05

Installation, use and maintenance instructions

RIELLO BURNERS

Oil burner

Single stage operation

PRESS GBV

CODE	MODEL	TYPE
3473653	PRESS GBV	604T50

2915808 (0)

MANUAL TO BE GIVEN TO BURNER USER

These instructions are an integral part of the product and should therefore never be detached from the plant. Read carefully for important information regarding burner installation, use and maintenance and conserve for future consultation.

The Manufacturer declines all liability for damages and injuries caused to property, persons, and animals by erroneous burner installation, setting, maintenance and use, the failure to respect the indications provided in this Manual or by any operations performed by unqualified personnel.

NOTE

The application of the burner on the boiler, adjustment and testing must be carried out observing the instruction manual of the boiler, including verification of the CO and CO_2 concentration in the flue gases, their temperatures and the average temperature of the water in the boiler.

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N.B.

Figures mentioned in the text are identified as follows:
1)(A) = part 1 of figure A, same page as text
1)(A)p.6 = part 1 of figure A, page number 6

SAFETY REGULATIONS

THE BURNER ROOM

• The burner room's external air openings must conform to the norms prevailing locally. When in doubt regarding air circulation, we recommend first measuring the CO_2 count with the burner operating at its maximum delivery and the room ventilated only by the burner ventilation air openings and then measuring the CO_2 count a second time with the door open. The CO_2 count measured in both cases must not differ significantly. Should there be more than one burner and fan in the same room, this test must be performed with all the equipment operating simultaneously.
• Never obstruct the burner room's air openings, the burner fan suction opening, and any air ducts and ventilation grates existing in order to avoid:
- the build-up of toxic/explosive gas mixes in the burner room air;
- combustion with insufficient air, resulting in dangerous, expensive, and polluting operation.
• The burner must always be protected against rain, snow, and freezing conditions.
• The burner room must be kept clean and free of volatile substances that may be sucked into the fan and clog the inner burner or combustion head air ducts. Dust is also extremely harmful, especially if it is allowed to build up on the fan blades where it will reduce ventilation and produce pollution during combustion. Dust can also accumulate on the rear part of the flame stability disk in the combustion head and cause a poor air-fuel mixture.

FUEL

• The burner must be fed with the type of fuel for which it has been preset as indicated on the rating plate and in the technical specifications provided in this Manual.
• The fuel pressure at the entry to the pump must not exceed the value listed in this Manual.
• The fuel line that feeds the burner must be perfectly sealed in order to prevent air from entering the pump, and must be sized according to the distance and the height differences present in the system as required by this Manual. The fuel supply line must also be equipped with all the control and safety mechanisms required by local regulations in force. The line should preferably be in copper and be free from all impurities; take particular care that foreign matter does not enter the line during installation.
• The light oil storage tank must be adequately protected against penetration of impurities and water. The fuel tank must be kept full of fuel during the summer in order to avoid the condensation of humidity.
• Clean the tank carefully before filling with fuel.
• Both the tank and the burner fuel supply line must be protected from frost.
• The light oil tank must be positioned in conformity with existing regulations.

ELECTRICAL INPUT

• Make sure that the electrical power supply used for connection conforms to the specifications indicated on the rating plate and in this Manual.
• The burner must be correctly connected to an efficient ground system in conformity to the prevailing norms and checked and controlled for efficiency by qualified personnel when in doubt.
• Never confuse neutral wires with phase wires.
• The burner can be hooked up to the electrical network with a plug-socket connection only provided that the configuration of the coupling is such as to prevent inversion of phase and neutral. Install a master switch for the heating plant as requested by existing legislation.
• The entire electrical system, and all cable sections in particular, must be adequate to deliver the maximum absorbed power value indicated on the equipment's rating plate and in this Manual.
• If the mains power cable is found to be defective, it must be replaced only by qualified personnel.
• Never touch the burner with wet parts of the body or without wearing shoes.
• Never stretch power supply cables and keep them well away from sources of heat.
• The length of the cables used must permit the opening of the burner and the boiler doors.
• Electrical connections must be made exclusively by qualified personnel and all prevailing electrical regulations must be scrupulously observed.

PACKAGING

• After removing all packaging materials, check the contents to make sure that no damage has occurred during shipping. When in doubt, do not use the burner and contact the supplier.
• The packaging materials (wooden crates, plastic bags, plastic foam, clips, etc.) are a source of pollution and potential hazard if left lying around; collect them together and dispose of them properly.

THE BURNER

• Never permit children or unauthorized persons to tamper with the burner.
• The burner must be used only for its expressed applications. The burner may be used with water, steam, and diathermic oil boilers, and in all the other applications expressly provided for by the manufacturer. All other uses are considered dangerous.
The burner's minimum and maximum delivery settings, the combustion chamber pressure and its size, and the surrounding temperature must all be contained in the range stipulated in this Manual.
• Use only original spare parts when equipping the burner with optional, kits, or accessories.
• Modification of the equipment in order to alter its performance or application is prohibited.
• Do not open or tamper with components of the burner other than those parts of the unit that are subject to maintenance operations.
• Only parts indicated by the manufacturer in the Spare Parts Catalogue may be replaced.
• Never touch the hot parts of the burner; these parts, usually located near the flame, heat up during operation and may remain hot for quite some time after the burner has switched off.
• When the burner is not to be used for a certain period, the main power switch on the electrical control panel must be switched off and the manual valve on the burner fuel supply line must be closed. When the burner is no longer required for use, the following operations must be performed:
- the electrical power cable must be disconnected from the main power switch by qualified personnel;
- the manual valve on the burner fuel supply line must be closed and the command handwheel must be locked in place or removed.

BURNER INSTALLATION AND SETTING

• The installation and calibration of the burner must be performed exclusively by qualified personnel in conformity with existing regulations and the indications provided in this Manual.
• The burner must be secured tightly to the boiler in such way that the flame is generated only inside its combustion chamber.
• Before firing the burner, obtain permission from the person in charge of the boiler room to make sure that the boiler has been filled with water or diathermic oil, that the water circuit valves are open, and that the flue gas stacks have been suitably sized and freed from all obstruction. Then perform the following operations:
- Set the fuel delivery according to the power required by the boiler within the burner's firing rates range as listed in this Manual.
- Adjust the comburent air delivery, the combustion head, and the pressure of the fuel at the nozzle.
- Make sure that the combustion chamber pressure conforms to the value provided by the boiler manufacturer.
- Analyse the flue gas to make sure that pollutant values do not exceed the limits established by law.
- Check the efficiency of the safety and adjustment mechanisms.
- Check the efficiency of the flue gas exhaust duct.
- Make sure that all mechanical fixing on the adjustment mechanisms are sufficiently tight before leaving the plant.

BURNER MALFUNCTION

• If the burner stops working and goes into lock out and does not resume operation after two or three manual lockout reset attempts, contact a qualified specialist.
• If the burner breaks down and/or malfunctions, disconnect the power supply, do not attempt to repair, and contact a qualified specialist.
All burner repairs required must be performed exclusively at a technical servicing center authorized by the manufacturer using original spare parts only.
Failure to observe the above may compromise the reliability and safety of the equipment.

MAINTENANCE

• Burner maintenance must be performed by qualified personnel regularly or at least once a year according to the indications given in this Manual.
• Prior to performing any burner maintenance operations, switch off the power supply by using the main switch and cut off the fuel supply as well.

BURNER USER INSTRUCTION

The burners described in this Manual are completely automatic and do not require any commands or supervision by the operator, who should in any case be aware of the following information in order to prevent problems from arising or solve them in advance without requiring servicing assistance.

1 - Read the SAFETY REGULATIONS on Page 3, these regulations contain a series of information that is relevant for the operator.

2 - In order to achieve the greatest level of reliability and the most economical operating conditions in the heating system, burner maintenance must be carried out on a regular basis, at least once a year, by qualified personnel only in accordance with the indications provided in Appendix 6.

3 - Contact a qualified servicing specialist whenever anomalous noises are heard during burner operation.

4 - If the burner fails to start and the control box lockout pilot light 8)(A)P.6 is not lit up, check to make sure that the electrical power supply is reaching the equipment, that the heating system's main power switch is on, that the fuses are OK and that the burner control devices are all closed.
On the other hand, if the burner has stopped and gone into lockout (pilot light on), it can be reset by pressing the respective pilot light. The burner will then attempt to fire automatically. If the burner fails to fire and goes into lock out again, check to make sure that there is fuel in the tank and that the manual valves located on the light oil supply line are open.
If the above conditions are true and the burner still refuses to start, contact the technical assistance centre.

5 - We recommend topping up the fuel level before it has run out completely (consequently shutting down the burner) in order to avoid the following two problems:
- the suction of air mixed with light oil that creates unstable pressure in the pump and anomalous burner operation;
- the failure of the pump to remain primed and the necessity of contacting the servicing department to re-prime the pump and the repetition of the procedure described on Page 12.
For this reason we recommend installing a tank fuel level indication system to permit the level to be topped up in time.
After fuel supply wait a short time, if possible, before starting the burner, to allow impurities to deposit on the bottom of the fuel tank.

6 - The characteristics of the fuel most suited to the burner are indicated on Page 5.

7 - In areas where the temperature falls below -10°C and the fuel tank is located outside, protect the tank and the fuel supply line. At this temperature, the paraffin contained in the light oil can solidify and cause the burner to lockout.
Use winterized light oil, and if the paraffin continues to solidify, use a specific additive for the problem.

8 - Approximately every 5 years, check to make sure that no water has collected on the bottom of the fuel tank. If water is found, use a separate pump that can lift the water from the bottom. If water is sucked into the burner pump rusting will ensue and the pump will eventually break down.

9 - Make sure that the burner room is never dusty. Dust sucked by the fan can deposit on the blades and reduce the ventilation air flow and obstruct the flame stability disk to reduce its efficiency.

Every time the servicing department carries out a repair or maintenance operation, request a written report (on the data check sheet on page 24 of this manual or a similar document) with the date and relevant signature. These documents should be conserved in the boiler room.

