GB

Light oil burners

Low - High or modulating operation

CODE	MODEL
C9514300 - C9514301	RL 70/M
C9515300 - C9515301	RL 100/M
C9516300 - C9516301	RL 130/M

Original instructions

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.

WARNING

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

2.2 Personnel training

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

The user:

➤ undertakes to entrust the machine exclusively to suitably trained and qualified personnel;

➤ undertakes to inform his personnel in a suitable way about the application and observance of the safety instructions. With that aim, he undertakes to ensure that everyone knows the use and safety instructions for his own duties;

➤ Personnel must observe all the danger and caution indications shown on the machine.

➤ Personnel must not carry out, on their own initiative, operations or interventions that are not within their province.

➤ Personnel must inform their superiors of every problem or dangerous situation that may arise.

➤ The assembly of parts of other makes, or any modifications, can alter the characteristics of the machine and hence compromise operating safety. The manufacturer therefore declines any and every responsibility for any damage that may be caused by the use of non-original parts.

In addition:

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

➤ the user must inform the manufacturer if faults or malfunctioning of the accident prevention systems are noticed, along with any presumed danger situation.

➤ Personnel must always use the personal protective equipment envisaged by legislation and follow the indications given in this manual.

3 Technical description of the burner

3.1 Technical data

Model			RL 70/M	RL 100/M	RL 130/M
Output (1)	High	MBtu/hr (3) GPH	1792 - 3136 12.8 - 22.4	2688 - 4480 19.2 - 32	3564 - 5824 25.6 - 41.6
	Low	MBtu/hr (3) GPH	756 - 1792 5.4 - 12.8	1260 - 2688 9 - 19.2	1568 - 3584 11.2 - 25.6
Fuel			# 2 fuel oil		
Operation			Low - high or modulating		
Nozzle		number	1 (return flow nozzle)		
Standard applications			Boilers: water, steam, thermal oil		
Ambient temperature		°F	32 - 104 (0 - 40 °C)		
Combustion air temperature		°F max	140 (60 °C)		
Pump	delivery (at 290 PSI) pressure range fuel temperature	GPH PSI ° F max	60.8 145 - 304.5 194 (90 °C)		
Noise levels (3)		dB(A)	75	77	78.5

Tab. A

(1) Reference conditions: Ambient temperature 68 °F (20 °C) - Barometric pressure 394” WC - Altitude 329 ft a.s.l.
(2) Sound pressure measured in manufacturer’s combustion laboratory, with burner operating on test boiler and at maximum rated output.
(3) Equivalent Btu values based on 1 USGPH = 140,000 Btu/hr.

3.2 Electrical data

Fan and pump motor IE3 NEMA Premium Efficiency

Model		RL 70/M	RL 100/M	RL 130/M
Main electrical supply Control circuit power supply	V/Ph/Hz		208-230/3/60 120/1/60	
Fan and pump motor	rpm W - HP V A	3490 1100 - 1.5 208-230 4	3480 2200 - 3 208-230 7.6	3480 2200 - 3 208-230 7.6
Ignition transformer	V1 - V2 I1 - I2		120 V - 2 X 5 kV 2.7 A - 30 mA	
Electrical power consumption	W max	1300	2550	2550
Electrical control circuit consumption	W		750	
Total electrical consumption	W	2050	3300	3300
Electrical protection			NEMA 1	

Tab. B

Model		RL 70/M	RL 100/M	RL 130/M
Main electrical supply Control circuit power supply	V/Ph/Hz		460/3/60 120/1/60	
Fan and pump motor	rpm W - HP V A	3490 1100 - 1.5 460 2	3480 2200 - 3 460 3.8	3480 2200 - 3 460 3.8
Ignition transformer	V1 - V2 I1 - I2		120 V - 2 X 5 kV 2.7 A - 30 mA	
Electrical power consumption	W max	1250	2550	2550
Electrical control circuit consumption	W		750	
Total electrical consumption	W	2050	3300	3300
Electrical protection			NEMA 1	

Tab. C

Model		RL 70/M	RL 100/M	RL 130/M
Main electrical supply Control circuit power supply	V/Ph/Hz		575/3/60 120/1/60	
Fan and pump motor	rpm W - HP V A	3490 1100 - 1.5 575 1.6	3480 2200 - 3 575 3	3480 2200 - 3 575 3
Ignition transformer	V1 - V2 I1 - I2		120 V - 2 X 5 kV 2.7 A - 30 mA	
Electrical power consumption	W max	1250	2500	2500
Electrical control circuit consumption	W		750	
Total electrical consumption	W	2000	3250	3250
Electrical protection			NEMA 1	

Tab. D

3.3 Burner models designations

Model	Code	Code RBNA	Voltage	Flame safeguard
RL 70/M	3477070	C9514300	208-230/3/60	Burner mounted
		C9514310	460/3/60	
	3477075	C9514301	575/3/60	
RL 100/M	3477270	C9515300	208-230/3/60	Burner mounted
		C9515310	460/3/60	
	3477275	C9515301	575/3/60	
RL 130/M	3477470	C9516300	208-230/3/60	Burner mounted
		C9516310	460/3/60	
	3477475	C9516301	575/3/60	

Tab. E

3.4 Packaging - weight (Approximate measurements)

➤ The burners is supplied skid mounted. Outer dimensions of packaging are indicated in Fig. 1.
➤ The weight of the burner complete with packaging is indicated in Tab. F.

inch	A	B	C	lbs
RL 70/M	45 9/32”	23 5/8”	31 3/16”	143
RL 100/M	45 9/32”	23 5/8”	31 3/16”	150
RL 130/M	45 9/32”	23 5/8”	31 3/16”	157

Tab. F

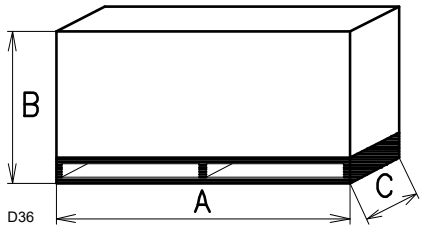


Fig. 1

3.5 Overall dimensions

The maximum dimensions of the burner are given in Fig. 2.

Keep in mind that inspection of the combustion head requires the burner to be opened and the rear part withdrawn on the slide bars.

The maximum dimension of the burner when open, without casing, is given in measurement I.

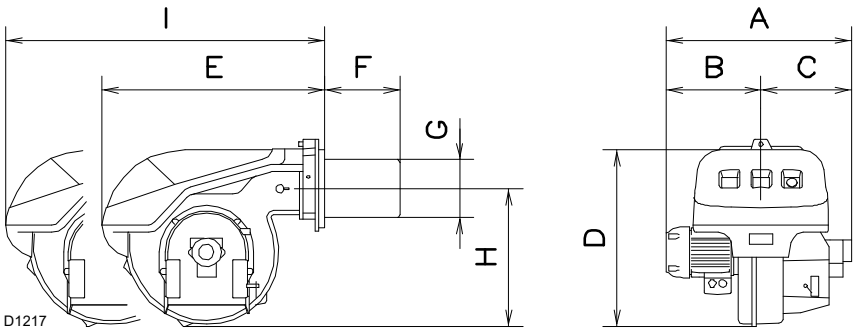


Fig. 2

inch	A	B	C	D	E	F (1)	G	H	I (1)
RL 70/M	26 1/8”	11 21/32”	14 15/32”	21 27/32”	26 25/32”	10 23/32”-15 5/32”	7 1/16”	16 15/16”	37 7/16”-42 3/4”
RL 100/M	26 1/8”	12 9/32”	14 15/32”	21 27/32”	26 25/32”	10 23/32”-15 5/32”	7 1/16”	16 15/16”	37 7/16”-42 3/4”
RL 130/M	27 3/4”	13 5/16”	14 15/32”	21 27/32”	26 25/32”	10 23/32”-15 5/32”	7 7/16”	16 15/16”	37 7/16”-42 3/4”

Tab. G

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

3.6 Standard equipment

The burner is supplied complete with:

Screws to secure the burner flange to the boiler 1/2 W . . . . . No. 4
Flexible hoses . . . . . No. 2
Gaskets for flexible hoses . . . . . No. 2
Adaptor G 1/8” / 1/8” NPT . . . . . No. 1
Burner head gasket . . . . . No. 1
Instruction booklet and spare parts list. . . . . No. 1

3.7 Burner description

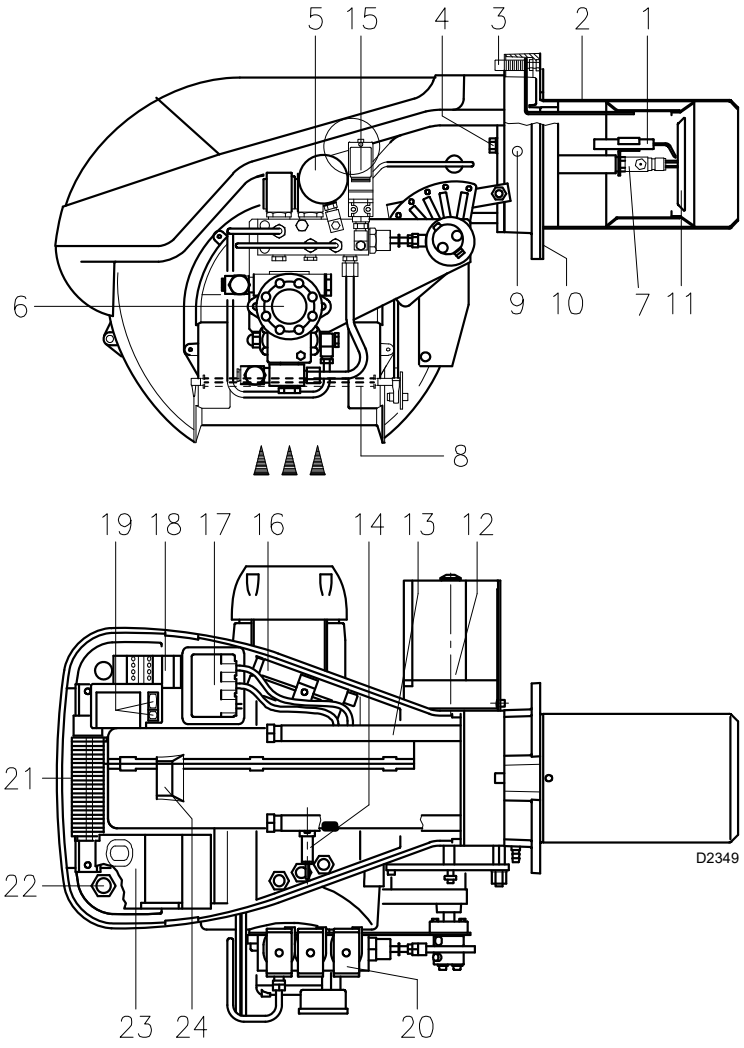


Fig. 3

1 Ignition electrodes
2 Combustion head
3 Screw for combustion head adjustment
4 Screw for fixing fan to flange
5 Pressure gauge for pressure on nozzle return
6 Pump
7 Non-drip nozzle holder
8 Air damper
9 Fan pressure test point
10 Boiler mounting flange
11 Flame stability disk
12 Servomotor, provides adjustment of fuel delivery regulator and of air damper.
When the burner is not operating the air damper is fully closed in order to reduce to a minimum heat dispersion from the boiler.
13 Slide bars for opening the burner and inspecting the combustion head
14 Photocell (cad cell)
15 High oil pressure switch
16 Extensions for slide bars 14) (with kit)
17 Ignition transformer
18 Motor contactor and thermal overload with reset button
19 Power switch for different operations: automatic - manual - off
Button for: power increase - power reduction
20 Valve assembly with pressure regulator on nozzle return
21 Terminal strip
22 Knockouts for electrical connections by installer
23 Flame safeguard with lock-out pilot light and lock-out reset button
24 Flame inspection window

Two types of burner failure may occur:

➤ **Flame safeguard lock-out**: if the flame relay 23)(Fig. 3) pushbutton lights up, it indicates that the burner is in lock-out. To reset, press the pushbutton.

➤ **Motor trip**: release by pressing the pushbutton on thermal overload 18)(Fig. 3).

3.8 Firing rates

During operation, burner output varies between:
– **minimum output**: area A;
– **maximum output**: area B (and C for model RL 130/M).

The firing rate may be found by plotting a vertical line from the desired delivery and a horizontal line from the pressure in the combustion chamber. The intersection of these two lines is the firing rate which must lie within area A, for MIN output, and within area B, for MAX output.

In order to utilize also area C (RL 130/M) it is necessary to perform the calibration of the combustion head as explained on page 18.

NOTE:
The firing rate areas given in Fig. 4 have been reduced by 10% with respect to the maximum range that can be reached.

WARNING

The firing rate area values have been obtained considering an ambient temperature of 68 °F (20°C), and an atmospheric pressure of 394” WC and with the combustion head adjusted as shown on page 7.

Consult the Procedure below to refer burner operating condition in high altitude plants.

