GB

Light oil burners

Progressive two-stage or modulating operation

RL/M

CODE	MODEL	TYPE
3477810 - 3477811	RL 190/M	674 T1
20011021 - 20011022	RL 190/M	674 T1
20052628	RL 190/M TL	674 T1

1 Declarations

Declaration of conformity in accordance with ISO / IEC 17050-1		
Manufacturer:	RIELLO S.p.A.	
Address:	Via Pilade Riello, 7 37045 Legnago (VR)	
Product:	Light oil burners	
Model:	RL 190/M	
These products are in compliance with the following Technical Standards:		
EN 267		
EN 12100		
and according to the European Directives:		
MD	2006/42/EC	Machine Directive
LVD	2006/95/EC	Low Voltage Directive
EMC	2004/108/EC	Electromagnetic Compatibility
Such products are marked as follows:		
CE	CE-0440/B	

The quality is guaranteed by a quality and management system certified in accordance with UNI EN ISO 9001.

Manufacturer's Declaration			
RIELLO S.p.A. declares that the following products comply with the NOx emission limits specified by German standard "**1. BImSchV release 26.01.2010**".			
Product	Type	Model	Power
Light oil burner	674 T1	RL 190/M	534 - 2431kW

Legnago, 12.06.2012

Burners Division Department
RIELLO S.p.A.

Eng. I. Zinna

Eng. R. Cattaneo

2 Information and general instructions

2.1 Information about the instruction manual

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 RIELLO 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.

2.1.1 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.

2.1.2 Danger: live components

This symbol indicates operations which, if not carried out correctly, lead to electric shocks with lethal consequences.

Other symbols

ENVIRONMENTAL PROTECTION

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

➤ This symbol indicates a list.

Abbreviations used

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

Delivery of the system and the instruction manual

When the system is delivered, it is important that:

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

    .....

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

    .....
    .....
    .....

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

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

2.2 Guarantee and responsibility

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

WARNING

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

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

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

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

3 Safety and prevention

3.1 Introduction

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

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

It is a good idea to remember the following:

- The burner must only be used as expressly described. Any other use should be considered improper and therefore dangerous.
  In particular:
  it can be applied to boilers operating with water, steam, diathermic oil, and to other users expressly named by the manufacturer;
  the type and pressure of the fuel, the voltage and frequency of the electrical power supply, the minimum and maximum deliveries for which the burner has been regulated, the pressurisation of the combustion chamber, the dimensions of the combustion chamber and the room temperature must all be within the values indicated in the instruction manual.
- Modification of the burner to alter its performance and destinations is not allowed.
- The burner must be used in exemplary technical safety conditions. Any disturbances that could compromise safety must be quickly eliminated.
- Opening or tampering with the burner components is not allowed, apart from the parts requiring maintenance.
- Only those parts envisaged by the manufacturer can be replaced.

3.2 Personnel training

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

The user:

- undertakes to entrust the machine exclusively to suitably trained and qualified personnel;
- must take all the measures necessary to prevent unauthorised people gaining access to the machine;
- undertakes to inform his personnel in a suitable way about the application and observance of the safety instructions. With that aim, he undertakes to ensure that everyone knows the use and safety instructions for his own duties;
- must inform the manufacturer if faults or malfunctioning of the accident prevention systems are noticed, along with any presumed danger situation.
- Personnel must always use the personal protective equipment envisaged by legislation and follow the indications given in this manual.
- Personnel must follow all the danger and caution indications shown on the machine.
- Personnel must not carry out, on their own initiative, operations or interventions that are not within their province.
- Personnel are obliged to inform their superiors of every problem or dangerous situation that may arise.
- The assembly of parts of other makes, or any modifications, can alter the characteristics of the machine and hence compromise operating safety. The manufacturer therefore declines any and all responsibility for any damage that may be caused by the use of non-original parts.

4 Technical description of the burner

4.1 Technical data

MODEL			RL 190/M	
CODE			3477810 - 3477811 - 20052628	20011021 - 20011023
OUTPUT (1) DELIVERY (1)	2nd stage°	kW Mcal/h kg/h	1423 - 2431 1224 - 2091 120 - 205	
	1st stage°	kW Mcal/h kg/h	534 - 1423 459 - 1224 45 - 120	
FUEL			LIGHT OIL	
- net calorific value		kWh/kg Mcal/kg	11,8 10,2 (10.200 Kcal/kg)	
- density		kg/dm^3	0,82 - 0,85	
- Viscosity at 20 °C		mm^2/s max	6 (1,5 °E - 6 cSt)	
OPERATION			• Intermittent (min. 1 stop in 24 hours). These burners are also fiitted for the continuous operation, if they are equipped with the control box LANDIS type LOK 16.250 A27 (interchangeable with the burner control box LANDIS LAL 1.25). • Progressive two-stage (modulating by Kit)	
NOZZLES		number	1 (nozzle with return)	
STANDARD APPLICATIONS			Boilers: water, steam, diathermic oil	
AMBIENT TEMPERATURE		°C	0 - 40	
COMBUSTION AIR TEMPERATURE		°C max	60	
PUMP TA3	delivery (at 20 bar) pressure range fuel temperature	kg/h bar °C max	665 7 - 40 140	
NOISE LEVELS (2)		dBA	83,9	

(1) Reference conditions: Ambient temperature 20 °C - Barometric pressure 1000 mbar - Altitude 100 m a.s.l.

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

4.2 Electrical data

Motor IE1

CODE		3477810 - 3477811 - 20052628	20011021 - 20011023
ELECTRICAL SUPPLY	V Hz	400 with neutral ~ +/- 10% 50 - three-phase	230 with neutral ~ +/- 10% 50 - three-phase
ELECTRIC MOTOR	rpm W V	2860 4500 400	2860 4500 230
Operating current	A	9,1	15,8
Acceleration current	A	73	126
IGNITION TRANSFORMER	V1 - V2 I1 - I2	230 V - 2 x 5 kV 1,9 A - 35 mA	
ELECTRICAL POWER CONSUMPTION	W max	5500	
ELECTRICAL PROTECTION		IP 44	

Motor IE2

CODE		3477810 - 3477811 - 20052628	20011021 - 20011023
ELECTRICAL SUPPLY	V Hz	400 with neutral ~ +/- 10% 50 - three-phase	230 with neutral ~ +/- 10% 50 - three-phase
ELECTRIC MOTOR	rpm W V	2900 4500 400	2900 4500 230
Operating current	A	8,7	15
Acceleration current	A	81	141
IGNITION TRANSFORMER	V1 - V2 I1 - I2	230 V - 2 x 5 kV 1,9 A - 35 mA	
ELECTRICAL POWER CONSUMPTION	W max	5500	
ELECTRICAL PROTECTION		IP 44	

4.2.1 Variants

Model	Code	Power supply electrical
RL 190/M	3477810 3477811 20052628	400 V
RL 190/M	20011021 20011022	230 V

4.2.2 Accessories (optional):

- **OUTPUT MODULATION REGULATOR KIT**

Two components should be ordered:
➤ the output regulator to install on the burner;
➤ the probe to install on the heat generator.

PARAMETER TO BE CHECKED		PROBE		POWER REGULATOR	
	Range	Type	Code	Type	Code
Temperature	- 100...+ 500 °°C	PT 100	3010110	RWF40	3010212
Pressure	0...2,5 bar 0...16 bar	Probe with output 4...20 mA	3010213 3010214		

