.97	0.4
	3371	988	2.28	0.5
	3617	1060	2.56	0.5
	3862	1132	2.87	0.7
	4108	1204	3.27	0.7
	4405	1291	3.66	0.9
RS 130/M	3521	1032	1.50	0.6
	3825	1121	1.77	0.7
	4129	1210	2.01	0.9
	4432	1299	2.28	1.0
	4736	1388	2.56	1.1
	5036	1476	2.83	1.3
	5340	1565	3.11	1.4
	5545	1625	3.20	1.6

Tab. G

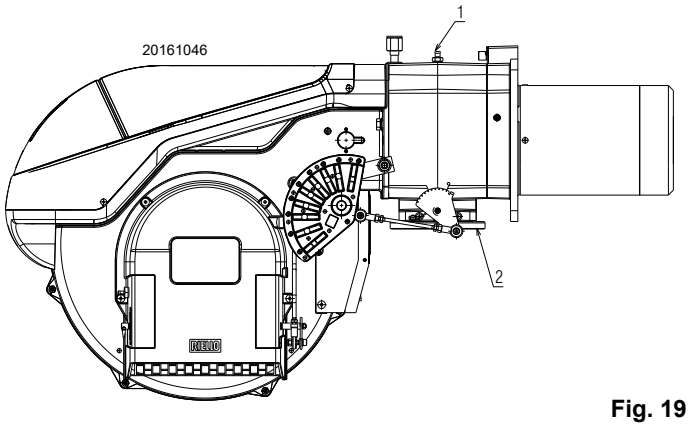

Fig. 19

4.10 Electrical wiring

Notes on safety for the electrical wiring

- ➤ The electrical wiring must be carried out with the electrical supply disconnected.
- ➤ Electrical wiring must be carried out by qualified personnel and in compliance with the regulations currently in force in the country of destination.
- ➤ The manufacturer declines all responsibility for modifications or connections different from those shown in the electrical layouts.
- ➤ Check that the electrical supply of the burner corresponds to that shown on the identification label and in this manual.
- ➤ Do not invert the neutral with the phase in the electrical supply line.
  Any inversion would cause a lockout due to firing failure.
- ➤ The electrical safety of the device is obtained only when it is correctly connected to an efficient earthing system, made according to current standards.
  It is necessary to check this fundamental safety requirement. In the event of doubt, have the electrical system checked by qualified personnel.
  Do not use the gas tubes as an earthing system for electrical devices.
- ➤ The electrical system must be suitable for the maximum input power of the device, as indicated on the label and in the manual, checking in particular that the section of the cables is suitable for the input power of the device.
- ➤ For the main power supply of the device from the electricity mains:
  – do not use adapters, multiple sockets or extensions;
  – use an omnipolar switch with an opening of at least $^1/_8$" (overvoltage category) between the contacts, as indicated by the current safety standards.
- ➤ Do not touch the device with wet or damp body parts and/or in bare feet.
- ➤ Do not pull the electric cables.

Before carrying out any maintenance, cleaning or checking operations:

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

Close the fuel interception tap.

Avoid condensate, ice and water leaks from forming.

If the hood is still present, remove it and proceed with the electrical wiring according to the wiring diagrams.

4.10.1 Notes on terminals

On the electrical panel there terminals with a “spring” system. The opening of these terminals must be made via a suitable tool, using a flat-blade screwdriver of the correct size.
The clamp uses a pressurised opening system.

Clamp opening

- ➤ insert the correct screwdriver into the opening, pushing down until the hole for the cable is completely open.
- ➤ Insert the previously stripped cable and remove the screwdriver. Make sure the cable is securely fastened Fig. 20.

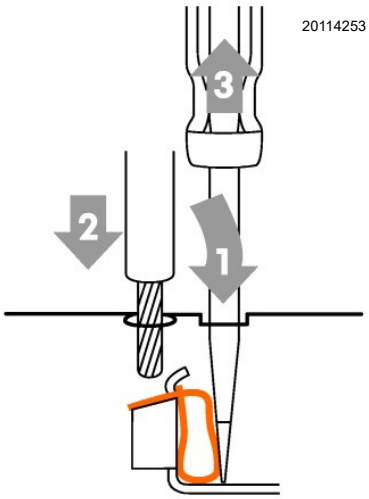

Fig. 20

4.10.2 Supply cables and external connections passage

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 $^{1}/_{2}$ inch cable grommet;
2 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.

Cable grommets used in factory:
A - Fan motor
B - Maximum gas pressure switch
C - Air/Gas servomotor

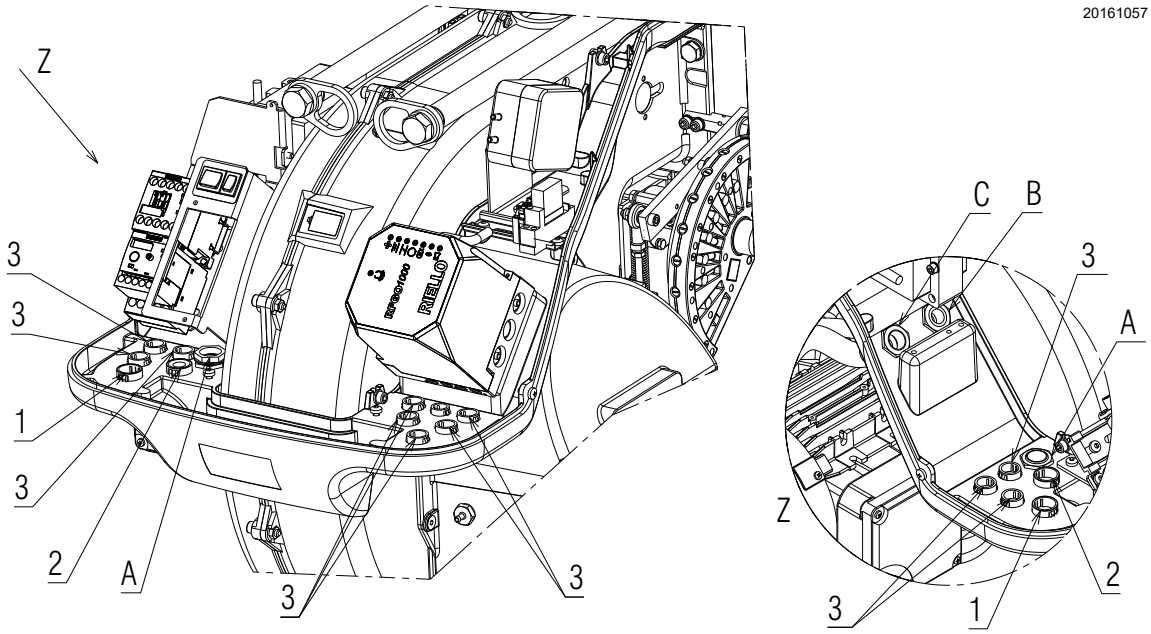

Fig. 21

The control panel is in compliance with UL508A.

WARNING

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

4.11 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)

4.11.1 Electro-mechanical thermal relay

The electro-mechanical thermal relay (Fig. 22) is used to avoid damage to the motor owing to a strong increase in absorption or the lack of a phase.

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

This arises when the power supply of the motor is 400V.

➤ To reset, in the case of an intervention of the thermal relay, press the button “**RESET**” (Fig. 22).

➤ The button “**STOP**” (Fig. 22) opens the NC (95-96) contact and stops the motor.

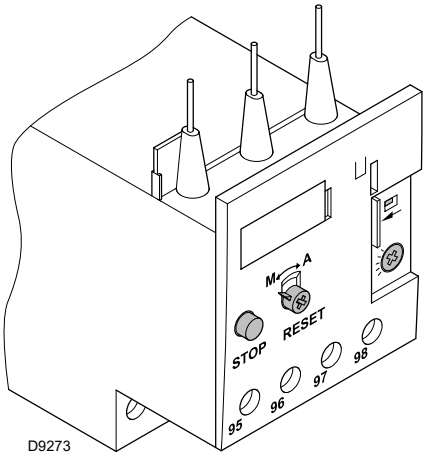

Fig. 22

➤ To test the thermal relay, insert a screwdriver in the window “**TEST**” (Fig. 23) 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.

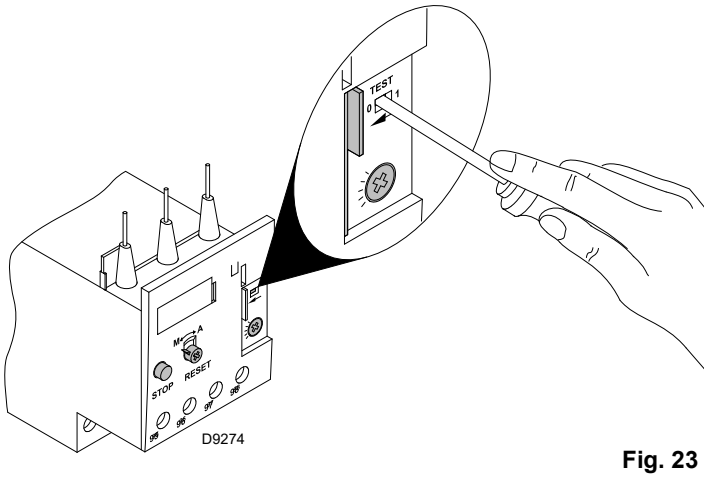

Fig. 23

4.11.2 Electronic thermal relay

➤ To reset, in the case of an intervention of the thermal relay, press the button “**RESET**” (Fig. 24).