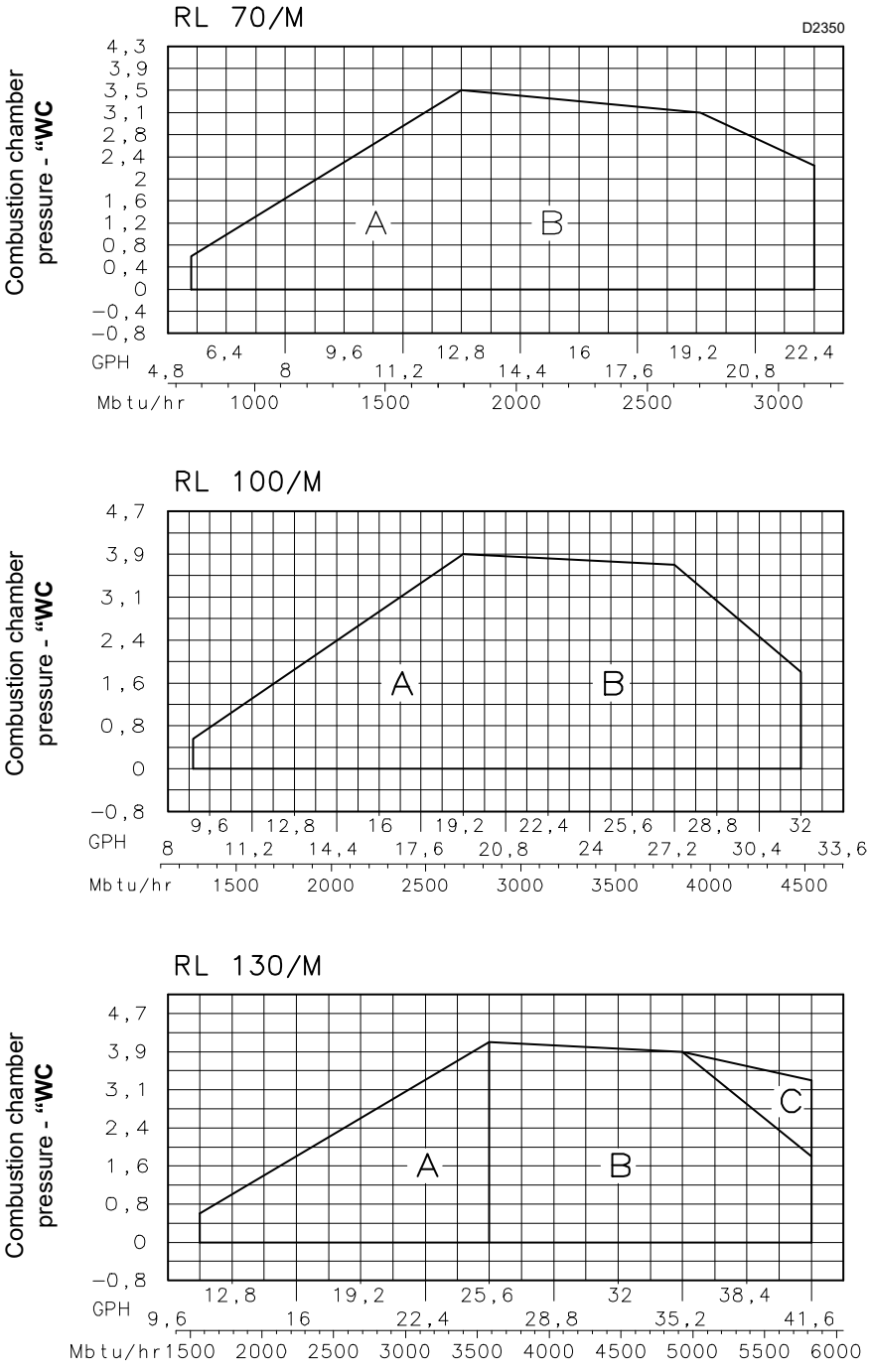


Fig. 4

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

				AIR TEMPERATURE								
Altitude	Altitude	bar. press.	bar. press.	**0**	**5**	**10**	**15**	**20**	**25**	**30**	**40**	°C
ft a.s.l.	m a.s.l.	"w.c.	mbar	**32**	**41**	**50**	**59**	**68**	**77**	**86**	**104**	°F
0	0	399	1013,00	1,087	1,068	1,049	1,031	1,013	0,996	0,980	0,948	
328	100	394	1000,00	1,073	1,054	1,035	1,017	**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. H

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

Reference conditions:

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

Example

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

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

3.9 Minimum furnace dimensions

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

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

Example

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

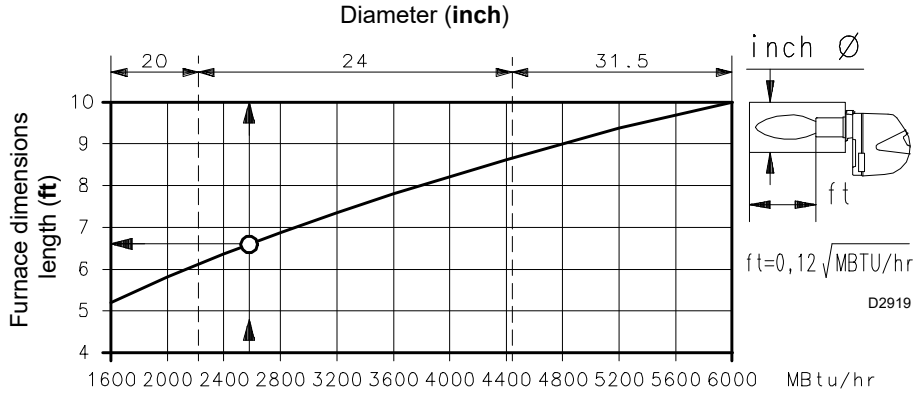


Fig. 5

3.10 Control box for the air/fuel ratio (LAL2...)

Warning notes

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

The LAL2... is a safety device!
Do not open, interfere with or modify the unit.

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

➤ All activities (mounting, installation and service work, etc.) must be performed by qualified staff.
➤ Before making any wiring changes in the connection area, completely isolate the plant from mains supply (all-polar disconnection). Ensure that the plant cannot be inadvertently switched on again and that it is indeed dead. If not observed, there is a risk of electric shock hazard.
➤ Ensure protection against electric shock hazard by providing adequate protection for the burner control's connection terminals.
➤ Each time work has been carried out (mounting, installation, service work, etc.), check to ensure that wiring and parameters is in an orderly state.
➤ Fall or shock can adversely affect the safety functions. Such units must not be put into operation, even if they do not exhibit any damage.

Introduction

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

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

Installation notes

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

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

Electrical connection of the flame detectors

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

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

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

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


CAUTION

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 Operating position

WARNING

- The burner is designed to operate only in positions **1**, **2**, **3** and **4** (Fig. 6).
- Installation **1** is preferable, as it is the only one that allows the maintenance operations as described in this manual.
- Installations **2**, **3** and **4** permit operation but make maintenance and inspection of the combustion head more difficult.

DANGER

- Any other position could compromise the correct operation of the appliance.
- Installation **5** is prohibited for safety reasons.

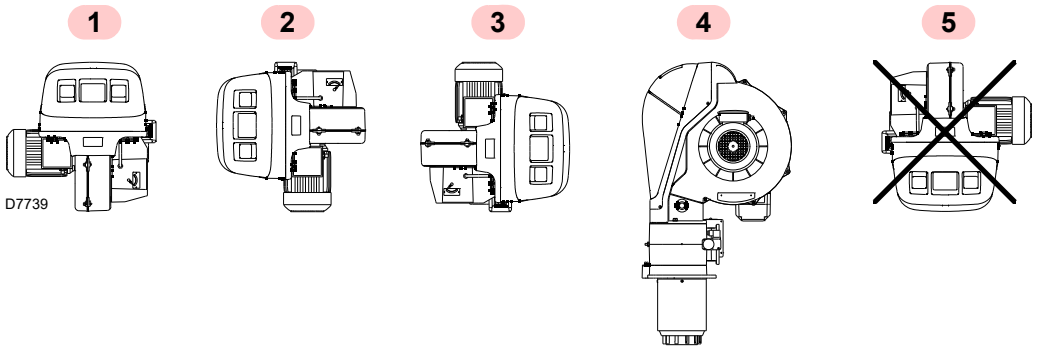


Fig. 6

4.5 Preparing the boiler

4.5.1 Boring the 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.

4.5.2 Length of the blast tube

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

The range of lengths available, L (inch), is as in the Tab. I:

Model	Short blast tube	Long blast tube (with kit)
RL 70/M	10 23/32”	15 5/32”
RL 100/M	10 23/32”	15 5/32”
RL 130/M	10 23/32”	15 5/32”

Tab. I

For boilers with front flue passes 12)(Fig. 8) or flame inversion chambers, protective insulation material 10) must be inserted between the boiler refractory 11) and the blast tube 9).

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

For boilers having a water-cooled front the insulation 10)-11)(B) is not required unless it is required by the boiler manufacturer.

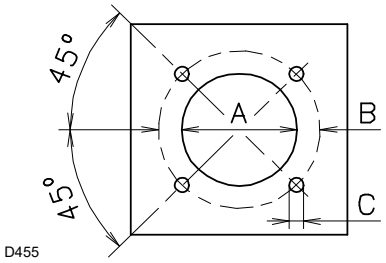


Fig. 7

inch	A	B	C
RL 70/M	7 9/32”	10 27/32” - 12 13/16”	1/2 W
RL 100/M	7 9/32”	10 27/32” - 12 13/16”	1/2 W
RL 130/M	7 21/32”	10 27/32” - 12 13/16”	1/2 W

Tab. J

4.6 Securing the burner to the boiler

Disassemble the blast tube 9)(Fig. 8) from the burner 6) by proceeding as follows:

- ➤ loosen the four screws 3) and remove the cover 1);
- ➤ remove the screws 2) from the two slide bars 5);
- ➤ remove the two screws 4) fixing the burner 6) to the flange 7);
- ➤ withdraw the blast tube 9) complete with flange 7) and slide bars 5).

WARNING

The burner-boiler seal must be airtight.

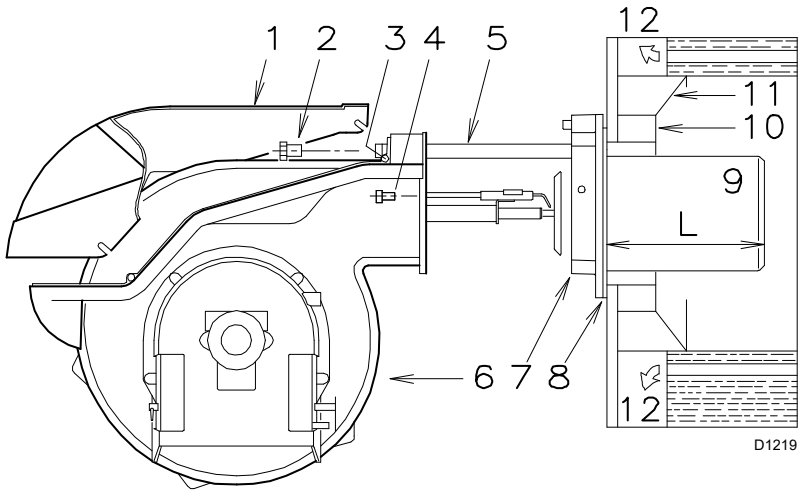


Fig. 8

4.6.1 Combustion head calibration (RL 130/M)

At this point check, whether the maximum delivery of the burner is contained in area B) or in area C) of the firing rate. See Fig. 4 on page 10.

If it is in area B) then no operation is required.

If, on the other hand, it is in area C):

- ➤ unscrew the screws 1)(Fig. 9) and disassemble the blast tube 5);
- ➤ unscrew the screws 3) and remove the shutter 4);
- ➤ tighten the screws 3) on the rod 2);
- ➤ now refit the blast tube 5) and the screws 1).

Once this operation has been carried out (if required):

- ➤ secure flange 7)(Fig. 8) to the boiler plate inserting the supplied gasket 8).
- ➤ Use the 4 screws provided after having protected the thread with an anti-seize product.

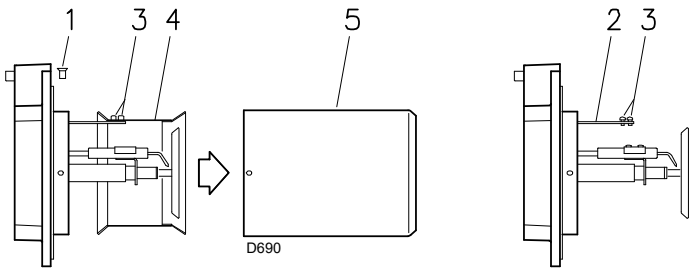


Fig. 9

4.7 Nozzle

The burner complies with the emission requirements of the UL 296 Standard.

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

WARNING

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

CAUTION

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

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

4.7.1 Recommended nozzles

Type A4 return flow nozzles - 45° angle

4.7.2 Nozzle assembly

At this stage of installation the burner is still disassembled from the blast tube; it is therefore possible to fit the nozzle with the box wrench 1)(Fig. 10), inserting the wrench through the central hole in the flame stability disk.