4.3 Burner description

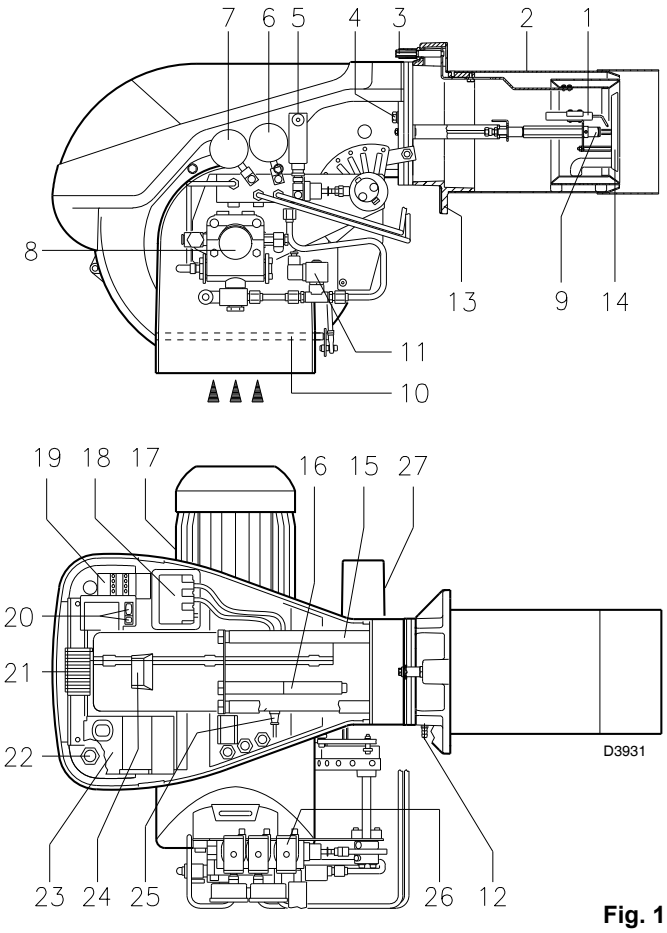

Fig. 1

1 Ignition electrodes
2 Combustion head
3 Screw for combustion head adjustment
4 Screw for fixing fan to flange
5 Oil pressure switch
6 Pressure gauge for pressure on nozzle return
7 Pressure gauge for pressure on nozzle delivery
8 Pump
9 Non-drip nozzle holder
10 Air gate valves
11 Safety solenoid valve
12 Fan pressure test point
13 Boiler mounting flange
14 Flame stability disk
15 Slide bars for opening the burner and inspecting the combustion head
16 Extensions for slide bars 15)
17 Electrical motor
18 Ignition transformer
19 Motor contactor and thermal cut-out with reset button
20 Power switch for different operations:
automatic - manual - off.
Button for:
power increase - power reduction.
21 Terminal strip
22 Fairleads for electrical connections by installer
23 Control box with lock-out pilot light and lock-out reset button
24 Flame inspection window
25 Photocell for flame presence control
26 Valve assembly with pressure regulator on nozzle return
27 Servomotor, provides adjustment of fuel delivery regulator and of air gate valve.
When the burner is not operating the air gate valve is fully closed in order to reduce to a minimum heat dispersion from the boiler due to the flue draught which draws air from the fan suction inlet.

Two types of burner failure may occur:

Control Box Lock-out: if the control box 23) (Fig. 1) pushbutton lights up, it indicates that the burner is in lock-out.

To reset, press the pushbutton, no sooner than 10 s after the lock-out.

Motor trip: release by pressing the pushbutton on thermal cut-out 19)(Fig. 1).

4.3.1 **Weight** - approximate measurements

- The weight of the burner complete with its packaging is shown in table (Tab. A)

	kg
RL 190/M	121 - 123

Tab. A

4.3.2 Max. dimensions - approximate measurements

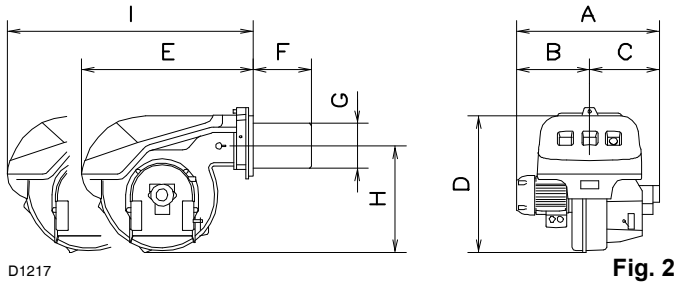

Fig. 2

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

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

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

mm	A	B	C	D	E	F	G	H	I
RL 190/M	813	366	447	555	712	370-528	222	430	1166-1324

4.3.3 Standard equipment

2 - Flexible hoses (L = 1340 mm)
2 - Gaskets for flexible hoses
2 - Nipples for flexible hoses
1 - Thermal insulation screen
4 - Extensions 16)(Fig. 1) for slide bars 15)(Fig. 1)
4 - Screws to secure the burner flange to the boiler: M 16 x 40
1 - Instruction booklet
1 - Spare parts list

4.4 Firing rates

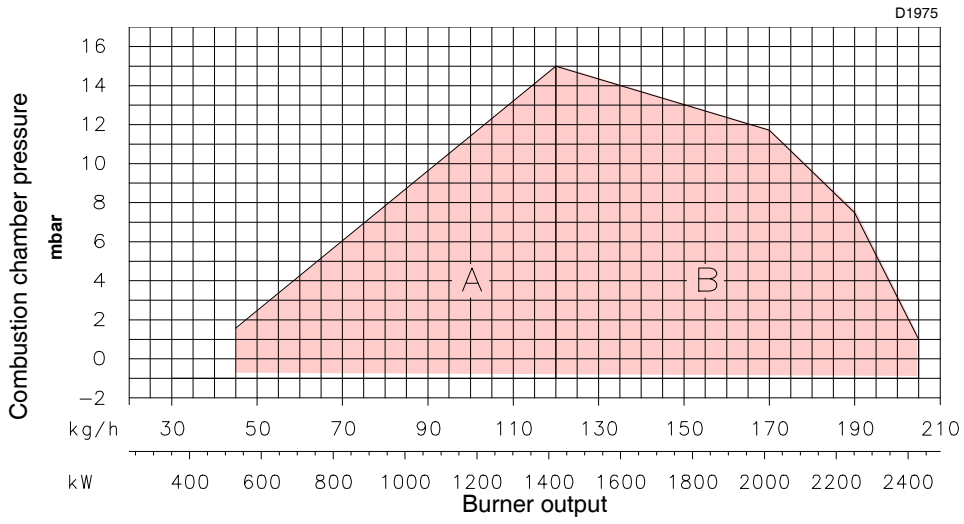

Fig. 3

During operation, burner output varies between:

➤ **MINIMUM OUTPUT**: area A;

➤ **MAXIMUM OUTPUT**: area B.

The work point 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 work point which must lie within area A, for MIN output, and within area B, for MAX output.

Burner firing rates according to air density

The FIRING RATE area values have been obtained considering a surrounding temperature of 20 °C, and an atmospheric pressure of 1000 mbar (approx. 100 m above sea level) and with the combustion head adjusted as shown on page 9.

It may be that a burner has to operate with combustive air at a higher temperature and/or higher altitudes.

The heating of the air and the increase in altitude produce the same effect: the expansion of the air volume (i.e. the reduction of its density).

The delivery of the burner fan remains essentially the same, but the oxygen per m^3 of air, and the thrust (discharge head) of the fan are reduced.

It is therefore important to know if the maximum output requested from the burner at a determinate combustion chamber pressure remains within the firing rate of the burner even with the changed temperature and altitude conditions.

m a.s.l.	(1)	F AIR °C							
M	mbar	0	5	10	15	20	25	30	40
0	1013	1,087	1,068	1,049	1,031	1,013	0,996	0,980	0,948
100	1000	1,073	1,054	1,035	1,017	1,000	0,983	0,967	0,936
200	989	1,061	1,042	1,024	1,006	0,989	0,972	0,956	0,926
300	978	1,050	1,031	1,013	0,995	0,978	0,962	0,946	0,916
400	966	1,037	1,018	1,000	0,983	0,966	0,950	0,934	0,904
500	955	1,025	1,007	0,989	0,972	0,955	0,939	0,923	0,894
600	944	1,013	0,995	0,977	0,960	0,944	0,928	0,913	0,884
700	932	1,000	0,982	0,965	0,948	0,932	0,916	0,901	0,872
800	921	0,988	0,971	0,954	0,937	0,921	0,906	0,891	0,862
900	910	0,977	0,959	0,942	0,926	0,910	0,895	0,880	0,852
1000	898	0,964	0,946	0,930	0,914	0,898	0,883	0,868	0,841
1200	878	0,942	0,925	0,909	0,893	0,878	0,863	0,849	0,822
1400	856	0,919	0,902	0,886	0,871	0,856	0,842	0,828	0,801
1600	836	0,897	0,881	0,866	0,851	0,836	0,822	0,808	0,783
1800	815	0,875	0,859	0,844	0,829	0,815	0,801	0,788	0,763
2000	794	0,852	0,837	0,822	0,808	0,794	0,781	0,768	0,743

(1) Average barometric pressure

Tab. B

To check it, proceed as follows:
1 Find the corrective factor F (Tab. B) relating to the air temperature and altitude of the system.
2 Divide the burner's delivery Q by F in order to obtain the equivalent delivery Qe:

Qe = Q : F (kg/h)

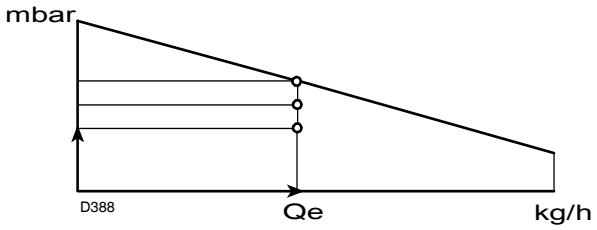

Fig. 4

3 In the firing rate range of the burner, (Fig. 4), indicate the work point defined by:
Qe = equivalent delivery
H1 = combustion chamber pressure
The resulting point A must remain within the firing rate range.
4 Trace a vertical line from point A, (Fig. 4), and find the maximum pressure H2 of the firing rate.
5 Multiply H2 by F to obtain the maximum lowered pressure H3 of the firing rate

H3 = H2 : F (mbar)

If H3 is greater than H1, as in (Fig. 4), the burner can produce the delivery requested.

If H3 is lower than H1, the burner's delivery must be reduced. A reduction in delivery is accompanied by a reduction of the pressure in the combustion chamber:
Qr = reduced delivery
H1r = reduced pressure

$$H1r = H1 \times \left(\frac{Qr}{Q}\right)^2$$

Example, a 5% delivery reduction:
Qr = Q x 0.95
H1r = H1 x $(0,95)^2$

With the new values - Qr and H1r - repeat steps 2 - 5.

