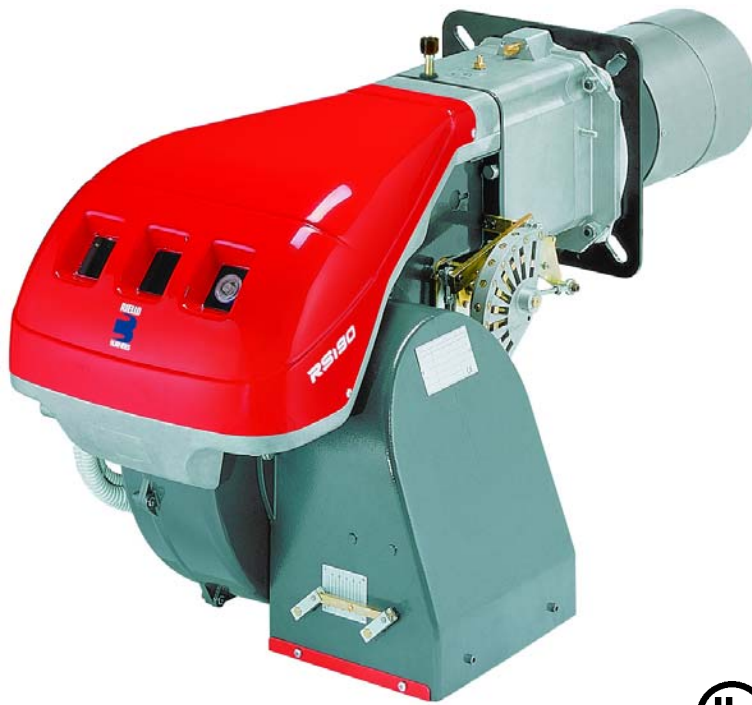


Gas Burners



RS 190/M

Low-High-Low or Modulating Operation

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WARNING

If you smell gas:

- Do not touch any electrical items.
- Open all windows.
- Close all gas supply valves.
- Contact your local gas authority immediately.

Do not store flammable or hazardous materials in the vicinity of fuel burning appliances.

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death. Refer to this manual for instructional or additional information. Consult a certified installer, service representative or the gas supplier for further assistance.

Burner shall be installed in accordance with manufacturers requirements as outlined in this manual, local codes and authorities having jurisdiction.

TECHNICAL DATA

MODEL			RS 190/M
Output ⁽¹⁾	High	kW MBtu/hr	1420 - 2542 4845 - 8673
	Low	kW MBtu/hr	522 1781
Fuel			Natural or Propane gas
- max. delivery		SCFH	8673
- pressure at max. delivery ⁽²⁾		" WC	5.9
Operation			Low - high or modulating
Standard applications			Boilers: water, steam, thermal oil
Ambient temperature		°F	32 - 104 (0 - 40 °C)
Combustion air temperature		°F max	140 (60 °C)
Main electrical supply (+/- 10%)		V/Ph/Hz	208 - 230/460/575/3/60
Fan motor		rpm W - HP V A	3400 4000 - 5.5 208-230/460/575 15.8 - 9.1 - 6
Ignition transformer		V1 - V2 I1 - I2	120 V - 1 x 7 kV 1.6 A - 23 mA
Electrical power consumption		W max	5500
Electrical protection			NEMA 1
Noise levels ⁽³⁾		dBA	83.1

(1) Reference conditions: Ambient temperature 68 °F (20 °C) - Barometric pressure 394" WC - Altitude 329 ft.

(2) Pressure at test point 17)(A)p.4, with zero pressure in the combustion chamber, with open gas ring 2)(B)p.6 at maximum burner output

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

Burner models designations:

Model	Code	Voltage	Flame safeguard
RS 190/M	C9527300 (3787670)	208-230/460/3/60	Burner mounted
	C9527301 (3787675)	575/3/60	Burner mounted
	C9727300 (3787673)	208-230/460/3/60	In an auxiliary panel (see Accessories)
	C9727301 (3787673)	575/3/60	In an auxiliary panel (see Accessories)

ACCESSORIES (optional):

• Available auxiliary panels

Control panel code	Flame safeguard type
3010332	Fireye
3010336	Landis
3010338	Honeywell

• Kit for LPG operation: The kit allows the RS 190/M burners to operate on LPG.

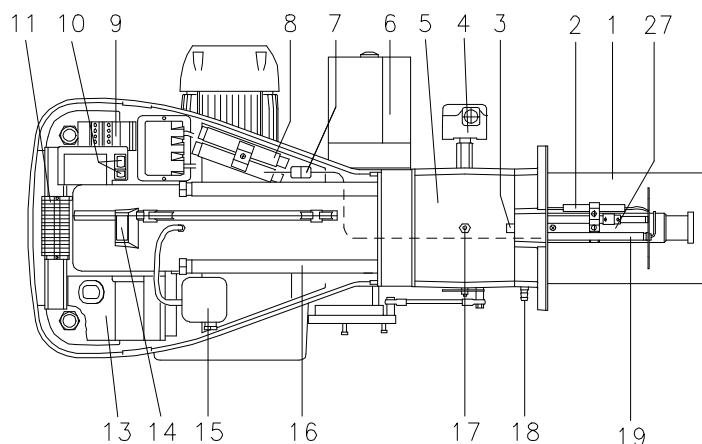
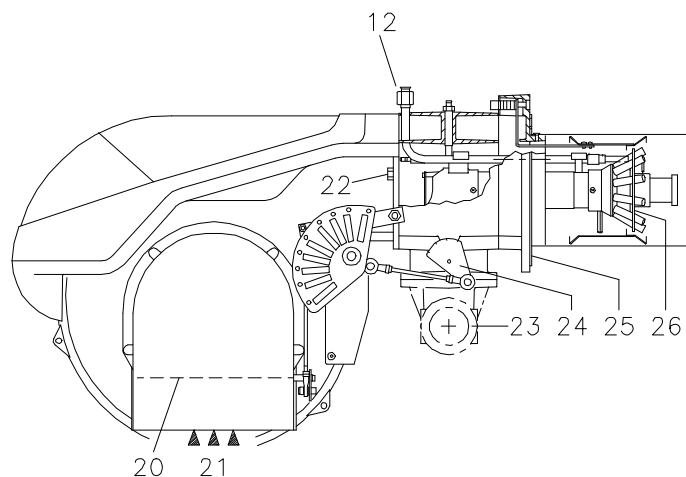
BURNER		RS 190/M
Output	kW	516 - 2542
	MBtu/hr	1761 - 8673
Code		3010276

• Gas train according to UL regulation: see page 9.

Important:
The installer is responsible for the supply and installation of any safety device(s) not indicated in this manual.

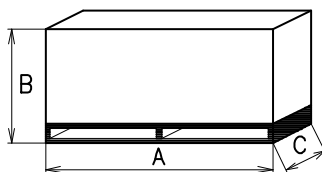


3013980: Thermal overload for 460 V power supply.

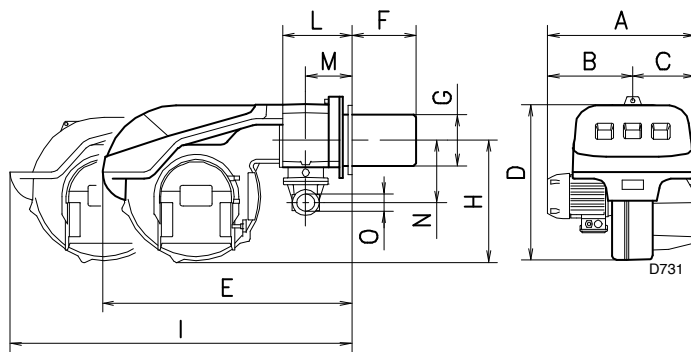


(A) D2430

A	B	C	lbs
49 ³¹ / ₃₂ "	28 ¹ / ₂ "	30 ²⁹ / ₃₂ "	181



(B) D36



A	B	C	D	E	F	G	H	I	L	M	N	O
26 ¹³ / ₁₆ "	14 ¹³ / ₃₂ "	12 ¹³ / ₃₂ "	21 ²⁷ / ₃₂ "	33 ³¹ / ₃₂ "	14 ²¹ / ₃₂ "	8 ³ / ₄ "	16 ¹⁵ / ₁₆ "	52 ⁹ / ₃₂ "	9 ¹¹ / ₁₆ "	52 ⁹ / ₃₂ "	7 ⁵ / ₁₆ "	2"

(C)

BURNER DESCRIPTION (A)

- 1 Combustion head
- 2 Ignition electrode
- 3 Screw for combustion head adjustment
- 4 High gas pressure switch
- 5 Sleeve
- 6 Servomotor controlling the gas butterfly valve and of air damper (by means of a variable profile cam mechanism).
When the burner is not operating the air damper is fully closed in order to reduce heat dispersion from the boiler due to the flue draught which draws air from the fan suction inlet.
- 7 Plug-socket on ionisation probe (flame rod) cable
- 8 Extensions for slide bars 16) (with kit)
- 9 Motor contactor and thermal overload with reset button
- 10 Power switch for different operations:
automatic - manual - off
Switch for:
Power increase - power reduction
- 11 Terminal strip
- 12 Pilot burner attachment
- 13 Flame safeguard (flame relay) with lock-out pilot light and lock-out reset button
- 14 Flame inspection window
- 15 Low air pressure switch (differential operating type)
- 16 Slide bars for opening the burner and inspecting the combustion head
- 17 Gas pressure test point and head fixing screw
- 18 Air pressure test point
- 19 Flame sensor probe (flame rod)
- 20 Air damper
- 21 Air inlet to fan
- 22 Screws securing fan to sleeve
- 23 Gas input pipework
- 24 Gas butterfly valve
- 25 Boiler mounting flange
- 26 Flame stability disk
- 27 Ignition pilot

Two types of burner failure may occur:
Flame safeguard lock-out: if the flame relay 13)(A) push-button lights up, it indicates that the burner is in lock-out. To reset, press the pushbutton.
Motor trip: release by pressing the pushbutton on thermal relay 9)(A).