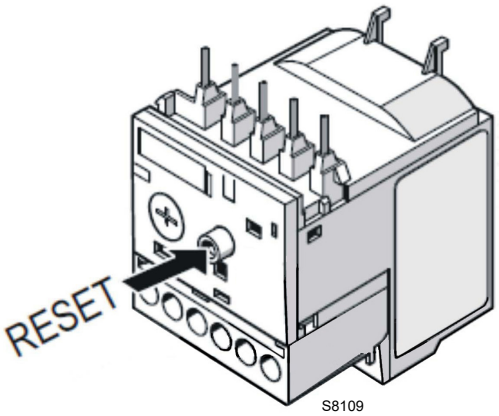

Fig. 24

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

➤ **Device test (Fig. 25)**
Push slowly the button in the window with a little screwdriver.

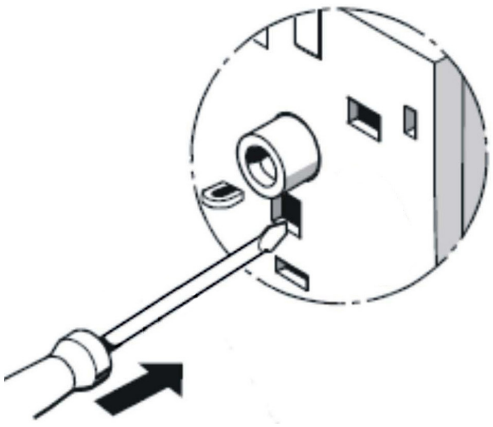

Fig. 25

➤ **Contact test NC (95-96) and NO (97-98)(Fig. 26)**
Insert in the window a little screwdriver and move it in the sense of the arrow.

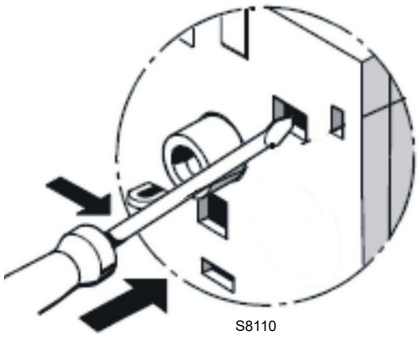

Fig. 26

4.12 Motor connection at 208-230 or 460V

WARNING:
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.

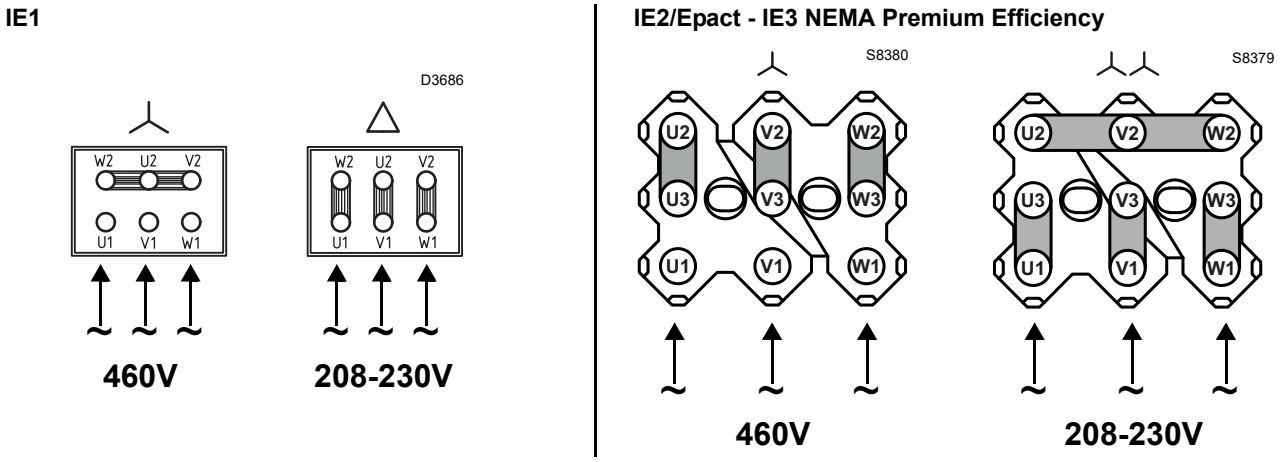

Fig. 27

4.13 Motor connection at 575V

WARNING:
the motors, manufactured for 575V **IE3 NEMA Premium Efficiency** voltage, have the same control box base of the **IE1** and **IE2/Epact** motors.
Please pay attention to the indications in case of maintenance or substitution.

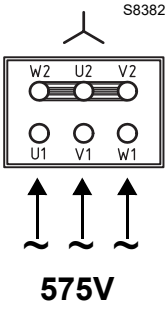

Fig. 28

4.14 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**, **IE2/Epact** and **IE3 NEMA Premium Efficiency.**

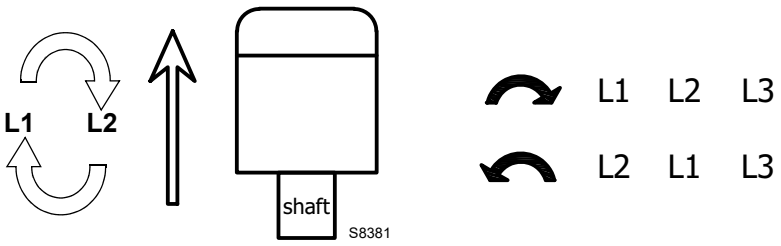

Fig. 29

4.15 Burner operation

4.15.1 Burner starting

- Operating closes.
  Fan motor starts (A Fig. 30).
- Servomotor starts:
  130° rotation to right, until contact is made on red cam.
  The air damper is positioned to MAX. output.
- Pre-purge stage with air delivery at MAX. output.
- After pre-purge stage, servomotor rotates to left up to the angle set on black cam for MIN. output.
- The air damper and the gas butterfly are positioned to MIN. output.
- Ignition electrode strikes a spark.
- Pilot valve opens. The pilot flame is ignited.
- After about 12s the main flame ignites and after 10s there is the consent to modulation and the servomotor reads the input signal and starting cycle ends.

4.15.2 Steady state operation

Burner with external control signal

At the end of the starting cycle, the servomotor control then passes to the load control for boiler pressure or temperature.

By three types of input signals:
- 4-20 mA
- 2-10V
- 0-135 ohm

(The flame safeguard continues, however, to check that the flame is present and that the air pressure switch is in the correct position.)

- If the input signals is high, the burner progressively increases its output to the MAX. value.
- If the input signals is low, the burner progressively decreases its output to the MIN. value. And so on.
- The burner locks out when demand for heat is less than the heat supplied by the burner at min. output. Load control opens. The servomotor returns to the 0° angle limited by contact with orange cam. The air damper closes completely to reduce thermal dispersion to a minimum.

Every time output is changed, the servomotor automatically modifies gas delivery (gas butterfly valve) and air delivery (fan damper).

RFGO A13			
t1	30s	**t6**	31s
t2	4.2s	**t7**	12s
t3	2s	**t8**	4s
t4	10s	**t9**	17s
t5	36s	**t10**	4.2s

Tab. H

FULL MODULATION 20162566

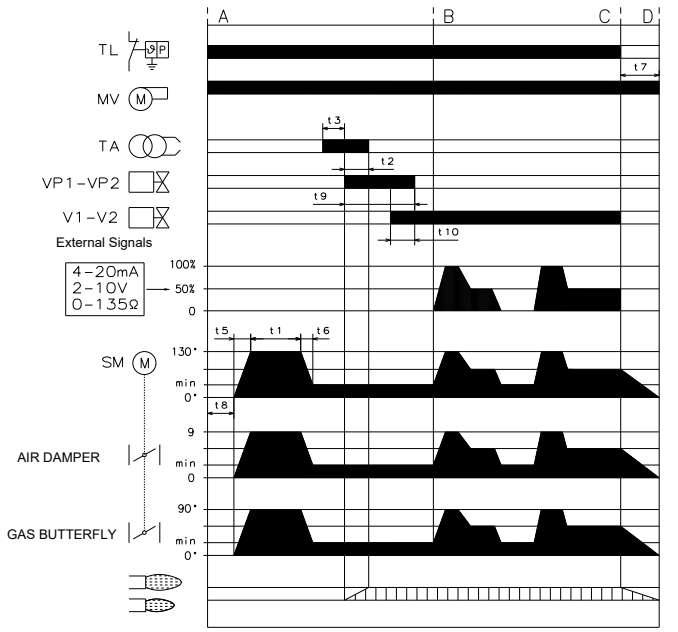

Fig. 30

Key for the times

t1	Pre-purge time with air damper open
t2	First safety time
t3	Pre-ignition time, short (ignition transformer on terminal 16)
t4	Interval between main fuel piloted valve and release to modulation
t5	Running time of air damper into OPEN position
t6	Running time of air damper into low-flame position (MIN)
t7	Post-purge time
t8	Interval until OPEN command for the air damper is given
t9	Running time of pilot
T10	Second safety time
TL	Operating control
MV	Fan Motor
SM	Air and Fuel Actuator
TA	Ignition transformer
VP1	Safety pilot valve
VP2	Main pilot valve
V1	Safety gas valve
V2	Main gas valve

4.15.3 Firing failure

If the burner does not fire, it locks out within 2.5 seconds from opening the pilot valve and then within 5 seconds from opening the main valves.

4.15.4 Burner flame goes out during operation

If the flame should accidentally go out during operation, the burner will lock out within 1s.

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.

WARNING

Refer to paragraph "Safety test - with gas ball valve closed" on page 34 before the first start-up.

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. 31) switch to the start of the scale.