WARNING

the combustion head must be adjusted in respect to the equivalent delivery Qe.

4.4.1 Test boiler

The firing rates were set in relation to special test boilers in accordance with the methods defined in EN 267 standards.

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

Example:
delivery 200 kg/hour:

diameter = 80 cm; length = 3,5 m.

Whenever the burner is operated in a much smaller commercially-available combustion chamber, a preliminary test should be performed.

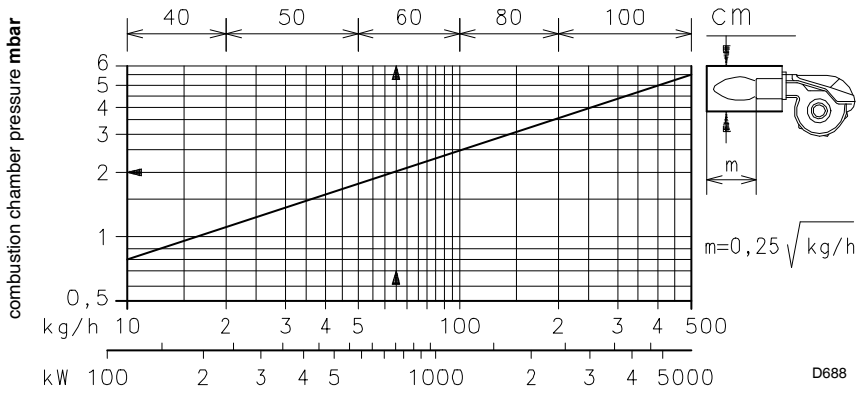

Fig. 5

5 Installation

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.

5.1 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.

5.2 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.

Checking the characteristics of the burner

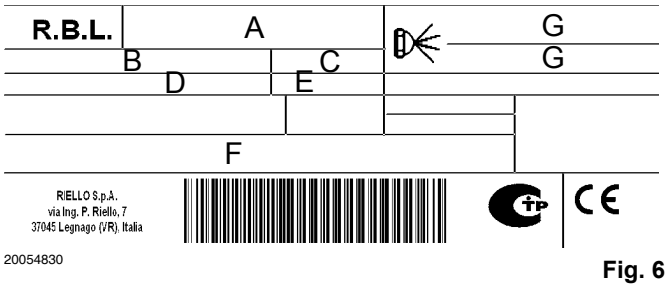

Fig. 6

Check the identification label of the burner, showing:
- ➤ the model (see **A** in Fig. 6) and type of burner (**B**);
- ➤ the year of manufacture, in cryptographic form (**C**);
- ➤ the serial number (**D**);
- ➤ the electrical input power (**E**);
- ➤ the types of fuel used and the relative supply pressures (**F**);
- ➤ the data of the burner's minimum and maximum output possibilities (**G**) (see Firing rate)

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.

5.3 Boiler plate

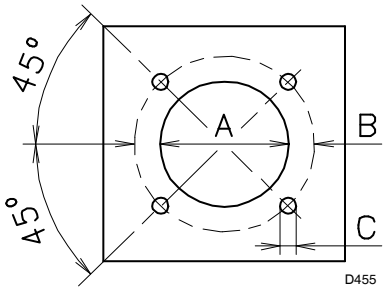

Fig. 7

Drill the combustion chamber locking plate as shown in (Fig. 7). The position of the threaded holes can be marked using the thermal screen supplied with the burner.

mm	A	B	C
RL 190/M	230	325-368	M 16

5.4 Blast tube length

The length of the blast tube must be selected according to the indications provided by the manufacturer of the boiler, and in any case it must be greater than the thickness of the boiler door complete with its fettling. The length available, L (mm), is 370 mm.

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

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

For boilers having a water-cooled front the refractory fettling 10)-11) (Fig. 8) is not required unless it is expressly requested by the boiler manufacturer.

5.5 Securing the burner to the boiler

Disassemble the blast tube 9) 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).

Secure flange 7) (Fig. 8) to the boiler plate interposing the supplied gasket 8) (Fig. 8). Use the 4 screws provided after having protected the thread with antiscruffing products.

The burner-boiler seal must be airtight.

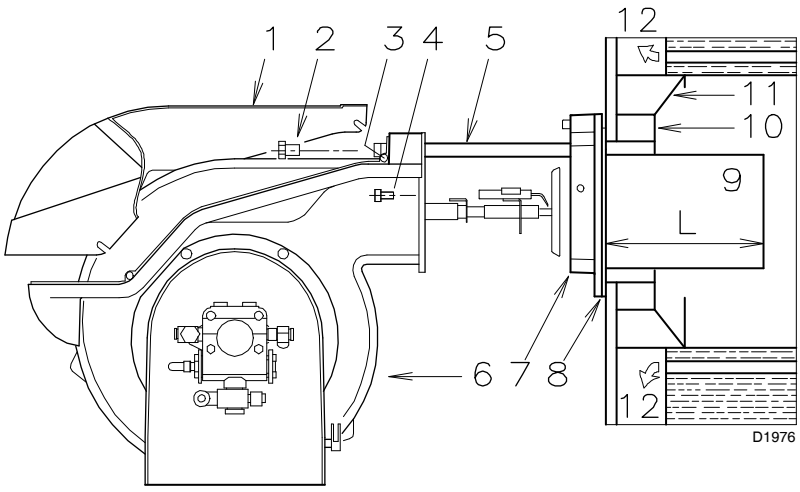

Fig. 8

5.6 Choice of nozzle

See diagrams (Fig. 25 and Fig. 26, page 22).

In case an intermediate delivery between the two values indicated in the diagrams (Fig. 25 and Fig. 26, page 22), is required, a nozzle with higher delivery must be chosen. Delivery reduction will be obtained by means of the pressure regulator.

RECOMMENDED NOZZLES:

Type A3 or A4 Bergonzo nozzles - 45° angle

5.7 Nozzle assembly

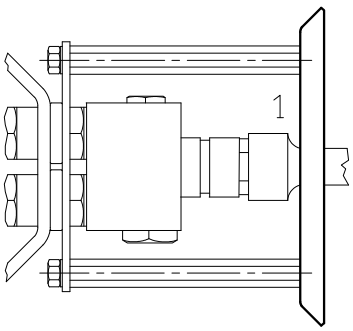

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Fig. 9

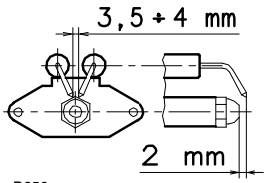

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Fig. 10

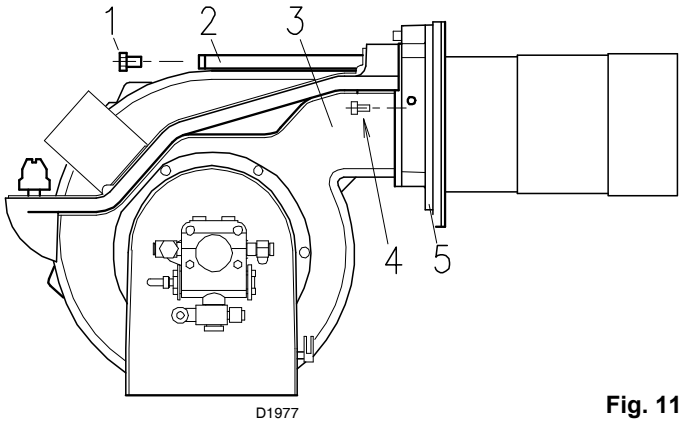

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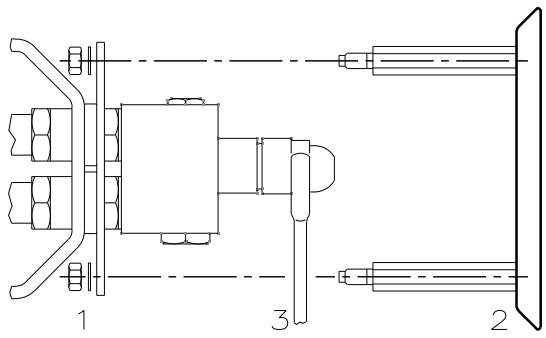
Fig. 11



D1222

Fig. 12

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 spanner 1) (Fig. 9), fitting the spanner through the central hole in the flame stability disk. Do not use any sealing products such as gaskets, sealing compound, or tape. Be careful to avoid damaging the nozzle sealing seat.

Make sure that the electrodes are positioned as shown in (Fig. 10)

Finally refit the burner 3) (Fig. 11) to 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:

– Retract the burner on its slide bars as shown in (Fig. 8, page 12).
– Remove the nuts 1) (Fig. 12) and the disk 2).
– Use spanner 3) (Fig. 12) to change the nozzles.

5.8 Combustion head setting

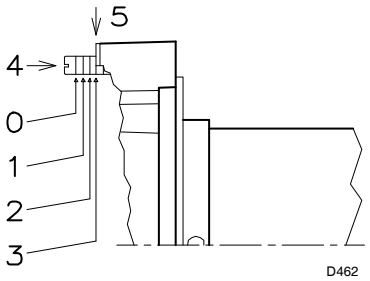


Fig. 13

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

Turn screw 4) (Fig. 13) until the notch shown in diagram (Fig. 14) is level with the front surface of flange 5) (Fig. 13).