PACKAGING - WEIGHT (B) - Approximate measurements

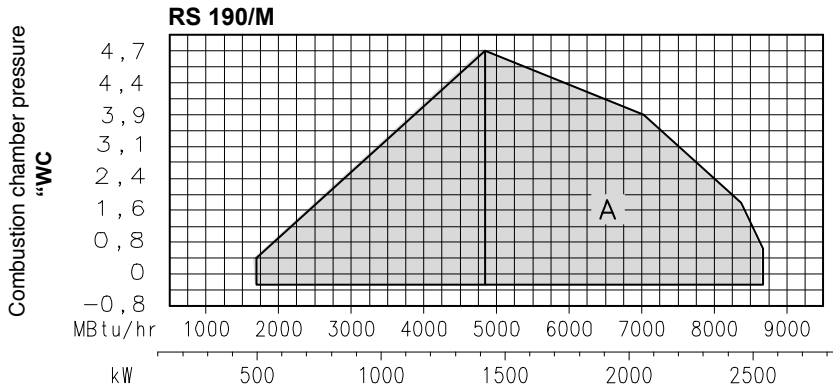
- The burner is shipped skid mounted Outer dimensions of packaging are indicated in (B).
- The weight of the burner complete with packaging is indicated in Table (B).

MAX. DIMENSIONS (C) - Approximate measurements
The maximum dimensions of the burners 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 dimension of the burner, without casing, when open is give by measurement I.

STANDARD EQUIPMENT

- 1 - Gas train flange
- 1 - Flange gasket
- 4 - Flange fixing screws
- 1 - Burner head gasket
- 4 - Screws to secure the burner flange to the boiler:
1/2 W x 1³/₈"
- 1 - Cap for combustion head
- 1 - Disc for combustion head
- 1 - Instruction booklet
- 1 - Spare parts list



FIRING RATES (A)

During operation, burner output varies between:

- **MAXIMUM OUTPUT**, selected within area A,
- and **MINIMUM OUTPUT**, which must not be lower than the minimum limit in the diagram.

RS 190 /M = 1781 MBTU/h = 522 kW

Important:

The FIRING RATE value range has been obtained considering an ambient temperature of 68 °F (20 °C), and an atmospheric pressure of 394" WC and with the combustion head adjusted as shown on page 8.

Note:

The FIRING RATE areas given in figure (A) have been reduced by 10% with respect to the maximum range that can be reached.

Consult Procedure on page 15 to refer burner operating condition in high altitude plants.

MINIMUM FURNACE DIMENSIONS (B)

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

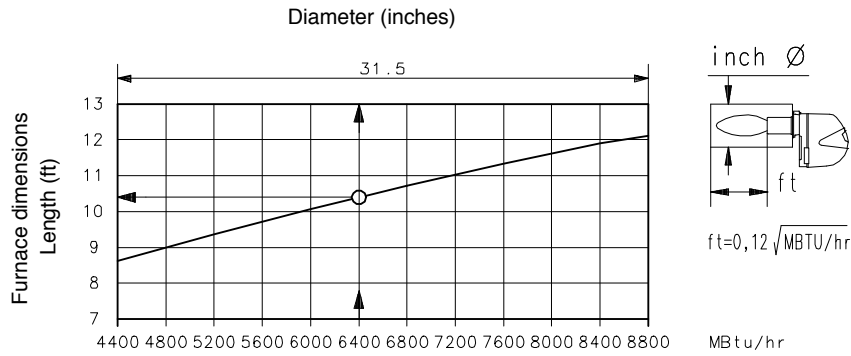
Figure (B) indicates the diameter and length of the test combustion chamber.

Example:

Output 6400 MBtu/hr:
diameter = 31.5 inch; length 10.4 ft

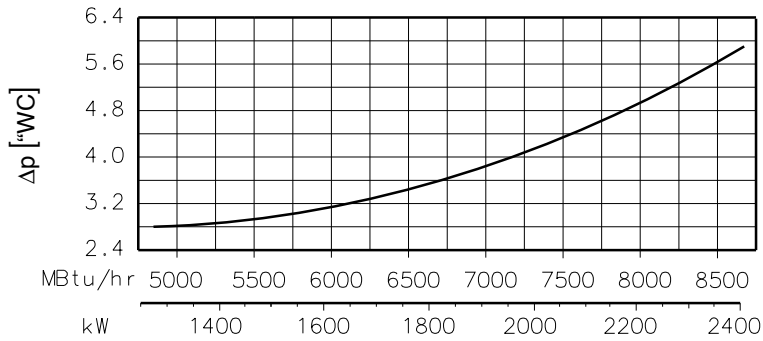
(A)

D2431



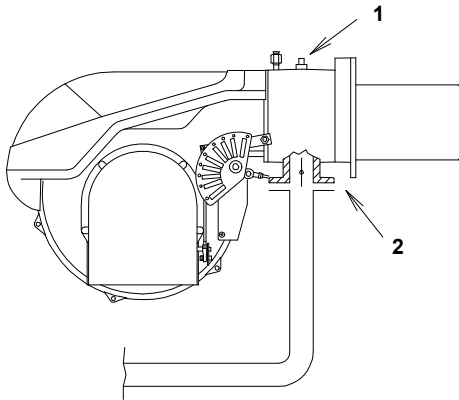
(B)

D2920



(A)

D3190



(B)

D2441

GAS PRESSURE

The adjacent tables are used to calculate manifold pressure taking into account combustion chamber pressure.

Column 1

Gas manifold pressure measured at test point 1)(B), with:

- Combustion chamber at 0" WC;
- Burner operating at maximum output;
- Combustion head adjusted as indicated in diagram (C)p. 8.

Calculate the approximate maximum output of the burner as follows:

- subtract the combustion chamber pressure from the gas pressure measured at test point 1)(B).
- Find the nearest pressure value to your result in column 1 of the table (A).
- Read off the corresponding output on the left.

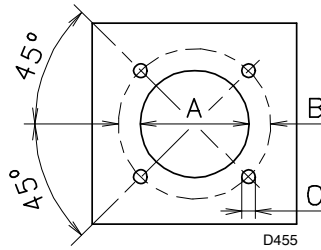
Example

- Maximum output operation
 - Natural gas
 - Gas pressure at test point 1)(B) = 4.33" WC
 - Pressure in combustion chamber = 1.18" WC
- $$4.33 - 1.18 = 3.15" \text{ WC}$$

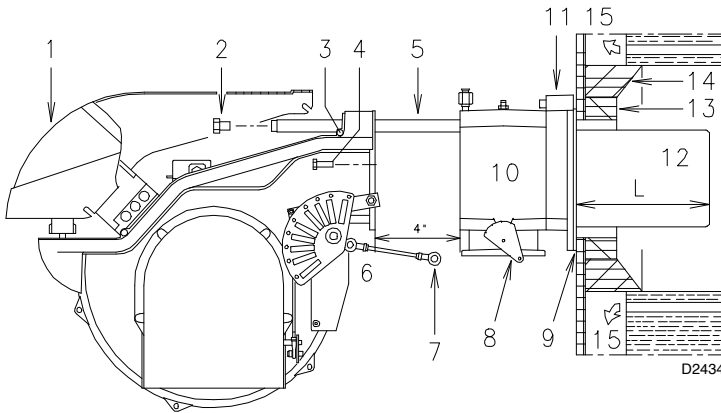
An output of 6060 MBtu/hr shown in table (A) corresponds to 3.15" WC pressure, column 1.

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

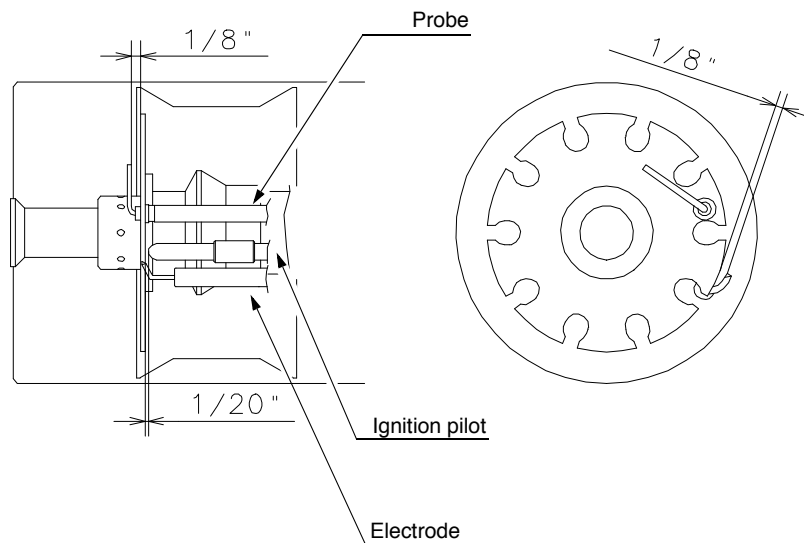
inch	A	B	C
RS 190/M	9 ¹ / ₁₆ "	12 ²⁵ / ₃₂ " - 14 ¹ / ₂ "	5 ⁸ / ₈ W



(A)

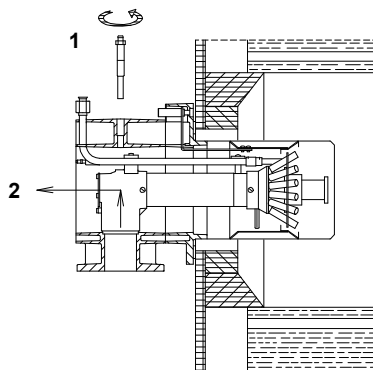


(B)



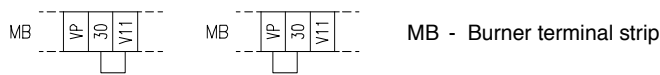
(C)

D2435



(D)

D2436



(E)

D2317

INSTALLATION

BOILER PLATE (A)

Drill the combustion chamber mounting plate as shown in (A). The position of the threaded holes can be marked using the burner head gasket 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 insulation. The length available, L (inches), is 14²¹/₃₂".

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

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

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

SECURING THE BURNER TO THE BOILER (B)

Before securing the burner to the boiler, check through the blast tube opening to make sure that the flame sensor probe is correctly set in position, as shown in (C).

Now detach the combustion head from the burner, fig. (B):

- Loosen the four screws 3) and remove the cover 1).
- Disengage the swivel joint 7) from the graduated sector 8)
- Remove the screws 2) from the two slide bars 5).
- Remove the two screws 4) and pull the burner back on slide bars 5) by about 4".
- Disconnect the wires from the probe and the electrode and then pull the burner completely off the slide bars.

Secure the flange 11)(B) to the boiler plate, inserting the gasket 9)(B). Use the 4 screws, also supplied with the unit, after first protecting the thread with an anti-locking product.

The seal between burner and boiler must be airtight.