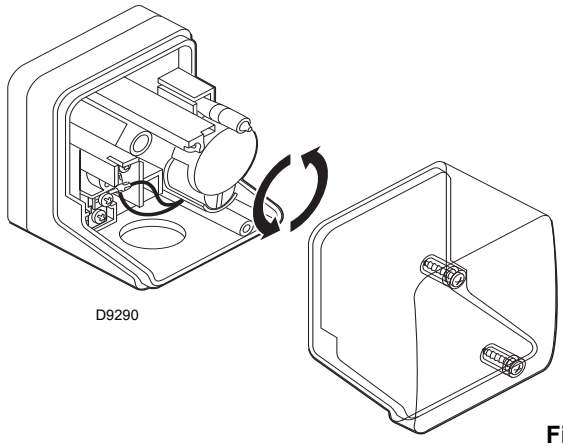

Fig. 31

➤ Adjust the maximum gas pressure switch (Fig. 32) to the end of the scale.

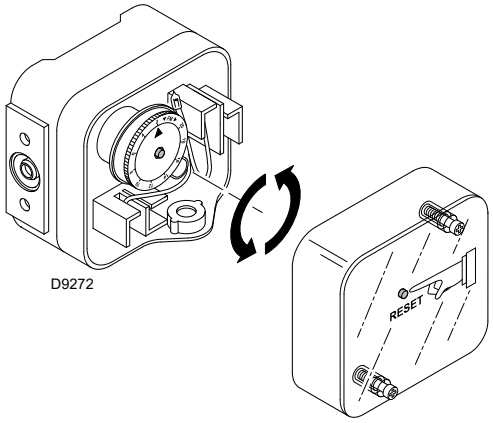

Fig. 32

➤ Adjust the air pressure switch (Fig. 33) to the start of the scale.

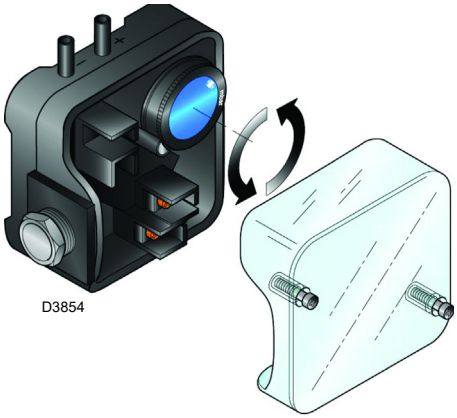

Fig. 33

➤ Purge the air from the gas line.
Fit a manometer (Fig. 34) 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 21.

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.

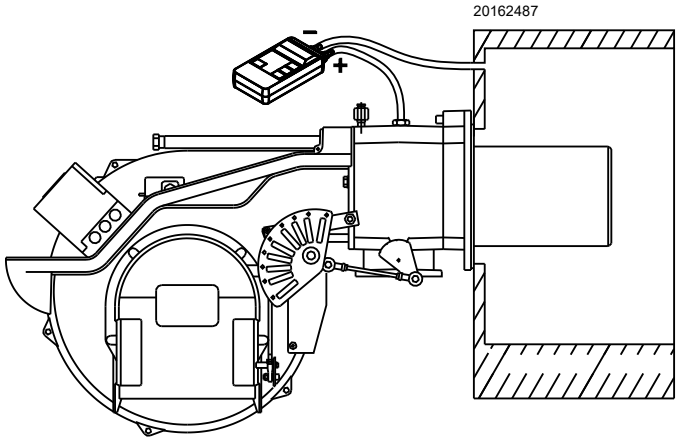

Fig. 34

5.3 Servomotor

The servomotor (Fig. 36) provides simultaneous adjustment for the gas butterfly valve, by means of the adjustable profile cam and the air damper: 1) Fig. 35 and Fig. 36.

It rotates by 130° in approx. 36 s.

To open the servomotor and release the mechanical cam and the gas butterfly valve, see procedure (Refer to paragraph “Servomotor adjustment” on page 29).

Key (Fig. 35)
1 Servomotor
2 Graduated sector for gas butterfly valve
3 Index for graduated sector 2)
4 Adjustable profile cam
5 Adjustment screws for cam starting profile
6 Adjustment fixing screws
7 Adjustment screws for cam and profile
8 Cam
9 Servomotor cams, check that they are shown below in the event of a modification, follow what is described below for each cam
10 Potentiometer already set in factory, do not carry out any adjustment.

The factory settings must not be changed for the first firing, just check that they comply with the details below.

CAM I **(RED): 130°** (The same for all models). Limits the rotation towards the maximum.

WARNING

In the event of a variation, absolutely do not adjust beyond 130°.

CAM V **(BLACK): 15°** Adjusts the ignition position and MIN. output.

CAM VI **(GREEN): 0°** Limits the rotation towards the minimum. With the burner off the air damper and the gas butterfly valve should be closed: 0°. **It is recommended that no adjustments are made.**

CAM II III IV **(BLUE ORANGE YELLOW): 0°**

Do not use, they have no effect on the operation of the burner.

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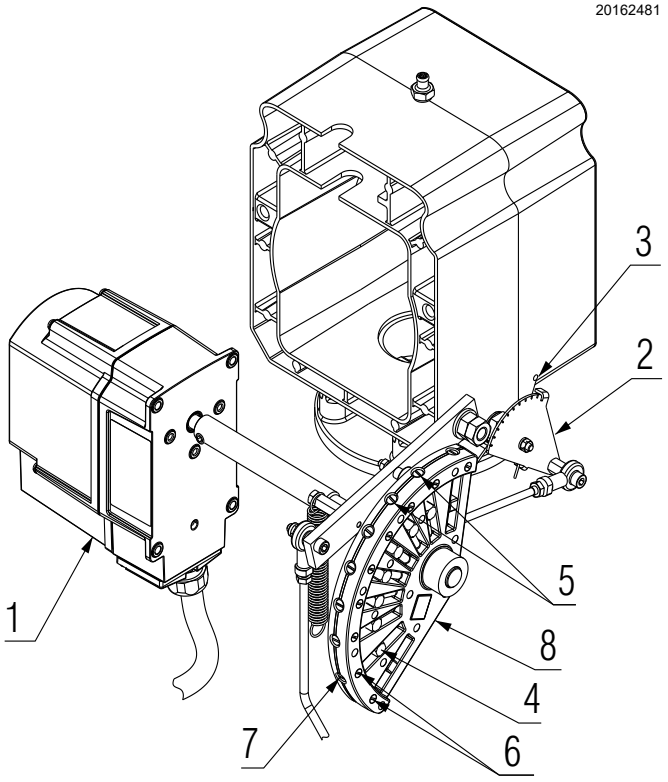

Fig. 35

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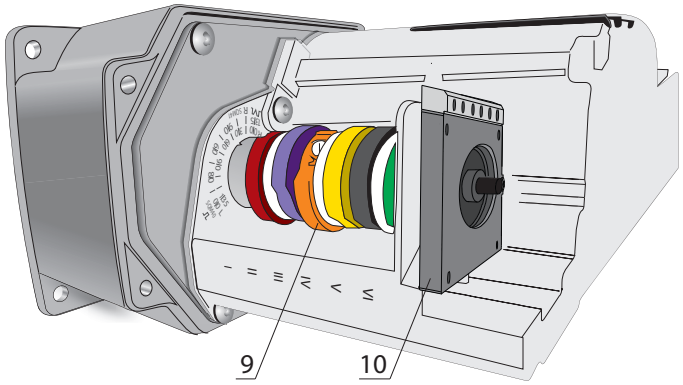


Fig. 36

5.4 Servomotor adjustment

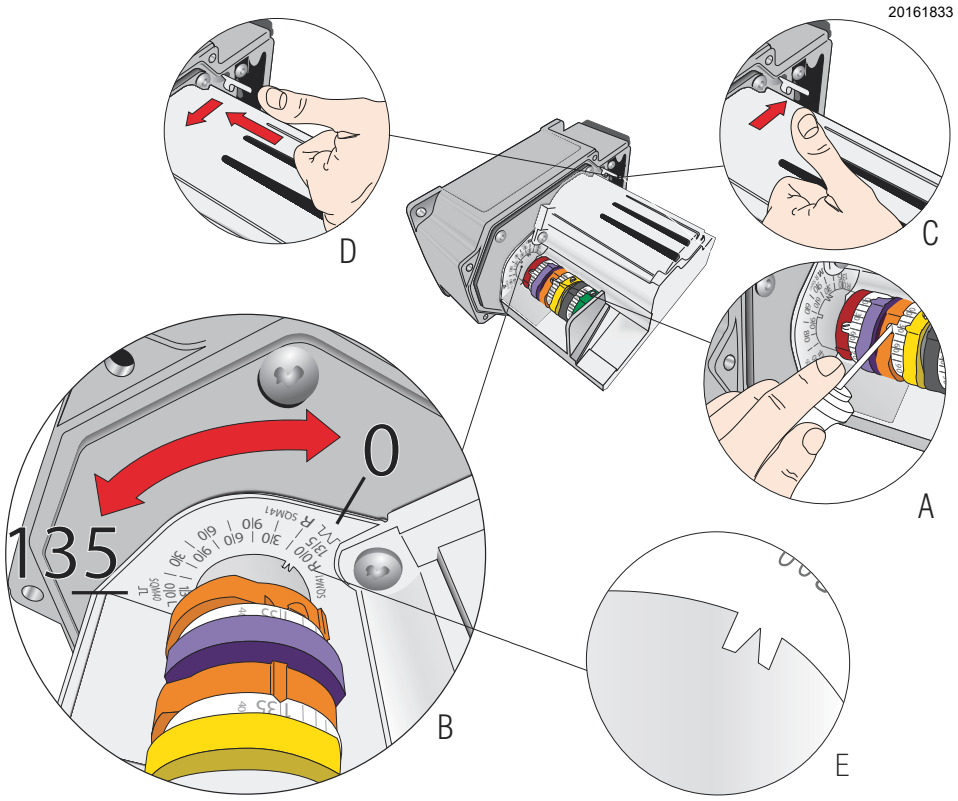


Fig. 37

5.4.1 Disengage the gears of the servomotor

WARNING

Switch off the burner using the switch 1)(Fig. 38), OFF position.