Example:

RL 190/M, maximum light oil delivery = 150 kg/h

Diagram (Fig. 14) indicates that for a delivery of 150 kg/h the RL 190/M Model requires the combustion head to be set to approx. three notches, as shown in (Fig. 13)

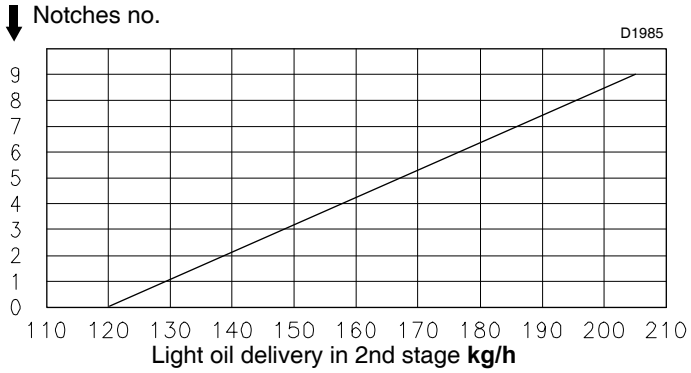


Fig. 14

6 Electrical system

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. Refer to the wiring diagrams.
- ➤ RIELLO declines all responsibility for modifications or connections different from those shown in the electrical layouts.
- ➤ Do not invert the neutral with the phase in the electrical supply line. Any inversion would cause a lockout due to firing failure.
- ➤ The RL 190/M 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 start-up efficiency. Normally the boiler's thermostat/pressure switch ensures the stopping of the burner.
  If this is not the case, it is necessary to apply in series with IN a timer switch that turns off the burner at least once every twenty-four hours. Refer to the wiring diagrams.

DANGER

- ➤ 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.
- ➤ 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 3 mm (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.

6.1 Electrical system (factory set)

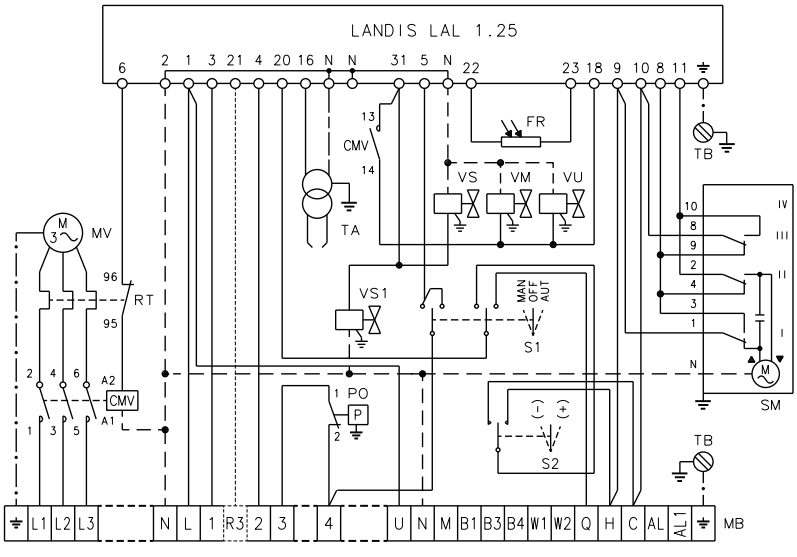


Fig. 15

Key to wiring diagram (Fig. 15)

CMV	-	Motor contactor
LAL 1.25	-	Control box
FR	-	Photocell
MB	-	Terminal strip
MV	-	Fan motor
PO	-	Oil pressure switch
RT	-	Thermal cut-out
S1	-	Power switch for different operations:
		MAN = manual
		AUT = automatic
		OFF = 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)
VS1	-	Safety valve on return
VU	-	Valve on nozzle return

6.1.1 Electrical connections

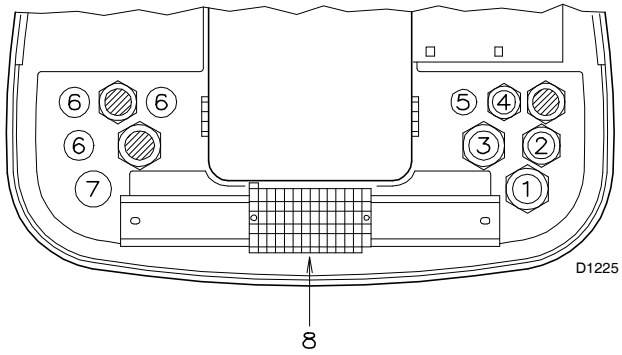


Fig. 16

Set up by the installer

Use flexible cables according to regulation EN 60 335-1:

➤ if in PVC boot, use at least H05 VV-F

➤ if in rubber boot, use at least H05 RR-F.

All the cables to be connected to the burner terminal strip 8) (Fig. 16) must be routed through the fairleads.

The fairleads can be used in various ways. One example is given below:

RL 190/M (Fig. 16)

1	Pg 13,5	Three-phase power supply
2	Pg 11	Single-phase power supply
3	Pg 11	Control device TL
4	Pg 9	Control device TR or probe (RWF40)
5	Pg 9	Set up for faird lead
6	Pg 11	Set up for faird lead
7	Pg 13,5	Set up for faird lead

RL 190/M electrical connection three-phase 230/400 V power supply with neutral phase wire

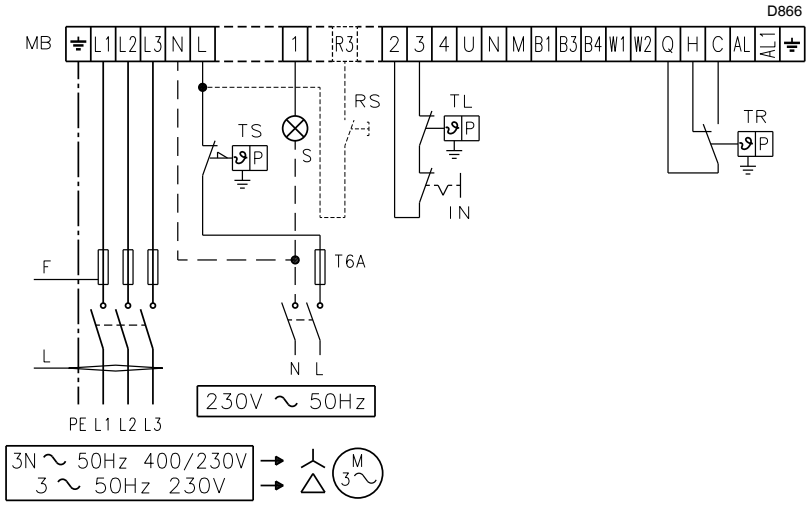


Fig. 17

		RL 190/M	
		230 V	400 V
F	A	T25	T25
L	mm^2	2.5	2.5

Fuses and cables section layout, see table (Fig. 17).

Cable section not indicated: 1.5 mm^2.

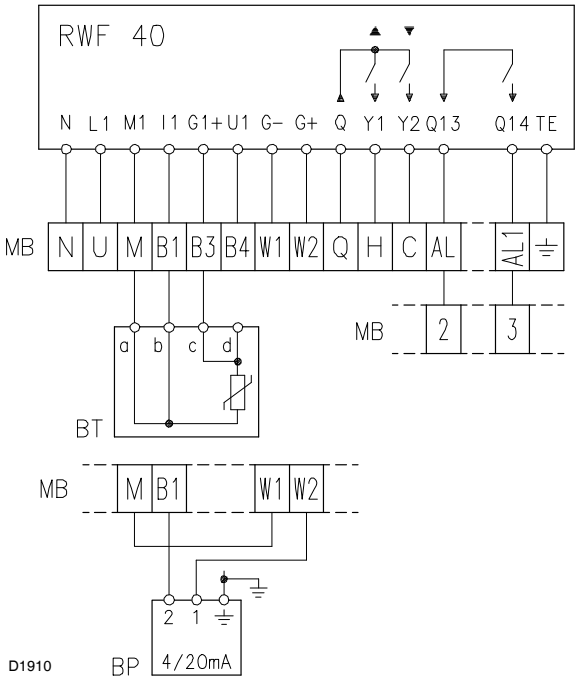


Fig. 18

Key to Layout (Fig. 17) - (Fig. 18)

BT - Temperature probe
BP - Pressure probe
IN - Manual burner stop switch
MB - Terminal strip
RS - Remote lock-out reset button (if present)
S - Remote lock-out signal
TL - Limit control device system: this shuts down the burner when the boiler temperature or pressure exceeds the set-point value.
TR - High-low mode control device system: this controls operating stages 1 and 2 and the TR load control is not required when the regulator RWF40 is connected as its function is performed by the regulator RWF40 itself.
TS - Safety control device system: this operates when TL is faulty.

WARNING

The burner is factory set for two-stage operation and the TR remote control device that commands light oil valve V2 must therefore be connected.