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

IGNITION PILOT ADJUSTMENT

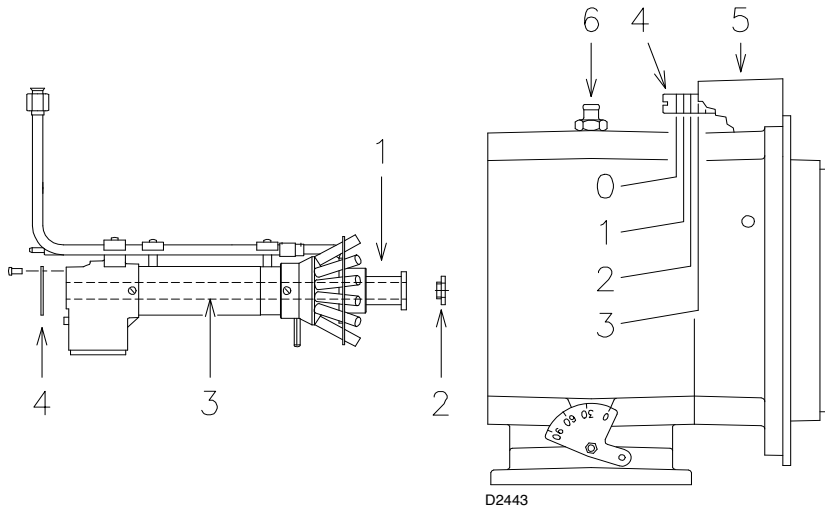
Place the pilot and electrode as shown in fig. (C).

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

Important

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

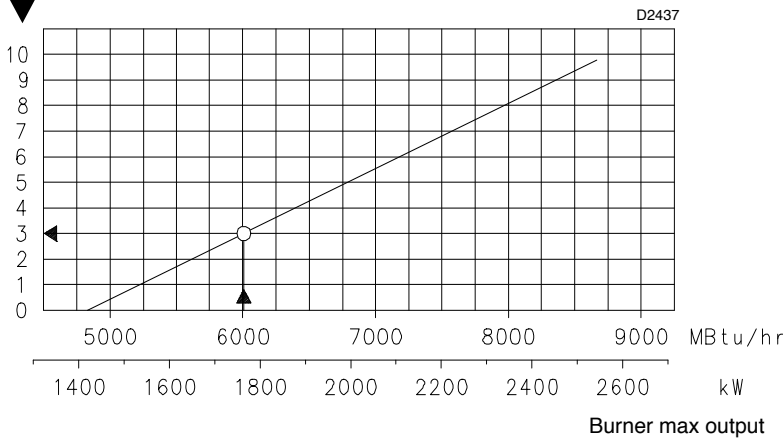
- Move the jumper from terminals "30-V11" to terminals "30-VP", as given in fig. (E), this way the main valve is cut out.
- With the burner in the manual position, hold the air damper in the minimum position and make the setting.
- When the setting is correct, replace the jumper on "30-V11".



D2443

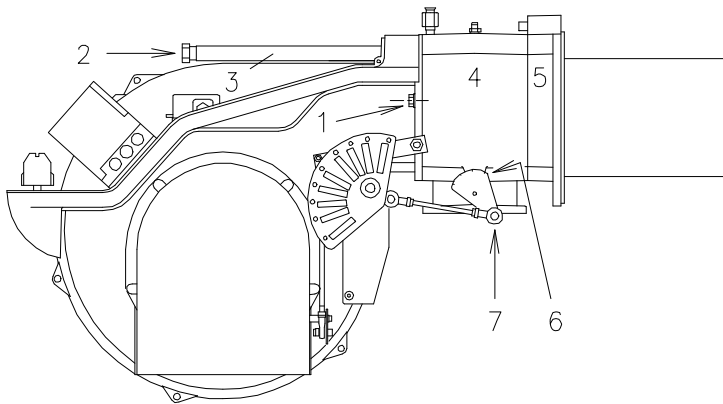
(A) (B)

Notches (Air = Gas)



D2437

(C)



D2442

(D)

COMBUSTION HEAD ADJUSTMENT

Installation operations are now at the stage where the blast tube and sleeve are secured to the boiler as shown in fig. (B). It is now a very simple matter to set up the combustion head, as this depends solely on the MAX output developed by the burner.

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

There are two adjustments to make on the head.

Air adjustment (B)

See diagram (C). Turn screw 4(B) until the notch identified is aligned with the front surface 5(B) of the flange.

Gas adjustment (A)

When the burner is installed for a maximum output ≤ 5726 MBtu/hr unscrew and remove the front part 1(A). Replace it with the supplied cap 2(A), after removing the inner pipe 3(A). Replace the disc 4(A) with the supplied disc without hole. If there is low gas supply pressure, the head may be left in standard configuration, limiting the minimum modulation to 1980 MBtu/hr.

Example

Maximum burner output = 6000 MBtu/hr.

If we consult diagram (C) we find that for this output, air must be adjusted using notch 3, as shown in fig. (B).

Continuing with the previous example, page 6 indicates that for burner with output of 6000 MBtu/hr a pressure of approximately 3.15 "WC is necessary at test point 6(B).

Once you have finished setting up the head, refit the burner to the slide bars 3(D) at approximately 4" from the sleeve 4(D) - burner positioned as shown in fig. (B)p. 7 - insert the flame rod cable and the ignition electrode cable and then slide the burner up to the sleeve so that it is positioned as shown in fig. (D).

Refit screws 2) on slide bars 3).

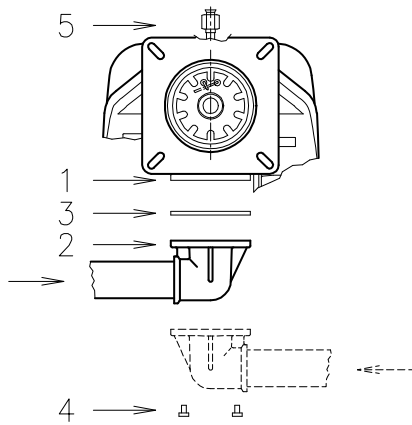
Secure the burner to the sleeve by tightening screw 1).

Reconnect the swivel joint 7) to the graduated sector 6).

Connect gas train and pilot train as shown in fig. (A) page 9.

Important

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



(A)

D2393

TYPICAL SCHEMATIC GAS PIPING

GAS PIPING

- The main gas train must be connected to the gas attachment 1)(A), using flange 2), gasket 3) and screws 4) supplied with the burner.
- The gas train can enter the burner from the right or left side, depending on which is the most convenient, see fig. (A).
- The gas safety shut-off valves 5)-6)(A) must be as close as possible to the burner to ensure gas reaches the combustion head within the safety time range.
- The pilot gas train must be connected to the gas attachment 5)(A) and can enter the burner from the right or left side.

GAS TRAIN (B)

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

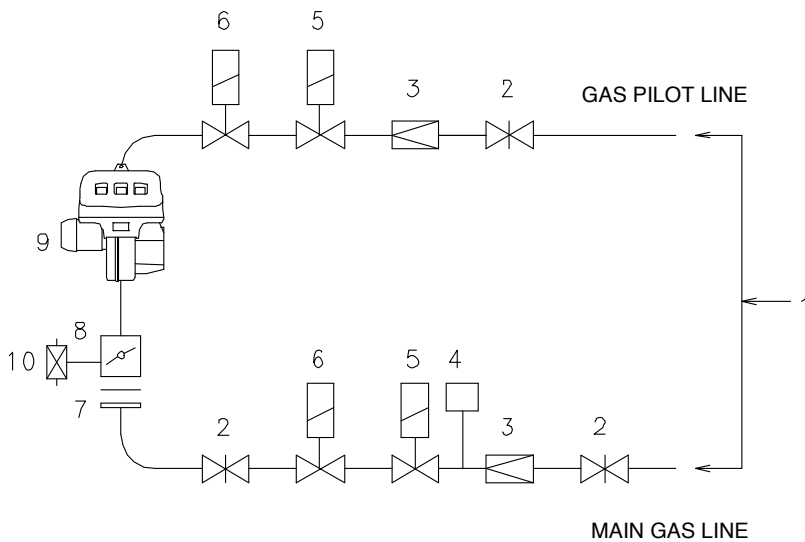
Note

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

KEY (A)

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

* On the burner

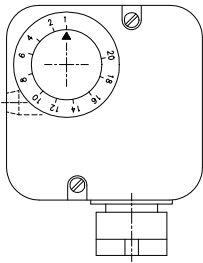


(B)

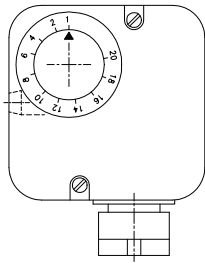
D2438

LOW GAS PRESSURE SWITCH HIGH GAS PRESSURE SWITCH

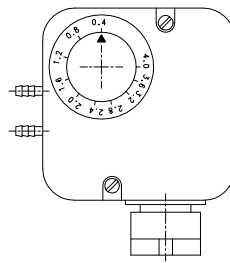
AIR PRESSURE SWITCH



(A)



(B)



(C)

ADJUSTMENTS BEFORE FIRST FIRING

Adjustment of the combustion head, and air and gas deliveries has been illustrated on page 8.

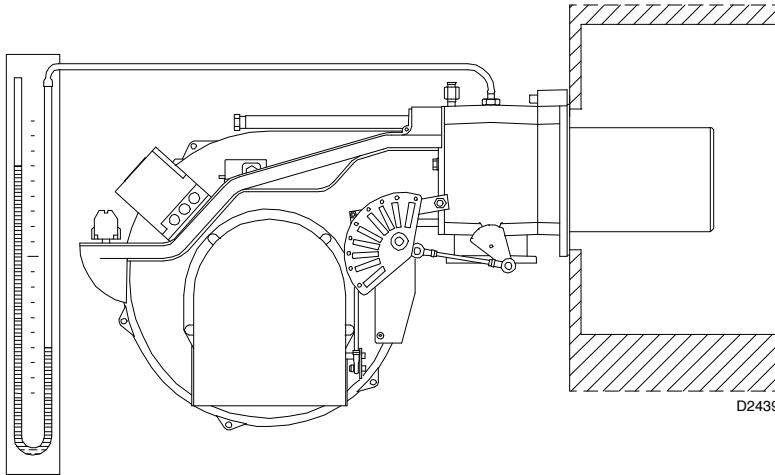
In addition, the following adjustments must also be made:

- Open manual valves up-stream from the gas train.
- Adjust the low gas pressure switch to the start of the scale (A).
- Adjust the high gas pressure switch to the end of the scale (B).
- Adjust the air pressure switch to the zero position of the scale (C).
- Purge the air from the gas line.