Release the mechanical cam 8)(Fig. 35, page 28) to separate the gears of the servomotor, pressing and shifting downwards the button (Fig. 37 **D**) and by manually turning the mechanical cam 8)(Fig. 35, page 28) backwards and forwards.

We recommend binding the mechanical cams 8)(Fig. 35, page 28) again to the servomotor by shifting upwards the button (Fig. 37 **C**).

5.4.2 Cams adjustment

For adjusting the cams, see Fig. 37 **A**.

Proceed with care and without forcing. It is necessary a small flat screwdriver and turn clockwise or counter-clockwise to the desired position, indicated by the graduated scale and the index on the cam.

5.4.3 Servomotor positioning

During the adjustment operations, pay attention to the correct positioning of the servomotor; the correct index is that one indicated in Fig. 37 **E**.

5.5 Burner start-up

Close the control circuit and set switch 1)(Fig. 38) to “MAN”. As soon as the burner starts check the direction of rotation of the fan blade, looking through the flame inspection window 18)(Fig. 4, page 12).

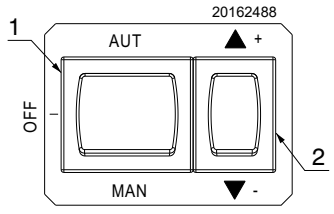


Fig. 38

5.6 Final calibration of the pressure switches

5.6.1 Air pressure switch

Adjust the air pressure switch after having performed all other burner adjustments with the air pressure switch set to the start of the scale (Fig. 39).

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

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

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

During these operations it may be useful to measure the air pressure with a pressure gauge.

The connection of the pressure gauge is shown in Fig. 40.

The standard configuration is that with the air pressure switch connected in absolute mode.
Note the presence of a “T” connection, not supplied.

The air pressure switch may operate in "differential" operation in two pipe system.
If a negative pressure in the combustion chamber during pre-purging prevents the air pressure switch from switching, switching may be obtained by fitting a second pipe between the air pressure switch and the suction inlet of the fan. In such a manner the air pressure switch operates as differential pressure switch.

Fig. 39

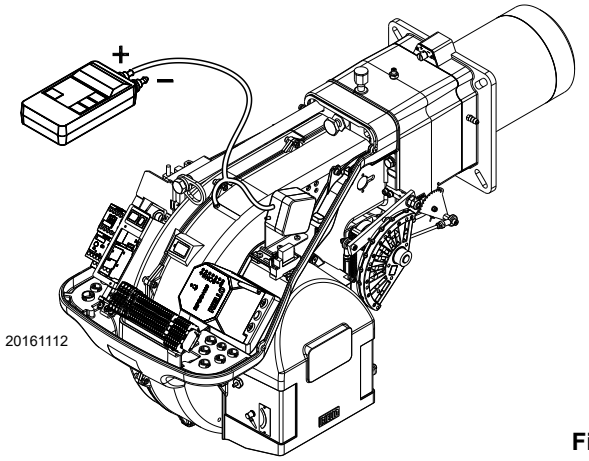


Fig. 40

5.6.2 Maximum gas pressure switch

Adjust the maximum gas pressure switch (Fig. 41) 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.

5.6.3 Minimum gas pressure switch

The purpose of the minimum gas pressure switch is to prevent the burner from operating in an unsuitable way due to too low gas pressure.

Adjust the minimum gas pressure switch (Fig. 42) 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

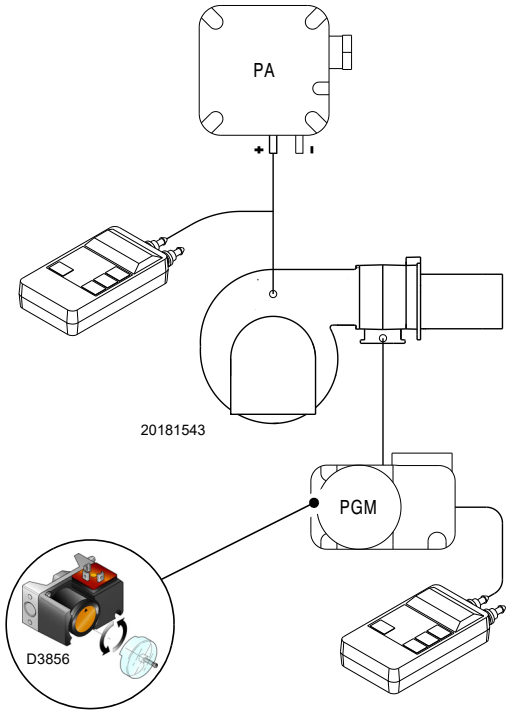


Fig. 41

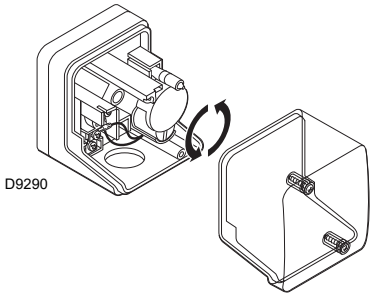


Fig. 42

5.7 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 page 18.

WARNING

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.

5.8 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
- ➤ Maximum gas pressure switch

5.8.1 Firing output

Pilot adjustment has been illustrated on page 18.

5.8.2 Maximum burner output

Maximum output of the burner must be set within the “Firing rates” range shown at page 10. In the above instructions we left the burner running in MIN. output operation.

- ➤ Move the selector 1)(Fig. 38, page 29) in manual position.
- ➤ Move the selector 2)(Fig. 38, page 29) in position (+) (increase output) and keep it until the servomotor has opened the air damper and the gas butterfly valve to 90°.

Gas Calibration

Measure the gas delivery at the meter.

A guideline indication can be calculated from the Tab. G, page 21, simply read off the gas pressure on the manometer (Fig. 34), and follow the instructions at page 21.

- ➤ If delivery needs to be reduced, reduce outlet gas pressure and, if it is already very low, slightly close adjustment valve.
- ➤ If delivery needs to be increased, increase outlet gas pressure.

Adjusting air delivery

Progressively adjust the end profile of cam 4)(Fig. 43) by turning the cam adjustment screws as they appear through the access opening 6).

- ➤ Turn the screws clockwise to increase air delivery.
- ➤ Turn the screws counter-clockwise to reduce air delivery.

5.8.3 Minimum burner output

Minimum output must be selected within the “Firing rates” range shown at page 10.

- ➤ Move the selector 1)(Fig. 38, page 29) in manual position.
- ➤ Move the selector 2)(Fig. 38, page 29) in position (-) (reduction output) until the servomotor has closed the air damper and the gas butterfly valve to 15° (factory set adjustment).

Adjusting gas delivery

Measure the delivery of gas from the gas meter.

- ➤ If this value is to be reduced, decrease the angle of black cam slightly by proceeding a little at a time until the angle is changed from 15° to 13° or 11°....
- ➤ Move the selector 1)(Fig. 38, page 29) in manual position.
- ➤ If it has to be increased move the selector 2)(Fig. 38, page 29) in position (+) (increase output) (i.e. open the gas butterfly valve by 10-15°), increase the cam black angle with small successive movements, i.e. take it from angle 15° to 17° - 19°.... (Refer to paragraph “Cams adjustment” on page 29).
- ➤ Move the selector 2)(Fig. 38, page 29) in position (-) (reduction output) until the servomotor is taken to the minimum opening position and measure the gas delivery.

WARNING

The servomotor follows the adjustment of cam only when the cam angle is reduced.

If it is necessary to increase the cam angle, first increase the servomotor angle with the switch “output increase”, then increase the black cam angle, and at the end bring the servomotor back to the MIN output position with the switch ”output decrease”.

Adjustment of air delivery

Progressively adjust the starting profile of cam 4)(Fig. 43) by turning the screws working through the access hole 6).

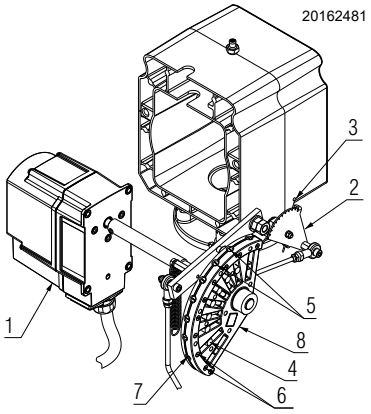


Fig. 43

Key

1 Servomotor
2 Graduated sector for gas butterfly valve
3 Index for graduated sector 2
4 Adjustable profile cam
5 Adjustment screws for cam starting profile
6 Adjustment fixing screws
7 Adjustment screws for cam and profile
8 Cam

5.8.4 Intermediate outputs

Adjustment of gas delivery

No adjustment of gas delivery is required.

Adjustment of air delivery

- ➤ Place the selector 1)(Fig. 38, page 29) in manual position.
- ➤ Place the selector 2)(Fig. 38, page 29) in middle position and set the variable profile cam 4)(Fig. 43) by turning the screws 5).
- ➤ If the burner operation is low-high it is sufficient to set only minimum and maximum firing rates
- ➤ If the burner operation is modulating, all the points of modulation should be adjusted.