WARNING

- ➤ Do not use any sealing products such as gaskets, sealing compound, or tape.
- ➤ Be careful to avoid damaging the nozzle sealing seat.

Finally remount the burner 3)(Fig. 11) on the slide bars 2) and slide it up to the flange 5), keeping it slightly raised to prevent the flame stability disk from pressing against the blast tube.

Tighten the screws 1) on the slide bars 2) and screws 4) fixing the burner to the flange.

If it proves necessary to change a nozzle with the burner already fitted to the boiler, proceed as outlined below:

- ➤ pull back the burner on its slide bars as shown in Fig. 8;
- ➤ remove the nuts 1)(Fig. 12) and the disk 2);
- ➤ use wrench 3)(Fig. 12) to change the nozzles.

4.7.3 Choice of nozzle

In case an intermediate delivery between the two values indicated in the diagram (Fig. 13) is required, a nozzle with higher delivery must be chosen.

NOTE:

the values indicated in the right side of the diagram (Fig. 13), refer to the data printed on the nozzle.

Delivery reduction will be obtained by means of the pressure regulator.

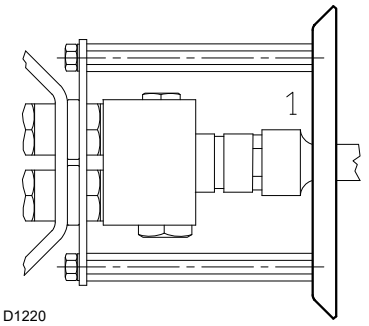


Fig. 10

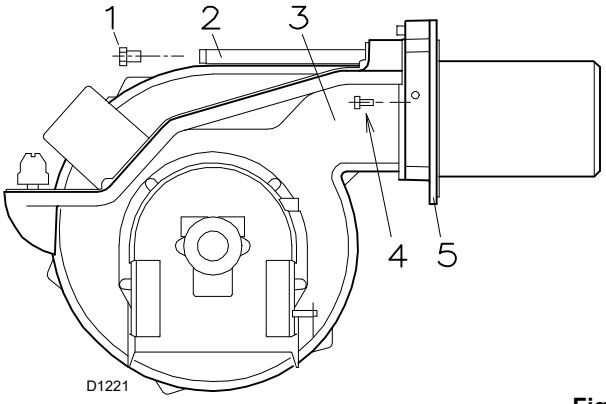


Fig. 11

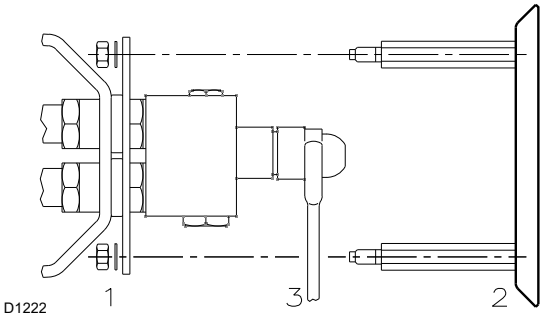


Fig. 12

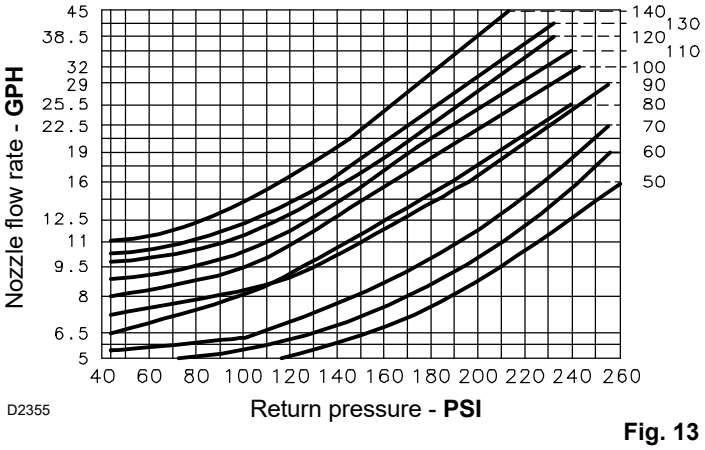


Fig. 13

4.7.4 Adjusting the nozzle flow rate

The nozzle flow rate varies according to the fuel pressure on the nozzle return.

Diagram (Fig. 13) indicates this relationship for type A4 return flow nozzles with pump delivery pressure of 290 PSI.

NOTE:

with a pump delivery pressure of 290 PSI, the pressure on the nozzle return must not exceed 246.5 PSI.

The pressure difference between pump delivery and nozzle return must be at least 43.5 PSI. With smaller pressure differences, the pressure on the nozzle return can be unstable.

4.8 Pressure controller

The nozzle return pressure value is indicated by the pressure gauge 1)(Fig. 14).

The output and the pressure of the nozzle are at maximum when the servomotor is positioned on maximum.

- ➤ The fine adjustment of the pressure in the return line may be carried out by changing the setting of the eccentric 6)(Fig. 14), of the nut and lock-nut 4)(Fig. 14).
- ➤ The eccentric setting should be carried out by loosening screws 7), and turning the screw 5) to obtain the desired eccentricity.
- ➤ Turn clockwise, screw 5) to increase the eccentricity, increasing the difference between the min. and max. capacity of the nozzle.
- ➤ Turn counter-clockwise, screw 5) to decrease the eccentricity and, consequently the difference between the min. and max. capacity of the nozzle.

WARNING

The proper setting of the eccentric 6) is possible when its operation field follows the servomotor operation field (20°-130°): so, that every variation of the servomotor position corresponds to a pressure variation.

CAUTION

Do not let the piston bottom out repeatedly: the stop ring 3)(Fig. 14) determines the max. stroke.

When the setting is carried out, verify manually that no slow-down occurs between 0° and 130° and that the maximum and minimum pressures correspond to those chosen as per diagrams (Fig. 13).

If you wish to check the delivery capacity of the nozzle, open the burner, attach the nozzle, simulate the start-up and then proceed with observing of the maximum and minimum pressures of the fuel.

If at the maximum capacity of the nozzle (maximum pressure in the return line) pressure fluctuations are detected on the gauge 1), slightly decrease the pressure in the return line until they are completely eliminated.

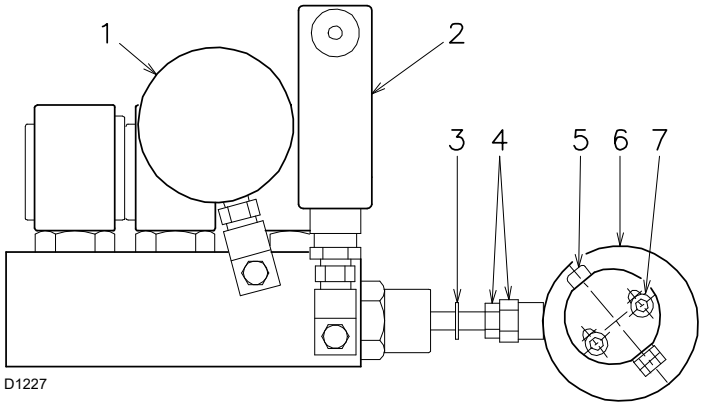


Fig. 14

Key (Fig. 14)

1 Gauge for pressure in return line
2 Oil pressure switch
3 Ring for piston stop
4 Nut and lock-nut for piston setting
5 Eccentric adjusting screw
6 Variable eccentric
7 Eccentric locking screws

4.9 Electrode adjustment

WARNING

Make sure that the electrodes are positioned as shown in Fig. 15.

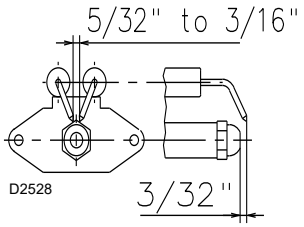


Fig. 15

4.10 Combustion head setting

The setting of the combustion head depends exclusively on the maximum burner delivery at which it will be operating.

Turn screw 4)(Fig. 16) until the notch shown in diagram (Fig. 17) is level with the front surface of flange 5)(Fig. 16).

Example:
RL 70/M, maximum light oil delivery = 16 GPH

Diagram (Fig. 17) indicates that for a delivery of 16 GPH the RL 70/M Model requires the combustion head to be set to approx. three notches, as shown in Fig. 16.

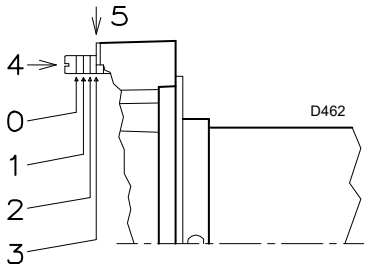


Fig. 16

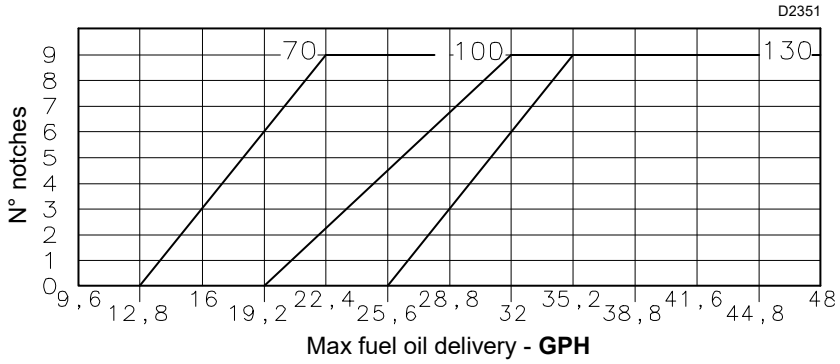


Fig. 17

4.11 Hydraulic system

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

Precautions: avoid knocking, attrition, sparks and heat.

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

WARNING

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

4.11.1 Fuel supply

Double-pipe circuit (Fig. 18)

The burner is equipped with a self-priming pump which is capable of feeding itself within the limits listed in the Tab. K.

The tank higher than the burner A

Distance "P" must not exceed 33 ft in order to avoid subjecting the pump's seal to excessive strain; distance “V” must not exceed 13 ft in order to permit pump self-priming even when the tank is almost completely empty.

The tank lower than the burner B

Pump suction values higher than 13” Hg must not be exceeded because at higher levels gas is released from the fuel, the pump starts making noise and its working life-span decreases.

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

The loop circuit

A loop circuit consists of a loop of piping exiting and returning to the tank with an auxiliary pump that circulates the fuel under pressure.

A branch connection from the loop goes to feed the burner.

This circuit is extremely useful whenever the burner pump does not succeed in self-priming because the tank distance and/or height difference are higher than the values listed in the Tab. K.

+/- H (ft)	L (ft) Ø 3/8”	Ø 1/2”	Ø 5/8”
+ 13	234	454	493
+ 10	204	401	493
+ 6.6	174	399	493
+ 3.3	145	296	493
+ 1.6	132	270	493
0	118	243	451
- 1.6	105	217	405
- 3.3	92	191	359
- 6.6	63	138	266
- 10	33	86	174
- 13	–	33	82

Tab. K

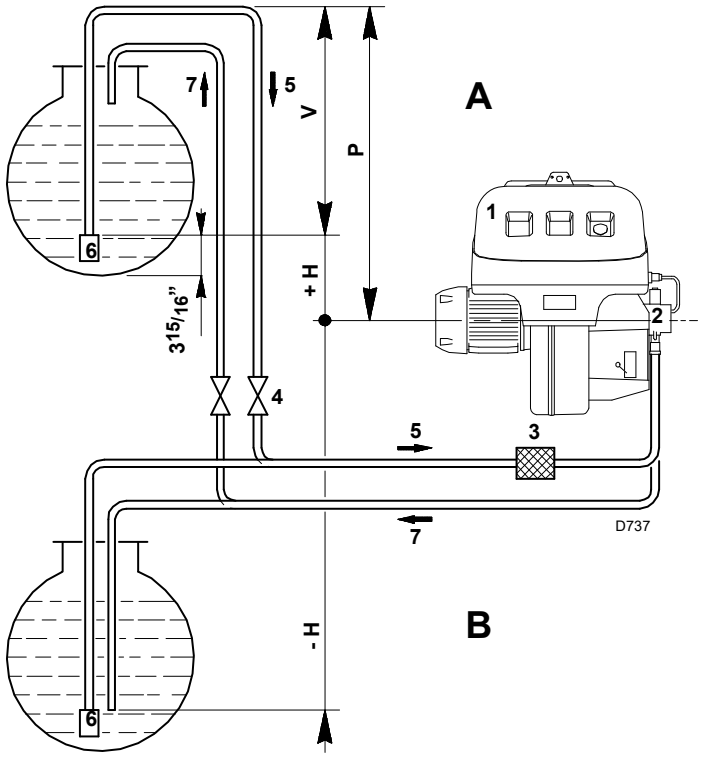


Fig. 18

Key (Fig. 18)
1 Burner
2 Pump
3 Filter
4 Manual on/off valve
5 Suction line
6 Foot valve
7 Return line
H Pump/foot valve height difference
L Piping length
Ø Inside pipe diameter

4.11.2 Hydraulic connections

The pumps are equipped with a by-pass that connects the return line and suction line. The pumps are installed on the burner with the by-pass closed by screw 6)(Fig. 20).