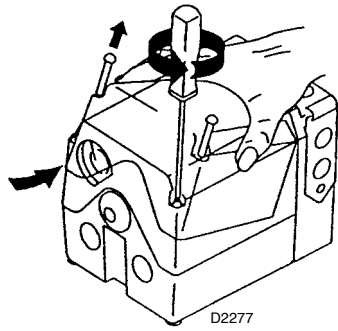
Fit a U-type manometer (D) to the gas pressure test point on the sleeve.

The manometer readings are used to calculate the MAX. burner power using the table on page 6.

Before starting up the burner it is good practice to adjust the gas train so that ignition takes place in conditions of maximum safety, i.e. with gas delivery at the minimum.



(D)



(A)

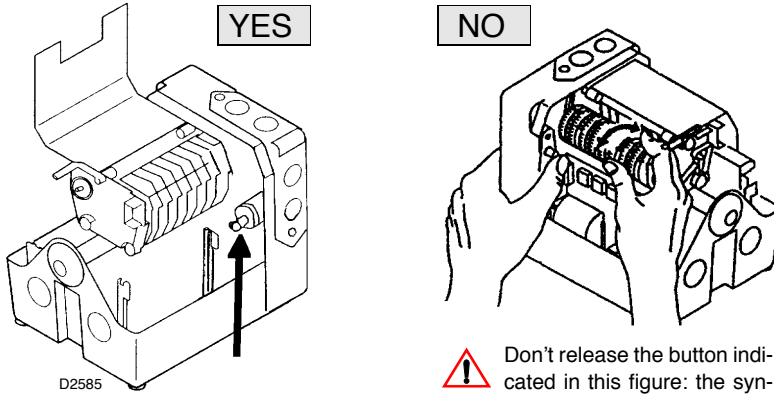
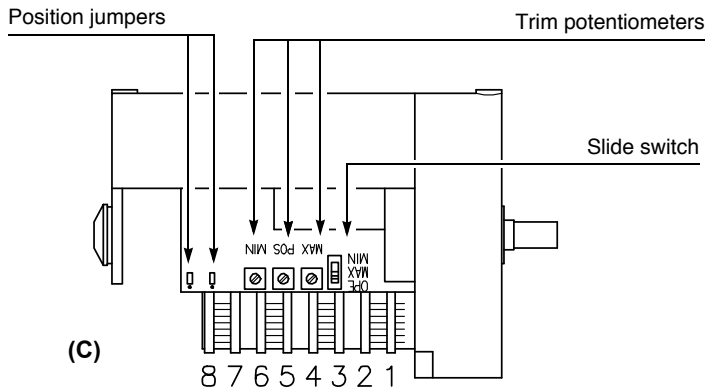


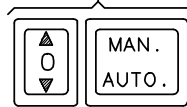
Figure above shows how the servomotor is released to manually check there is no binding through its motion.

⚠ Don't release the button indicated in this figure: the synchronization of the cams made in factory would be changed.

(B)

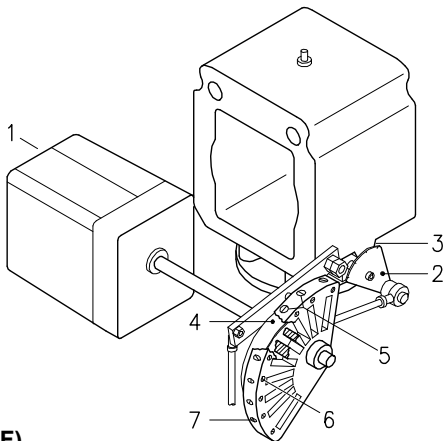


(C)



(D) (E)

D2593



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

(F)

D2594

SERVOMOTOR

The servomotor gives simultaneous regulation of the air damper through the variable cam profile 4(F) and the gas butterfly valve.

It rotates by 130° in approx. 35 s.

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

To open the servomotor, remove the screws and pull the cover outward, fig. (A).

CAMS AND TRIM POTENZIOMETERS FUNCTIONS

Cam 1: 130°

Limits rotation towards maximum for gas.

Cam 2: 0°

Limits rotation towards minimum, air damper closed on stand by.

Cam 3: 20°

Limits gas ignition regulation.

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

Trim potentiometer MAX

Limits maximum modulation.

It must be set near the stroke end (cam 1) to exploit as far as possible the variable stroke profile cam and maximum opening of the gas butterfly valve.

Trim potentiometer MIN

Limits minimum modulation.

It must be set near the stroke end (cam 2) to exploit as far as possible the variable profile cam.

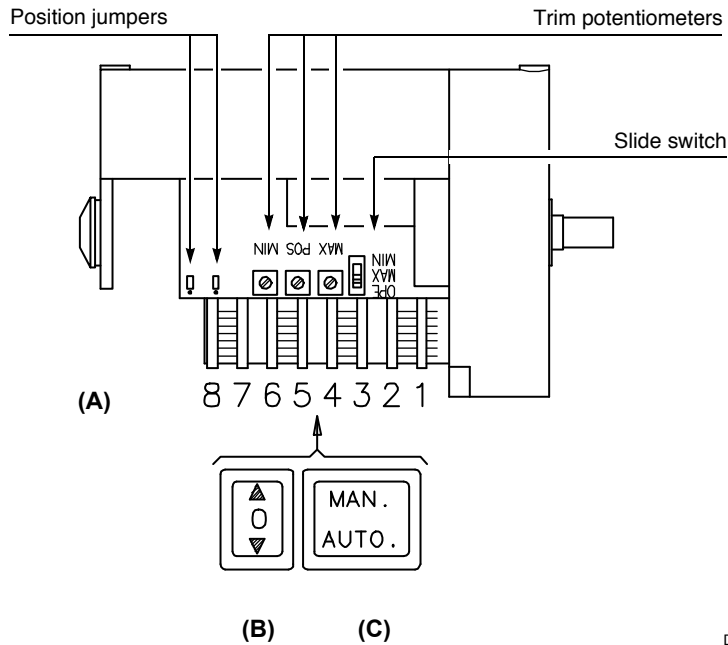
Trim potentiometer POS

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

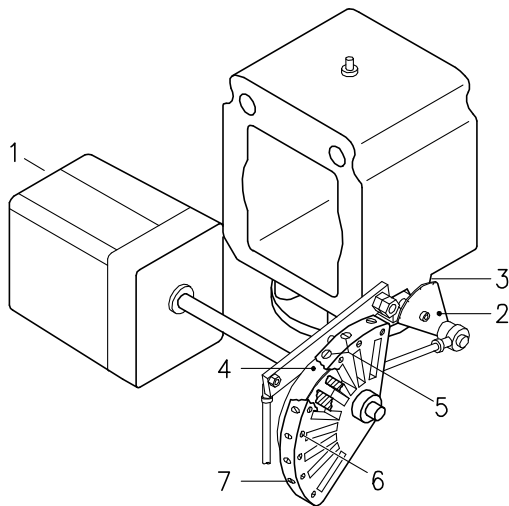
Note

Using the slide switch to select MAX or MIN, the servomotor goes into the position for the respective settings of the MAX and MIN TRIM POTENZIOMETERS.

When the settings are complete, place the slide switch on OPE. (Operating position)



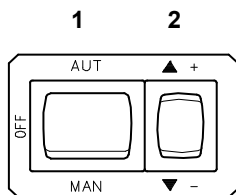
D2593



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

(D)

D2594



(E)

D791

BURNER STARTING

Close the control circuit, with the switch in fig. C) in the AUTO position.

On firing (pilot burner and main valve) turn the switch (C) to MAN and the switch 1)(E) in the AUT position.

MAXIMUM OUTPUT

Using button (B), "increase output" until it locks out, app. 130° (cam 1).

Place the slide switch on MAX and set the relative MAX trim potentiometer (setting must be very near to 130°) to exploit as far as possible the variable profile cam 4)(D) and have the gas butterfly valve on maximum opening, graduated sector 2) on index 3) fig. (D).

The setting of the gas flow must be made on the gas train pressure regulator and, if necessary, on the gas valve.

The air setting must be made on the variable profile cam 4)(D) by turning the screws 5), after loosening the screws 6).

MINIMUM OUTPUT

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

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

Set the air using the variable profile cam 4)(D).

If a lower modulation minimum is required than the level set on cam 3 of the servomotor (20°), decrease the cam setting.

INTERMEDIATE OUTPUTS

With the switch (C) in the AUTO position, the slide switch in the OPE position and the switch 1)(E) in the MAN position, move the button 2)(E) in various intermediate levels between maximum and minimum and set the variable profile cam 4)(D) to achieve optimum combustion, by turning the screws 5).

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

Check the various setting levels with a combustion analysis.

Important

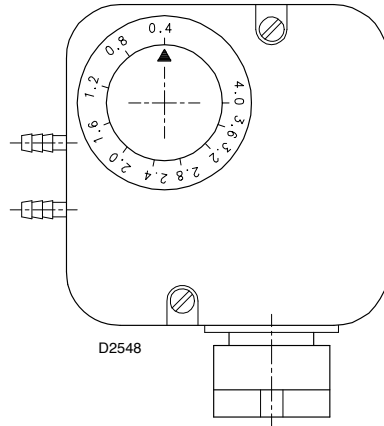
Make a progressive setting of the profile, without sharp changes.

When the setting is complete, lock the cam profile using screws 6)(D).

Turn the burner off, release the servomotor as shown in fig. (B) page 11 and manually turn cam 4)(D) to check for smooth cam operation.

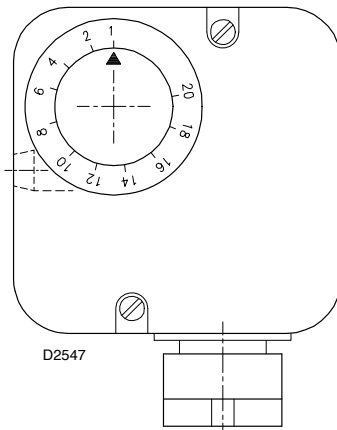
Finally fix the adjustment by turning the screws 6)(D).