Alternatively, if single stage operation is required, instead of control device TR install a jumper lead between terminal 5 and 6 of the terminal strip.

Model	Thermal relay adjustment
RL 190/M - 230 V	16 A
RL 190/M - 400 V	9,5 A

NOTE:
The RL 190/M burner has 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.
If this is not the case, it is necessary to apply in series with IN a timer switch that turns off the burner at least once every twenty-four hours.
These burners are also fiitted for the continuous operation, if they are equipped with the control box LANDIS type LOK 16.250 A27 (interchangeable with the burner control box LANDIS LAL 1.25).


WARNING

Do not invert the neutral with the phase in the electrical supply line.

7 Hydraulic system

7.1 Fuel supply

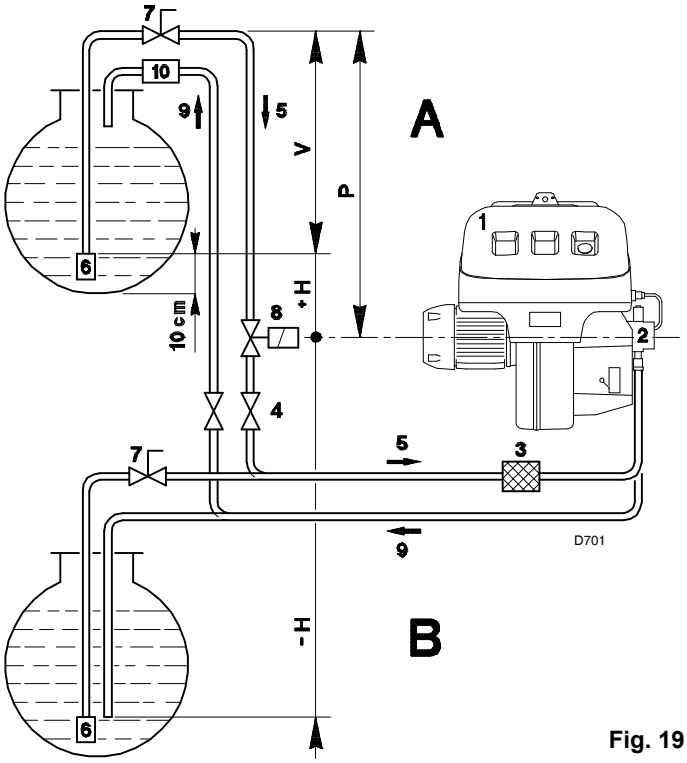


Fig. 19

Double-pipe circuit (Fig. 19)

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

The tank higher than the burner A

The distance “P” must not exceed 10 meters in order to avoid subjecting the pump’s seal to excessive strain; the distance “V” must not exceed 4 meters in order to permit pump self-priming even when the tank is almost completely empty.

The tank lower than the burner B

Pump depression values higher than 0.45 bar (35 cm Hg) must not be exceeded because at higher levels gas is released from the fuel, the pump starts making noise and its working life-span decreases.

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

The loop circuit

A loop circuit consists of a loop of piping departing from and returning to the tank with an auxiliary pump that circulates the fuel under pressure. A branch connection from the loop goes to feed the burner. This circuit is extremely useful whenever the burner pump does not succeed in self-priming because the tank distance and/or height difference are higher than the values listed in the table.

+ H - H (m)	L (m) Ø (mm) 16	 18
+ 4.0	60	80
+ 3.0	50	70
+ 2.0	40	60
+ 1.5	35	55
+ 1.0	30	50
+ 0.5	25	45
0	20	40
- 0.5	18	35
- 1.0	15	30
- 1,5	13	25
- 2.0	10	20
- 3.0	5	10
- 4.0	-	6

Tab. C

Key

H = Pump/foot valve height difference
L = Piping length
Ø = Inside pipe diameter
1 = Burner
2 = Pump
3 = Filter
4 = Manual on/off valve
5 = Suction line
6 = Foot valve
7 = Rapid closing manual valve remote controlled (only Italy)
8 = On/off solenoid valve (only Italy)
9 = Return line
10 = Check valve (only Italy)

7.1.1 Hydraulic connections

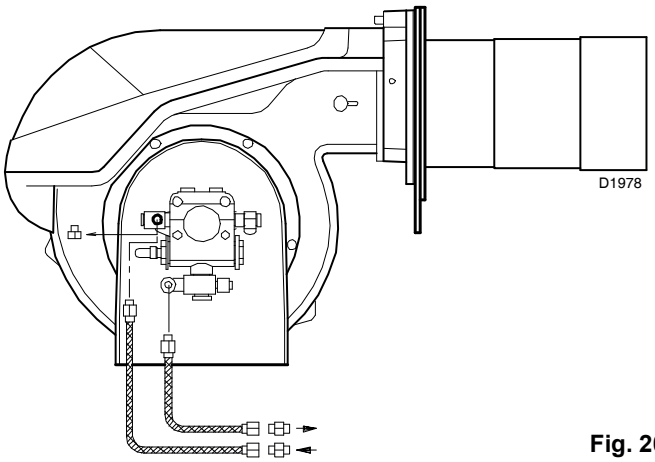


Fig. 20

The pumps are equipped with a by-pass that connects return line with suction line. The pumps are installed on the burner with the by-pass closed by screw 6) (Fig. 22).

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

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

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

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

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

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

Now connect the other end of the hoses to the suction and return lines by using the supplied nipples.

7.1.2 Servomotor

The servomotor provides simultaneous adjustment of the air gate valve, by means of the variable profile cam and the pressure regulator. The servomotor rotates through 130° in 42 seconds.

Do not alter the factory setting for the 5 cams; simply check that they are set as indicated below:

Cam I : 130°

Limits rotation toward maximum position.

Cam II : 0°

Limits rotation toward the minimum position.

When the burner is shut down the air gate valve must be closed: 0°.

Cam III : 20°

Adjusts the ignition position and the MIN output.

Cam IV - V : not utilized.

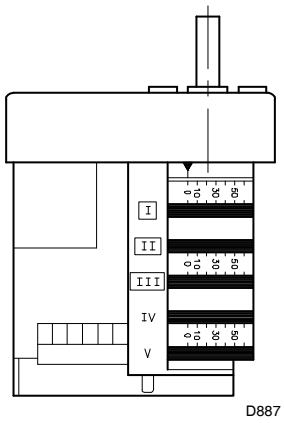


Fig. 21

7.1.3 Oil pressure switch

The oil pressure switch 5) (Fig. 1, page 8) is factory set to 3 bar. If the gas oil pressure reaches this value in the return piping, the pressure switch stops the burner.

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

If a loop circuit with Px pressure feeds the burner, the pressure switch should be adjusted to Px + 3 bar.

7.2 Pump

PUMP

SUNTEC TA 3

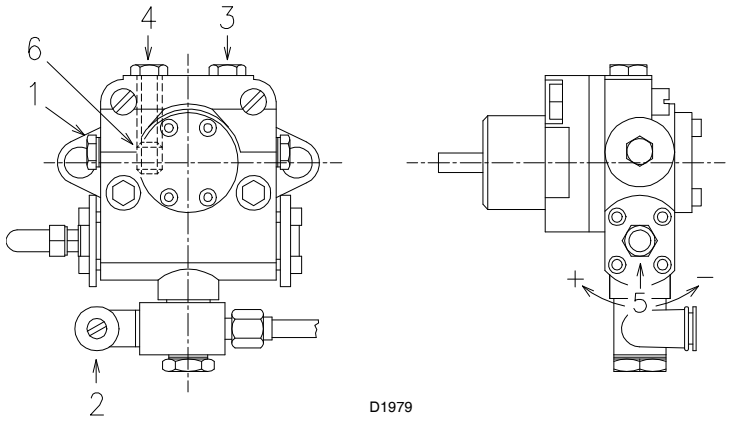


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Fig. 22

1 - Suction G 1/2”
2 - Return G 1/2”
3 - Pressure gauge connection G 1/8”
4 - Vacuum meter connection G 1/8”
5 - Pressure adjustment screw
6 - Screw for by-pass

		TA 3
A	kg/h	665
B	bar	7 - 40
C	bar	0,45
D	cSt	4 - 800
E	°C	140
F	bar	5
G	bar	30

A - Min. delivery rate at 20 bar pressure
B - Delivery pressure range
C - Max. suction depression
D - Viscosity range
E - Light oil max. temperature
F - Max. suction and return pressure
G - Pressure calibration in the factory

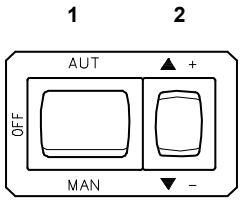

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Fig. 23

7.2.1 Pump priming

– **Before starting the burner, make sure that the tank return line is not clogged. Obstructions in the line could cause the sealing organ located on the pump shaft to break.**
– In order for self-priming to take place, one of the screw 3) (Fig. 22) of the pump must be loosened in order to bleed off the air contained in the suction line.
– Start the burner by closing the control devices with switch 1) (Fig. 23) in the “MAN” position. As soon as the burner starts, check the direction of rotation of the fan blade, by looking through the flame inspection window 24) (Fig. 1, page 8).
– The pump can be considered primed when the light oil starts coming out of the screw 3). Stop the burner: switch 1) (Fig. 23) set to “OFF” and tighten the screw 3).