It is therefore necessary to connect both hoses to the pump.

WARNING

The pump seal will be damaged immediately if it is run with the return line closed and the by-pass screw inserted.

➤ Remove the plugs from the suction and return connections of the pump.

➤ Insert the hose connections with the supplied seals into the connections and screw them down.

CAUTION

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

➤ Install the hoses where they cannot be stepped on or come into contact with hot surfaces of the boiler.

➤ Now connect the other end of the hoses to the suction and return lines.

4.11.3 Hydraulic system layout

Key (Fig. 20)

1 Pump suction
2 Solenoid valve
3 Pump
4 Pressure regulator
5 Return pipe
6 By-pas screw
7 Pump return
8 Solenoid valve
9 Solenoid valve
10 Piping
11 Filter
12 Piping
13 Pressure regulator
14 Servomotor
M Pressure gauge
P Oil pressure switch
SM Servomotor
V Vacuum gauge

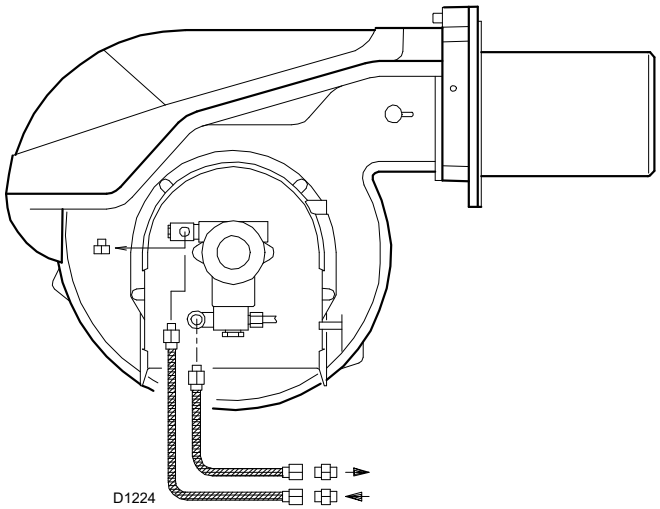


Fig. 19

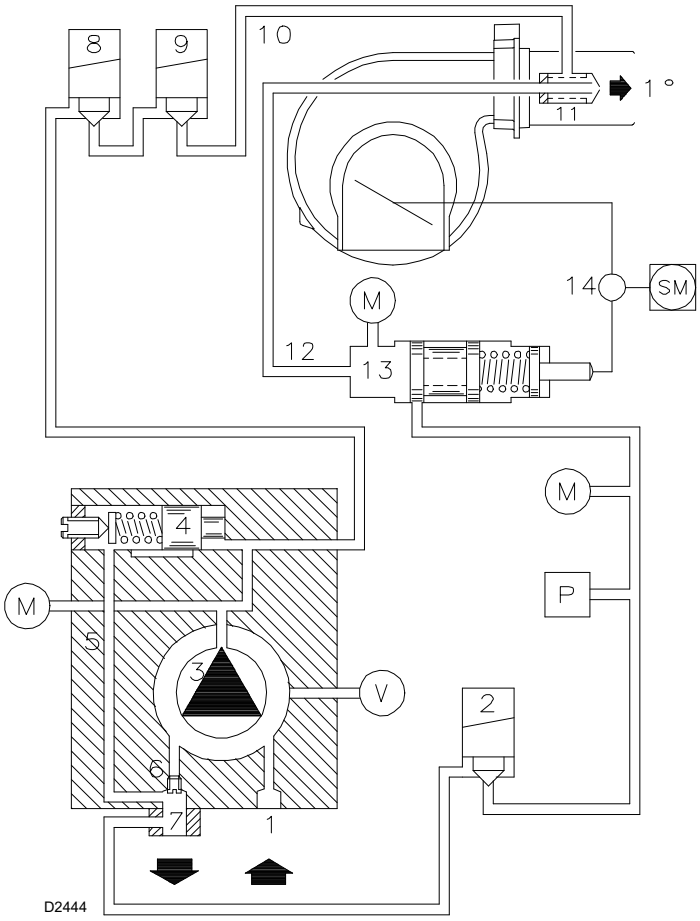


Fig. 20

4.11.4 Pump

Technical data

Pump model	SUNTEC J7 C	
Min. delivery rate at 290 PSI pressure	GPH	60.8
Delivery pressure range	PSI	145 - 304.5
Max. suction pressure	“Hg	13
Viscosity range	cSt	2.8 - 200
Max light oil temperature	°F	194 (90 °C)
Max. suction and return pressure	PSI	21.8
Pressure calibration in the factory	PSI	290
Filter mesh width	inch	0.006

Tab. L

Pump priming

WARNING

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

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

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

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

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

CAUTION

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

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

Whenever the length of the suction piping exceeds 66 - 98 ft, the supply line must be filled using a separate pump.

4.11.5 Oil pressure switch

The oil pressure switch 15)(Fig. 3 on page 9) is factory set to 43.5 PSI (3 bar).

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

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

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

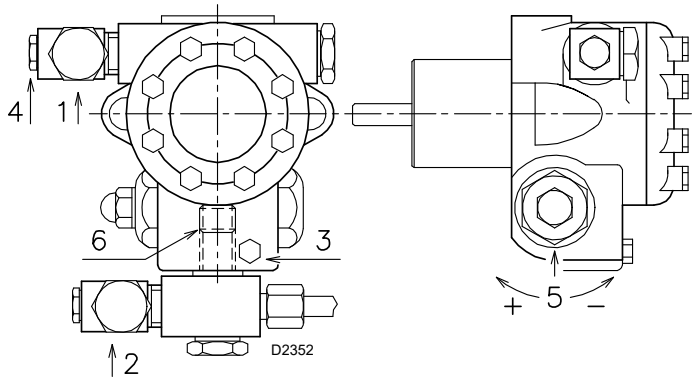


Fig. 21

Key (Fig. 21)

1	Suction	1/2” NPT
2	Return	1/2” NPT
3	Pressure gauge attachment	G 1/8”
4	Vacuum gauge attachment	G 1/8”
5	Pressure adjustment screw	
6	By-pass screw	

4.12 Electrical wiring

Notes on safety for the electrical wiring


DANGER

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

Before carrying out any maintenance, cleaning or checking operations:


DANGER

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


DANGER

close the fuel interception tap;


DANGER

avoid condensate, ice and water leaks from forming.

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

4.12.1 Factory wiring diagram

RL 70-100-130/M with burner mounted Siemens LAL control.

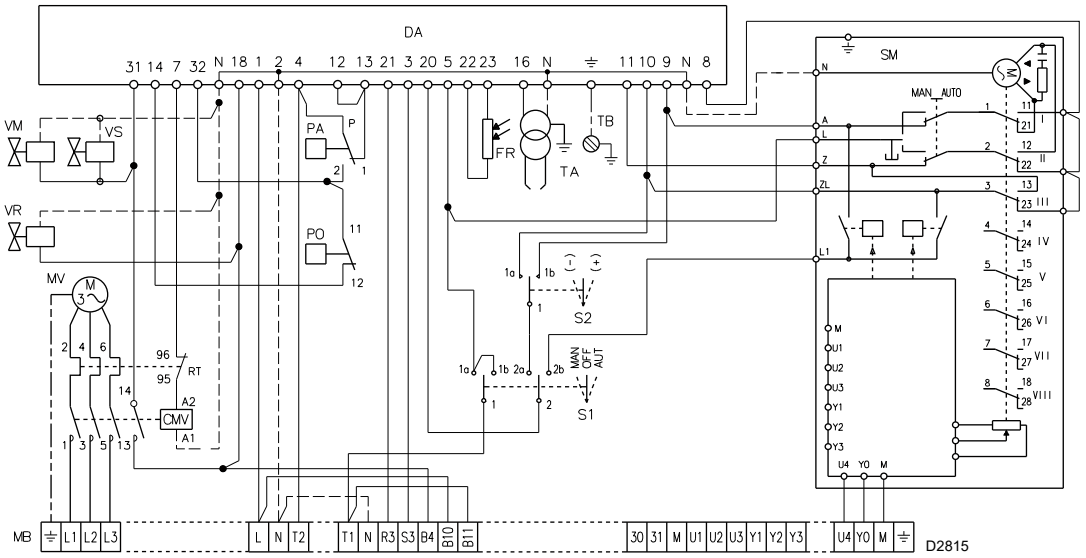


Fig. 22

Continuous fan operation

Change the wire connection from terminal 7 to terminal 1, move the jumper from terminals 12-13 to terminals 4-12 and remove the wire from terminal 13 of control box.

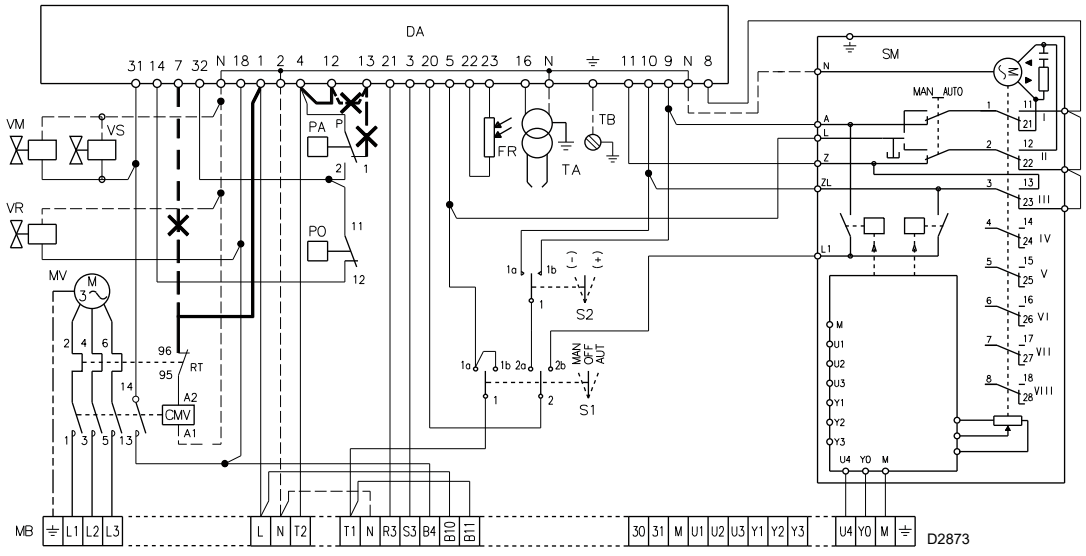


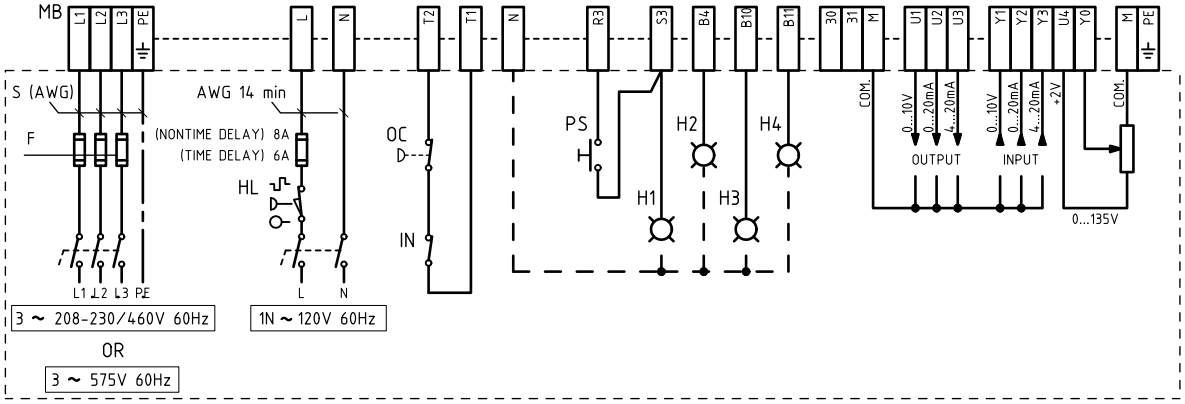
Fig. 23

Key to wiring layout (Fig. 22 and Fig. 23)

CMV	Motor contactor
DA	Control box
FR	Photocell
MB	Terminal strip
MV	Fan motor
PA	Air pressure switch
PO	High oil pressure switch
RT	Thermal overload
S1	Switch for following operations: MAN = manual AUT = automatic OFF
S2	Button for: - = power reduction + = power increase
SM	Servomotor
TA	Ignition transformer
TB	Burner ground (earth) connection
VM	Delivery pump valve
VS	Delivery pump valve (safety valve)
VR	Valve on nozzle return

4.12.2 Field wiring diagram

RL 70-100-130/M with burner mounted LAL flame safeguard.