AIR PRESSURE SWITCH



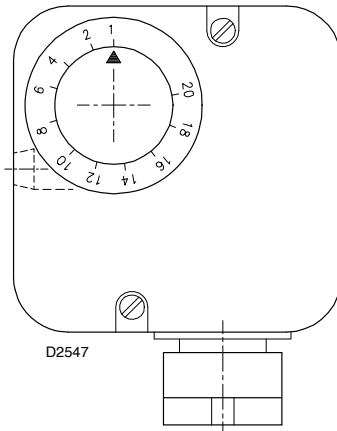
(A)

HIGH GAS PRESSURE SWITCH

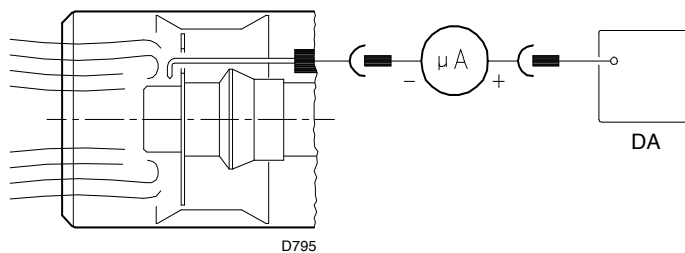


(B)

LOW GAS PRESSURE SWITCH



(C)



(D)

AIR PRESSURE SWITCH (A)

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

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

Then turn the dial anti-clockwise by about 20% of the set point and repeat burner starting to ensure it is correct. If the burner locks out again, turn the dial anti-clockwise a little bit more.

Attention:

As a rule, the air pressure switch must block the formation of CO.

To check this, insert a combustion analyser into the chimney, slowly close the fan suction inlet (for example with cardboard) and check that the burner locks out, before the CO in the fumes exceeds 400 ppm.

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

HIGH GAS PRESSURE SWITCH (B)

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

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

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

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

LOW GAS PRESSURE SWITCH (C)

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

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

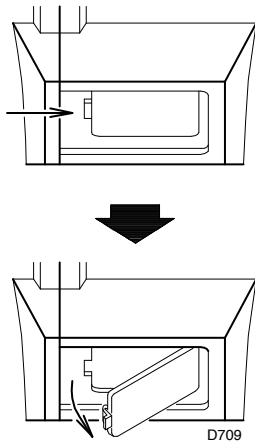
Then turn the dial anti-clockwise by 0.8" WC and repeat burner starting to ensure it is uniform.

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

FLAME PRESENT CHECK (D)

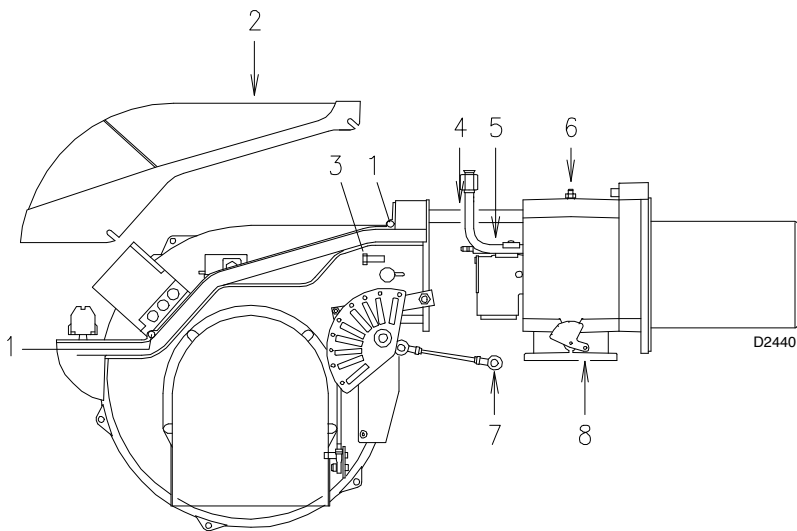
The burner is fitted with an ionisation system (flame rod) which ensures that a flame is present. The minimum current for reliable operation is 6 μA (see manufacturers documentation). The burner provides a much higher current, so that controls are not normally required. However, if it is necessary to measure the ionisation current, disconnect the plug-socket 7)(A)p.4 on the ionisation probe cable and insert a direct current microammeter with a base scale of 100 μA . Carefully check polarities.

FLAME INSPECTION WINDOW



(A)

OPENING THE BURNER



(B)

MAINTENANCE

Combustion

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

Gas leaks

Make sure that there are no gas leaks on the pipework between the gas meter and the burner.

Flame inspection window

Clean the flame inspection window (A).

Combustion head

Open the burner and make sure that all components of the combustion head are in good condition, not deformed by the high temperatures, free of impurities from the surroundings and correctly positioned. If in doubt, disassemble the elbow fitting 5)(B).

Servomotor

Disengage the cam 4)(D)p. 12 from the servomotor and turn it backwards and forwards by hand to make sure it moves freely.

Burner

Check for excess wear or loose screws in the mechanisms controlling the air damper and the gas butterfly valve. Also make sure that the screws securing the electrical leads in the burner terminal strip are fully tightened.

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

Combustion

Adjust the burner if the combustion values found at the beginning of the operation do not comply with the regulations in force, or at any rate, do not correspond to good combustion. Record the new combustion values; they will be useful for subsequent controls.

TO OPEN THE BURNER (B):

- Switch off the electrical power.
- Loosen screws 1) and withdraw cover 2).
- Disengage the swivel joint 7) from the graduated sector 8).
- Fit the two extensions onto the slide bars 4).
- Remove screws 3), and pull the burner back by about 4" on the slide bars 4). Disconnect the probe and electrode leads and then pull the burner fully back.
- Now extract the gas distributor 5) after having removed the screw 6) and disconnecting the pilot gas line.

TO CLOSE THE BURNER (B):

- Push the burner until it is about 4" from the sleeve.
- Re-connect the leads and slide in the burner until it comes to a stop.
- Refit screws 3), and pull the probe and electrode leads gently out until they are slightly stretched.
- Re-couple the swivel joint 7) to the graduated sector 8).
- Remove the two extensions from the slide bars 4).
- Connect the pilot gas line.

PROCEDURE TO REFER BURNER OPERATING CONDITION IN HIGH ALTITUDE PLANTS

- Find the **corrected burner capacity** for the plant's altitude in chart 1 and the **corrected pressure** in chart 2.
- Check in the firing rate graph of the burner (page 5), if the working point defined by the values above is within the range limits. If not, higher burner size is needed.

Note

Charts are based only on altitude variation (reference temperature = 68°F , 20°C)

To get the combined correction in case of different air temperature, a compensation of **1000 ft each 20°F (305 m each 11°C)** is applicable.

Example

Rated capacity = 3000 MBtu/hr - Rated air pressure = 1.5" w.c.

Real altitude = 5000 ft - Real temperature = 108°F

$\Delta = 108^\circ\text{F} - 68^\circ\text{F}$ (reference temp.) = 40°F (equivalent 2000 ft variation)

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

- the corrected capacity is 3847 MBtu/hr;

- the corrected burner air pressure is 1.92.



Burner RS 190/M is OK

1

CORRECTED BURNER CAPACITY ACCORDING TO ALTITUDE

Rated Capacity	Altitude										
	m. a.s.l. ft a.s.l.	0	100	305	610	915	1220	1525	1830	2135	2440
500		494	500	512	530	551	571	593	616	641	669
1000		987	1000	1023	1061	1101	1142	1186	1232	1282	1337
1500		1481	1500	1535	1591	1652	1713	1778	1848	1924	2006
2000		1974	2000	2046	2121	2202	2284	2371	2464	2565	2675
2500		2468	2500	2558	2652	2753	2855	2964	3079	3206	3343
3000		2962	3000	3069	3182	3303	3425	3557	3695	3847	4012
3500		3455	3500	3581	3712	3854	3996	4149	4311	4488	4680
4000		3949	4000	4092	4243	4404	4567	4742	4927	5130	5349
4500		4442	4500	4604	4773	4955	5138	5335	5543	5771	6018
5000		4936	5000	5116	5303	5505	5709	5928	6159	6412	6686
5500		5429	5500	5627	5834	6056	6280	6520	6775	7053	7355
6000		5923	6000	6139	6364	6606	6851	7113	7391	7694	8024
6500		6417	6500	6650	6894	7157	7422	7706	8006	8335	8692
7000		6910	7000	7162	7425	7708	7993	8299	8622	8977	9361
7500		7404	7500	7673	7955	8258	8564	8892	9238	9618	10029
8000		7897	8000	8185	8485	8809	9135	9484	9854	10259	10698
8500		8391	8500	8697	9016	9359	9705	10077	10470	10900	11367
9000		8885	9000	9208	9546	9910	10276	10670	11086	11541	12035
9500		9378	9500	9720	10076	10460	10847	11263	11702	12183	12704
10000		9872	10000	10231	10607	11011	11418	11855	12318	12824	13373
Average barometric Pressure (20°C)	mbar	1013	1000	977,4	942,8	908,2	875,8	843,5	811,85	779,8	747,8
Average barometric Pressure (68°F)	"w.c.	399	394	385	371	358	345	332	320	307	294