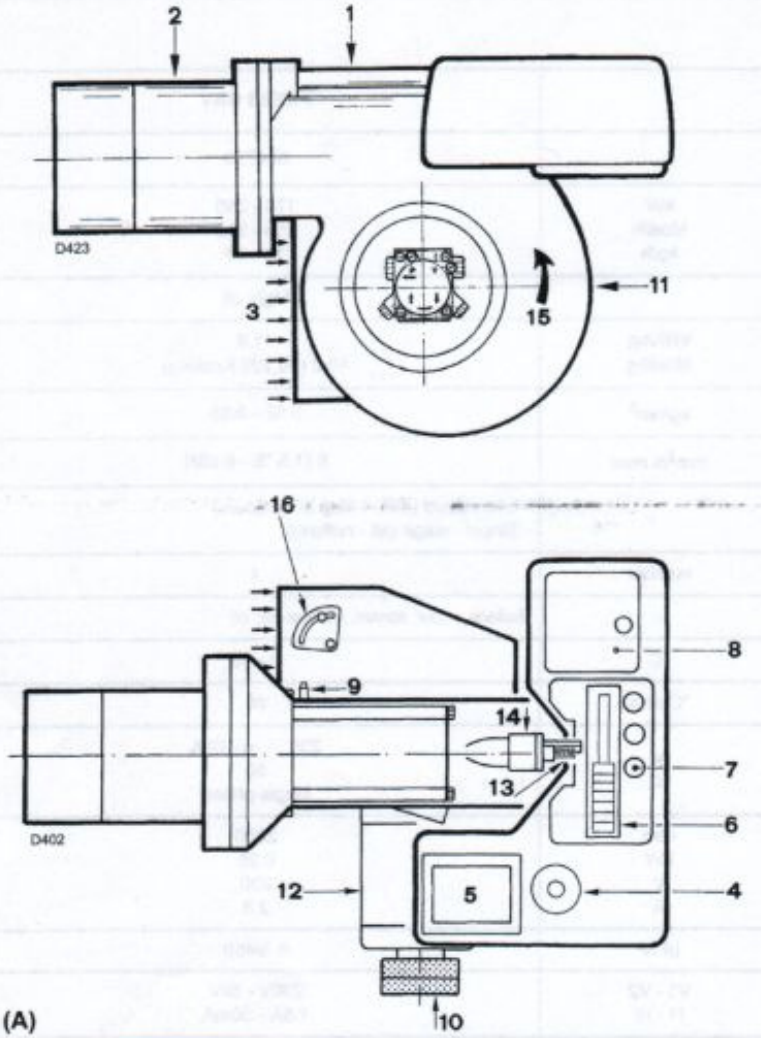
If the plant is not to be used for a long period of time, the main power switch must be set to off and the supply line valve must be closed.

TECHNICAL SPECIFICATIONS

TECHNICAL DATA

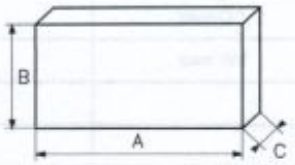
MODEL		PRESS GBV
TYPE		604T50
OUTPUT (1) DELIVERY (1)	kW Mcal/h kg/h	178 - 356 153 - 306 15 - 30
FUEL		Light oil
- net calorific value	kWh/kg Mcal/kg	11.8 10.2 (10,200 Kcal/Kg)
- density	kg/dm^3	0.82 - 0.85
- viscosity at 20 °C	mm^2/s max	6 (1.5 °E - 6 cSt)
OPERATION		- Intermittent (min. 1 stop in 24 hours) - Single - stage (all - nothing)
NOZZLE	number	1
STANDARD APPLICATION		Boilers: water, steam, diathermic oil
AMBIENT TEMPERATURE	°C	0 - 40
COMBUSTION AIR TEMPERATURE	°C max	60
ELECTRICAL SUPPLY	V Hz	230 − +/- 10% 50 single-phase
ELECTRIC MOTOR	rpm kW V A	2800 0.25 230 2.3
MOTOR CAPACITOR	µF/V	6.3/450
IGNITION TRANSFORMER	V1 - V2 I1 - I2	230V - 8kV 1.8A - 30mA
PUMP delivery (at 12 bar) pressure range fuel temperature	kg/h bar ° C max	65 10 - 18 60
ELECTRICAL POWER CONSUMPTION	kW max	0.50
ELECTRICAL PROTECTION		IP 40
IN CORFORMITY WITH EEC DIRECTIVES		89/336 - 73/23 - 92/42 - 98/37

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



(A)

	A	B	C	kg
mm	695	468	542	36



(B)

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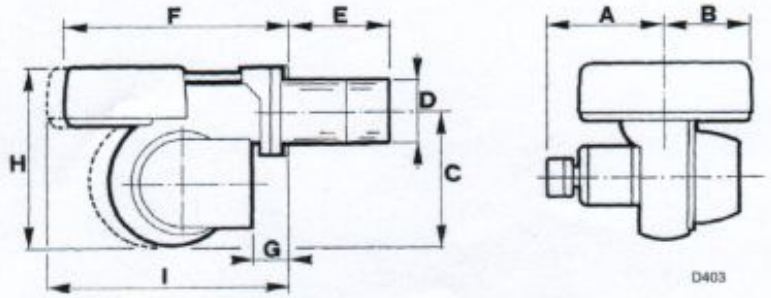


	A	B	C	D	E	F	G	H	I
mm	234	205	292	140	185	473	59	397	688

(C)

BURNER DESCRIPTION (A)

1 Slide bars for opening the burner and inspecting the combustion head
2 Combustion head
3 Air inlet to fan
4 Motor capacitor
5 Ignition transformer
6 Terminal strip
7 Fairleads for wiring carried out by the installer
8 Control box with lockout pilot light and lockout reset button
9 Fan pressure test point
10 Pump (See Appendix 3 - P.17)
11 Fan
12 Electrical motor
13 Screw for combustion head adjustment
14 Photocell for flame presence control
15 Fan rotation direction
16 Indexed selector.
Opens the fan gate to the value necessary at the burner delivery.

N.B.:

If the control box 8)(A) push-button lights up, it indicates that the burner is in lockout.
To reset, press the pushbutton for a minimum of three seconds.

PACKAGING-WEIGHT (B)

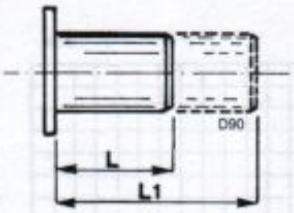
Approximate measurements
- The burner is shipped in a cardboard box with the maximum dimensions shown in Table (B).
- The weight of the burner complete with packaging is indicated in Table (B).

MAX. DIMENSIONS (C)

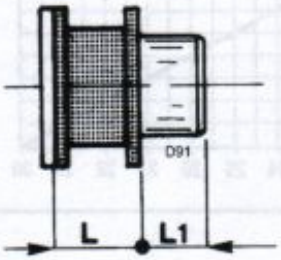
Approximate measurements.
The maximum dimensions of the burner are given in (C).
Bear in mind that inspection of the combustion head requires the burner to be opened and the rear part withdrawn on the slide bars.
The maximum dimensions of the burner when open are given by measurement I.

STANDARD EQUIPMENT

2 - Flexible hoses
2 - Gaskets for flexible hoses
2 - Nipples for flexible hoses
2 - Reducers with gasket for connection of flexible hoses
1 - Thermal insulation screen
4 - Screws to secure the burner flange to the boiler: M10 x 25
1 - Instruction booklet

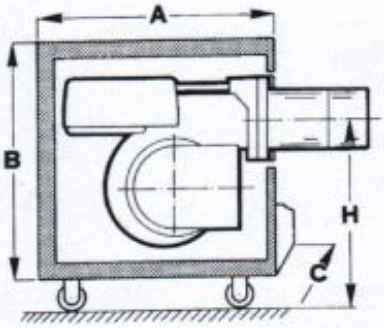


(A) cod. **3000580** L = 185 L1 = 320 mm



(B) cod. **3000755** L = 142 L1 = 43 mm

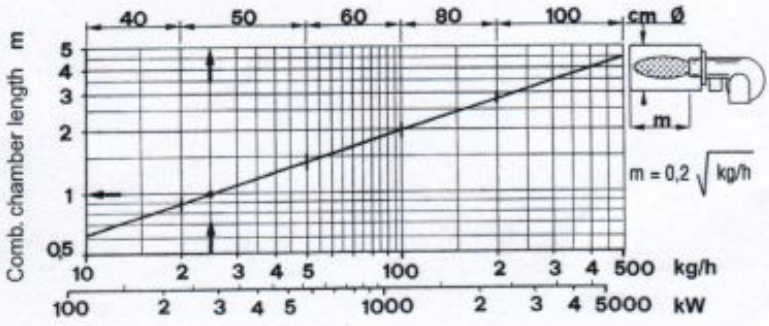
	A	B	C	H MIN.	H MAX.	kg
mm	600	600	635	550	1170	52



(C) cod. **3000776**

cod. **3010054** without filter
cod. **3010055** with filter

(D)



(E)

ACCESSORIES (optional)

(A) KIT FOR LENGTHENING THE COMBUSTION HEAD

L = Standard length
L1 = Length obtainable with the kit

(B) SPACER FOR SHORTENING THE COMBUSTION HEAD

L = Spacer thickness
L1 = Resulting length of combustion head

(C) SOUNDPROOFING

The sound attenuating shroud significantly reduces the noise generated by the burner (- 10 dBA). The casing is in steel and sound-damping material and fully encloses the burner.
The casing is wheel-mounted so that it can be easily removed for burner inspection.