		RL 70/M			RL 100 - 130/M			RL 190/M		
		208-230 V	460 V	575 V	208-230 V	460 V	575V	208-230 V	460 V	575 V
F1 (A) FUSE	NONTIME DELAY	20 A	10 A	8 A	35 A	15 A	12 A	60 A	30 A	25 A
	TIME DELAY	12 A	6 A	6 A	20 A	10 A	8 A	35 A	20 A	15 A
S1 (AWG) CABLE		AWG 14 (min)	AWG 16 (min)	AWG 16 (min)	AWG 12 (min)	AWG 14 (min)	AWG 14 (min)	AWG 10 (min)	AWG 12 (min)	AWG 14 (min)
MOTOR AND THERMAL RELAY										
3 ~		FAN MOTOR 1,5 HP			FAN MOTOR 3 HP			FAN MOTOR 7,5 HP		
		SET TO 4,6 (max)	SET TO 2,3 (max)	SET TO 1,8 (max)	SET TO 8,7 (max)	SET TO 4,4 (max)	SET TO 3,5 (max)	SET TO 20,5 (max)	SET TO 10,2 (max)	SET TO 8,2 (max)

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Fig. 24

Key to wiring layout (Fig. 24)

HL High limit
H1 Remote lock-out signal
H2 Low fire signal
H3 High fire signal
H4 Power on signal
H5 Limit satisfied
IN Manual burner stop switch
MB Burner terminal strip
OC Operating control
OC2 High-low control
PS Remote lock-out reset

The burners leave the factory pre-set for:

– **208-230V power supply**: only in this case, if 460 V power supply is required, change the fan motor connection from double star to star for IE3 NEMA Premium Efficiency;
– or **575V power supply**: depending on the burner model (see page 7).

WARNING

The burner is factory set for high operation and must be connected to the OC2 control to control fuel oil valve V2.

If on-off operation is required, install a jumper lead between terminals T6 and T8 of burner terminal strip.

The burners have been type-approved for intermittent operation. This means they should compulsorily be stopped at least once every 24 hours to enable the control box to perform checks of its own efficiency at start-up.

Burner halts are normally provided for automatically by the boiler load control system.

Note

The setting of the thermal overload must be according to the table of Fig. 24.

4.13 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)

4.13.1 Electro-mechanical thermal relay

The electro-mechanical thermal relay (Fig. 25) is used to avoid damage to the motor owing to a strong increase in absorption or the lack of a phase.

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

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

➤ To reset, in the case of an intervention of the thermal relay, press the button “**RESET**” (Fig. 25).

➤ The button “**STOP**” (Fig. 25) opens the NC (95-96) contact and stops the motor.

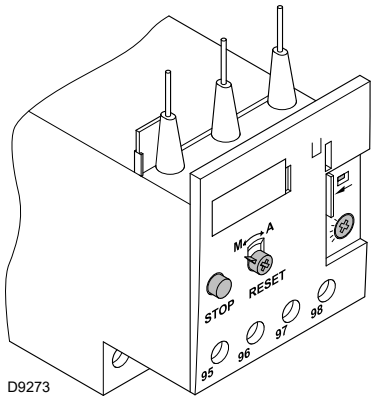


Fig. 25

➤ To test the thermal relay, insert a screwdriver in the window “**TEST**” (Fig. 29) 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.

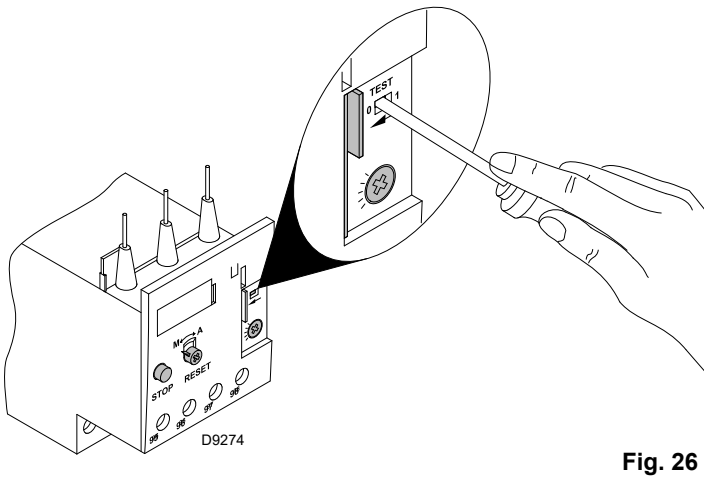


Fig. 26

4.13.2 Electronic thermal relay

➤ To reset, in the case of an intervention of the thermal relay, press the button “**RESET**” (Fig. 27).

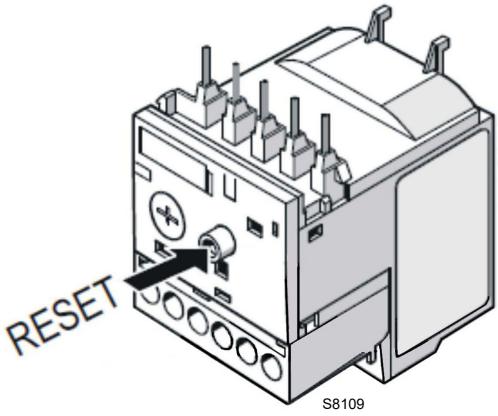


Fig. 27

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

➤ **Device test (Fig. 28)**
Push slowly the button in the window with a little screwdriver.

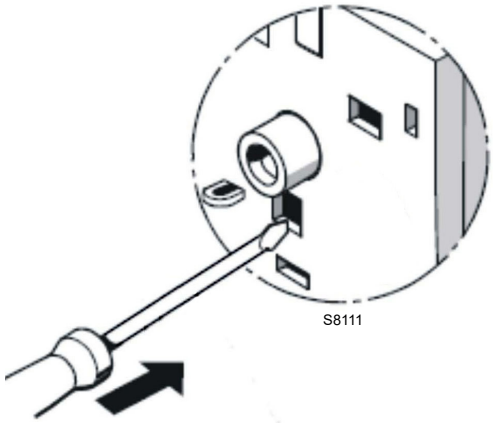


Fig. 28

➤ **Contact test NC (95-96) and NO (97-98)(Fig. 29)**
Insert in the window a little screwdriver and move it in the sense of the arrow.

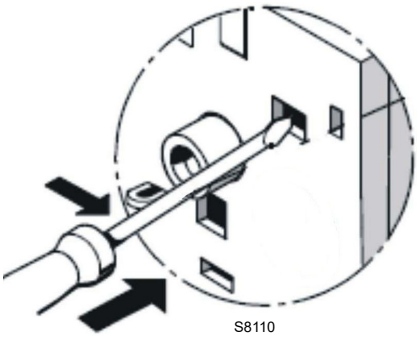
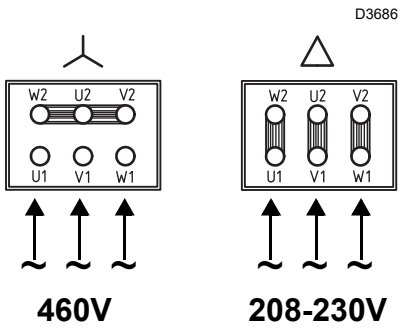


Fig. 29

4.14 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.

IE1



IE2/Epact - IE3 Nema Premium efficiency

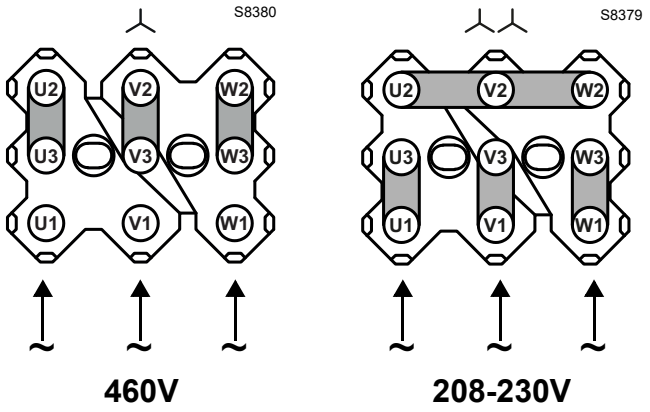


Fig. 30

4.15 Motor connection at 575V

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

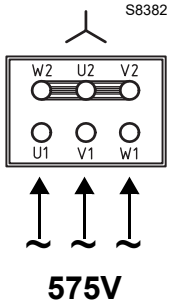


Fig. 31

4.16 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.**

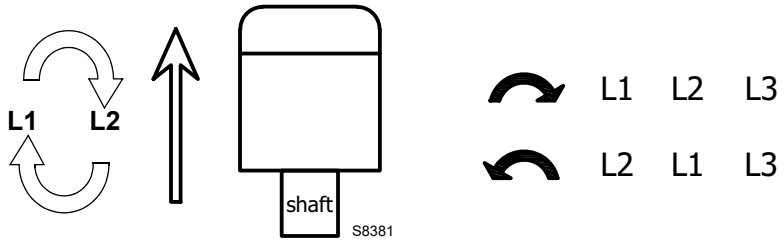


Fig. 32

5 Start-up, calibration and operation of the burner

5.1 Notes on safety for the first start-up

WARNING

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

WARNING

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

5.2 Burner calibration

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

The following settings that have already been made do not require modification under normal circumstances:

5.2.1 Combustion head setting

Refer to page 18.

5.2.2 Nozzle adjustment

Refer to page 16.

5.2.3 Electrode position

Refer to Fig. 15.

5.2.4 Servomotor, cams I - II - III

Refer to page 28.

5.3 Burner starting

Close the control circuit, with the switches in Fig. 38 and Fig. 33 in the “**AUTO**” position.

On firing turn the switch (Fig. 38) to “**MAN**”.

5.3.1 Maximum output

Using button B)(Fig. 38), “increase output” until it stops at app. 130° (cam 1).

Place the slide switch on MAX and set the relative MAX trim potentiometer (setting must be very near to 130°) to exploit as far as possible the variable profile cam 2)(Fig. 34).

The setting of the oil delivery must be made on the variable eccentric 6)(Fig. 14 on page 17) by turning the screw 5)(Fig. 14 on page 17).

The air setting must be made on the variable profile cam 2)(Fig. 34) after loosening the screws 4)(Fig. 34) by turning the screws 3).

5.3.2 Minimum output

With the slide switch on the “**OPE**” position, use button B)(Fig. 38) “decrease output” until it stops at app. 20° (cam 3).

Put the slide switch in the MIN position and set the modulation minimum using the relative MIN trim potentiometer.

The setting of the oil delivery must be made on the nut and lock-nut 4)(Fig. 14 on page 17) and, if necessary, on the variable eccentric 6)(Fig. 14 on page 17).

WARNING

When the eccentricity is modified, it is necessary to bring back to MAX and check the setting again.

The setting must be made on the adjustable profile cam 2)(Fig. 34).

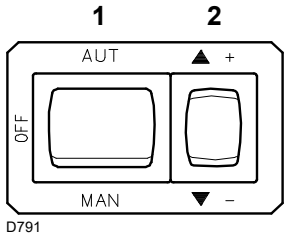


Fig. 33

5.3.3 Intermediate outputs

With the switch C)(Fig. 38) in the “**AUTO**” position, the slide switch in the “**OPE**” position and the switch 1)(Fig. 33) in the “**MAN**” position, move the button 2)(Fig. 33) in various intermediate levels between maximum and minimum and set the variable profile cam 2)(Fig. 34) to achieve optimum combustion, by turning the screws 3)(Fig. 34).

If possible, do not change the previously set maximum and minimum levels.

WARNING

Do not change the eccentric, already adjusted for MAX and MIN.

Check the various setting levels with a combustion analysis.

Make a progressive setting of the profile, without sharp changes.

When the setting is complete, lock the cam profile using screws 4)(Fig. 34).

5.4 Servomotor

The servomotor gives simultaneous regulation of the air damper through the adjustable profile cam 2)(Fig. 34) and the pressure controller (Fig. 14 on page 17).

It rotates by 130° in approx. 35 s.

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

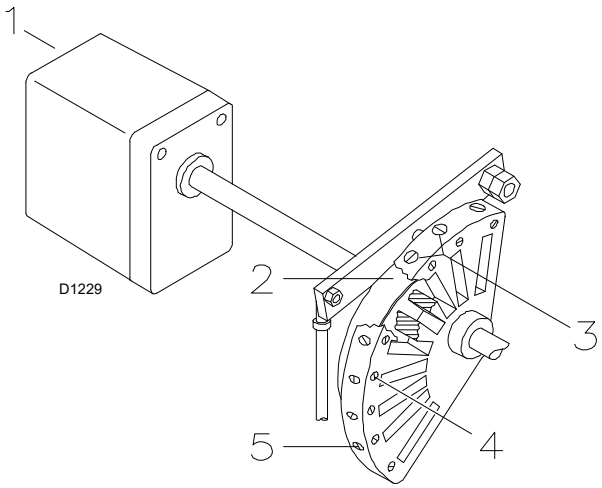


Fig. 34

Key (Fig. 34)
1 Servomotor
2 Adjustable profile cam
3 Adjustment screws for cam starting profile
4 Adjustment fixing screws
5 Adjustment screws for cam and profile

To open the servomotor, remove the screws and pull the cover outward (see Fig. 35).