The time required for this operation depends upon the diameter and length of the suction tubing. If the pump fails to prime at the first starting of the burner and the burner locks out, wait approx. 15 seconds, reset the burner, as often as required. After 5 or 6 starting operations allow 2 or 3 minutes for the transformer to cool.

WARNING

The a.m. operation is possible because the pump is already full of fuel when it leaves the factory. If the pump has been drained, fill it with fuel through the opening on the vacuum meter prior to starting; otherwise, the pump will seize.

Whenever the length of the suction piping exceeds 20-30 meters, the supply line must be filled using a separate pump.

8 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:

➤ Combustion head

➤ Servomotor, cams I - II - IV - V

Contrarily, the settings listed below must be adjusted in sequence:

1 MIN burner output;
2 MAX burner output;
3 Intermediate outputs between MAX and MIN output.

Using the pressure-output diagram which characterises the return-type nozzles, see (Fig. 25) and (Fig. 26), it is possible to determine the size of the nozzle to use in relation to the maximum fuel output to be burnt and consequently establish the minimum and maximum pressure of the fuel on the nozzle return in relation to the corresponding minimum and maximum modulation output.

The fuel pressure on the nozzle delivery is adjusted on the pressure transformer unit and displayed on the pressure gauge 1)(Fig. 24).

The fuel pressure on the nozzle return is adjusted on the pressure transformer unit and displayed on the pressure gauge 2)(Fig. 24).

The adjustment of the MINIMUM pressure of the fuel on the nozzle return must be carried out solely by means of the nut 5) (Fig. 24); screw down said nut to decrease the pressure and unscrew to increase it.

The adjustment of the MAXIMUM pressure of the fuel on the nozzle return must be carried out solely by means of the eccentric 6) (Fig. 24) screw 7) (Fig. 24); screw down said screw to increase the pressure and unscrew to decrease it.

Adjustment of the air is carried out by means of the screws 3) of the variable profile cam 2)(Fig. 27 page 23) which control the air damper; screw down said screws to increase the air delivery and unscrew to decrease it.

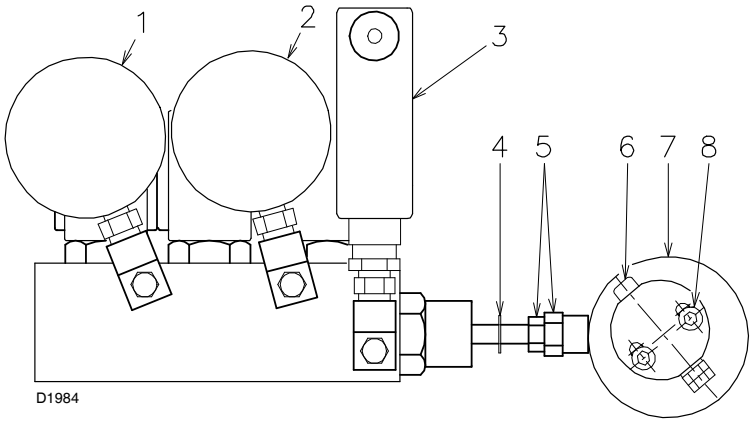

Fig. 24

Pressure regulator

1 Pressure gauge for pressure on nozzle delivery
2 Pressure gauge for pressure on nozzle return
3 Oil pressure switch
4 Ring for piston stop
5 Nut and lock-nut for piston setting
6 Eccentric adjusting screw
7 Variable eccentric
8 Eccentric locking screws

Type A3 Bergonzo nozzles (45°)

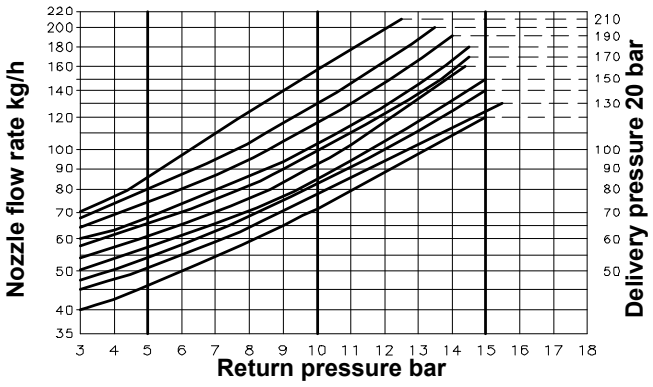

Fig. 25

Type A4 Bergonzo nozzles (45°)

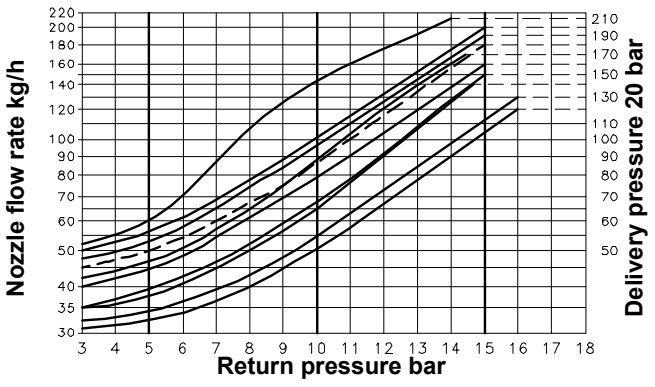

Fig. 26

8.1 Burner firing

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.

Before firing the burner, make sure that the air and fuel regulation parts are workable; in other words loosen the screws 4) of the cam 2) (Fig. 27), loosen the nut and lock nut 5) (Fig. 24) and the two screws 8) (Fig. 24) of the pressure transformer unit and eccentric (Fig. 24).

Close load controls and set switch 1) (Fig. 22, page 21) to “MAN”. The burner will start and after the pre-purge stage the flame will light.

1 - MIN Output

Min. output must be selected within the firing rate range seen on page 9.

Press button 2) (Fig. 23, page 21) “ output reduction “ and keep it pressed until the servomotor has reached 20° (factory setting).

Adjust the pressure of the fuel on the nozzle return, **operating solely by means of the nut 5) (Fig. 24)**; the desired pressure for firing and minimum output is set in this manner.

2 - Output MAX

Max output of the burner must be set within the firing rate range shown on page 9.

After adjusting the firing and minimum modulation output, proceed with adjusting the maximum output by pressing the button 2) (Fig. 23, page 21) towards the “+” sign until the servomotor 27) (Fig. 1, page 8) reaches the maximum position of 130°.

Once maximum opening of the servomotor has been achieved, adjust the pressure of the fuel on the nozzle return again only by means of the screw 6) (Fig. 24) of the eccentric; the desired pressure for maximum output is set in this manner.

Screw down the screw 6) (Fig. 24) only until it corresponds to an increase in pressure; in this way a variation on the whole rotation angle is ensured.

At this point lock the nut and the lock nut 5) (Fig. 24) and the two screws 8) (Fig. 24) of the pressure transformer unit.

3 - Intermediate output

The setting of the minimum and maximum pressure automatically determines the pressure values and therefore those of the intermediate outputs.

Combustion setting

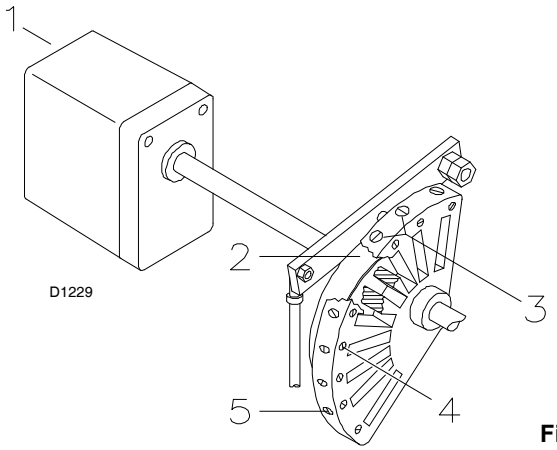

Fig. 27

1 Servomotor
2 Adjustable profile cam
3 Adjustment screws for cam profile
4 Adjustment fixing screws
5 Adjustment screws for cam profile

During setting of the minimum and maximum pressure it is sufficient to regulate an acceptable excess of combustion air judged visibly solely.

Only after having set the minimum and maximum pressure, carry out an accurate setting of the combustion on different positions of modulation operating solely on the setting of the air delivery by means of the screws 3) (Fig. 27) of the cam.

Press the switch 2) (Fig. 23, page 21) “output increase” a little so that the servomotor turns by about 15°. Adjust the screws until optimal combustion is obtained. Proceed in the same way with the other screws.

Take care that the cam profile variation is progressive.

Once the setting of the combustion is complete, lock the screws 4) (Fig. 27) and check ignition once again: noise emission at this stage must be identical to the following stage of operation.If you notice any sign of pulsations, reduce the ignition stage delivery.

NOTE:

The servomor follows the adjustment of cam III only when the cam angle is reduced. If it is necessary to increase the cam angle, first increase the servomotor angle with the key “output increase”, then increase the III cam angle, and finally bring the servomotor back to the MIN output position with the key “output decrease”.