(D) THE DEGASSING UNIT

It may occur that a certain amount of air is contained in the light oil sucked by the pump. This air may originate from the light oil itself as a consequence of depressurization or air leaking past imperfect seals.
In double-pipe systems, the air returns to the tank from the return pipe; in single-pipe systems, the air remains in circulation causing pressure variations in the pump and burner malfunctions. For this reason, we advise installing a degaussing unit near the burner in single-pipe installations. Degaussing units are provided in two versions: with and without filter:

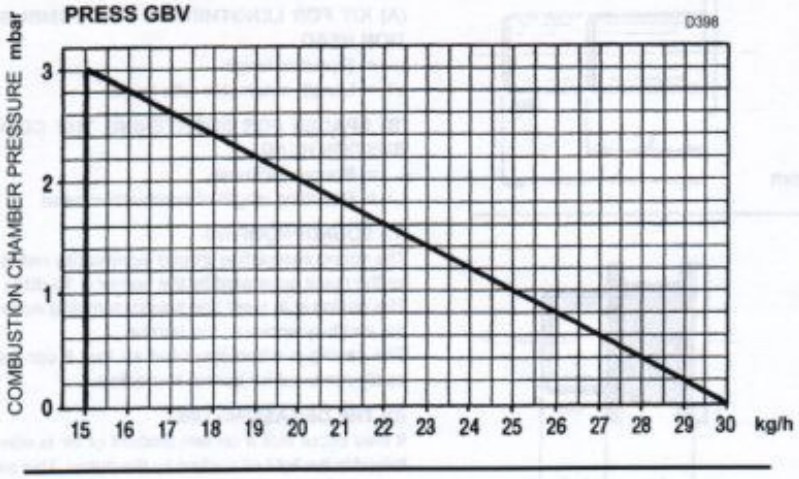
Technical data:

- Burner delivery	: 80	kg/h max.
- Light oil pressure	: 0.7	bar max.
- Ambient temperature	: 50	°C max. (without filter)
- Ambient temperature	: 40	°C max. (with filter)
- Light oil temperature	: 50	°C max. (without filter)
- Light oil temperature	: 40	°C max. (with filter)
- Attachment connectors	: 1/4	inch

TEST BOILER (E)

The firing rate on page 8 was set in relation to special test boilers in accordance with the methods defined in DIN 4787, UNI 7824 standards.
Figure (E) indicates the diameter and length of the test combustion chamber.
Example: delivery 25 kg/hour:
diameter = 50 cm; length = 1 m.

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



FIRING RATE

The burner delivery must be selected within the range of the adjacent diagram. This area is known as the FIRING RATE and provides the delivery of the burner according to the combustion chamber pressure.
For the PRESS GBV Model, this area is delimited by:

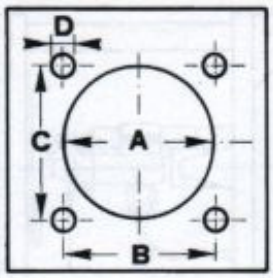
- the 15 - 30 kg/h delivery line
- the 0 + 3 mbar combustion chamber pressure line
- the combustion chamber maximum pressure curve

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 the FIRING RATE area.

Important:
The FIRING RATE area value has 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 10.
Consult Appendix 7, Page 21, for operation at different surrounding temperatures and/or altitudes.

The burner can also operate in depression combustion chambers.

	A	B	C	D
mm	155	160	160	M10



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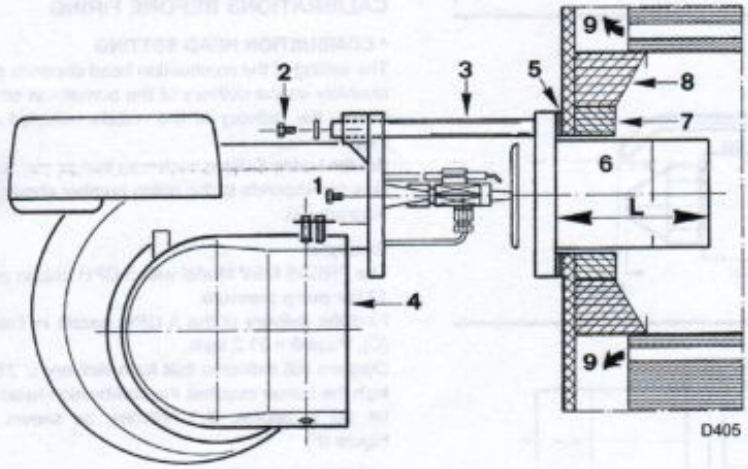
(A)



D405

(B)

Burner	Nozzles 60° - GPH	Delivery kg/h (1)			kW 12 bar
		10 bar	12 bar	14 bar	
PRESS GBV	4.00	15.4	17.0	18.4	201.6
	4.50	17.3	19.1	20.7	226.5
	5.00	19.2	21.2	23.0	251.4
	5.50	21.1	23.3	25.3	276.3
	6.00	23.1	25.5	27.7	302.4
	6.50	25.0	27.6	30.0	327.3
	7.00	26.9	29.7	32.3	352.4
	7.50	28.8	31.8	34.6	377.2

(1) light oil: density 0.84 kg/dm^3 - viscosity 4.2 cSt/20°C - temperature 10°C

(C)

INSTALLATION

BOILER PLATE (A)

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

BLAST TUBE LENGTH (B)

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 range of lengths available, L, is as follows:

Blast tube:
- shortened 43 mm
- standard 185 mm
- lengthened 320 mm

For boilers with front flue passes 9) or flame inversion chambers, protective fettling in refractory material 7) must be inserted between the boiler's fettling 8) and the blast tube 6).
This protective fettling must not compromise the extraction of the blast tube.

SECURING THE BURNER TO THE BOILER (B)

Disassemble the blast tube 6) from the burner by proceeding as follows:
- Remove the screws 2) from the two slide bars 3).
- Remove the screws 1) that secure the blast tube 6) to the burner 4).
- Now disassemble the blast tube complete with the slide bars.

Fasten the blast tube 6) to the boiler plate (A), inserting the gasket provided 5). Use the 4 screws provided after having protected the thread with antiscruffing products (high-temperature grease, compounds, graphite). The burner-boiler seal must be airtight.
Reassemble the burner 4) on the slide bars 3) and re-insert the screws 2).
Leave the burner open as shown in Figure (B).

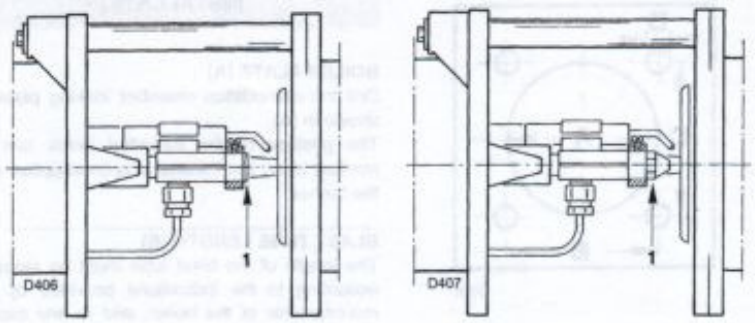
CHOICE OF NOZZLE

The nozzle must be chosen from among those listed in Table (C).
Use nozzle with atomization angle of 60° and, if possible, at a pressure of 12 bar.

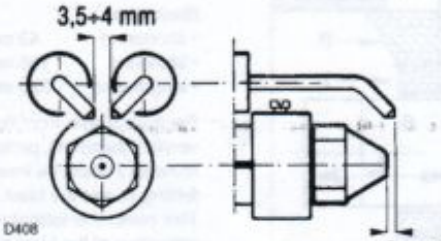
Example:
Boiler output = 230 kW - efficiency 90%
Output required by the burner =
230: 0.9 = 255 kW (21.5 kg/h);

therefore:
1 nozzle - 5 GPH - 60° - 12 bar
is required.

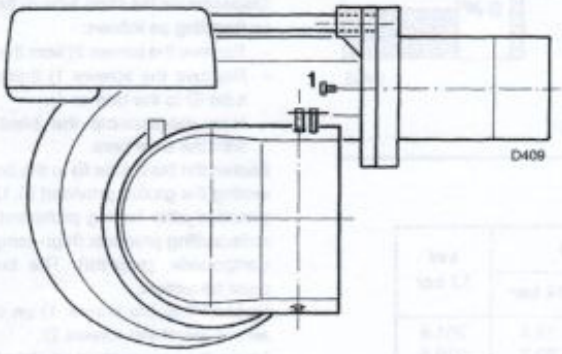
NOTE: other information regarding nozzles may be found in Appendix 2 on Page 16.



(A) (B)

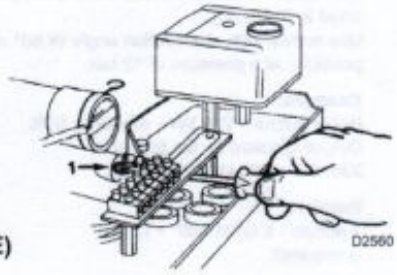


(C)



(D)

SETTING THE COMBUSTION HEAD



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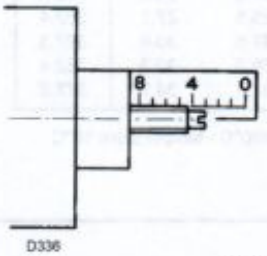

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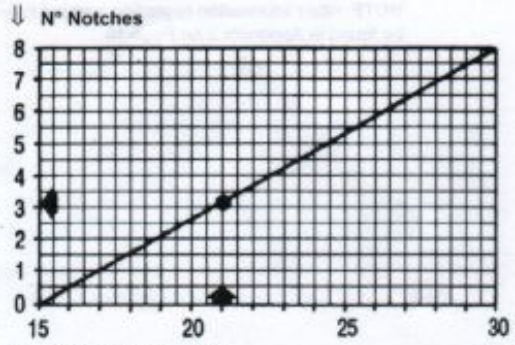
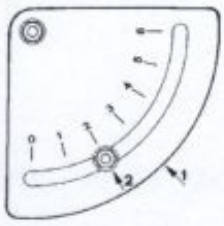


(G)



(H)

NOZZLE ASSEMBLY

With the burner open on the slide bars as shown in Fig. (B), Page 9, unscrew and remove the plastic plug 1)(A) and screw the nozzle 1)(B) into the same place using a 16 mm wrench. Do not use any sealing products such as gaskets, sealing compound, or tape. The nozzle must be screwed into place tightly but not to the maximum torque value provided by the wrench.
Be careful to avoid damaging the nozzle sealing seat.
Make sure that the electrodes are positioned as shown in Figure (C).
Lastly, close the burner by screwing in the two screws 1)(D).