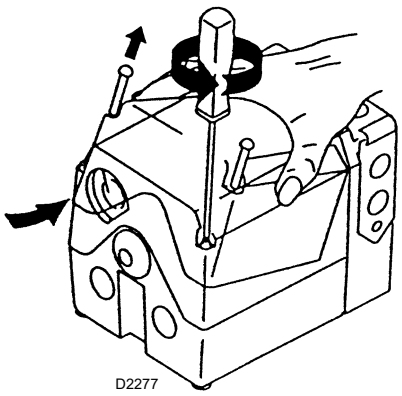


Fig. 35

WARNING

Fig. 36 shows how the servomotor is released to manually check there is no binding though its motion.

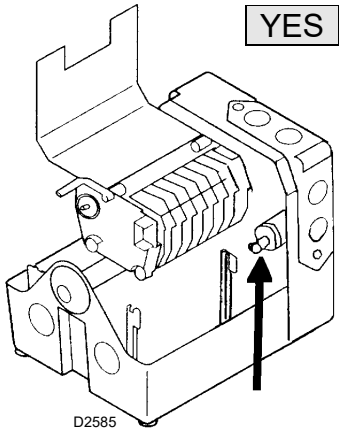


Fig. 36

WARNING

Don't release the button indicated in the Fig. 37: the synchronization of the cams made in factory would be changed.

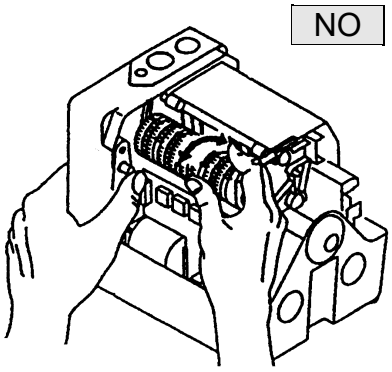


Fig. 37

5.4.1 Cams and trim potentiometers functions

Cam 1: 130°
Limits rotation towards maximum

Cam 2: 0°
Limits rotation towards minimum, air damper closed on stand by

Cam 3: 20°
Limits ignition position

Cams 4 - 5 - 6 - 7 - 8: not used

Trim potentiometer MAX
Limits maximum modulation. It must be set near the stroke end (cam 1) to exploit as far as possible the variable profile cam.

Trim potentiometer MIN
Limits minimum modulation. It must be set near the stroke end (cam 2) to exploit as far as possible the variable profile cam.

Trim potentiometer POS
Limits an intermediate operating position between MAX and MIN, supplying power to the "P" terminal in the servomotor (through an external command). This function cuts out any external signals.

NOTE:
using the slide switch (Fig. 38) to select MAX or MIN, the servomotor goes into the position for the respective settings of the MAX and MIN TRIM POTENTIOMETERS.

When the settings are complete, place the slide switch on "**OPE**" (operate).

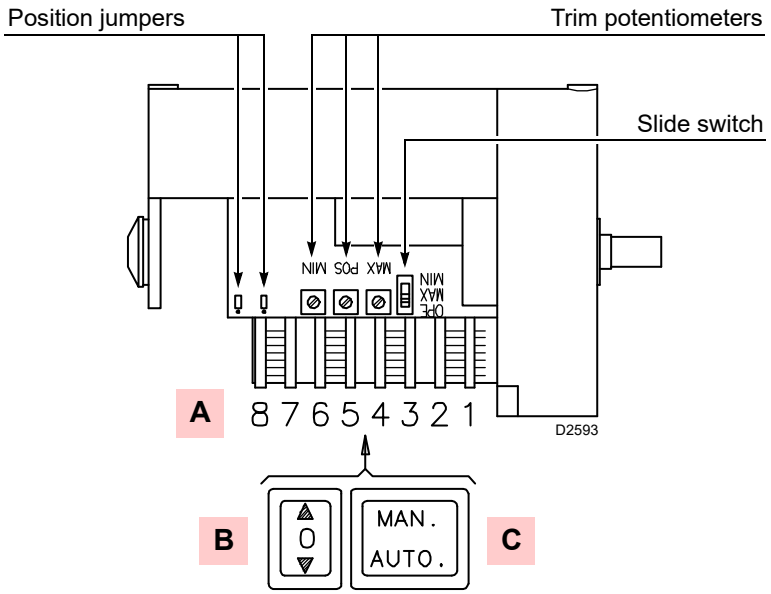


Fig. 38

5.5 Final calibration of the pressure switch

5.5.1 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 (B).

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

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

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

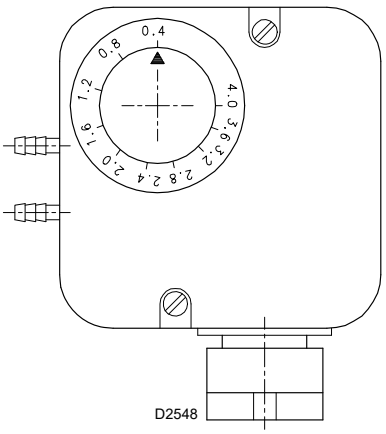


Fig. 39

5.6 Burner operation

5.6.1 Burner starting

- Operating control closes, the motor starts.
  The pump 3)(Fig. 40) draws the fuel from the tank through the piping 1) and pumps it under pressure for delivery.
  The piston 4) rises and the fuel returns to the tank through the piping 5) - 7).
  The screw 6) closes the by-pass heading towards suction and the de-energized solenoid valves 8) - 9) - 2) close the passage to the nozzle.
- Servomotor starts: 130° rotation to right, until contact is made on cam 1. The air damper is positioned on MAX. output.
- Pre-purge stage with air delivery at MAX. output.
- Servomotor rotates to left until contact is made on cam 3.
- Air damper and pressure regulator are positioned on MIN output.
- Ignition electrode strikes a spark.
- Solenoid valves 8) - 9) - 2) open; the fuel passes through the piping 10) and filter 11), and enters the nozzle.
  A part of the fuel is then sprayed out through the nozzle, igniting when it comes into contact with the spark: flame at a low output level; the rest of the fuel passes through piping 12 at the pressure adjusted by the regulator 13, then, through piping 7), it goes back into the tank.
- The spark goes out.
- The starting cycle ends.

5.6.2 Steady state operation

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

If the temperature or pressure is low (and the load control is consequently closed), the burner progressively increases output up to MAX.

If subsequently the temperature or pressure increases until the load control opens, the burner progressively decreases output down to MIN.

The burner shuts off when demand for heat is less than the heat supplied by the burner in the MIN output.
The servomotor returns to the 0° angle limited by contact with cam 2. The air damper closes completely to reduce thermal dispersion to a minimum.

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

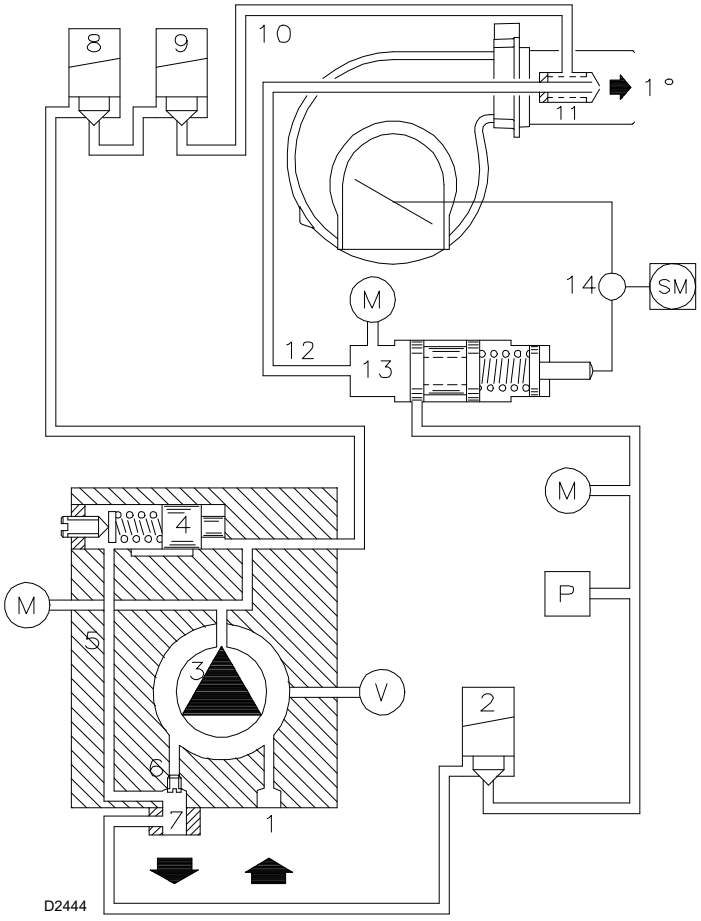


Fig. 40

5.6.3 Firing failure

If the burner does not fire, it goes into lock-out within 5 s of the opening of the light oil valve.

5.6.4 Firing failure

If the flame should go out for accidental reasons during operation, the burner will lock out in 1 s.

5.7 Sequence of operation - LAL control box

Switching times are given in seconds, in the burner start-up sequence (see Tab. M).

Switching times	Seconds
t1	18
t2	4
t3	2
t4	12
t5	optional
t6	optional
t7	12
t8	4

Tab. M

Key for the times (Fig. 41 and Fig. 42)

t1 Pre-purge time with air damper open
t2 Safety time
t3 Pre-ignition time, short (“Z” connected to terminal “16”)
t4 Interval between voltage at terminals “18” and “20”
t5 Air damper running time to “OPEN” position
t6 Air damper running time to low-flame position (MIN)
t7 Permissible after-burn time
t8 Interval to the “OPEN” command for the air damper

FULL MODULATION

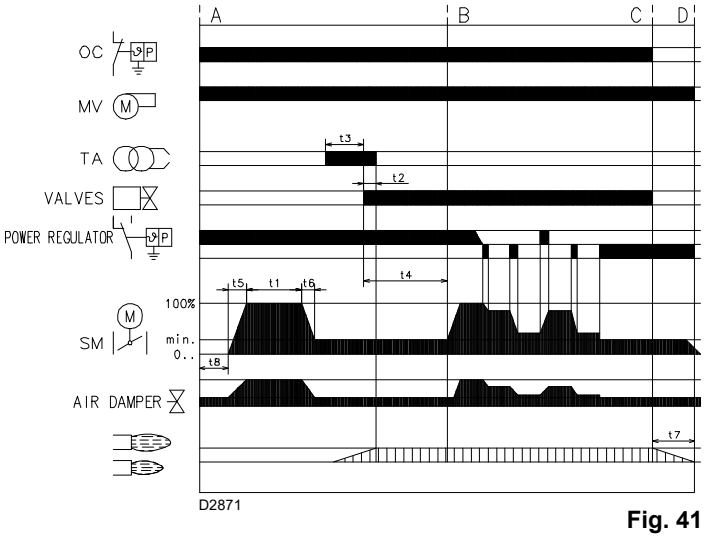


Fig. 41

HIGH - LOW

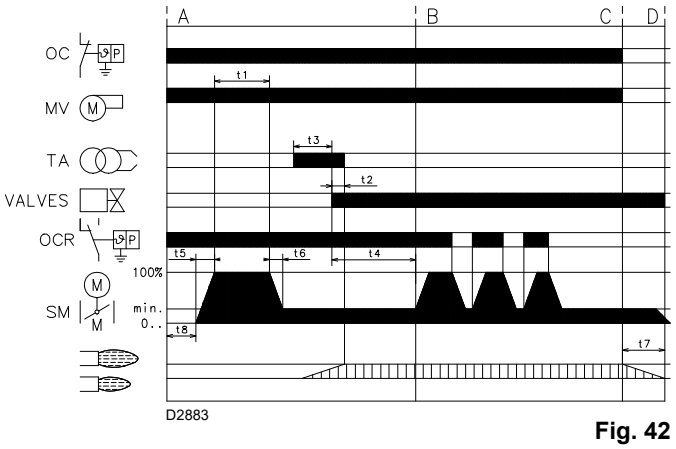


Fig. 42

5.8 Final checks (with the burner working)

Obscure the flame sensor and switch on the control devices	⇨	The burner should start and then lock-out about 5 s after starting
Illuminate the flame sensor and switch on the control devices	⇨	Burner should go into lock-out
Obscure the flame sensor while the burner is operating	⇨	Flame should go out and burner lock out within 1 s.
Switch off control devices while the burner is operating	⇨	The burner should stop

Tab. N

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 Checking and cleaning

The operator must use the required equipment during maintenance.

Combustion

An analysis of the flue gases at the boiler outlet is required. Significant differences with respect to the previous measurements indicate the points where more care should be exercised during maintenance.

Combustion head

Check to make sure that all the parts of the combustion head are in good condition, positioned correctly, free of all impurities, and that no deformation has been caused by operation at high temperatures.

Fan

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

Flame signal measurement

Min value for a good signal: 8 µA. If the value is lower, it can be due to:

– worn flame sensor
– low current
– bad set up of the burner

In order to measure the current, use a microammeter of 100 µA c.c., connected to the scanner, as in the diagram.