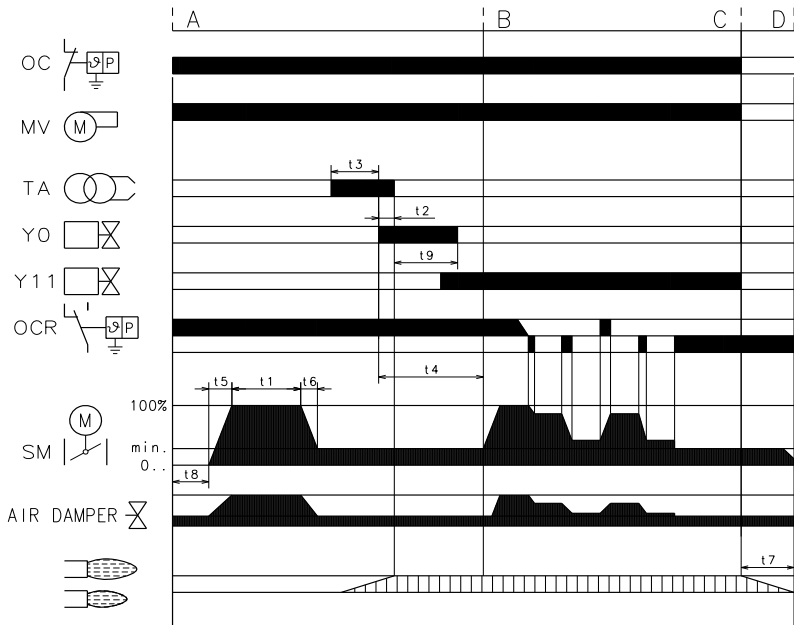
2

CORRECTED BURNER AIR PRESSURE ACCORDING TO ALTITUDE

Rated Pressure	Altitude										
	m. a.s.l. ft a.s.l.	0	100	305	610	915	1220	1525	1830	2135	2440
0,50		0,49	0,50	0,51	0,53	0,55	0,57	0,59	0,62	0,64	0,67
1,00		0,99	1,00	1,02	1,06	1,10	1,14	1,19	1,23	1,28	1,34
1,50		1,48	1,50	1,53	1,59	1,65	1,71	1,78	1,85	1,92	2,01
2,00		1,97	2,00	2,05	2,12	2,20	2,28	2,37	2,46	2,56	2,67
2,50		2,47	2,50	2,56	2,65	2,75	2,85	2,96	3,08	3,21	3,34
3,00		2,96	3,00	3,07	3,18	3,30	3,43	3,56	3,70	3,85	4,01
3,50		3,46	3,50	3,58	3,71	3,85	4,00	4,15	4,31	4,49	4,68
4,00		3,95	4,00	4,09	4,24	4,40	4,57	4,74	4,93	5,13	5,35
4,50		4,44	4,50	4,60	4,77	4,95	5,14	5,33	5,54	5,77	6,02
5,00		4,94	5,00	5,12	5,30	5,51	5,71	5,93	6,16	6,41	6,69
5,50		5,43	5,50	5,63	5,83	6,06	6,28	6,52	6,77	7,05	7,35
6,00		5,92	6,00	6,14	6,36	6,61	6,85	7,11	7,39	7,69	8,02
6,50		6,42	6,50	6,65	6,89	7,16	7,42	7,71	8,01	8,34	8,69
7,00		6,91	7,00	7,16	7,42	7,71	7,99	8,30	8,62	8,98	9,36
7,50		7,40	7,50	7,67	7,96	8,26	8,56	8,89	9,24	9,62	10,03
8,00		7,90	8,00	8,18	8,49	8,81	9,13	9,48	9,85	10,26	10,70
8,50		8,39	8,50	8,70	9,02	9,36	9,71	10,08	10,47	10,90	11,37
9,00		8,88	9,00	9,21	9,55	9,91	10,28	10,67	11,09	11,54	12,04
9,50		9,38	9,50	9,72	10,08	10,46	10,85	11,26	11,70	12,18	12,70
10,00		9,87	10,00	10,23	10,61	11,01	11,42	11,86	12,32	12,82	13,37
Average barometric Pressure (20°C)	mbar	1013	1000	977,4	942,8	908,2	875,8	843,5	811,85	779,8	747,8
Average barometric Pressure (68°F)	"w.c.	399	394	385	371	358	345	332	320	307	294

Reference conditions (Charts 1-2): Ambient temperature 68 °F (20 °C) - Barometric pressure 394" WC (1000 mbar) - Altitude 328 ft a.s.l. (100 m a.s.l.)

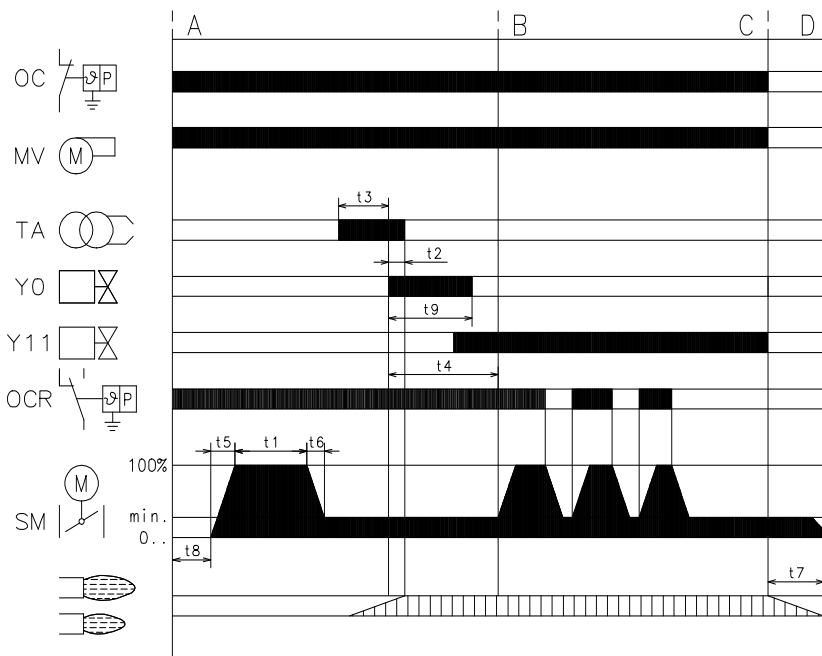
Full Modulation



(A)

D2273

Low - High



(B)

D2274

BURNER OPERATION

BURNER STARTING

- Load control close.
Fan motor starts.
- Servomotor starts:
130° rotation to right, until contact is made on cam 1)(A) page 12.
The air damper is positioned to MAX. output.
- Pre-purge stage with air delivery at MAX. output.
- After pre-purge stage, servomotor rotates to left up to the angle set on cam 3)(A) page 12 for MIN. output.
- The air damper and the gas butterfly are positioned to MIN. output.
- Ignition electrode strikes a spark.
- Pilot valve opens. The pilot flame is ignited.
- After about 12 s the main flame ignites and starting cycle ends.

STEADY STATE OPERATION

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

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

- If the temperature or pressure is low, the burner progressively increases its output to the MAX. value.
- If the temperature or pressure is high, the burner progressively decreases its output to the MIN. value.
And so on.
- The burner locks out when demand for heat is less than the heat supplied by the burner at min. output.
Load control opens. The servomotor returns to the 0° angle limited by contact with cam 2. The air damper closes completely to reduce thermal dispersion to a minimum.

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

Switching times are given in seconds, in the burner start-up sequence.

LFL 1.335 Series 01

t1	30	t5	optional
t2	2	t6	optional
t3	4	t7	12
t4	20	t8	4

Legend for the times

- t1 Pre-purge time with air damper open
- t2 Safety time
- t3 Pre-ignition time, short (ignition transformer on terminal 16)
- t4 Interval between start of t2 and release of valve at terminal 19
- t5 Interval between end of t4 and release of load controller or valve at terminal 20
- t5 Running time of air damper into OPEN position
- t6 Running time of air damper into low-flame position (MIN)
- t7 Permissible after-burn time
- t8 Interval until OPEN command for the air damper is given

FIRING FAILURE

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

BURNER FLAME GOES OUT DURING OPERATION

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

Control program under fault conditions and lock-out indication

In case of any disturbance, the sequence mechanism stops and with it the lock-out indicator. The symbol above the reading mark of the indicator gives the type of disturbance:

- ◀ **No start**, e.g. because one contact is not closed. Lock-out during or after control program sequence due to extraneous light (e.g. non-extinguished flames, leaking fuel valves, defects in the flame supervision circuit, etc.)

- ▲ **Interruption of startup sequence**, because the OPEN signal has not been delivered to terminal 8 by limit switch "a". Terminals 6, 7 and 14 remain under voltage until the fault has been corrected!

- P **Lockout**, because there is no air pressure indication at the beginning of air pressure control. **Every air pressure failure after this moment in time leads to lock-out, too!**

- **Lock-out** due to a fault in the flame supervision circuit.

- ▼ **Interruption of startup sequence**, because the position signal for the low-flame position has not been delivered to terminal 8 by auxiliary switch "m". Terminals 6, 7 and 14 remain under voltage until the fault has been corrected!

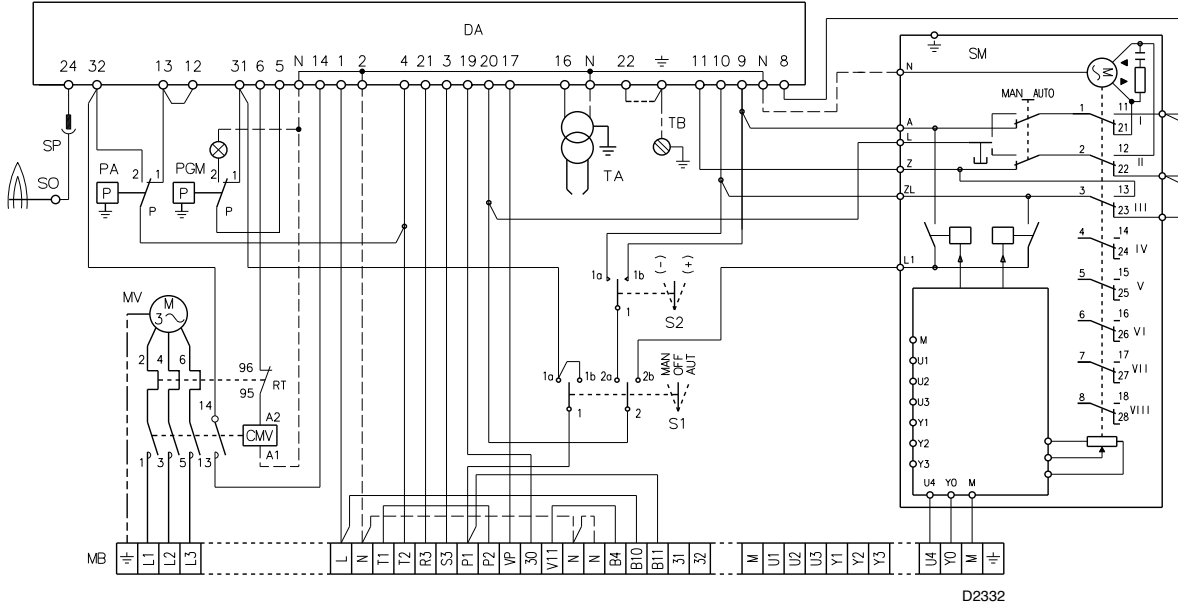
- 1 **Lock-out**, because no flame signal is present after completion of the (1st) safety time.

- 2 **Lock-out**, because no flame signal has been received on completion of the 2nd safety time (flame signal of the main flame with interrupted pilot burners).

- | **Lock-out**, because the flame signal has been lost during burner operation.

If lock-out occurs at any other moment in time between the start and the pre-ignition which is not marked by a symbol, this is usually caused by a premature, i.e. faulty flame signal, e.g. caused by a self-igniting UV tube.