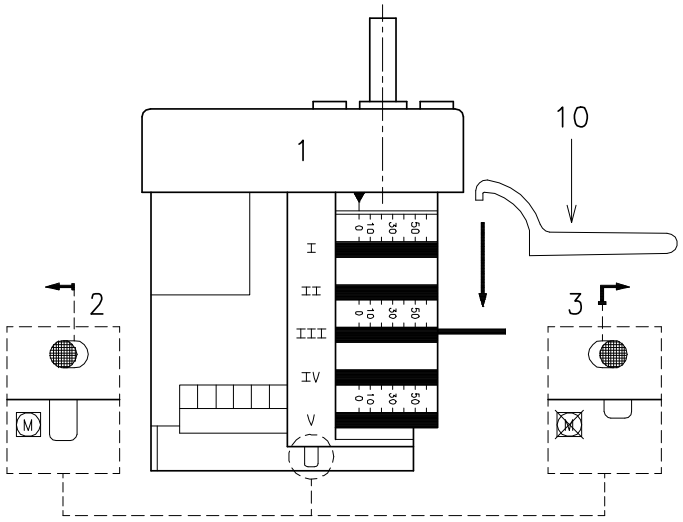

Fig. 28

In order to adjust cam III, especially for fine movements, key 10) (Fig. 28), held by a magnet under the servomotor, can be used.

Warning

- ➤ The proper setting of the eccentric 7) (Fig. 24, page 22) 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.
- ➤ Do not let the piston beat repeatedly: the stop ring 4) (Fig. 24, page 22) determines the max. stroke.
- ➤ When the setting has been carried out and the burner switched off, verify manually, after having released the servomotor pushing and moving the button 3) (Fig. 28), towards the right, that betewwn 0° and 130° no slow-down occurs.
- ➤ 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 weighing of the maximum and minimum pressures of the fuel.
- ➤ In the minimum modulation position, in order to facilitate the firing of the flame, adjust the pressure on the nozzle return to a value ranging between 3 and 6 mbar with an air pressure to the head, measured at the socket 12) (Fig. 1, page 8) ≤ 5 mbar.
- ➤ If, during adjustment of the maximum output, flame instability or pressure fluctuations on the return arise, then it is necessary to decrease this pressure until such problems have been eliminated.
- ➤ During adjustment of the intermediate outputs it is advisable to adjust the air in certain positions so that the bearing which slides over the variable profile foil of the cam is found directly by the side of one of the screws 3) (Fig. 28), this is necessary in order that the adjustment carried out on a screw alters the contiguous adjustments as little as possible.

8.2 Burner operation

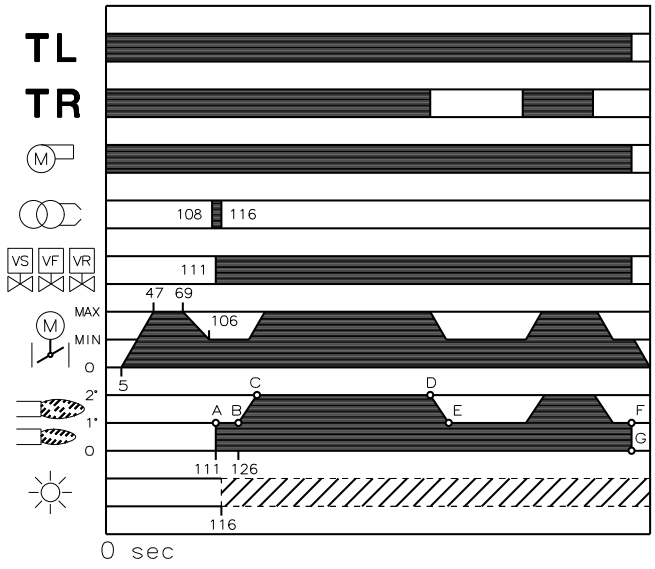

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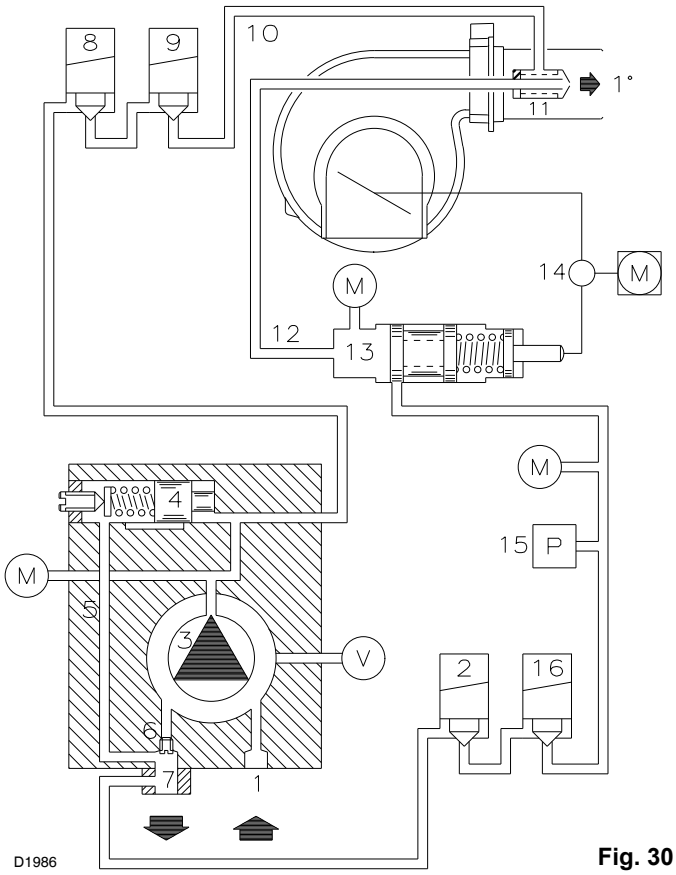
Fig. 29



D1986

Fig. 30

8.2.1 Burner starting

- **0 s :**
  Control device TL closes, the motor starts.
  The pump 3) sucks the fuel from the tank through the piping 1) and the filter 2) and pumps it under pressure to 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) - 16) close the passage to the nozzle.
- **5 s :**
  Servomotor starts: 130° rotation to right, until contact is made on cam I)(Fig. 21 page 20). The air gate valve is positioned on MAX. output.
- **47 s :**
  Pre-purge stage with air delivery at MAX. output.
- **69 s :**
  Servomotor rotates to left until contact is made on cam III) (Fig. 21 page 20).
- **106 s :**
  Air gate valve and pressure regulator are positioned on MIN output.
- **108 s :**
  Ignition electrode strikes a spark.
- **111 s :**
  Solenoid valves 8) - 9) - 16) 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, point A; 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.
- **116 s :**
  The spark goes out.
- **126 s :**
  The starting cycle ends.

8.2.2 Steady state operation

Burner without output regulator RWF40

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

- If the temperature or pressure is low (and the TR load control is consequently closed), the burner progressively increases output up to MAX (section B-C).
- If subsequently the temperature or pressure increases until TR opens, the burner progressively decreases output down to MIN (section D-E). And so on.
- The burner locks out when demand for heat is less than the heat supplied by the burner in the MIN output (section F-G). Load control TL opens. The servomotor returns to the 0° angle limited by contact with cam II) (Fig. 21, page 20). The gate valve closes completely to reduce thermal dispersion to a minimum.

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

Burner with output regulator RWF40

See the handbook enclosed with the regulator.

8.2.3 Firing failure

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

8.2.4 Undesired shutdown during operation

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

8.2.5 Final checks

- ➤ **Obscure the photocell and switch off the control devices:** the burner should start and then lock-out about 5 s after opening of the valves.
- ➤ **Illuminate the photoresistor and switch on the control devices:** the burner should start and then go into lock-out after about 10 s.
- ➤ **Obscure the photocell while the burner is in operation, the following must occur in sequence:** flame extinguished within 1 s, and starting cycle repetition.
- ➤ **Switch off control device TL followed by control device TS while the burner is operating:** the burner should stop.

9 Maintenance

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.

DANGER

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:

DANGER

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

DANGER

close the fuel interception tap;

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.

Pump

The pump delivery pressure must be stable at 20 bar.

The depression must be less than 0.45 bar.

Unusual noise must not be evident during pump operation.

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

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

Filters (Fig. 31)

Check the following filter boxes:

• on line 1) • at nozzle 2), and clean or replace as required.

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

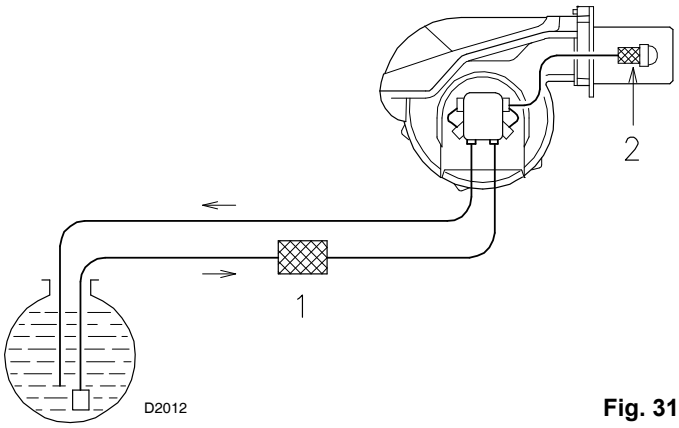


Fig. 31

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.