CALIBRATIONS BEFORE FIRING

• COMBUSTION HEAD SETTING

The setting of the combustion head depends exclusively on the delivery of the burner - in other words, the delivery of the nozzle selected on Page 9.
Set the screw 1)(E) in such way that its rear surface corresponds to the notch number shown in diagram (G).

Example:
The PRESS GBV Model with 5 GPH nozzle and 12 bar pump pressure.
Find the delivery of the 5 GPH nozzle in Table (C), Page 9 = 21.2 kg/h.
Diagram (G) indicates that for a delivery of 21.2 kg/h the burner requires the combustion head to be set to approx. 3.1 notches, as shown in Figure (F).

• PUMP ADJUSTMENT

No presetting are required for the pump, which is set to 12 bar by the manufacturer. This pressure must be checked and adjusted (if required) after the burner has been ignited.
The only operation required in this phase is the application of a pressure gauge on the apposite pump attachment indicated in Appendix 3, Page 17.

• FAN GATE ADJUSTMENT

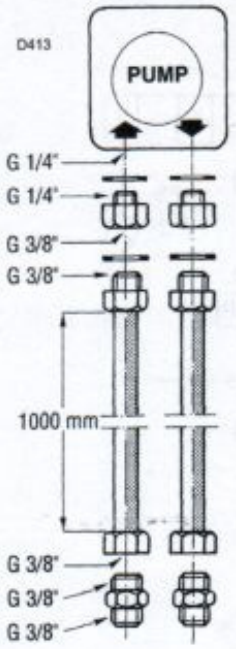
The fan gate is set using the indexed selector 1)(H), after having loosened the nut 2)(H).

This setting must be adapted case by case to the burner's delivery and combustion chamber pressure.
The first time the burner is fired, this setting should be left as originally set by the manufacturer: notch 2.

In summary, the operations and settings that must be performed prior to firing the burner for the first time are as follows:
- choice of the nozzle;
- setting of the combustion head;

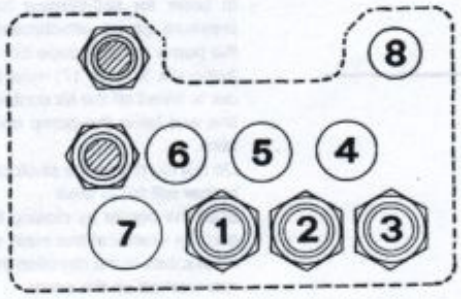
The following require no adjustment operations and may remain as they are provided:
- pump pressure;
- setting of the fan's air gate valve.

HYDRAULIC CONNECTIONS



(A)

ELECTRICAL CABLE FASTENING



(B)

HYDRAULIC CONNECTIONS (A)

NOTE:

The hydraulic circuit feeding system must be designed to the indications provided in Appendix 1, Page 15.

Remove the plugs from the suction and return pump connectors and screw in the flexible hoses, the connectors, and the gaskets provided in their place as shown in Figure (A).

Do not twist the flexible hoses during installation.

Important:

- The opening of the burner or the boiler door must not twist or strain the flexible hoses.
- Arrange the flexible hoses in such way that they will never be stepped on or contact hot boiler surfaces.
- Use two wrenches to screw in the flexible hoses/nipples: one to grip the flexible hose connector and the other to grip the nipple in order to apply the opposite force.

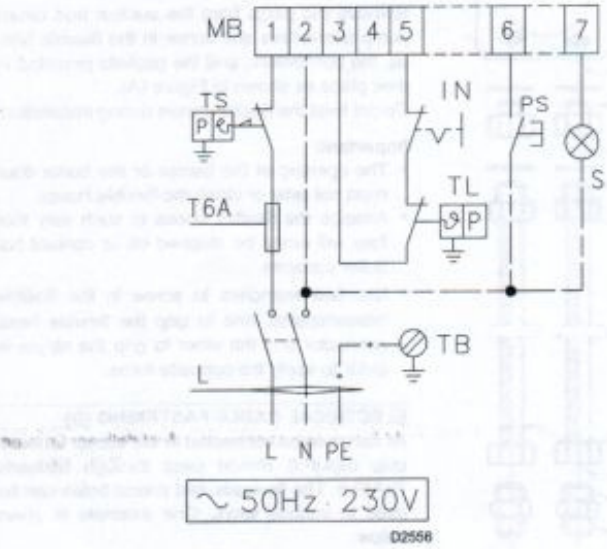
ELECTRICAL CABLE FASTENING (B)

All cables to be connected to the burner terminal strip 6)(A)P.6 should pass through fairleads 7)(A)P.6. The fairleads and precut holes can be used in various ways. One example is given below:

1 - Single-phase power supply . . . . . Pg 13.5
2 - Control device TL. . . . . Pg 13.5
3 - Spare fairlead. . . . . Pg 13.5
4 - Fitting hole for fairlead, if required . . Pg 13.5
5 - Fitting hole for fairlead, if required . . Pg 13.5
6 - Fitting hole for fairlead, if required . . Pg 13.5
7 - Fitting hole for fairlead, if required . . Pg 21
8 - Fitting hole for fairlead, if required . . Pg 11

To ensure that the IP 40 protection classification is maintained, close all unused fairlead fitting holes.

ELECTRICAL CONNECTION OF BURNER BY INSTALLER



Fuse and cable sections:
(cable section not indicated: 1,5 mm^2)

(A)

ELECTRICAL CONNECTION
(Electrical system as set up by the manufacturer: Appendix 5, Page 19)

• LAYOUT (A)
PRESS GBV Model electrical connection: single-phase 230V power supply

Key to wiring layout (A):
IN - Manual burner stop switch
MB - Burner terminal strip
PS - Lock-out reset button
S - Remote lockout signal
TB - Burner ground (earth) connection
TL - Limit control device system:
This shuts down the burner when the boiler temperature or pressure exceeds the setpoint value.
TS - Safety control device system:
This operates when TL is faulty.

WARNING: Do not invert the neutral with the phase wire in the electricity supply line.

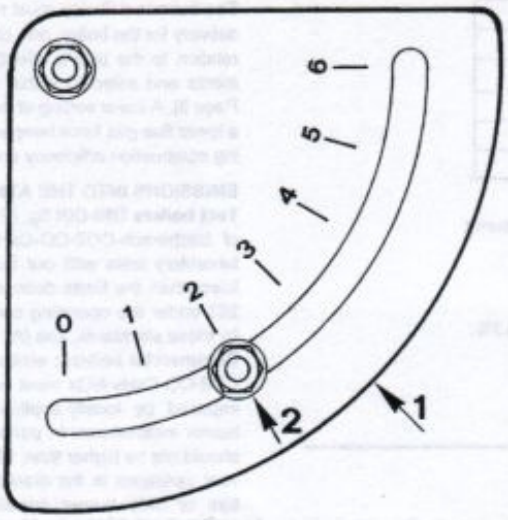
PUMP PRIMING

- **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.**
(The pump leaves the factory with the bypass closed).
- Also check to make sure that the valves located on the suction line are open and that there is sufficient fuel in the tank.
- In order for self-priming to take place, the pressure gauge attachment plug located on the pump (or the gauge itself, if applied) (See Appendix 3, Page 17) must be loosened in order to bleed off the air contained in the suction line and bring the pump delivery pressure to zero.
- Do not illuminate the photocell; otherwise, the burner will fail to start.
- Start the burner by closing the control device and the electrical line main switch. The pump must rotate in the direction indicated by the arrow marked on the cover.
- When the light oil begins to flow out of the gauge attachment, the pump is primed. At this point, stop the burner immediately.

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. 40 seconds, reset the burner, and then repeat the starting operation as often as required.

Important:
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 by hand using a separate pump.

Once the pump has been primed, screw in the plug or the gauge on the pump's delivery line tightly and close the control devices.



(A) D412

BURNER CALIBRATION

FIRING

The firing of the burner must generate a noise similar to the noise generated during operation. If one or more pulsations or a delay in firing in respect to the opening of the light oil solenoid valve occur, see the suggestions provided in Appendix 8, Page 22.

OPERATION

The optimum calibration of the burner requires an analysis of the flue gases at the boiler outlet and interventions on the following points:

• Nozzle
See the information listed on Page 9.

• Pump pressure
12 bar: This is the pressure calibrated in the factory which is usually sufficient for most purposes. Sometimes, this pressure must be adjusted to:
10 bar in order to reduce fuel delivery. This adjustment is possible only if the surrounding temperature remains above 0°C;
14 bar in order to increase fuel delivery or to ensure firing even at temperatures of less than 0°C.
In order to adjust pump pressure, use the relevant screw indicated in Appendix 3, P. 17.

• Fan air gate valve
Adjust the fan air gate valve by using the indexed selector 1)(A) after having loosened the nut 2)(A).

NOTE: Burner starting and operation phases are indicated in Appendix 4, Page 18.