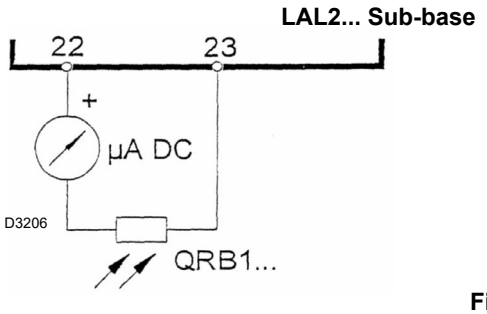


Fig. 43

Min. detector current required at AC 230 V	8 µA
Max. detector current required without flame	0.8 µA
Max. detector current that can occur	35 µA
Instrument's + pole	to term. 22
Length of detector line	
In the same cable as the control lines	not perm.
Separate cable in the cable duct	20 m
Three-wire cable	--
Two-wire cable for the detector line (bl, sw); separate single-wire cable for the line (br)	--
Shielded cable (e.g. RG62, shielding insulated)	200 m
Shielding	to term. 23

Tab. O

Flame inspection window

Clean the flame inspection window (Fig. 44).

Flame sensor

Clean the glass cover from any dust that may have accumulated. flame sensor 1)(Fig. 45) can be removed by pulling it outward forcefully.

Servomotor

Disengage the cam (Fig. 34 on page 28) from the servomotor and turn it backwards and forwards by hand to make sure it moves freely.

Nozzles

It is advisable to replace nozzles once a year during periodical maintenance. Do not clean the nozzle openings;

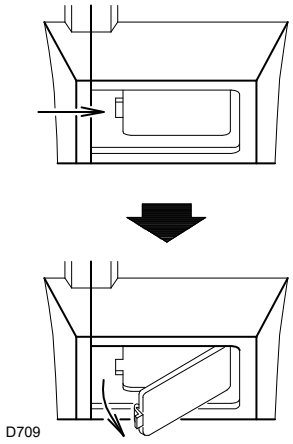


Fig. 44

Hoses

Check that these are in good conditions.

Pump

The pump delivery pressure must be stable at 290 PSI.

The suction must be less than 6.5 PSI.

Unusual noise must not be evident during pump operation.

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

If the pump is found to be responsible, check to make sure that the filter is not dirty. The vacuum gauge is installed up-line from the filter and consequently will not indicate whether the filter is clogged or not. If the problem lies in the suction line, check to make sure that the filter is clean and that air is not entering the piping.

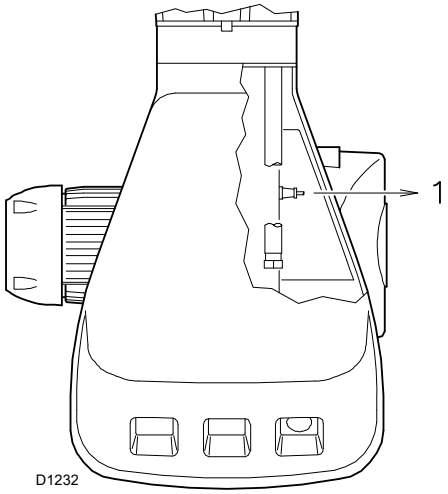


Fig. 45

Filters

Check the following filters: on line 1), in pump 2), at nozzle 3), and clean or replace as required (Fig. 46).

If rust or other impurities are observed inside the pump, use a separate pump to suck out any water and other impurities that may have deposited on the bottom of the tank.

Burner

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.

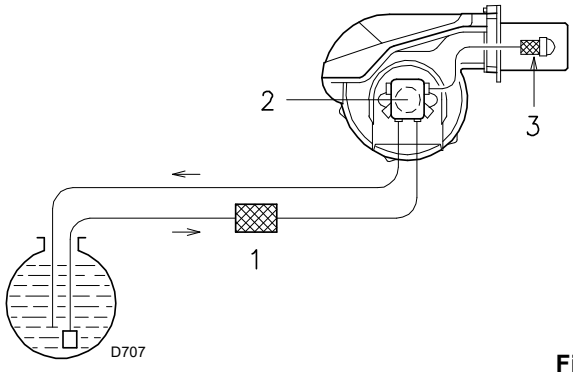


Fig. 46

Fuel tank

Approximately every 5 years, suck any water on the bottom of the tank using a separate pump.

6.2.3 Fuel pump and/or couplings replacement

As per Fig. 47, dimension A should be set:

Model	A (inch)
RL 70/M	1/2”
RL 100/M	5/16”
RL 130/M	7/16”

Tab. P

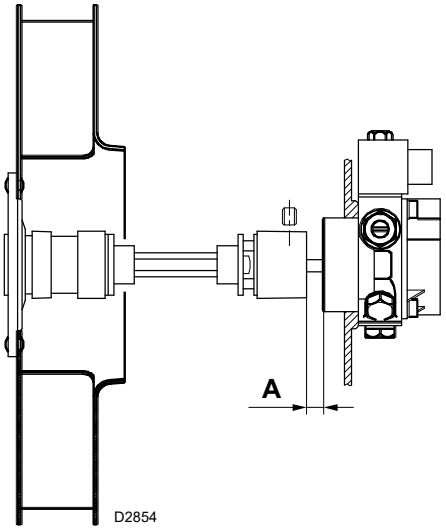


Fig. 47

6.3 Opening the burner

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

Close the fuel interception tap.

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

- ➤ Loosen screws 1)(Fig. 48) and withdraw the cover 2);
- ➤ unscrew screws 3);
- ➤ fit the two extensions 4) supplied with a kit on request onto the slide bars 5) (models with long blast tube);
- ➤ pull part A) backward keeping it slightly raised to avoid damaging the disk 6) on blast tube 7).

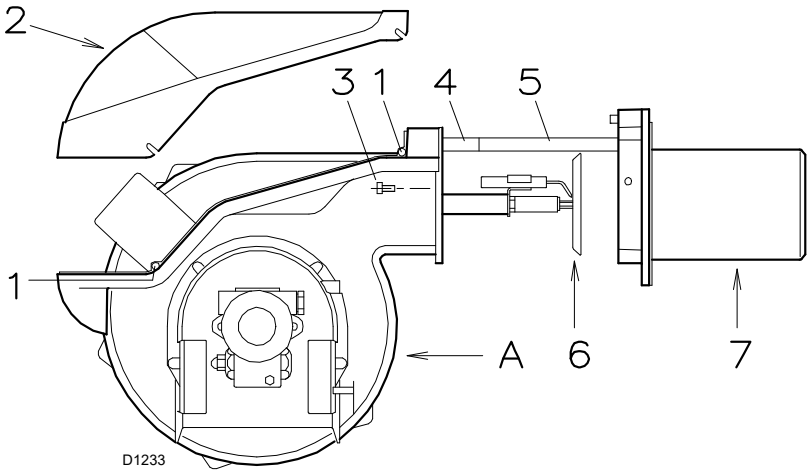


Fig. 48

6.4 Closing the burner

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

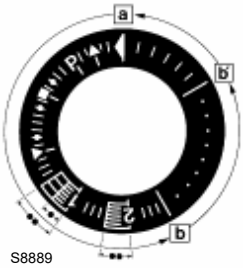
After carrying out maintenance, cleaning or checking operations, reassemble the hood and all the safety and protection devices of the burner.

7 Faults - Probable causes - Solutions

The control box is equipped with a lockout indicator (Fig. 49) that turns during the start-up programme, and is visible from the small lockout window.

When the burner does not start or stops, due to a failure, the symbol that appears on the indicator indicates the type of interruption.

The positions of the lockout indicator are shown in Fig. 50.



Lockout indicator

a-b	Start-up sequence
b-b'	Idle stages (without contact confirmation)
b(b')-a	Post-purging programme

Fig. 49

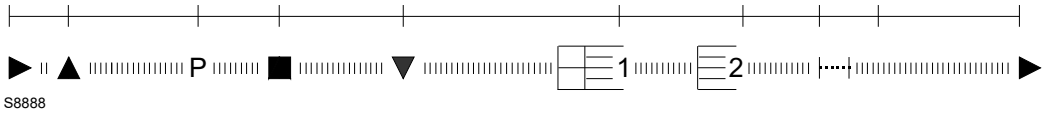


Fig. 50

Fuse replacement

The fuse 2)(Fig. 51) is in the rear part of the control box. A spare fuse 1) is also available: it can be extracted after breaking the panel tab A) that houses it. In the event that fuse 2) has been tripped, replace it as shown in Fig. 51.

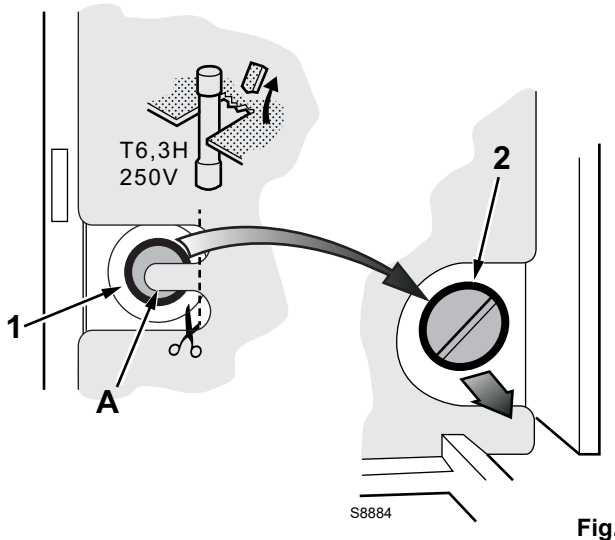


Fig. 51

Find a list of faults, causes and possible solutions for a set of failures that may occur and result in irregular burner operation or no functioning at all.

If a burner malfunction is detected, first of all:
- check that the electrical wiring is adequately connected;
- check whether fuel is delivered;
- check that every adjustment parameter is adequately set.

WARNING

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

DANGER

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

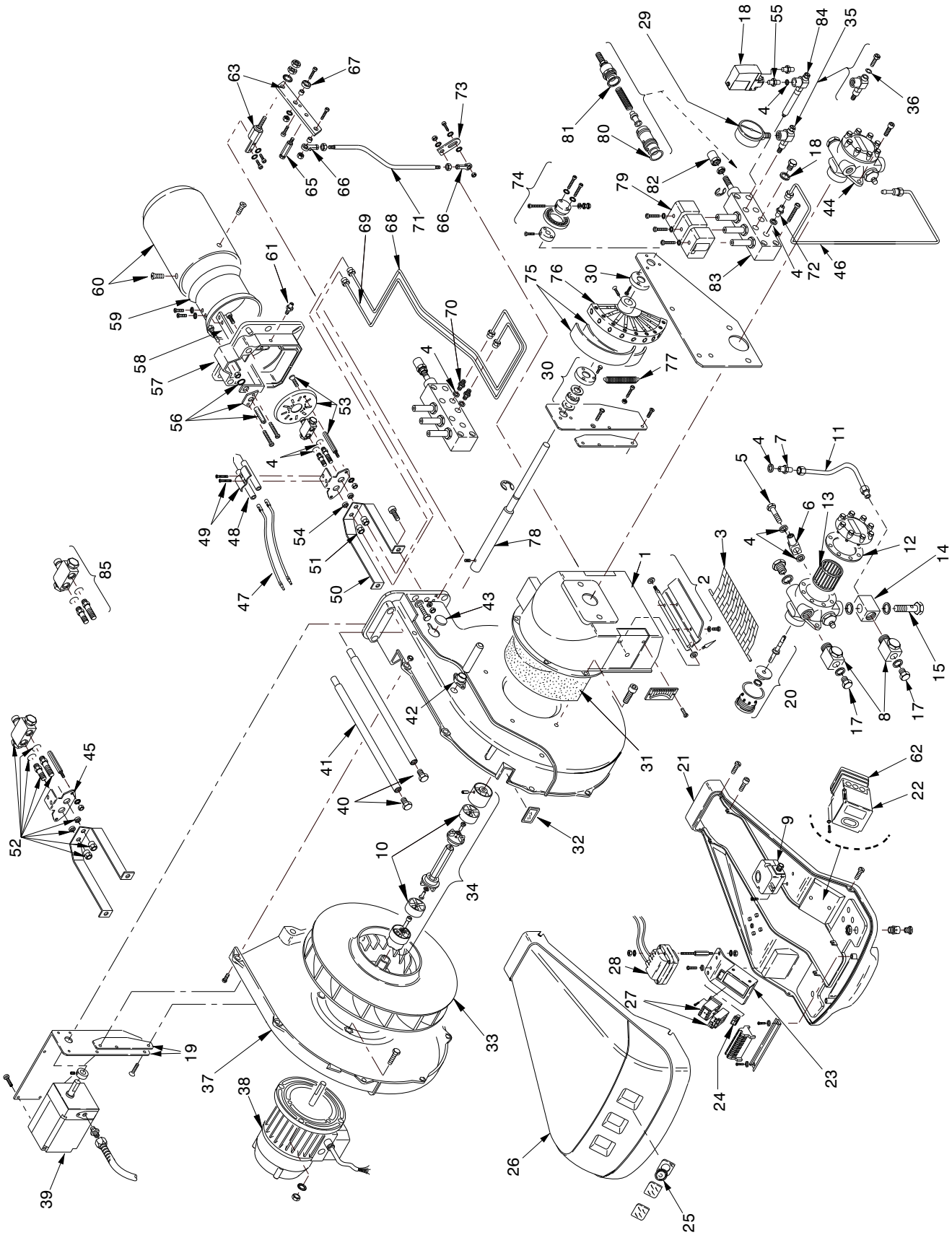
Symbol (1)	Fault	Probable cause	Suggested remedy
◀	The burner does not start	A limit or safety control device is open	Adjust or replace
		Control box lock-out	Reset control box
		Oil pressure switch tripped	Adjust pressure switch or eliminate pressure
		Motor protection tripped	Reset thermal cut-out
		No electrical power supply	Close all switches - Check connections
		Flame safeguard fuse blown	Replace
		Contact II of servomotor does not operate, flame safeguard terminals 11 - 8	Adjust cam II or replace servomotor
		Pump is jammed	Replace
		Defective motor command control device	Replace
		Defective Flame safeguard	Replace
		Defective electrical motor	Replace
	The burner does not start and a function lock-out occurs	Flame simulation	Replace control box
		Photocell short-circuit	Replace photocell
		Missing phase thermal cut-out trips	Reset thermal cut-out when third phase is re-connected
▲	The burner starts but stops at maximum air damper setting	Contact I of servomotor does not operate, flame safeguard terminals 9-8	Adjust cam I or replace servomotor
■	The burner starts and then goes into lock-out	Fault in flame detection circuit	Replace flame safeguard
▼	The burner remains in pre-purging phase	Contact III of servomotor does not operate, flame safeguard terminals 10-8	Adjust cam III or replace servomotor
1	After pre-purge and the safety time, the burner goes to lock-out and the flame does not appear	No fuel in tank; water on tank bottom	Top up fuel level or suck up water
		Inappropriate head and air damper adjustments	Adjust
		Light oil solenoid valves fail to open	Check connections; replace coil
		Nozzle clogged, dirty, or deformed	Replace
		Dirty or poorly adjusted firing electrodes	Adjust or clean
		Grounded electrode due to broken insulation	Replace
		High voltage cable defective or grounded	Replace
		High voltage cable deformed by high temperature	Replace and protect
		Ignition transformer defective	Replace
		Poor electrical connections of valves or transformer	Check
		Defective flame safeguard	Replace
		Pump unprimed	Prime pump and see "Pump unprimes"
		Pump/motor coupling broken	Replace
		Pump suction line connected to return line	Correct connection
		Valves up-line from pump closed	Open
		Filters dirty: line - pump - nozzle	Clean
		Incorrect motor rotation direction	Change motor electrical connections
	The flame ignites normally but the burner locks out when the safety time has elapsed	Defective flame sensor or flame safeguard	Replace flame sensor or flame safeguard
		Dirty flame sensor	Clean