When the adjustment is complete, switch off the burner using the switch 1)(Fig. 38, page 29), OFF position, release the mechanical cam 8)(Fig. 35, page 28) to separate the gears of the servomotor (Refer to paragraph “Disengage the gears of the servomotor” on page 29), and by manually turning several times the mechanical cam 8)(Fig. 35, page 28) backwards and forwards check that the movement is smooth and without any hindrance.

WARNING

We recommend binding the mechanical cams 8)(Fig. 38, page 29) to the servomotor.

As far as is possible, try not to move those screws at the ends of the mechanical cam that were previously adjusted for the opening of the gas butterfly valve to MAX and MIN output.

5.9 TRIM potentiometers functions calibration

5.9.1 Range Adjustment range

Place the selector 1)(Fig. 38, page 29) in AUTO position and adjust the range of the analog signal to match the switch positions (minimum and maximum position):

1 Set cam I to the required high-fire position (e.g. 130°; position is indicated on the scale next to the cam).
2 2. Set cam V to the required low-fire position (e.g. 15°).
3 3. Pre-set the signal at the analog input according to the required high-fire position (e.g. 20 mA).
4 4. Turn the max potentiometer for maximum angular rotation
  a) clockwise, if the actuator has not yet reached its maximum angular rotation, or
  b) counter-clockwise until the actuator starts
5 Pre-set the signal at the analog input according to the low-fire position (e.g. 4 mA).
6 Turn the min. potentiometer for minimum angular rotation
  a) counter-clockwise, if the actuator has not yet reached its minimum angular rotation, or
  b) clockwise until the actuator starts

Modulation always takes place between high- and low-fire.

Also, it is possible to define a closed position or a separate ignition position by setting cam VI (independent of cam V, e.g. for defining a position higher than the low-fire position).

NOTE:
When starting up, the direction of rotation of the potentiometer setting must be observed (Fig. 45).

NOTE:
The working range of the potentiometer setting, shown as an example for the current input 4 ... 20 mA (Fig. 46).

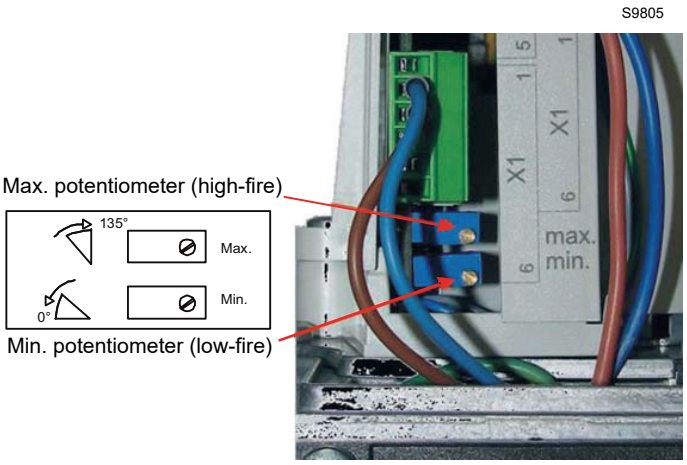


Fig. 44

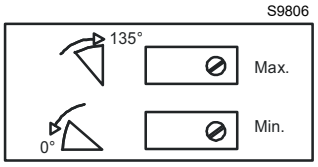


Fig. 45

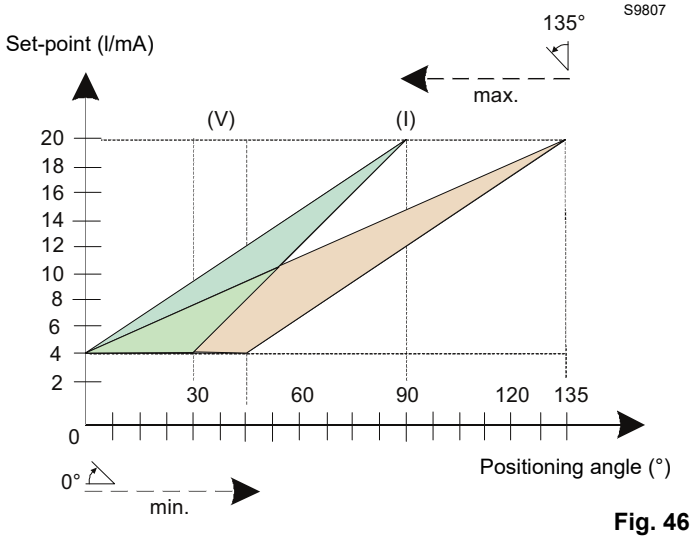


Fig. 46

5.10 Final checks (with the burner working)

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

WARNING

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 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 control box 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

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.

Adjust the burner if the combustion values found at the beginning of the operation do not comply with the regulations in force, or do not correspond to good combustion.

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.

If in doubt, disassemble the elbow fitting 7)(Fig. 49, page 36).

Servomotor

Disengage the cam from servomotor and turn it backward and forward by hand to make sure it is free moving.

Now engage cam again (Refer to paragraph “Cams adjustment” on page 29).

Flame inspection window

Clean the flame inspection window (Fig. 47).

Burner

Check for excess wear or loose screws in the mechanisms controlling the air damper and the gas butterfly valve.

Also make sure that the screws securing the electrical leads in the burner connections are fully tightened.

Clean the outside of the burner, taking special care with the linkages joints and cam.

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 Flame presence check

The burner is fitted with an ionisation system which ensures that a flame is present. The minimum current for plant operation is 3 µA.

The burner provides a much higher current, so that controls are not normally required.

However, if it is necessary to measure the ionisation current, there are two methods:

➤ **Flame presence check with RFGO function**

– Check the level of the flame detection signal with the “Check mode” function from the flame control: the LEDs from 2 to 6 indicate the flame signal level, respectively. See “LED indicator and special function” on page 37.

Check Mode

With burner flame on:

– hold the reset button on the flame control pressed for at least 3 sec.;
– the button colour will change from green to yellow;
– each operating status signalling LED will be compared to 20% of the maximum brightness;
– press the reset button again (<0.5 sec) to reset the standard operation of the signalling LEDs.Safety components.

➤ **Flame presence check with microamperometer instrument**

– disconnect the plug-socket 6)(Fig. 4, page 12) on the ionisation probe cable and insert a direct current microamperometer with a base scale of 100 µA.

WARNING

Carefully check polarities!

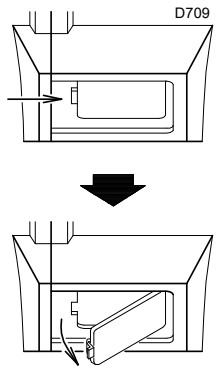


Fig. 47

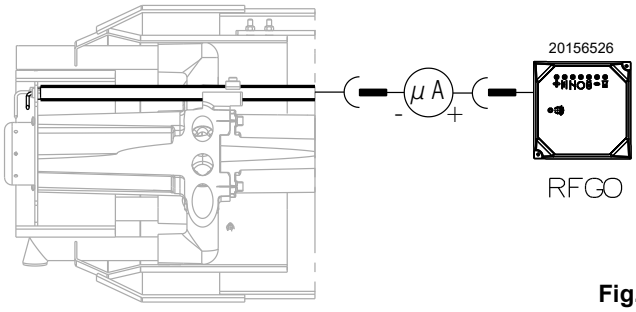


Fig. 48

6.2.5 Safety components

The safety components should be replaced at the end of their life cycle indicated in the following table.

WARNING

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
Flexible hoses (if present)	5 years or 30,000 pressurised cycles
Fan impeller	10 years or 500,000 start-ups

Tab. I

6.3 Opening the burner

DANGER

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

DANGER

Close the fuel interception tap.

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

To open the burner proceed as follows:

- ➤ remove screws 1)(Fig. 49) and withdraw the cover 2);
- ➤ disconnect the swirler joint 7) to the graduate sector;
- ➤ remove screw 3) and pull the burner back on slide bars 4) by about 4”;
- ➤ disconnect the electrode wires and then pull the burner completely back;
- ➤ unscrew the screw 6) and extract the inner part 5).

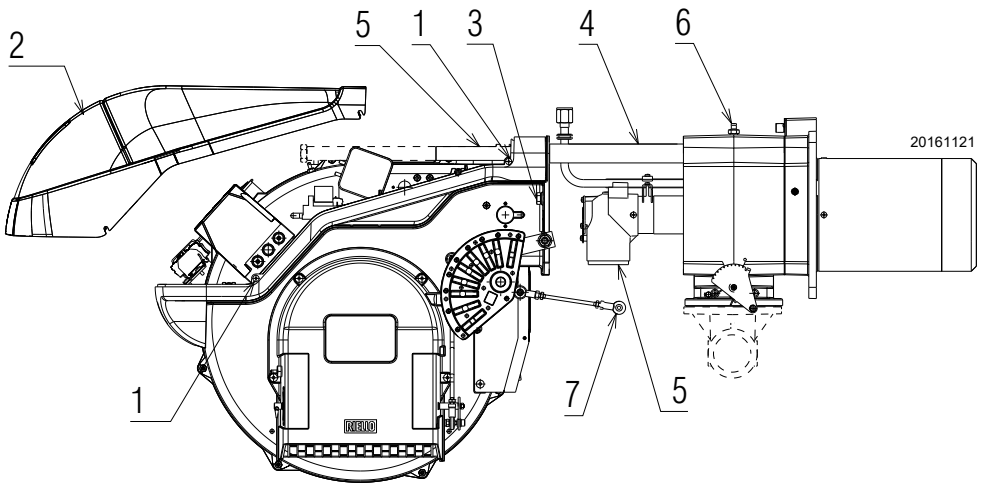


Fig. 49

6.4 Closing the burner

To close the burner proceed as follows:

- ➤ push the burner 13)(Fig. 49) at approximately 4” from the electrical board 14);
- ➤ insert the ignition electrode cables and then slide the burner up to the sleeve so that it is positioned as shown in Fig. 49;
- ➤ secure the burner to the sleeve by tightening screw 3);
- ➤ reconnect the swirler joint 7).