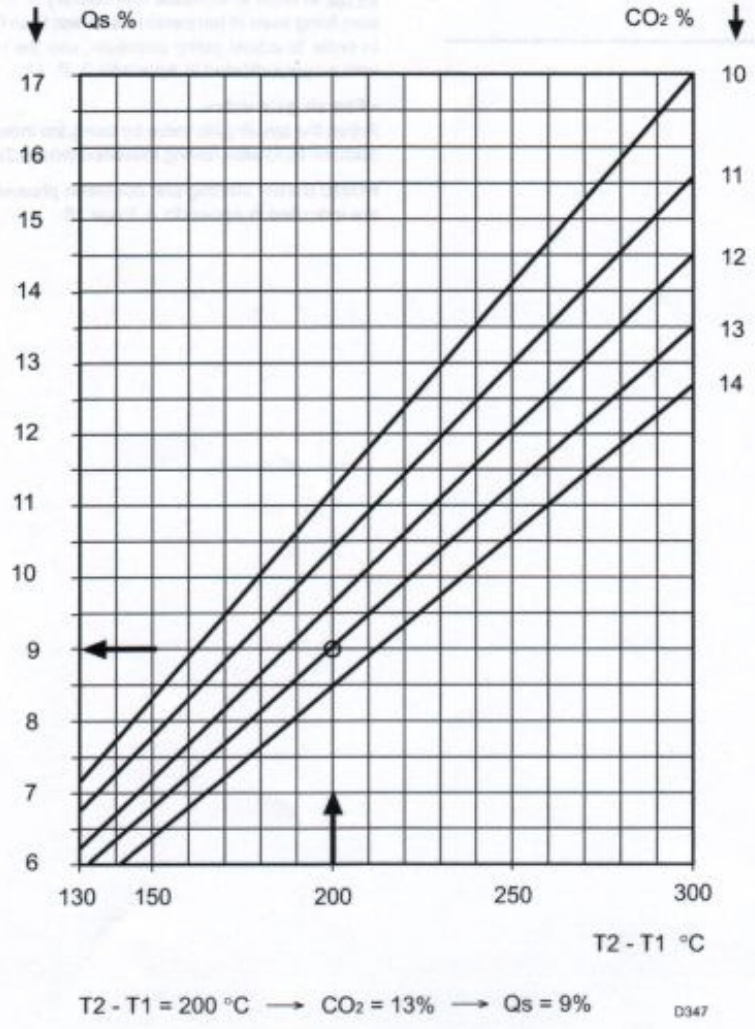
EN 267 (5-91)		
Bacharach	n°	< 1
CO_2	%	> 12.3
CO	ppm	< 100
CxHy	ppm	< 10
NOx	ppm	< 150

N.B. Excess air % = CO_2 max : CO_2 measured
CO_2 max = 15,2%

Example CO_2 measured = 13,5%
Excess air = 15,2 : 13,5 = 1,13 = 13%

(A)

LOSS OF HEAT



T2 - T1 = 200 °C ⟶ CO_2 = 13% ⟶ Qs = 9%

D347

T2 - T1 = Flue gas temperature - Ambient temperature

(B)

COMBUSTION CHARACTERISTICS

The burner delivery must not exceed the rated delivery for the boiler, and should be adjusted in relation to the user's effective heating requirements and selected within the firing rate (See Page 8). A lower setting of the boiler provides for a lower flue gas fume temperature, thus increasing combustion efficiency and saving fuel.

EMISSIONS INTO THE ATMOSPHERE

Test boilers UNI-DIN fig. (E) Page 7: emissions of Bacharach-CO2-CO-CxHy-NOx obtained in laboratory tests with our burners proved to be lower than the limits defined by EC Norms EN 267 under the operating conditions established by these standards, see (A).

Commercial boilers: emissions of Bacharach-CO2-CO-CxHy-NOx must not exceed the limits imposed by locally-applicable regulations for burner installations. In particular, the CO_2 level should not be higher than 13.5% in order to prevent variations in the draught and air temperature or dirty burner conditions from causing polluting combustion.

An insufficient CO_2 level must also be avoided, since, in addition to raising costs and falling short of the established range, this can also be the cause for the generation of a dangerous quantity of uncombusted hydrocarbons in the flue gas (yellow Bacharach) and the detachment of the flame upon ignition.

The combustion values measured may be considered reliable only if there are no entries of air between the burner and the stack flue gas sampling point. Check for penetration of outside air by placing a column of smoke near the suspected leak in the seal: if the smoke column is drawn towards the seal there must be an entry of air.

FLUE GAS TEMPERATURE

This temperature varies in relation to the delivery generated: the lower the delivery, the lower the temperature and the higher the fuel saving.

Bear in mind that excessive temperature reduction, however, gives rise to the formation of condensate.

COMBUSTION CHAMBER PRESSURE

This must correspond to the setting indicated by the boiler manufacturer.

Chamber pressure is lowered with reduced burner delivery and higher CO_2 levels.

If the combustion chamber pressure is significantly higher than expected and the burner's delivery is correct, make sure that the boiler is not dirty, that the flue gas duct is not obstructed, and that the flue gas stack has been correctly sized.

LOSS OF HEAT FROM THE FLUE

Heat losses from the flue gas stack Qs are determined by the formula given on Page 23 or Diagram (B).

FINAL CHECKS

- Shine a light on the photocell and close the control devices: the burner should not start.
- Obscure the photocell while the burner is working: the burner should stop and automatically repeat the starting operation.
- Switch off control device TL while the burner is operating: the burner should stop.
- Switch off control device TS while the burner is operating: the burner should stop.

Fill out the information sheet on Page 23 before leaving the plant.

APPENDIXES

1 - FUEL SUPPLY

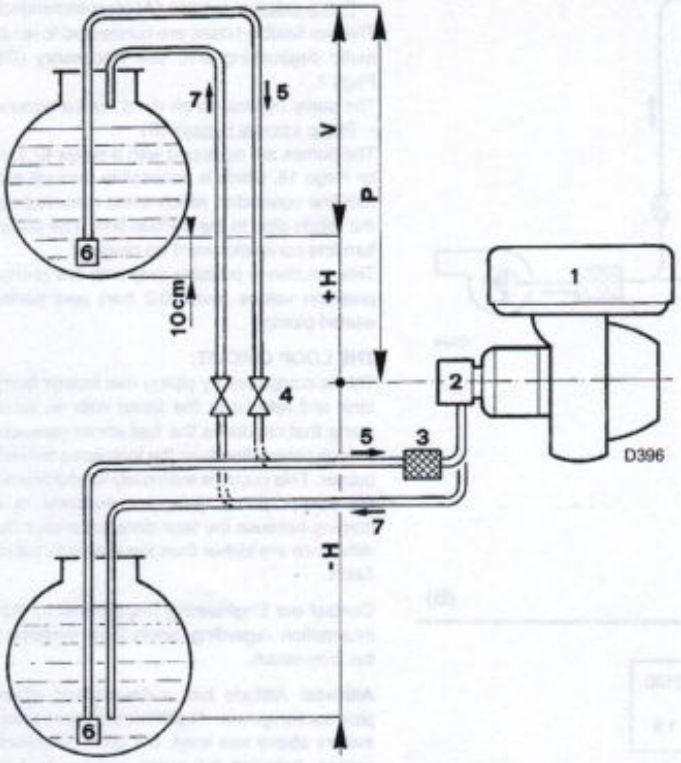
The burner is equipped with a self-priming pump which is capable of feeding itself within the limits listed in the table at the side.
There are three types of fuel hydraulic circuits:
- double-pipe circuits (the most common)
- single-pipe circuits
- loop circuits.

According to the burner/tank layout, either of two fuel supply systems can be used:
- siphon-type (with the tank higher than the burner);
- suction-type (with the tank lower than the burner).

DOUBLE-PIPE SIPHON-TYPE SYSTEMS (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.

DOUBLE-PIPE SUCTION-TYPE SYSTEMS (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 lifespan decreases.
It is good practice to ensure that the return and suction lines enter the burner from the same height; in this way it will be more improbable that the suction line fails to prime or stops priming.

Useful suggestions for both systems (A) and (B):
- Use copper pipes whenever possible.
- Any curves used in the system should be made with the widest possible radius.
- Use biconic connectors at both ends of the pipe.
- Whenever the burner is installed in areas with extremely cold winter climates (temperatures lower than -10°C), we recommend insulating both the tank and the piping. Avoid the smallest of the three pipe diameters provided in the Table and lay the piping along the most sheltered route possible. The paraffin in the fuel begins to solidify below 0°C, and the filters and nozzle begin to clog accordingly.
- Install a filter on the suction lines with a transparent plastic bowl if possible in order to permit the regular flow of fuel and quick checking of the state of the filter.
- The return pipe does not require an on/off valve, but if the user desires to insert one, a lever-type valve should be selected which clearly indicates when the valve is open or closed (if the burner starts with the return pipe closed, the sealing organ located on the pump shaft will break).
- The opening of the burner or the boiler door must not twist the flexible hoses that connect the copper pipes to the pump.
- If more than one burner is operating in the same room, each one must be equipped with its own suction pipe; the return pipe may be shared by all, providing it is sufficiently sized.
- The suction line must be perfectly airtight. In order to check the seal, close the pump's return line. Install a union T on the vacuum meter attachment. On one branch of this T install a pressure gauge and on the other branch inject air at a pressure of 1 bar. After the air injection, the gauge must remain at a constant pressure.



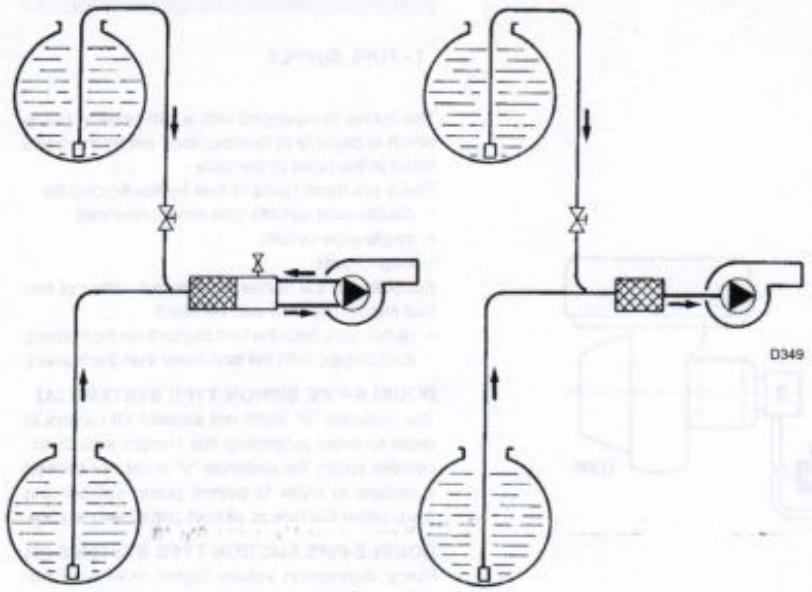
+H -H (m)	L (m) Ø (mm)		
	8	10	12
+ 4.0	35	90	152
+ 3.0	30	80	152
+ 2.0	26	69	152
+ 1.0	21	59	130
+ 0.5	19	53	119
0	17	48	108
- 0.5	15	43	97
- 1.0	13	37	86
- 2.0	9	27	64
- 3.0	4	16	42
- 4.0	-	6	20

Key

H = Pump/Foot valve height difference
L = Piping length
values calculated for light oil:
- viscosity = 6 cSt/20°C
- density = 0.84 kg/dm^3
- temperature = 0°C
- max altitude = 200 m (a.s.l.)