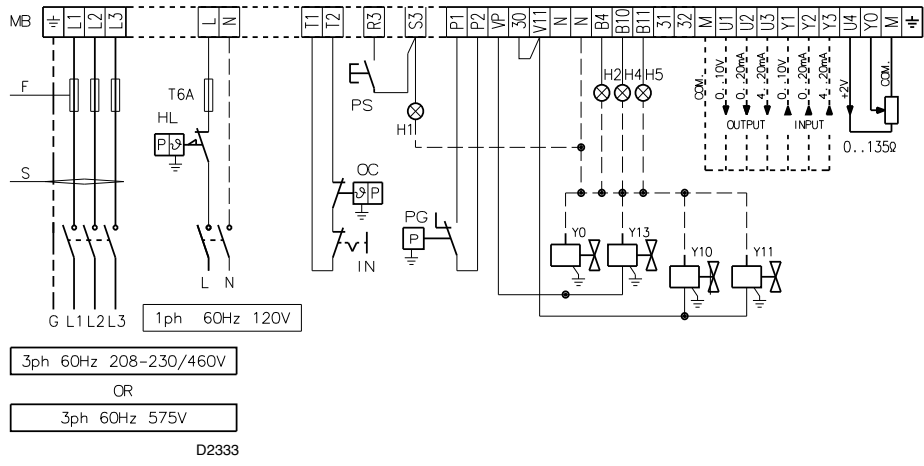
Factory Wiring Diagram
RS 190/M
 with burner mounted Siemens LFL control



D2332

(A)

Field Wiring Diagram
RS 190/M
 with burner mounted Siemens LFL control

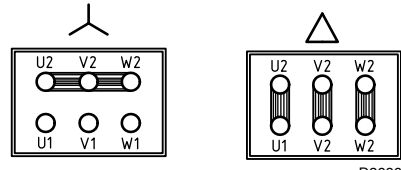


D2333

		RS 190/M		
		208 - 230 V	460 V	575 V
F	A	T25	T20	T15
S	AWG	12	12	12

Wire size when not indicated: AWG18.

Motor Connection



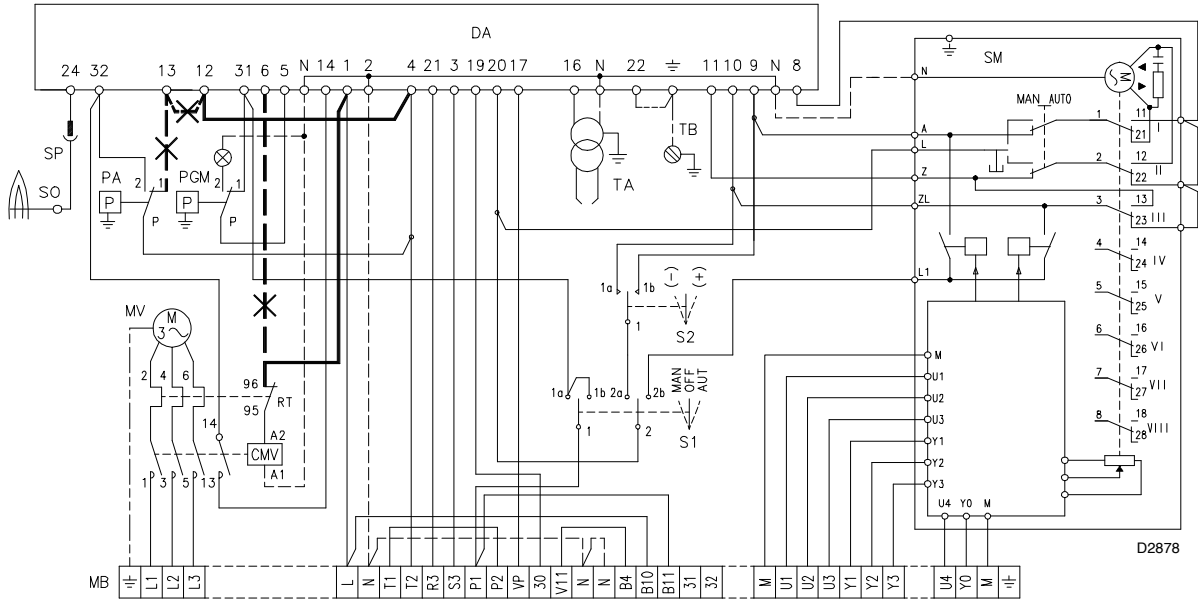
D3686

(B)

Factory Wiring Diagram
RS 190/M
with burner mounted Siemens LFL control

Continuous fan operation

Change the wire connection from terminal 6 to terminal 1, move the jumper from terminals 12-13 to terminals 4-12 and remove the wire from terminal 13 of control box as indicated below.



(C)

LAYOUT (A) - (B) - (C)
Burner RS 190/M

Key to Layouts

- CMV - Motor contactor
- DA - LFL Control box
- HL - High limit
- H1 - Remote lock-out signal
- H2 - Burner on signal
- H4 - Power on signal
- H5 - Permission ok
- IN - Burner manual stop switch
- MB - Burner terminal strip
- MV - Fan motor
- OC - Operating control
- OC2 - High-low control

- PA - Air pressure switch
- PG - Min. gas pressure switch
- PGM - High gas pressure switch
- PS - Remote lock-out reset
- RT - Thermal overload
- SM - Servomotor
- SO - Ionisation probe (flame rod)
- SP - Plug-socket
- TA - Ignition transformer
- TB - Burner ground
- Y0 - Pilot adjustment valve
- Y10 - Adjustment valve
- Y11 - Safety valve
- Y13 - Pilot valve (safety)

NOTES

- For electrical connection use flexible cables according to local Regulations.
- The setting of the thermal overload must be according to the total burner amperage draw.
- The RS 190/M burners leave the factory preset for:
 - **208-230 V** power supply: only in this case, if 460 V power supply is required, change the fan motor connection from delta to star and change the thermal overload as well (see page 3);
 - or **575 V** power supply; depending on the burner model (see page 3).
- The RS 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 check 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, a time switch should be fitted in series to IN to provide for burner shut-down at least once every 24 hours.



Important note

When installing for the first time and after any maintenance work, make sure the gas valves are connected properly to the orange terminals before proceeding to ignite the burner. Insert auxiliary lamps or check, with the aid of a tester, that power is not being supplied to the valves during standby or pre-purging. Burner ignition with the gas valves open during pre-purging may cause an explosive condition.

LAYOUT (A) page 20

Burner RS 190/M

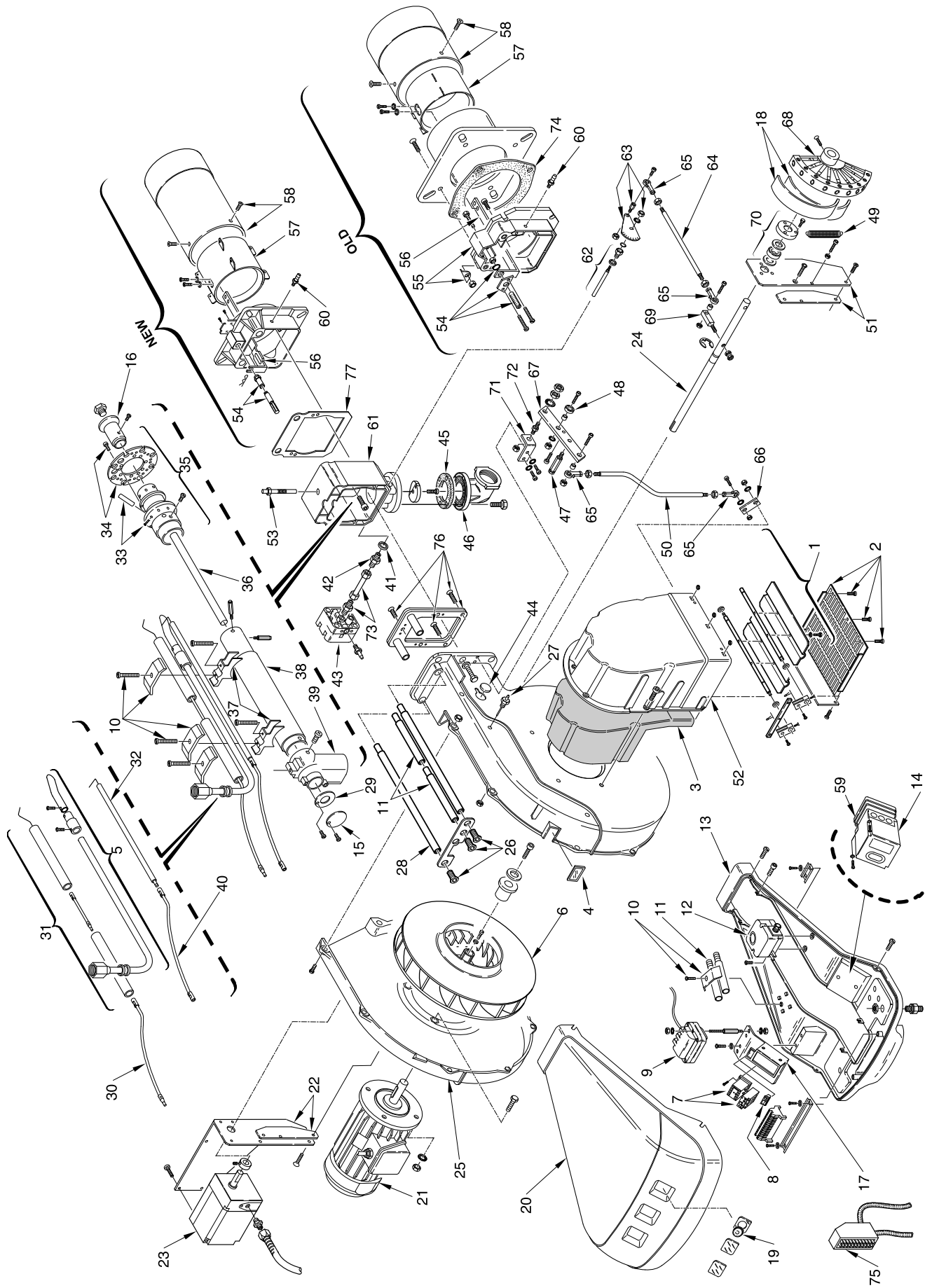
The flame safeguard is in an auxiliary panel.

See the internal electrical systems of the auxiliary panel in order to have the complete wiring diagram.