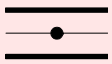
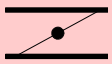
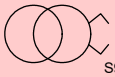
WARNING

When fitting the burner on the two slide bars, it is advisable to gently draw out the high tension cables until they are slightly stretched.

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

7 LED indicator and special function

7.1 Description of LED lamps

 S9740	Fan	It turns on when the fan motor is powered (T6) and blinks when RUN/CHECK switch is set to “CHECK” during damper movement phases, PTFI AND MTFI.
 S9741	Open damper	It blinks when the air damper is moving towards the maximum opening position until the position-reached feedback sent by the servomotor is received, then it stays steadily on for the time set by the flame control.
 S9742	Closed damper	If blinks when the air damper is moving towards the minimum opening position until the position-reached feedback sent by the servomotor is received, then it stays steadily on until the end of the pre-purging time.
 S9743	Auto	It indicates that the burner is ready for the output modulation.
 S9744	Ignition	It blinks during the ignition phase (1st safety time) and stays steadily on during the MTFI.
	Flame	It blinks during the first safety time and stays steadily on if the flame detection has been correctly performed.
 S9746	Alarm	It turns on in red when a lock-out condition occurs. Together with the other indicators, it indicates the type of fault during the lock-out phase. Together with the other LEDs, it indicates the operating status during the normal cycle.

Tab. J

T = Terminal
PTFI = Pilot ignition attempt
MTFI = Ignition attempt with main fuel valve

7.2 Check mode function

By the reset push button on the main panel of the control flame the check mode functions are available (prepurging, ignition, 1st safety time and 2nd safety time).

The CHECK MODE is designed to facilitate the checking of the working phase of the burner.
This function is particularly useful during the burner first commissioning or during maintenance.

To enable the check mode function:

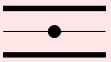
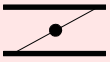
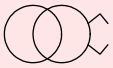
- keep the reset button pressed, see chapter 8 for more details, for at least 3 seconds, the status LED changes from green to yellow to signal that the control device is in check mode;
- the control device locks out during pre-purging, after a timeout of max 30 minutes the flame control will automatically exit the check mode function;
- check mode has a 2 minute timeout during the 2nd safety time. When the time out is expired, the flame control goes back to the normal operating status;
- check mode has a 2 minute timeout during the MTFI status. When the time out is expired, the flame control goes back to the normal operating status;
- during the check mode 1st or 2nd safety time, the flame signal level can be indicated by the 5 central LEDS on the flame control central panel, which turn on proportionally.
  Each lit LED (starting from the flame LED) represents 20% of the signal power.
  To exit the check mode function, press the reset button; the flame control will go back to the normal operating mode.

7.3 Flame control lock-out or emergency stop condition

The RFGO control device can be locked (emergency stop) at any time during the operating cycle and unlocked when already locked (lock-out) by simply pressing the key on the front panel or by means of the terminal T21 on the support base.

7.4 LED lamps: burner operating status

OPERATING STATUSES INDICATED BY LEDS DURING NORMAL OPERATION AND CHECK MODE

Operation LED ● = ON	Fan	Open damper	Closed damper	Modulation	Ignition	Flame	Status
Icon	 S9740	 S9741	 S9742	 S9743	 S9744	 S9745	 S9746
Power OFF/ON							OFF
Not ready/ Diagnostics							Green
Standby			●				Green
Servomotor movement (Note 3)	●	OFF Flashing ●	● Flashing OFF				Green
Waiting for closing	Green blinking						Green
OPEN (before ignition)	●	●					Green
Minimum (before ignition)	●		●				Green
Ignition	●		●		●		Green
PTFI	●		●		●	Green blinking	Green
MTFI	●		●			●	Green
Active modulation	●			●		●	Green
Minimum output position	●		●			●	Green
With flame present	●	●				●	Green
Economy mode	●		●				Green
Check during maximum opening phase	Flashing	●					Yellow
Check during minimum closing phase	Flashing		●				Yellow
Check during ignition phase with pilot PTFI	Flashing	● Note 1	● Note 1	● Note 1	● Note 1	● Note 1	Yellow
Check during ignition phase with main fuel valve MTFI	Flashing	● Note 1	● Note 1	● Note 1	● Note 1	● Note 1	Yellow
Fault/lock-out	● Note 2	● Note 2	● Note 2	● Note 2	● Note 2	● Note 2	Red
End of the cycle	●		●	●			Green

Tab. K

1. LEDs form a progress bar which indicates the Flame Signal Power in order to orientate the sensors during commissioning (LEDs “Grow” upwards, moving away from the Status at 20% intervals of flame power.)
2. LEDs indicate the error or lock-out code for troubleshooting.
3. LEDs change from ON to BLINKING to OFF showing the servomotor movement control until the position-reached feedback is received See “Problems - Causes - Remedies signalled by LED indicators” on page 39.“.

8 Problems - Causes - Remedies signalled by LED indicators

When an emergency stop occurs, the control device LEDs indicate the cause of the stop.
The terminal T3 is not powered.
The device operating status is internally memorised in case of lack of power supply.

The device lock-out condition can be caused by pressing (<1sec.) the reset button on the flame control front side or through the remote reset - terminal T21 on the base.
The reset button is very sensitive, do not press it strongly during the reset operation.

Unlocking the control device

The RFGO control device can be reset in two ways: reset button and remote reset terminal.
The remote reset must be a normally open connected button between T21 and flame control power supply voltage (see illustrative diagrams):

- the reset is performed when a faulty condition is detected by the flame control.
- Press the reset button to reset the system after a lock-out.
- Pressing the reset button during operation will cause an emergency stop.
- The reset or emergency stop condition can be obtained also by using the remote reset with the same modalities.
- The number of reset attempts is limited to a maximum of 5 within 15 minutes.

Error / RFGO LED lock-out Codes

During an alarm condition, the status LED becomes steady red.
The remaining LEDs turn on according to a coded sequence which identifies the lock-out cause.
The following table shows the different LED Lock-out codes.


WARNING

The device described in this manual can cause material problems, severe injuries or death.

It is the owner or user's responsibility to make sure that the equipment described is installed, used and commissioned in compliance with the requirements provided both by national and local law. The lock-out condition indicates the presence of a fault which occurred during the operating cycle or during stand-by mode.
Before performing an unlock attempt, it is necessary to restore the original optimal operating conditions.


WARNING

Thermal unit's operation, maintenance and troubleshooting interventions must be carried out by trained personnel.
The persons who solve lock-out problems or reset the control device must observe the error codes to solve the problems described in this product technical data sheet.

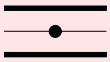
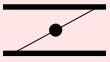
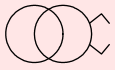
It is not admitted to tamper with or act on the system or control in a way that could compromise the product safety or warranty.
Any tests on safety devices or on loads, such as fan motor, valves, igniter, flame sensors, must be performed with the shut-off valves closed and by qualified personnel.

Do not by-pass nor exclude the safety devices connected to the flame control.
Failure to observe these guidelines will exclude any liability.


WARNING

The regulation prohibits the system from allowing more than 5 remote reset attempts within a 15 minute time window.
If more than 5 attempts are performed without solving the lock-out, the system will prevent the user to perform further remote resets and force him/her to wait for the 15 minutes to elapse.
The remote reset operation will be restored at the end of the waiting time.
It is recommended that qualified personnel evaluate the lock-out condition and implement the solution which is suitable for the fault to be solved.

Error / RFGO LED lock-out codes

No	Faults	LED 1	LED 2	LED 3	LED 4	LED 5	LED 6	LED 7
	Operation LED ● = ON	Fan	Open damper	Closed damper	Auto	Ignition	Flame	Status
	Icon	 S9740	 S9741	 S9742	 S9743	 S9744	 S9745	 S9746
1	Post-diagnostics fault	●						Red
2	Local reset		●					Red
3	Combustion air fan fault	●	●					Red
4	Supervisor processor diagnostics fault			●				Red
5	FR- NO Flame at the end of the 2nd safety time (MTFI)	●		●				Red
6	FR: internal circuit fault		●	●				Red
7	Internal communication fault	●	●	●				Red
8	Remote reset				●			Red
9	FR: internal fault	●			●			Red
10	Main processor fault		●		●			Red
11	Data memory test fault	●	●		●			Red
12	Data memory test fault			●	●			Red
13	Mains voltage or frequent fault	●		●	●			Red
14	Internal processor fault		●	●	●			Red
15	Internal processor fault	●	●	●	●			Red
o. 16	No flame: 1st safety time (PTFI)	●				●		Red
17	Wiring fault		●			●		Red
18	Safety relay fault	●	●			●		Red
19	Combustion airflow switch fault in the rest position			●		●		Red
20	UV: no flame at the end of the 2nd safety time (MTFI)	●		●		●		Red
21	Safety relay fault		●	●		●		Red
22	Supervisor processor fault	●	●	●		●		Red
23	Supervisor memory test fault				●	●		Red
24	Flame loss during the operation (AUTO)	●			●	●		Red
25	Supervisor processor data memory fault		●		●	●		Red
26	Supervisor processor internal fault	●	●		●	●		Red
27	Not used							
28	Not used							
29	Operating temperature out of range		●	●	●	●		Red
30	Code memory fault	●	●	●	●	●		Red
31	FR: external short circuit						●	Red
32	Check mode timeout (manual)	●					●	Red
33	False flame in stand-by mode		●				●	Red
34	Not used							
35	Internal processor timeout			●			●	Red
36	Internal processor timeout	●		●			●	Red
37	Combustion air check timeout		●	●			●	Red
38	Internal processor timeout	●	●	●			●	Red
39	Internal processor timeout				●		●	Red
40	Internal hardware fault	●			●		●	Red
41	Internal hardware fault		●		●		●	Red
42	Main processor fault	●	●		●		●	Red
43	Supervisor processor fault			●	●		●	Red