Ø = Inside pipe diameter

1 = Burner
2 = Pump
3 = Filter
4 = Mnual on/off valve
5 = Suction line
6 = Foot valve
7 = Return line



(A) (B)

m	200	300	600	900	1200	1500	1800	2100
F	0	0,1	0,4	0,7	1	1,3	1,6	1,9

m = Altitude in m a.s.l.

F = Compensation factor

Example:

Suction type system ..... - H = 2 m

Piping diameter ..... Ø = 10 mm

Altitude	m	200	1200
F		0	1
- H	m	2	2 + 1 = 3
Piping lenght	m	**27**	**16**

SPRAY	DELEVAN	MONARCH	DANFOSS	STEINEN
hollow	A	PL	H	H - PH
solid	B	AR	S	Q
universal	W	NS - PLP	B	SS
semi-solid	E	R	-	S

D350

(C)

SINGLE-PIPE SYSTEMS:

There are two solutions possible:

- Pump external bypass (A) (recommended)

The two flexible hoses are connected to an automatic degaussing unit, see Accessory (D) on Page 7.

The pump bypass screw must not be removed.

- Pump internal bypass (B)

The pumps are equipped with a screw 6), Layout on Page 18, which is accessible through the return line connector, which when removed opens the return pipe to the suction line. The pump return line connector must be plugged.

This solution is possible only with low pump depression values (max. 0.2 bar) and perfectly-sealed piping.

THE LOOP CIRCUIT:

This is composed by piping that leaves from the tank and returns to the same 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.

Contact our Engineering Department for further information regarding single-pipe systems and the loop circuit.

Altitude: Altitude has a determined effect on pipe suction power. At altitudes of more than 200 meters above sea level, the level difference, in metres, between the pump and the foot valve must be corrected by the factor "F", see Table (C), in order to obtain the equivalent height difference with which to determine the maximum piping length, i.e.:

if a suction-type system is involved:
(equivalent) **He** = (real) **H + F**

if a siphon-type system is involved:
(equivalent) **He** = (real) **H - F**

where:
F = (real altitude) **(m - 200) / 1000**

2 - NOZZLE

The spray patterns in relation to the leading brands of nozzle on sale are shown in table (D). The nozzle deliveries indicated in the table on Page 9 are the rated values. In reality, the delivery may differ by +/- 10% due to the reasons below:

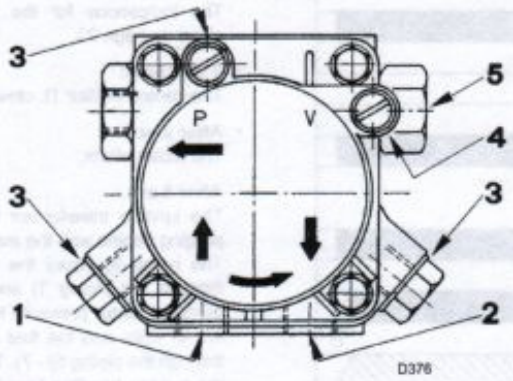
- tolerance values indicated by the manufacturer;
- temperature variation:
  delivery decreases with a rise in temperature and vice-versa;
- variations in fuel viscosity: delivery decreases with a decrease of viscosity and vice-versa.

A burner's exact delivery can only be determined by weighing. Suck the fuel from a recipient mounted on a weighing machine, or attach hoses to the nozzles and weigh the fuel that flows out.

A liter counter can be applied to the pump's suction line if a single-pipe supply system has been provided.

NOTE: Nozzle manufacturers discourage opening of the nozzle to clean its internal parts and especially its calibrated hole. The filter, on the other hand, may be cleaned or replaced as required. Grip the nozzle on its hexagonal part when handling.

PUMP SUNTEC
type AN 67



(A)

Min. delivery rate at 12 bar pressure	kg/h	65
Delivery pressure range	bar	10 ÷ 18
Max. suction depression	bar	0.45
Viscosity range	cSt	2 ÷ 75
Light oil max. temperature	°C	60
Max. suction and return pressure	bar	2
Pressure calibration in the factory	bar	12
Filter mesh width	mm	0.150

3 - PUMP

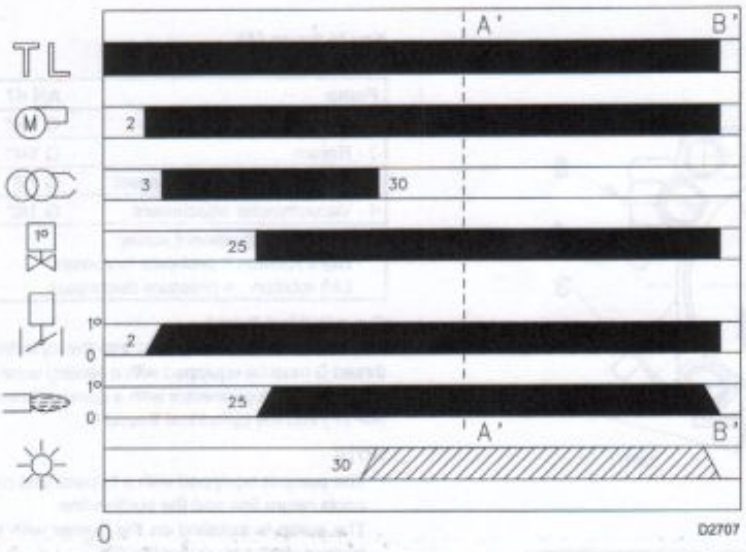
Key to figure (A)

Pump	AN 67
1 - Suction	G 1/4"
2 - Return	G 1/4"
3 - Pressure gauge attachment	G 1/8"
4 - Vacuummeter attachment	G 1/8"
5 - Pressure adjustment screw: Right rotation = pressure increases Left rotation = pressure decreases	

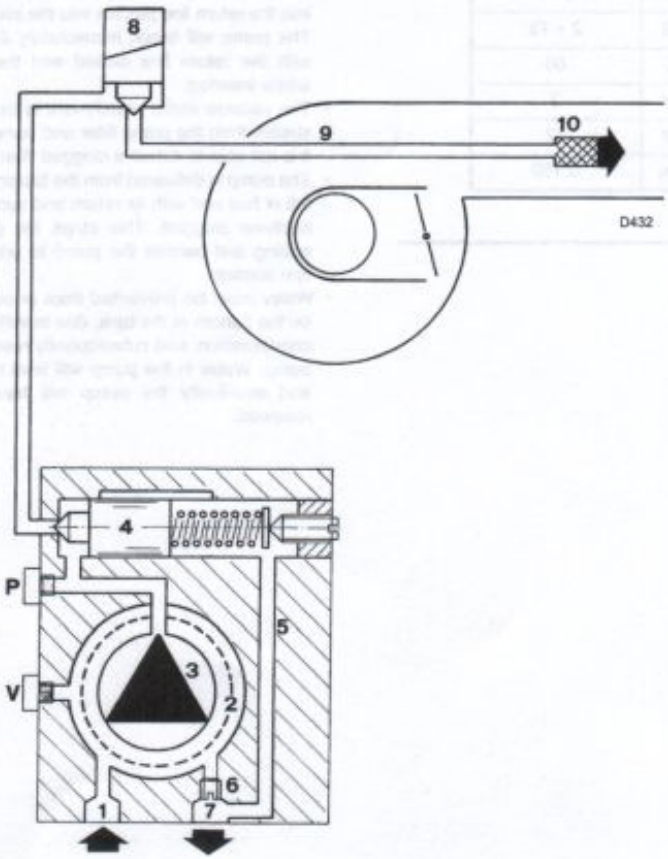
G = cylindrical thread
The connector to be screwed into the cylindrical thread G must be equipped with a sealing washer. Do not screw a connector with a conical thread (NPTF) into the cylindrical thread G.

NOTE

- The pump is equipped with a bypass that connects return line and the suction line.
  The pump is installed on the burner with the bypass closed by screw 6)p.18.
  When single-pipe fuel supply systems without degaussing units (B)P.16 are used, this screw, accessible from the connector 2), must be removed. In this way, the excess in the delivery discharged by the pressure regulator into the return line passes into the suction line. The pump will break immediately if it is run with the return line closed and the bypass screw inserted.
- The vacuum meter attachment is located upstream from the pump filter and consequently it is not able to detect a clogged filter.
- The pump is delivered from the factory already full of fuel and with its return and suction connections plugged. This stops the gear unit rusting and permits the pump to prime upon first starting.
- Water must be prevented from accumulating on the bottom of the tank, due to infiltration or condensation, and subsequently reaching the pump. Water in the pump will lead to rusting and eventually the pump will have to be renewed.



(A)



4 - BURNER OPERATION

BURNER STARTING (A) - (B)

- When the control device TL closes, the control box programmes the starting phase.
  The indications for the start-up cycle are given on page 23.
- **0 sec. time:**
  The control device TL closes.
- **After 2 sec.:**
  The motor starts.

  After 3 sec.:
  The ignition transformer is connected. Pre-purging begins with the max. air delivery.
  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 bypass heading towards suction and the solenoid valve 8), de-energized, closes the passage to the nozzle.
- **After 25 sec.:**
  Solenoid valve 8) opens and the fuel passes through the piping 9) and the filter 10) and is then sprayed out through the nozzle, igniting when it comes into contact with the spark.
- **After 30 sec.:**
  The ignition transformer switches off.
- **After 39 sec.:**
  The starting cycle comes to an end.

STEADY STATE OPERATION

When the temperature or pressure increases until control device TL opens, the burner shuts down.