Symbol (1)	Fault	Probable cause	Suggested remedy
	Firing with pulsations or flame detachment, (lift off) delayed firing	Poorly adjusted head	Adjust
		Poorly adjusted or dirty firing electrodes	Adjust
		Poorly adjusted fan air gate: too much air	Adjust
		Nozzle unsuited for burner or boiler	See Nozzle Table
		Defective nozzle	Replace
		Inappropriate pump pressure	Adjust
2	The burner does not pass to 2nd stage	Control device TR does not close	Adjust or replace
		Defective control box	Replace
	Uneven fuel supply	Check if cause is in pump or fuel supply system	Feed burner from tank located near burner
	Internally rusted pump	Water in tank	Remove water from tank bottom with separate pump
	Noisy pump, unstable pressure	Air has entered the suction line	Tighten connectors
		Depression value too high (higher than 35 cm Hg):	
		Tank/burner height difference too great	Feed burner with loop circuit
		Piping diameter too small	Increase
		Suction filters clogged	Clean
		Suction valves closed	Open
		Paraffin solidified due to low temperature	Add additive to light oil
	Pump loses prime after prolonged pause	Return pipe not immersed in fuel	Bring to same height as suction pipe
		Air enters suction piping	Tighten connectors
	Pump leaks light oil	Leakage from sealing organ	Replace pump
	Smoke in flame - dark Bacharach	Not enough air	Adjust head and fan damper
		Nozzle worn or dirty	Replace
		Nozzle filter clogged	Clean or replace
		Erroneous pump pressure	Adjust
		Flame stability disk dirty, loose, or deformed	Clean, tighten in place, or replace
		Boiler room air vents insufficient	Increase
	- yellow Bacharach	Too much air	Adjust head and fan damper
	Dirty combustion head	Nozzle or filter dirty	Replace
		Unsuitable nozzle delivery or angle	See recommended nozzles
		Loose nozzle	Tighten
		Impurities on flame stability disk	Clean
		Wrong head adjustment or not enough air	Adjust, open air damper
		Blast tube length unsuited to boiler	Contact boiler manufacturer
I	During operation, the burner stops in lock out	Dirty or defective flame sensor	Clean or replace

Tab. Q

(1) When the burner does not fire or stops following a fault, the symbol which appears on control box after lockout indicates type of problem.

A Appendix - Spare parts



N.	CODE		C9514300	C9514301	C9515300	C9515301	C9516300	C9516301	DESCRIPTION	*
1	**3012454**		•	•	•	•	•	•	AIR INTAKE	
2	**3003948**		•	•	•	•	•	•	AIR DAMPER ASSEMBLY	
3	**3003949**		•	•	•	•	•	•	GRID	
4	**3007079**		•	•	•	•	•	•	SEAL	B
5	**3003006**		•	•	•	•	•	•	CONNECTOR	C
6	**3012455**		•	•	•	•	•	•	CONNECTOR	C
7	**3009081**		•	•	•	•	•	•	CONNECTOR	C
8	**3012949**		•	•	•	•	•	•	CONNECTOR	C
9	**3012948**		•	•	•	•	•	•	AIR PRESSURE SWITCH	A
10	**3012622**		•	•	•	•	•	•	DRIVE DISC	
11	**3012458**		•	•	•	•	•	•	TUBE	
12	**3006292**		•	•	•	•	•	•	SEAL	B
13	**3006787**		•	•	•	•	•	•	FILTER	B
14	**3003055**		•	•	•	•	•	•	CONNECTOR	C
15	**3006184**		•	•	•	•	•	•	BAR	C
16	**3007164**		•	•	•	•	•	•	SEAL	B
17	**3012932**		•	•	•	•	•	•	PLUG	
18	**3012384**		•	•	•	•	•	•	OIL PRESSURE SWITCH	A
19	**3012957**		•	•	•	•	•	•	ANCHOR PLATE	
20	**3000805**		•	•	•	•	•	•	PUMP SEAL	A
21	**3013127**		•	•	•	•	•	•	BASE PLATE	
22	**3012933**	**C5830009**	•	•	•	•	•	•	CONTROL BOX	B
23	**3012343**		•	•	•	•	•	•	SUPPORT	A
24	**3012080**		•	•	•	•	•	•	SWITCH	
25	**3007627**		•	•	•	•	•	•	MEMBRAN	
26	**3012934**		•	•	•	•	•	•	COVER	
27	**20115409**		•		•	•	•	•	OVERLOAD+CONTACTOR 208-230/460V	C
27	**20120289**			•					OVERLOAD+CONTACTOR 575V	C
28	**3012938**		•	•	•	•	•	•	TRANSFORMER	B
29	**3006140**		•	•	•	•	•	•	PRESSURE GAUGE	
30	**3012357**		•	•	•	•	•	•	BEARING	C
31	**3003952**		•	•	•	•	•	•	SOUND DAMPING	
32	**3003763**		•	•	•	•	•	•	INSPECTION WINDOW	
33	**3012939**		•	•					FAN	C
33	**3012403**				•	•			FAN	C
33	**3012940**						•	•	FAN	C
34	**3013056**		•	•					DRIVE COUPLING	A
34	**3003954**				•	•	•	•	DRIVE COUPLING	A
35	**3012476**		•	•	•	•	•	•	NEEDLE VALVE	
36	**3007169**		•	•	•	•	•	•	O RING	B
37	**3012012**		•	•	•	•	•	•	HALF-SHELL	
38	**3012941**		•						MOTOR 208-230/460V	C
38	**3013059**			•					MOTOR 575V	C
38	**3012943**				•		•		MOTOR 208-230/460V	C
38	**20062892**					•		•	MOTOR 575V	C

N.	CODE	C9514300	C9514301	C9515300	C9515301	C9516300	C9516301	DESCRIPTION	*
39	3012944	•	•	•	•	•	•	SERVOMOTOR	B
40	3003481	•	•	•	•	•	•	SCREW	
41	3003970	•	•	•	•	•	•	BAR	C
42	20049909	•	•	•	•	•	•	UV PHOTOCELL	A
43	3003996	•	•	•	•	•	•	PLUG	
44	3006369	•	•	•	•	•	•	PUMP	C
45	3012092	•	•	•	•	•	•	SUPPORT	A
46	3012475	•	•	•	•	•	•	TUBE	
47	3012959	•	•	•	•	•	•	ELECTRODE CONNECTION	A
48	3003796	•	•	•	•	•	•	ELECTRODE	A
49	3003495	•	•	•	•	•	•	U BOLT	
50	3012461	•	•	•	•	•	•	SUPPORT	A
51	3012095	•	•	•	•	•	•	NUT	
52	20066897	•	•	•	•	•	•	NOZZLE HOLDER ASSEMNLY	C
53	3012462	•	•					DIFFUSER DISC	A
53	3012463			•	•	•	•	DIFFUSER DISC	A
54	3012127	•	•	•	•	•	•	SPACER	
55	3009075	•	•	•	•	•	•	CONNECTOR	C
56	3003974	•	•	•	•	•	•	CONTROL DEVICE	
57	3003975	•	•	•	•			FRONT PIECE	
57	3003976					•	•	FRONT PIECE	
58	3012464	•	•					SQUARE	
58	3012465			•	•			SQUARE	
58	3012466					•	•	SQUARE	
59	3003983	•	•	•	•			SHUTTER	C
59	3003984					•	•	SHUTTER	C
60	3012467	•	•					END CONE	B
60	3012468			•	•			END CONE	B
60	3012469					•	•	END CONE	B
61	3003322	•	•	•	•	•	•	CONNECTOR	C
62	3012950 C5360001	•	•	•	•	•	•	CONTROL BOX BASE	C
63	20034953	•	•	•	•	•	•	LEVER	
65	3012352	•	•	•	•	•	•	BAR	C
66	3006098	•	•	•	•	•	•	PIN JOINT	C
67	3003841	•	•	•	•	•	•	BEARING	C
68	3012470	•	•	•	•	•	•	TUBE	
69	3012471	•	•	•	•	•	•	TUBE	
70	3003005	•	•	•	•	•	•	CONNECTOR	C
71	3012351	•	•	•	•	•	•	TIE ROD	
72	3006723	•	•	•	•	•	•	CONNECTOR	C
73	3012359	•	•	•	•	•	•	LEVER	
74	3012472	•	•	•	•	•	•	BEARING	C
75	3006097	•	•	•	•	•	•	FLAT SPRING	
76	3012358	•	•	•	•	•	•	CAM ASSEMBLY	C
77	3012356	•	•	•	•	•	•	SPRING	

N.	CODE	C9514300	C9514301	C9515300	C9515301	C9516300	C9516301	DESCRIPTION	*
78	**3012945**	•	•	•	•	•	•	SHAFT	
79	**3003287**	•	•	•	•	•	•	COIL	B
80	**3007150**	•	•	•	•	•	•	O RING	B
81	**3003204**	•	•	•	•	•	•	SEAL	B
82	**3003200**	•	•	•	•	•	•	NUT	
83	**3012474**	•	•	•	•	•	•	MODULATOR	B
84	**3013065**	•	•	•	•	•	•	CONNECTOR	C
85	**20088026**	•	•	•	•	•	•	NOZZLE HOLDER	C

*

ADVISED PARTS

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

B Appendix - Accessories

- **Kit for lengthening the combustion head**

Burner	Standard length	Length obtainable with the kit	Code
RL 70/M	10 23/32”	15 5/32”	3010280
RL 100/M	10 23/32”	15 5/32”	3010281
RL 100/M	10 23/32”	15 5/32”	3010282

- **Flame inversion boiler kit**

Burner	Code
RL 70-100/M	3010180
RL 130/M	3010183

WARNING

The installer is responsible for the supply and installation of any 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:	

OIL OPERATION

Oil supply pressure:		CO_2: Low Fire		High Fire	
Oil suction pressure:		O_2: Low Fire		High Fire	
Control Power Supply:		CO: Low Fire		High Fire	
Burner Firing Rate:		NO_X: Low Fire		High Fire	
Low Fire Flame Signal:		Net Stack Temp - Low Fire:		High Fire	
High Fire Flame Signal:		Comb. Efficiency - Low Fire:		High Fire	
Low Fire Nozzle Size:		Overfire Draft:			
High Fire Nozzle Size:		Smoke number:			

CONTROL SETTINGS

Operating 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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