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.

Nozzles

Do not clean the nozzle openings; do not even open them.

Replace the nozzles every 2-3 years or whenever necessary. Combustion must be checked after the nozzles have been changed.

Photoresistor (Fig. 32)

Clean the glass cover from any dust that may have accumulated. Photocell 1) can be removed by pulling it outward forcefully.

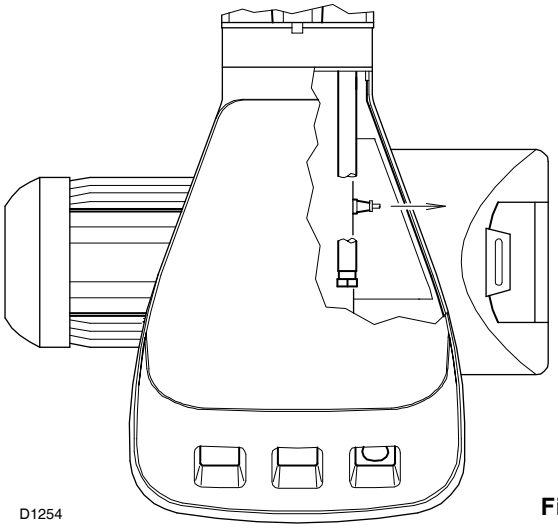


Fig. 32

Flame inspection window (Fig. 33)

Clean the glass.

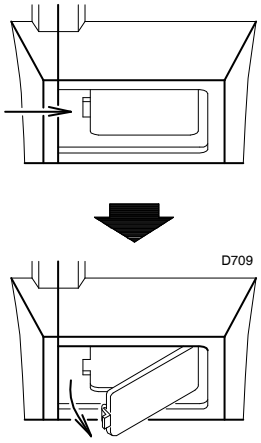


Fig. 33

Flexible hoses

Check to make sure that the flexible hoses are still in good condition.

Fuel tank

Approximately every 5 years, or whenever necessary, suck any water or other impurities present on the bottom of the tank using a separate pump.

Boiler

)Clean the boiler as indicated in its accompanying instructions in order to maintain all the original combustion characteristics intact, especially:

the flue gas temperature and combustion chamber pressure.

To open the burner (Fig. 34)

Switch off the electrical power

Loosen screws 1) and withdraw the cover 2)

Unscrew screws 3)

Fit the two extensions 4) supplied with the burner onto the slide bars 5)

Pull part A backward keeping it slightly raised to avoid damaging the disk 6) on blast tube 7).

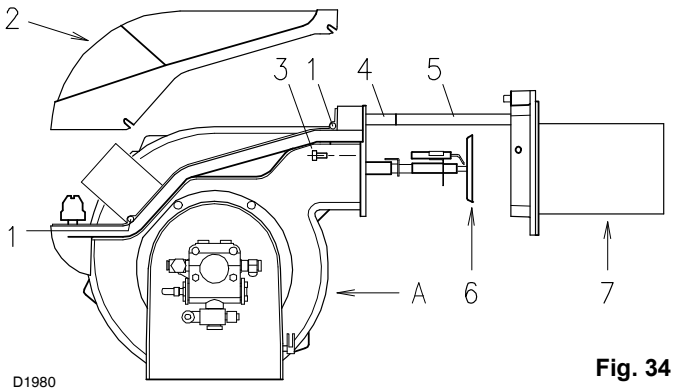


Fig. 34

SYMBOL (1)	FAULT	PROBABLE CAUSE	SUGGESTED REMEDY
◀	The burner does not start	1 - A limit or safety control device is open	Adjust or replace
		2 - Control box lock-out	Reset
		3 - Oil pressure switch intervenes (see page 20)	Adjust pressure switch or eliminate overpressure
		4 - Motor protection tripped	Reset thermal cut-out
		5 - No electrical power supply	Close all switches - Check connections
		6 - Control box fuse blown	Replace (2)
		7 - Contact II of servomotor does not operate	Adjust cam II or replace servo-motorcontrol box terminals 11 - 8
		8 - Pump is jammed	Replace
		9 - Defective motor command control device	Replace
		10 - Defective control box	Replace
		11 - Defective electrical motor	Replace
	The burner does not start and a function lock-out occurs	12 - Flame simulation	Replace control box
		13 - Photoresistor short-circuit	Replace photoresistor
		14 - 2-phase power supply thermal relay trips	Reset thermal cut-out when third phase is re-connected
▲	The burner starts but stops at maximum air damper setting	15 - Contact I of servomotor does not operate	Adjust cam I or replace servo-motorcontrol box terminals 9 - -8
■	The burner starts and then goes into lock-out	16 - Fault in flame detection circuit	Replace control box
▼	The burner remains in pre-purging phase	17 - Contact III of servomotor does not operate	Adjust cam III or replace servomotorcontrol box terminals 10-8
1	After pre-purge and the safety time, the burner goes to lock-out and the flame does not appear	18 - No fuel in tank; water on tank bottom	Top up fuel level or suck up water
		19 - Inappropriate head and air gate valve adjustments	Adjust
		20 - Light oil solenoid valves fail to open	Check connections; replace coil
		21 - Nozzle clogged, dirty, or deformed	Replace
		22 - Dirty or poorly adjusted firing electrodes	Adjust or clean
		23 - Grounded electrode due to broken insulation	Replace
		24 - High voltage cable defective or grounded	Replace
		25 - High voltage cable deformed by high temperature	Replace and protect
		26 - Ignition transformer defective	Replace
		27 - Erroneous valves or transformer electrical connections	Check
		28 - Defective control box	Replace
		29 - Pump unprimed	Prime pump and see "Pump unprimes" (53-54)
		30 - Pump/motor coupling broken	Replace
		31 - Pump suction line connected to return line	Correct connection
		32 - Valves up-line from pump closed	Open
		33 - Filters dirty: line - pump - nozzle	Clean
		34 - Incorrect motor rotation direction	Change motor electrical connections
	The flame ignites normally but the burner locks out when the safety time has elapsed	35 - Defective photoresistor or control box	Replace photoresistor or control box
		36 - Photoresistor dirty	Clean
	Firing with pulsations or flame detachment, delayed firing	37 - Poorly adjusted head	Adjust
		38 - Poorly adjusted or dirty firing electrodes	Adjust
		39 - Poorly adjusted fan air gate: too much air	Adjust
		40 - Nozzle unsuited for burner or boiler	See Nozzle Table
		41 - Defective nozzle	Replace
		42 - Inappropriate pump pressure	Adjust
	The burner does not pass to 2nd stage	43 - Control device TR does not close	Adjust or replace
		44 - Defective control box	Replace
	Uneven fuel supply	45 - Check if cause is in pump or in the fuel supply system	Feed the burner from a tank located nearby
	Rusty pump internal parts	46 - Water in tank	Suck water from tank bottom with separate pump
	Noisy pump, unstable pressure	47 - Air has entered the suction line	Tighten connectors
		- Depression value too high (higher than 35 cm Hg):	
		48 - Tank/burner height difference too great	Feed burner with loop circuit
		49 - Piping diameter too small	Increase
		50 - Suction filters clogged	Clean
		51 - Suction valves closed	Open
		52 - Paraffin solidified due to low temperature	Add additive to light oil
	Pump unprimes after prolonged pause	53 - Return pipe not immersed in fuel	Bring to same height as suction pipe
		54 - Air enters suction piping	Tighten connectors
	Pump leaks light oil	55 - Leakage from sealing organ	Replace pump

SYMBOL (1)	FAULT	PROBABLE CAUSE	SUGGESTED REMEDY
	Smoke in flame - dark Bacharach	56 - Not enough air	Adjust head and fan gate
		57 - Nozzle worn or dirty	Replace
		58 - Nozzle filter clogged	Clean or replace
		59 - Erroneous pump pressure	Adjust
		60 - Flame stability disk dirty, loose, or deformed	Clean, tighten in place, or replace
		61 - Boiler room air vents insufficient	Increase
	- yellow Bacharach	62 - Too much air	Adjust head and fan gate
	Dirty combustion head	63 - Nozzle or filter dirty	Replace
		64 - Unsuitable nozzle delivery or angle	See recommended nozzles
		65 - Loose nozzle	Tighten
		66 - Impurities on flame stability disk	Clean
		67 - Erroneous head adjustment or not enough air	Adjust, open air damper
		68 - Blast tube length unsuited to boiler	Contact boiler manufacturer
I	During operation, the burner stops in lock out	69 - Dirty or defective photocell	Clean or replace

(1) When the burner does not fire or comes to a halt following a fault, the symbol which appears on control box 24) (Fig. 1, page 8) indicates the type of problem.

(2) The fuse is located in the rear part of the control box 24) (Fig. 1, page 8). A pull-out fuse is also available as a spare part which can be fitted after breaking the tang on the panel which holds it in place.