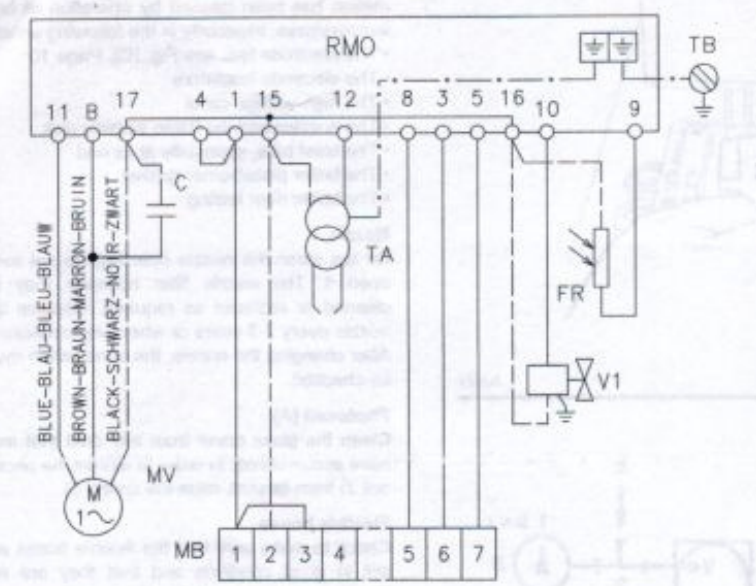
FIRING FAILURE

If the burner does not fire, it goes into lockout within 5 seconds of the opening of the solenoid valve and 30 seconds after the closing of control device TL.
The control box pilot light will light up.

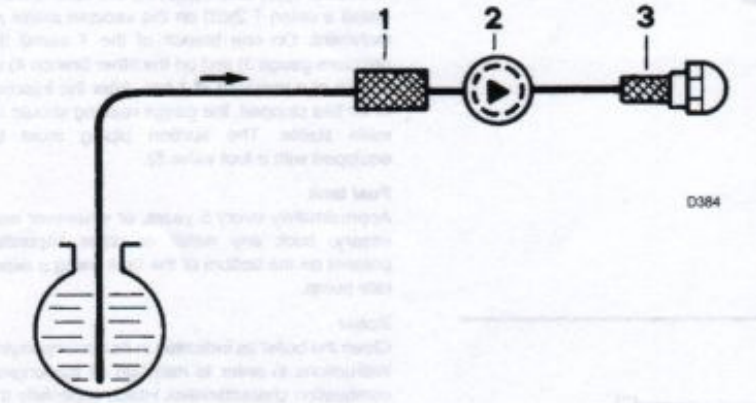
UNDESIRED SHUTDOWN DURING OPERATION

If the flame goes out during operation, the burner shuts down automatically within 1 second and automatically attempts to start again by repeating the starting cycle.

ELECTRICAL EQUIPMENT FACTORY-SET



(A) D2555



D384

(B)

5 - ELECTRICAL SYSTEM

as set up by the manufacturer

• LAYOUT (A)
PRESS GV (single-phase)

Key to Layout (A)

C	- Capacitor
RMO	- Control box
FR	- Photocell
MB	- Burner terminal strip
MV	- Fan motor
TA	- Ignition transformer
TB	- Burner ground (earth) connection
V	- Light oil solenoid valve

6 - MAINTENANCE

Install a pressure gauge and a vacuum meter on the pump, then start the burner and check the following:

Pump

The pressure must be stable and at the same level as measured during the previous check (between 10 and 14 bar).
The depression must be less than 0.45 bar. Values different from those measured previously may be due to a different level of fuel in the tank.
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 piping or the pump.
If the pump is found to be responsible, check to make sure that the filter is not dirty. The vacuum meter is installed upstream from the filter and consequently will not indicate whether the filter is clogged or not.
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.

Other control measurements

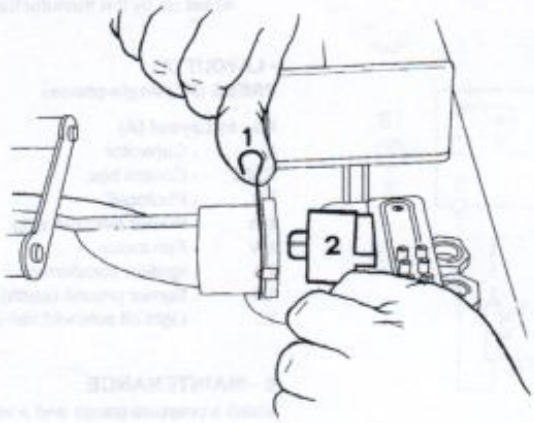
Check the parameters listed in the data sheet on Page 23.
Significant differences with respect to the previous measurements indicate the points where more care should be exercised during maintenance.
Once these controls and measurements have been performed, stop the burner, disconnect the power supply, and close the manual valves on the fuel lines and open the burner.

Filters (B)

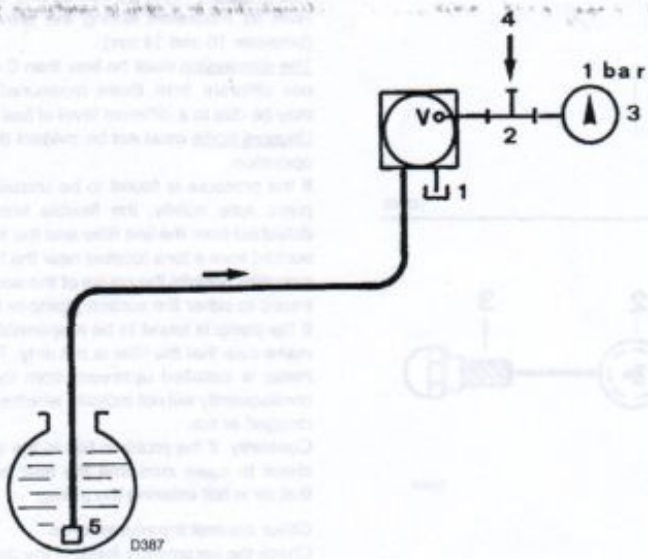
Check the following filter boxes:
• on line 1)
• in the pump 2)
• at the nozzle 3),
and clean or replace as required.
If rust or other impurities are observed inside the pump, use a separate pump to lift any water and other impurities that may have deposited on the bottom of the tank.
Then clean the insides of the pump and the cover sealing surface.

Fan

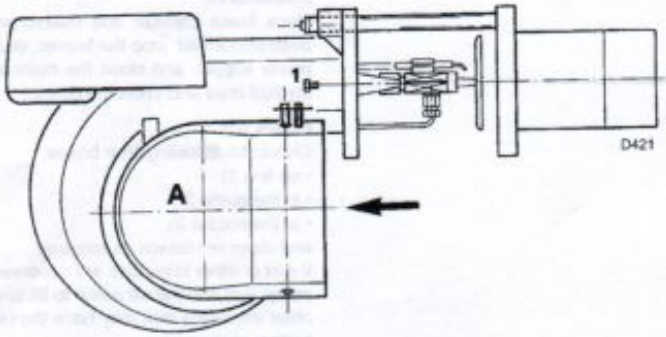
Check to make sure that no dust has accumulated inside the fan or on its blades, as this condition will cause a reduction in the air flow rate and provoke polluting combustion.



(A)



(B)



(C)

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, especially in the following areas:
- The electrode tips, see Fig. (C), Page 10
- The electrode insulators
- The high-voltage cable
- The nozzles and the flame stability disk
- The blast tube, especially at its end
- The boiler plate/burner gasket
- The boiler door fettling

Nozzle
Do not clean the nozzle opening; do not even open it. The nozzle filter however may be cleaned or replaced as required. Replace the nozzle every 2-3 years or whenever necessary. After changing the nozzle, the combustion must be checked.

Photocell (A)
Clean the glass cover from any dust that may have accumulated. In order to extract the photocell 2) from its seat, raise the spring 1).

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

Light oil fuel supply line (B)
If the previous checks have suggested that air may be entering the circuit somewhere, pressurize the circuit piping. Plug the pump's return line connector 1)(B) after removing the flexible hose. Install a union T 2)(B) on the vacuum meter attachment. On one branch of the T install the pressure gauge 3) and on the other branch 4) inject air at a pressure of 1 bar. After the injection of air has stopped, the gauge reading should remain stable. The suction piping must be equipped with a foot valve 5).

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. Lastly, check the condition of the flue gas stack.

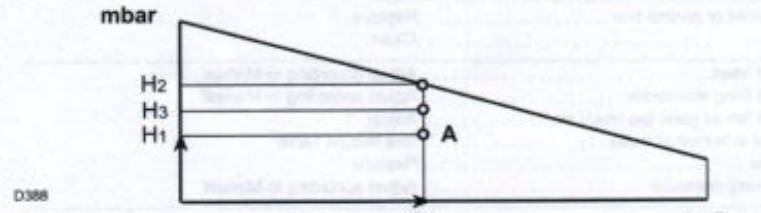
Close the burner and apply power.
If the combustion characteristics measured at the beginning of the control operation do not match the values listed in the previous inspection's technical report sheet or fail to provide satisfactory combustion, the burner must be recalibrated.Write the new values down on the data sheet illustrated on Page 23 or a similar document. These values will be useful for comparison during future checks. Lastly, check to make sure that the fan air gate valve is in good condition and that the screws are tightly locked. The tightness of the screws that fasten the cables to the burner terminal block must also be checked. Clean the outside surfaces of the burner and spray all parts that show signs of rusting with silicon rust-preventer.

In order to open the burner, proceed as follows (C)
1 Disconnect the power supply
2 Unscrew the screws 1)
3 Pull back part A while keeping it slightly lifted.

Altitude a.s.l.	(1)	Correction factor F							
		Air temperature °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 BAROM. PRESS.