Key to layout

B4	- Ionisation probe (flame rod)
F1	- Fan motor thermal overload
K1	- Fan motor contactor
MB	- Burner terminal strip
MV	- Fan motor
S10	- Air pressure switch
S12	- High gas pressure switch
SM	- Servomotor
T1	- Ignition transformer
TB	- Burner ground (earth) connection
XQ1	- Plug
XQ2	- Plug
XQ3	- Plug
XQ4	- Plug

SPARE PARTS LIST



N.	CODE	* *				DESCRIPTION	DESCRIZIONE	BURNER SERIAL NUMBER MATRICOLA BRUCIATORE
		C9527300 (3787670)	C9527301 (3787675)	C9727300 (3787673)	C9727301 (3787673)			
1	3012583	•	•	•	•	AIR DAMPER ASSEMBLY	GRUPPO SERRANDA	≤ 02406XXXXXX
1	3013684	•	•	•	•	AIR DAMPER ASSEMBLY	GRUPPO SERRANDA	≥ 02416XXXXXX
2	3003086	•	•	•	•	GRID	PROTEZIONE	≤ 02406XXXXXX
2	3013683	•	•	•	•	GRID	PROTEZIONE	≥ 02416XXXXXX
3	3012553	•	•	•	•	SOUND DAMPING	FONOASSORBENTE	≤ 02406XXXXXX
3	3013682	•	•	•	•	SOUND DAMPING	FONOASSORBENTE	≥ 02416XXXXXX
4	3003763	•	•	•	•	INSPECTION WINDOW	VISORE	
5	3012983	•	•	•	•	PILOT TUBE	TUBO PILOTA	
6	3012976	•	•	•	•	FAN	GIRANTE	
7	3013137	•	•	•	•	OVERLOAD+CONTACTOR 208-230V	RELE' + CONTATTORE 208-230V	
7	3013126	•	•	•	•	OVERLOAD+CONTACTOR 575V	RELE' + CONTATTORE 575V	
8	3012080	•	•	•	•	SWITCH	INTERRUTTORE	
9	3012956	•	•	•	•	TRANSFORMER	TRASFORMATORE	
10	3003409	•	•	•	•	U BOLT	CAVALLOTTO	
11	3003956	•	•	•	•	BAR EXTENSION	PROLUNGA PERNO	≤ 02406XXXXXX
11	3013687	•	•	•	•	BAR EXTENSION	PROLUNGA PERNO	≥ 02416XXXXXX
12	3012948	•	•	•	•	AIR PRESSURE SWITCH	PRESSOSTATO ARIA	
13	3013127	•	•	•	•	BASE PLATE	MENSOLA	
13	3013205	•	•	•	•	BASE PLATE	MENSOLA	
14	C5830008 3012955	•	•	•	•	CONTROL BOX LFL 1.335	APPRECCHIATURA LFL 1.335	
15	3012606	•	•	•	•	DISC	DISCO	
16	3012604	•	•	•	•	GAS NOZZLE	DIFFUSORE	
17	3012343	•	•	•	•	SUPPORT	SUPPORTO	
18	3006097	•	•	•	•	FLAT SPRING	MOLLA	
19	3007627	•	•	•	•	MEMBRAN	MEMBRANA	
20	3012934	•	•	•	•	COVER	COFANO	
21	3012978	•	•	•	•	MOTOR 208-230/460V	MOTORE 208-230/460V	
21	3013062	•	•	•	•	MOTOR 575V	MOTORE 575V	
22	3012979	•	•	•	•	ANCHOR PLATE	PIASTRA	
23	3012944	•	•	•	•	SERVOMOTOR	SERVOMOTORE	
24	3012972	•	•	•	•	SHAFT	ALBERO	
25	3012587	•	•	•	•	HALF-SHELL	GUSCIO	
26	3003481	•	•	•	•	SCREW	VITE	≤ 02406XXXXXX
26	3013681	•	•	•	•	SCREW	VITE	≥ 02416XXXXXX
27	3003891	•	•	•	•	CONNECTOR	RACCORDO	
28	3012013	•	•	•	•	BAR	PERNO	≤ 02406XXXXXX
29	3012588	•	•	•	•	DISC	DISCO	
30	3012959	•	•	•	•	H.T. LEAD	COLLEGAMENTO ELETTRODO	
31	3012980	•	•	•	•	ELECTROD	ELETTRODO	
32	3012178	•	•	•	•	PROBE	SONDA	
33	3012025	•	•	•	•	TUBE	TUBETTO	
34	3012962	•	•	•	•	DISC	DISCO	
35	3012981	•	•	•	•	GAS HEAD	DISTRIBUTORE	
36	3012590	•	•	•	•	INTERIOR TUBE	TUBO INTERNO	
37	3012966	•	•	•	•	SUPPORT	SUPPORTO	

* = Versione minima - Minimum Version

N.	CODE	* *				DESCRIPTION	DESCRIZIONE	BURNER SERIAL NUMBER MATRICOLA BRUCIATORE
		C9527300 (3787670)	C9527301 (3787675)	C9727300 (3787673)	C9727301 (3787673)			
38	3012984	•	•	•	•	EXTERIOR TUBE	TUBO ESTERNO	
39	3012042	•	•	•	•	ELBOW	GOMITO	
40	3012958	•	•	•	•	PROBE LEAD	COLLEGAMENTO SONDA	
41	3007088	•	•	•	•	SEAL	GUARNIZIONE	
42	3003864	•	•	•	•	CONNECTOR	RACCORDO	
43	C5332011 3012969	•	•	•	•	GAS PRESSURE SWITCH	PRESSOSTATO GAS	
44	3003996	•	•	•	•	PLUG	TAPPO	
45	3005482	•	•	•	•	SEAL	GUARNIZIONE	
46	3012971	•	•	•	•	FLANGE AND ELBOW	FLANGIA E GOMITO	
47	3012352	•	•	•	•	BAR	PERNO	
48	3003841	•	•	•	•	BEARING	CUSCINETTO	
49	3012356	•	•	•	•	SPRING	MOLLA	
50	3012646	•	•	•	•	TIE ROD	TIRANTE	
51	3012594	•	•	•	•	ANCHOR PLATE	PIASTRA	
52	3012595	•	•	•	•	AIR INTAKE	BOCCA D'ASPIRAZIONE	≤ 02406XXXXXX
53	3012049	•	•	•	•	SCREW	VITE	
54	3003974	•	•	•	•	CONTROL DEVICE	GRUPPO REGOLATORE	≤ 02406XXXXXX
54	3012639	•	•	•	•	CONTROL DEVICE	GRUPPO REGOLATORE	≥ 02416XXXXXX
55	3012559	•	•	•	•	FRONT PIECE	FRONTONE	≤ 02406XXXXXX
56	3003982	•	•	•	•	SQUARE	SQUADRETTA	≤ 02406XXXXXX
56	3013698	•	•	•	•	SQUARE	SQUADRETTA	≥ 02416XXXXXX
57	3012560	•	•	•	•	SHUTTER	OTTURATORE	
58	3012596	•	•	•	•	END CONE	IMBUTO FIAMMA	≤ 02406XXXXXX
58	3013699	•	•	•	•	END CONE	IMBUTO FIAMMA	≥ 02416XXXXXX
59	C5360002 3013010	•	•	•	•	CONTROL BOX BASE	ZOCOLO	
60	3003322	•	•	•	•	CONNECTOR	RACCORDO	
61	3012982	•	•	•	•	MANIFOLD	MANICOTTO	≤ 02406XXXXXX
62	3012598	•	•	•	•	BUTERFLY VALVE SHAFT	ALBERO MANICOTTO	
63	3012599	•	•	•	•	GRADUATE SECTOR	QUADRANTE	
64	3012600	•	•	•	•	TIE ROD	TIRANTE	≤ 02406XXXXXX
64	3013897	•	•	•	•	TIE ROD	TIRANTE	≥ 02416XXXXXX
65	3006098	•	•	•	•	PIN JOINT	SNODO SFERICO	
66	3012601	•	•	•	•	LEVER	LEVA	
67	3012354	•	•	•	•	LEVER	LEVA	
68	3012358	•	•	•	•	CAM	CAMMA	
69	3012350	•	•	•	•	LEVER	LEVA	
70	3012357	•	•	•	•	BEARING	CUSCINETTO	
71	3012602	•	•	•	•	SUPPORT	SUPPORTO	
72	3012603	•	•	•	•	BAR	PERNO	
73	3013055	•	•	•	•	TUBE	TUBO	
74	3012572	•	•	•	•	FLANGE GASKET	SCHERMO	≤ 02406XXXXXX
75	3013229	•	•	•	•	PLUG	SPINA	
76	3013685	•	•	•	•	PLATES ASSEMBLY	GRUPPO PIASTRE	≥ 02416XXXXXX
77	3013856	•	•	•	•	SEAL	GUARNIZIONE	≥ 02416XXXXXX

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BURNER START UP REPORT

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

GAS OPERATION			
Gas Supply Pressure: _____	CO ₂ : Low Fire _____	High Fire _____	
Main Power Supply: _____	O ₂ : Low Fire _____	High Fire _____	
Control Power Supply: _____	CO: Low Fire _____	High Fire _____	
Burner Firing Rate: _____	NO _x : Low Fire _____	High Fire _____	
Manifold Pressure: _____	Net Stack Temp - Low Fire: _____	High Fire: _____	
Pilot Flame Signal: _____	Comb. Efficiency - Low Fire: _____	High Fire: _____	
Low Fire Flame Signal: _____	Overfire Draft: _____		
High Fire Flame Signal: _____			

OIL OPERATION			
Oil supply pressure: _____	CO ₂ : Low Fire _____	High Fire _____	
Oil suction pressure: _____	O ₂ : Low Fire _____	High Fire _____	
Control Power Supply: _____	CO: Low Fire _____	High Fire _____	
Burner Firing Rate: _____	NO _x : Low Fire _____	High Fire _____	
Low Fire Flame Signal: _____	Net Stack Temp - Low Fire: _____	High Fire: _____	
High Fire Flame Signal: _____	Comb. Efficiency - Low Fire: _____	High Fire: _____	
Low Fire Nozzle Size: _____	Overfire Draft: _____		
High Fire Nozzle Size: _____	Smoke number: _____		

CONTROL SETTINGS			
Operating Setpoint: _____	Low Oil Pressure: _____		
High Limit Setpoint: _____	High Oil Pressure: _____		
Low Gas Pressure: _____	Flame Safeguard Model Number: _____		
High Gas Pressure: _____	Modulating Signal Type: _____		

NOTES



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