No	Faults	LED 1	LED 2	LED 3	LED 4	LED 5	LED 6	LED 7
44	Supervisor processor timeout	●		●	●		●	Red
45	Off-specification mains voltage		●	●	●		●	Red
46	Off-specification mains voltage	●	●	●	●		●	Red
47	UV: Internal fault					●	●	Red
48	Supervisor processor fault	●				●	●	Red
49	Main processor fault		●			●	●	Red
50	Ignition feedback fault	●	●			●	●	Red
51	Pilot feedback fault			●		●	●	Red
52	Piloted valve feedback fault	●		●		●	●	Red
53	Actuator feedback waiting time expired		●	●		●	●	Red
54	Direct ignition valve feedback fault	●	●	●		●	●	Red
55	Internal processor fault				●	●	●	Red
56	UV: false flame during operation			●	●	●	●	Red
57	FR: false flame during operation	●		●	●	●	●	Red
58	T8 inlet fault		●	●	●	●	●	Red
59	Internal hardware fault	●			●	●	●	Red
60	Local reset fault	●	●	●	●	●	●	Red
61	Open POC fault		●		●	●	●	Red
62	UV: strong UV flame fault	●	●		●	●	●	Red
63	Internal hardware fault					●		Red

Tab. L

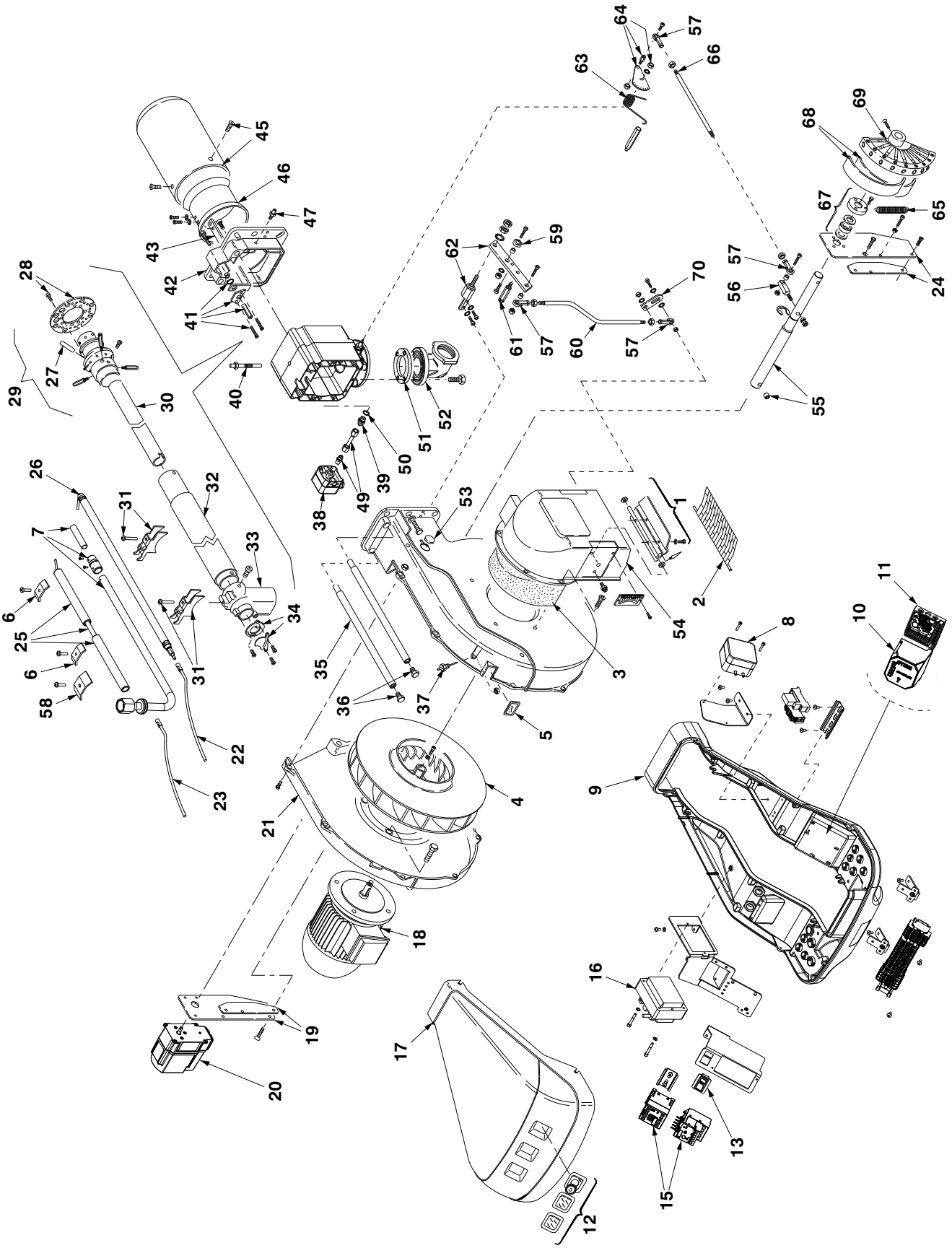
Fault explanation

No	Faults	Cause	Solution
1	Post-diagnostics fault	Initial power diagnostics fault Make sure that the status of inlets and outlets is correct upon ignition	Check T12, T13 and T14
2	Local reset	The user started the manual reset or the reset switch is faulty	Check T21 inlet or reset for normal operation
3	Combustion air fan fault	No Air Check signal (T14) during the bleed cycle or Air Check signal loss during the burner operation	Check the fan or the air pressure switch
4	Supervisor processor diagnostics fault	The system detected the presence of voltage on T16, T17, T18 or T19 at the wrong moment or there is no voltage when necessary	Check the wiring and make sure that the system is operating on a single-phase line (50/60Hz)
5	FR- No flame at the end of the 2nd safety time (MTFI)	No flame at the end of the second safety time	Inspect the system, check the gas pressure, inspect the flame detection electrode, check the wiring, etc.
6	FR: internal circuit fault	Internal fault	Replace the control device
7	Internal communication fault	Internal fault	Replace the control device
8	Remote reset	The user pressed the remote reset button or the reset switch is discontinuous/dynamic	Check the remote switch
9	FR: internal fault	Internal fault	Replace the control device
10	Main processor fault	Internal fault	Replace the control device
11	Data memory test fault	Internal fault	Replace the control device
12	Data memory test fault	Internal fault	Replace the control device
13	Mains voltage or frequent fault	Off-specification power supply voltage and/or frequency	Check the input power supply
14	Internal processor fault	Internal fault	Replace the control device
15	Internal processor fault	Internal fault	Replace the control device
o. 16	No flame: 1st safety time (PTFI)	No flame at the end of the first safety time	Inspect the system, check the gas pressure, check the flame sensor, check the wiring, etc.
17	Wiring fault	The system detected the presence of voltage on critical terminals (T16, T17, T18 or T19) at the wrong moment or there is no voltage when necessary	Inspect the wiring and make sure that the system is operating on a single-phase line (50/60Hz)
18	Safety relay fault	Internal fault	Replace the control device
19	Combustion airflow switch fault in the rest position	Open the circuit upon T13 start-up	Check the wiring for the air pressure switch
20	UV: no flame at the end of the 2nd safety time (MTFI)	No flame at the end of the 2nd safety time	Inspect the system, check the gas pressure, check the flame sensor, check the wiring, etc.
21	Safety relay fault	Internal fault	Replace the control device
22	Supervisor processor fault	Internal fault	Replace the control device
23	Supervisor memory test fault	Internal fault	Replace the control device
24	Flame loss during the operation (AUTO)	Loss of flame	Check the flame sensor or the fuel flow line
25	Supervisor processor data memory fault	Internal fault	Replace the control device
26	Supervisor processor internal fault	Internal fault	Replace the control device
27	Not used		
28	Not used		
29	Operating temperature out of range	Operating temperature below -40°C or above 70°C	Bring the control device within the specified temperature nominal values
30	Code memory fault	Internal fault	Replace the control device
31	FR: external short circuit	External short circuit between T24 and EARTH	Inspect the flame detection electrode
32	Check mode timeout (manual)	The interval for the manual mode (30 minutes) to end has elapsed	Exit the manual mode correctly to avoid timeout