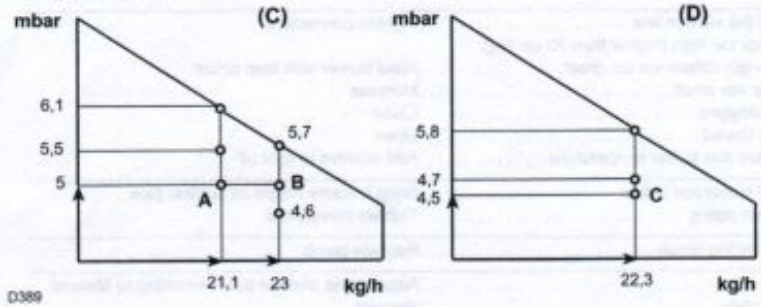
(A)



D388

(B)

Example



D389

Delivery Q = 19 kg/h - Comb. chamber press. H1 = 5 mbar

air 20 °C - altitude 1000 m a.s.l. - F = 0.898			**fig. (C)**
Qe = Q : F = 19 : 0.898 = 21,1 kg/h	5 mbar	A	
H2 = 6.1 mbar			
H3 = H2 x F = 6.1 x 0.898 = 5.5 mbar			
H3 > H1 (5.5 > 5) **OK**			

air 30 °C - altitude 1600 m a.s.l. - F = 0.808			**fig. (C)**
Qe = Q : F = 19 : 0.808 = 23 kg/h	5 mbar	B	
H2 = 5,7 mbar			
H3 = H2 x F = 5.7 x 0.808 = 4.6 mbar			
H3 < H1 (4.6 < 5) **IMPOSSIBLE**			

Delivery reduction 5%

Qr = 19 x 0,95 = 18 kg/h - H_{1r} = 5 x $(0,95)^2$ = 4,5 mbar

Qe = Q : F = 18 : 0.808 = 22.3 kg/h	4.5 mbar	C	**fig. (D)**
H2 = 5.8 mbar			
H3 = H2 x F = 5.8 x 0.808 = 4.7 mbar			
H3 > H1 (4.7 > 4.5) **OK**			

7 - BURNER FIRING RATES ACCORDING TO AIR DENSITY

The burner firing rate range provided in this Manual applies to operation at a surrounding temperature of 20°C at an altitude of 100 meters above sea level (atmospheric pressure approx. 1000 mbar).

The burner may be required to operate with comburent air at a higher temperature and/or at higher altitudes.

Heating of air and increase in altitude produce the same effect: the expansion of the air volume, i.e. the reduction of air density.

The burner fan's delivery remains substantially the same, but the oxygen content per cubic meter and the fan's head are reduced.

It is therefore important to know if the maximum output required of the burner at a given combustion chamber pressure remains within the burner's firing rate range even at different temperature and altitude conditions. Proceed as follows to check the above:

1 - Find the correction factor F in the Table (A) for the plant's air temperature and altitude.

2 - Divide the burner's delivery Q by F in order to obtain the equivalent delivery Qe:

Qe = Q : F (kg/h)

3 - In the firing rate range of the burner, Fig. (B), 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 - Plot a vertical line from Point A as shown in Figure (B) and find the maximum pressure H2 of the firing rate.

5 - Multiply H2 by F to obtain the maximum reduced pressure H3 of the firing rate.

H3 = H2 x F (mbar)

If H3 is greater than "H1", as shown in Fig. (B), the burner deliver the output required.
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

$H_{1r} = H_1 \times (Qr/Q)^2$

Example, a 5% delivery reduction:

Qr = Q x 0,95

$H_{1r} = H_1 \times (0,95)^2$

Steps 2-5 must now be repeated using the new Qr and H_{1r} values.

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

FAULT	PROBABLE CAUSE	SUGGESTED REMEDY - 8
The burner does not start	- No electrical power supply	Close all switches - Check fuses
	- A limit or safety control device is open	Adjust or replace
	- Control box lockout	Reset control box
	- Pump is jammed	Replace
	- Erroneous electrical connections	Check connections
	- Defective control box	Replace
	- Defective electrical motor	Replace
	- Defective capacitor	Replace
	- Photocell short-circuit	Replace photocell
	- Light is entering or flame is simulated	Eliminate light or replace control box
After pre-purge 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 gate valve adjustments	Consult Manual
	- Light oil solenoid valve fails 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 or protect
	- Firing transformer defective	Replace
	- Erroneous valve or transformer electrical connections	Check
	- Control box defective	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
	- Solenoid valve coil defective	Replace
The burner goes to lock out right after flame appearance	- Delayed firing by electrodes or poorly adjusted head	Adjust
	- Defective photocell or control box	Replace
	- Dirty photocell	Clean
Firing with pulsations or flame detachment	- Poorly adjusted head	Adjust according to Manual
	- Poorly adjusted firing electrodes	Adjust according to Manual
	- Poorly adjusted fan air gate: too much air	Adjust
	- Nozzle unsuited to burner or boiler	See Nozzle Table
	- Defective nozzle	Replace
	- Inappropriate pump pressure	Adjust according to Manual
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	Suck water from tank bottom with separate pump.
Noisy pump, instable 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 unprimes 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 gate according to Manual
	- Nozzle worn or dirty	Replace
	- Nozzle filter clogged	Clean or replace
	- Erroneous pump pressure	Adjust to between 10 - 14 bar
	- Dirty fan	Clean
	- Flame stability spiral 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 gate according to Manual
Dirty combustion head	- Nozzle or filter dirty	Replace
	- Unsuitable nozzle delivery or angle	See Recommended nozzles
	- Loose nozzle	Tighten
	- Impurities on flame stability spiral	Clean
	- Erroneous head adjustment or not enough air	Adjust as per Manual instructions; open gate valve
	- Blast tube length unsuited to boiler	Contact boiler manufacturer

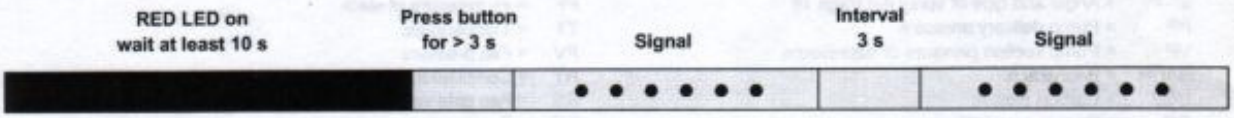
9 - BURNER START-UP CYCLE DIAGNOSTICS

During start-up, indication is according to the followin table:

COLOUR CODE TABLE	
Sequences	**Colour code**
Pre-purging	●●●●●●●●●●●
Ignition phase	●○●○●○●○●○●
Operation, flame ok	❑❑❑❑❑❑❑❑❑❑❑
Operating with weak flame signal	❑○❑○❑○❑○❑○
Electrical supply lower than ~ 170V	●▲●▲●▲●▲●▲●
Lock-out	▲▲▲▲▲▲▲▲▲▲▲
Extraneous light	▲❑▲❑▲❑▲❑▲❑▲
Key: ○ Off ● Yellow ❑ Green ▲ Red	

10 - OPERATING FAULT DIAGNOSTICS

The control box has a self-diagnostic system, which easily allows identifying the operating faults (**RED LED** signal).
ITo use this function, wait at least ten seconds from the safety lock out, and then press the reset button for a minimum of 3 seconds.
After releasing the button, the RED LED starts flashing as shown in the diagram below.



The pulses of the LED constitute a signal spaced by approximately 3 seconds.
The number of pulses will provide the information on the possible faults, according to the table below:

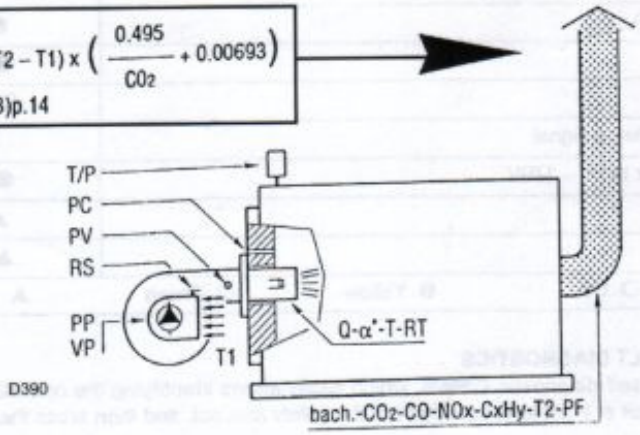
SIGNAL	PROBABLE CAUSE
2 flashes ●●	The flame does not stabilise at the end of the safety time: – faulty photocell; – faulty or soiled light-oil valves; – neutral/phase exchange; – faulty ignition transformer – poor burner regulation (insufficient light oil).
3 flashes ●●●	Min. air pressure switch does not close: – air pressure switch faulty; – air pressure switch incorrectly regulated; – max. air pressure switch triggered (if installed).
4 flashes ●●●●	Min. air pressure switch does not open or light in the chamber before firing: – air pressure switch faulty; – air pressure switch incorrectly regulated.
7 flashes ●●●●●●●	Loss of flame during operations: – poor burner regulation (insufficient light oil); – faulty or soiled light oil valves; – short circuit between photocell and earth.
10 flashes ●●●●●●●●●●	– Wiring error or internal fault.

11 - CONTROL CARD

BURNER	MODEL	TYPE	CODE
BOILER	COMPANY	MODEL	kW

$$Qs = (T2 - T1) \times \left(\frac{0.495}{CO_2} + 0.00693 \right)$$

⇓ = (B)p.14



Q = Delivery
α°-T = Angle and type of spray (D) Page 16
PP = Pump delivery pressure
VP = Pump suction pressure or depressure
BACH = Bacharach
CO2 = Carbon dioxide
CO = Carbon monoxide
NOx = Nitrogen oxide
CxHy = Uncombusted hydrocarbons

T2 = Temperature
PF = +/- pressure at stack
T1 = Temperature
PV = Fan pressure
RT = Combustion head adjustment
RS = Fan gate valve adjustment
T/P = Temperature or pressure
PC = Comb. chamber pressure
Qs = Heat loss at stack

NOZZLE		PUMP		FLUE GASES							AIR				BOILER		STACK
Q	α°-T	PP	VP	BACH	CO_2	CO	NOx	CxHy	T2	PF	T1	PV	RT	RS	T/P	PC	Qs
GPH		bar	bar	N°	%	ppm	ppm	ppm	°C	mbar	°C	mbar	n°	n°	°C/bar	mbar	%

NOZZLE		PUMP		FLUE GASES							AIR			
Q	α°-T	PP	VP	BACH	CO_2	CO	NOx	CxHy	T2	PF	T1	PV	RT	RS
GPH		bar	bar	N°	%	ppm	ppm	ppm	°C	mbar	°C	mbar	n°	n°

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