No	Faults	Cause	Solution
33	False flame in stand-by mode	Unexpected flame (false or parasitic flame) detected during the Stand-by status	Check flame sensor or interference
34	Not used		
35	Internal processor timeout	Internal fault	Replace the control device
36	Internal processor timeout	Internal fault	Replace the control device
37	Combustion air check timeout	The system could not perform verification tests of the combustion air during the burner sequence	Check the wiring or the air pressure switch
38	Internal processor timeout	Internal fault	Replace the control device
39	Internal processor timeout	Internal fault	Replace the control device
40	Internal hardware fault	Internal fault	Replace the control device
41	Internal hardware fault	Internal fault	Replace the control device
42	Main processor fault	Internal fault	Replace the control device
43	Supervisor processor fault	Internal fault	Replace the control device
44	Supervisor processor timeout	Internal fault	Replace the control device
45	Off-specification mains voltage	Off-specification mains voltage/frequency	Check the mains voltage level or the frequency. Contact the factory if the problem persists
46	Off-specification mains voltage	Off-specification mains voltage/frequency	Check the mains voltage level or the frequency. Contact the factory if the problem persists
47	UV: Internal fault	Internal fault	Replace the control device
48	Supervisor processor fault	Internal fault	Replace the control device
49	Main processor fault	Internal fault	Replace the control device
50	Ignition feedback fault	The system detected the presence of voltage on T16 at the wrong moment or there is no voltage when necessary	Check the wiring and make sure that the earthing is appropriate If the problem persists, contact the distributor/ factory
51	Pilot feedback fault	The system detected the presence of voltage on T17 at the wrong moment or there is no voltage when necessary	Check the wiring and make sure that the earthing is appropriate. If the problem persists, contact the distributor/factory
52	Piloted valve feedback fault	The system detected the presence of voltage on T19 at the wrong moment or there is no voltage when necessary	Check the wiring and make sure that the earthing is appropriate If the problem persists, contact the distributor/ factory
53	Actuator feedback waiting time expired	No actuator feedback on T8 for more than 10 minutes	Check the wiring Check the modulation equipment
54	Direct ignition valve feedback fault	The system detected the presence of voltage on T18 at the wrong moment or there is no voltage when necessary	Check the wiring and make sure that the earthing is appropriate. If the problem persists, contact the distributor/factory
55	Internal processor fault	Internal fault	Replace the control device
56	UV: false flame during operation	False flame detected before ignition	Check the flame sensor
57	FR: false flame during operation	False flame detected before ignition	Check the wiring Check the flame sensor Make sure that earthing is appropriate
58	T8 inlet fault	The system detected the presence of voltage on T8 at the wrong moment or there is no voltage when necessary	Check the wiring Check the actuator
59	Internal hardware fault	Internal fault	Replace the control device
60	Local reset fault	Local reset button pressed for more than 10 seconds or reset button locked	If the problem persists, replace the control device
61	Open POC fault	The fuel valve is open at the wrong moment	Check the wiring
62	UV: strong UV flame fault	The flame sensor is too close to the flame	Increase the distance between the flame sensor and the flame OR use an orifice to reduce the view field
63	Internal hardware fault	Internal fault	Replace the control device

Tab. M

A Appendix - Spare parts



N.	CODE	20160208 - (20166044/20166045)	20160227 - (20166046)	20160233 - (20166047/20166048)	20160238 - (20166049)	20160253 - (20166101/20166102)	20160256 - (20166103)	DESCRIPTION	*
1	**3003948**	•	•	•	•	•	•	AIR DAMPER ASSEMBLY	B
2	**3003949**	•	•	•	•	•	•	GRID	
3	**3003952**	•	•	•	•	•	•	SOUND DAMPING	
4	**3012939**	•	•					FAN	C
4	**3012403**			•	•			FAN	C
4	**3012940**					•	•	FAN	C
5	**3003763**	•	•	•	•	•	•	INSPECTION WINDOW	
6	**3013001**	•	•	•	•	•	•	U BOLT	
7	**3012973**	•	•	•	•			PILOT TUBE	
7	**3012974**					•	•	PILOT TUBE	
8	**3012948**	•	•	•	•	•	•	AIR PRESSURE SWITCH	A
9	**3013127**	•	•	•	•	•	•	TERMINAL BOARD	
10	**20144930**	•	•	•	•	•	•	CONTROL BOX	B
11	**20144947**	•	•	•	•	•	•	BASE	C
12	**3007627**	•	•	•	•	•	•	MEMBRANE	
13	**3012080**	•	•	•	•	•	•	SWITCH	C
15	**20115409**	•		•	•	•	•	STARTER	C
15	**20120289**		•					STARTER	C
16	**3012956**	•	•	•	•	•	•	TRANSFORMER	B
17	**3012934**	•	•	•	•	•	•	COVER	
18	**3012941**	•						MOTOR	C
18	**20084068**		•					MOTOR	C
18	**3012943**			•		•		MOTOR	C
18	**20062892**				•		•	MOTOR	C
19	**20161230**	•	•	•	•	•	•	ANCHOR PLATE	
20	**20161228**	•	•	•	•	•	•	SERVOMOTOR	B
21	**3012012**	•	•	•	•	•	•	HALF-SHELL	
22	**20155571**	•	•	•	•	•	•	CONNECTION	A
23	**3012959**	•	•	•	•	•	•	CONNECTION	A
24	**3012346**	•	•	•	•	•	•	ANCHOR PLATE	
25	**3012960**	•	•	•	•			IGNITION ELECTRODE	A
25	**20090516**					•	•	IGNITION ELECTRODE	A
26	**3012175**	•	•	•	•			PROBE	A
26	**3012176**					•	•	PROBE	C
27	**3012023**	•	•	•	•	•	•	TUBE	C

N.	CODE	20160208 - (20166044/20166045)	20160227 - (20166046)	20160233 - (20166047/20166048)	20160238 - (20166049)	20160253 - (20166101/20166102)	20160256 - (20166103)	DESCRIPTION	*
28	**3012961**	•	•					DIFFUSER	
28	**3012962**			•	•	•	•	DIFFUSER	C
29	**3012963**	•	•					DISTRIBUTOR	C
29	**3012964**			•	•			DISTRIBUTOR	C
29	**3012965**					•	•	DISTRIBUTOR	C
30	**3012031**	•	•	•	•			TUBE	C
30	**3012035**					•	•	TUBE	C
31	**3012966**	•	•	•	•	•	•	SUPPORT	C
32	**3012967**	•	•	•	•			TUBE	
32	**3012968**					•	•	TUBE	C
33	**3012042**	•	•	•	•	•	•	ELBOW	
34	**3012014**	•	•	•	•	•	•	RING NUT	
35	**3012013**	•	•	•	•	•	•	BAR	B
36	**3003481**	•	•	•	•	•	•	SCREW	
37	**3003891**	•	•	•	•	•	•	CONNECTOR	
38	**3012969**	•	•	•	•	•	•	GAS PRESSURE SWITCH	C
39	**3003220**	•	•	•	•	•	•	CONNECTOR	
40	**3012049**	•	•	•	•	•	•	SCREW	
41	**3003974**	•	•	•	•	•	•	CONTROL DEVICE	C
42	**3003975**	•	•	•	•			FRONT PIECE	B
42	**3003976**					•	•	FRONT PIECE	B
43	**20028666**	•	•					SQUARE	B
43	**20161284**			•	•			SQUARE	B
43	**20162255**					•	•	SQUARE	C
45	**3003987**	•	•					FLAME FUNNEL	
45	**3012055**			•	•			FLAME FUNNEL	
45	**3012057**					•	•	FLAME FUNNEL	B
46	**3003983**	•	•	•	•			SHUTTER	B
46	**3003984**					•	•	SHUTTER	
47	**3003322**	•	•	•	•	•	•	CONNECTOR	
49	**3013055**	•	•	•	•	•	•	TUBE	
50	**3007166**	•	•	•	•	•	•	SEAL	
51	**3005482**	•	•	•	•	•	•	SEAL	
52	**3012971**	•	•	•	•	•	•	FLANGE	C
53	**3003996**	•	•	•	•	•	•	PLUG	

N.	CODE	20160208 - (20166044/20166045)	20160227 - (20166046)	20160233 - (20166047/20166048)	20160238 - (20166049)	20160253 - (20166101/20166102)	20160256 - (20166103)	DESCRIPTION	*
54	**3012348**	•	•	•	•	•	•	AIR INTAKE	C
55	**20161231**	•	•	•	•	•	•	CAM-HOLDER SHAFT	
56	**3012350**	•	•	•	•	•	•	LEVER	C
57	**3006098**	•	•	•	•	•	•	PIN JOINT	
58	**20073810**	•	•	•	•	•	•	U BOLT	
59	**3003841**	•	•	•	•	•	•	BEARING	
60	**3012351**	•	•	•	•	•	•	TIE ROD	
61	**3012352**	•	•	•	•	•	•	BAR	
62	**20034953**	•	•	•	•	•	•	LIFTING ASSEMBLY	
63	**3013204**	•	•	•	•	•	•	SPRING	
64	**3012355**	•	•	•	•	•	•	GRADUATE SECTOR	C
65	**3012356**	•	•	•	•	•	•	SPRING	
66	**3012060**	•	•	•	•	•	•	TIE ROD	
67	**3012357**	•	•	•	•	•	•	BEARING	
68	**3006097**	•	•	•	•	•	•	SPRING	
69	**20188969**	•	•	•	•	•	•	CAM	
70	**3012601**	•	•	•	•	•	•	LEVER	

*

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

- **Kit for lengthening the combustion head**

Burner	Standard length	Length obtainable with kit	Code
RS 70/M	$97\,^{1}/_{32}$"	$14\,^{27}/_{32}$"	20029381
RS 100/M	$9\,^{17}/_{32}$"	$14\,^{27}/_{32}$"	20029382
RS 130/M	$10\,^{233}/_{2}$"	$16\,^{1}/_{32}$"	20029383

- **Kit for LPG operation**

The kit allows the burner to operate on LPG.

Burner	MBtu/hr	Code
RS 70/M	918 - 3084	3010273
RS 100/M	1320 - 4405	3010274
RS 130/M	1764 - 5545	3010275

- **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_2: Low Fire		High Fire	
Main Power Supply:		O_2: Low Fire		High Fire	
Control Power Supply:		CO: Low Fire		High Fire	
Burner Firing Rate:		NO_X: 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:					

CONTROL SETTINGS

Operating Set-point:		Low Oil Pressure:	
High Limit Set-point:		High Oil Pressure:	
Low Gas Pressure:		Flame Safeguard Model Number:	
High Gas Pressure:		Modulating Signal Type:	

NOTES

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