Dual Fuel Gas / Light Oil Burners

RLS 70 - 100 - 130

Modulating Gas / Low - High Oil Operation

C6505059

CONTENTS

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 juristiction.

TECHNICAL DATA

Model			RLS 70	RLS 100	RLS 130
Output (1)	Maximum	MBtu/hr (4)	1750 - 3094	2646 - 4396	3500 - 5292
Delivery (1)		kW	513 - 907	775 - 1288	1026 - 1551
		GPH	12.5 - 22.1	18.9 - 31.4	25 - 37.8
	Minimum	MBtu/hr (4)	854	1330	1750
		kW	250	390	513
		GPH	6.1	9.5	12.5
Fuel			#2 Fuel oil Natural gas / Propane gas		
Gas pressure at maximum delivery (2) Gas: Natural gas		"WC	2.44	3.94	4.29
Operation			Low-high light oil Low-high-low / modulating gas		
Nozzles		number	2		
Standard applications			Boilers: water, steam, thermal oil		
Ambient temperature		°F	32 - 104 (0 - 40 °C)		
Combustion air temperature		°F max	140 (60 °C)		
Main power supply (+/- 10%)		V/Ph/Hz	208 - 230 / 460 / 575 /3/60		
Electric motors		rpm	3400		
Fan motor		V	208 - 230 / 460 / 575	208 - 230 / 460 / 575	208 - 230 / 460 / 575
		W - HP	1100 - 1.5	1800 - 2.5	2200 - 3
		A	4.8 - 2.8 - 2.3	6.7 - 3.9 - 3.2	8.8 - 5.1 - 4.1
Pump motor		V	208 - 230 / 460 / 575		
		W - HP	550 - 0.75		
		A	2.6 - 1.5 - 1.2		
Ignition transformer	Oil	V1 - V2	120 V - 2 x 5 kV		
		I1 - I2	3.7 A - 35 mA		
	Gas	V1 - V2	120 V - 1 x 7 kV		
		I1 - I2	1.6 A - 23 mA		
Pump	delivery (at 174 PSI)	GPH	52.5		
	pressure range	PSI	145 - 290		
	fuel temperature	° F max	140 (60 °C)		
Electrical power consumption		W max	2200	3000	3400
Electrical protection			NEMA 1		
Noise levels (3)		dBA	74	77.5	80

(1) Reference conditions: Ambient temperature 68 °F (20°C) - Barometric pressure 394" WC - Altitude 329 ft.
(2) Pressure at test point 18)(A)p.4 with zero pressure in the combustion chamber and maximum burner output.
(3) Sound pressure measured in manufacturer's combustion laboratory, with burner operating on test boiler and at maximum rated output.
(4) Equivalent Btu values based on 1 USGPH = 140,000 Btu/hr.

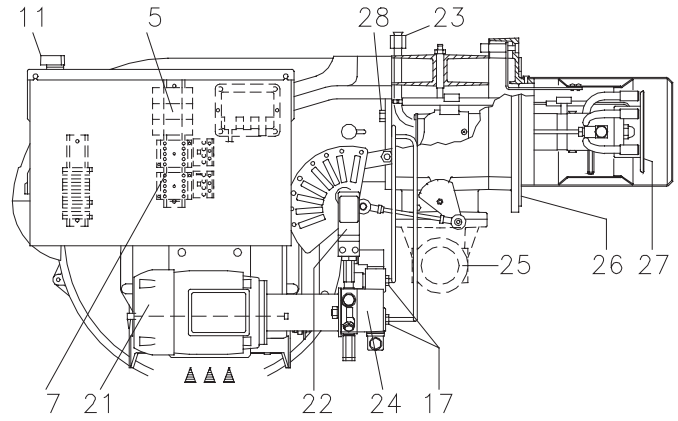
Burner model designations:

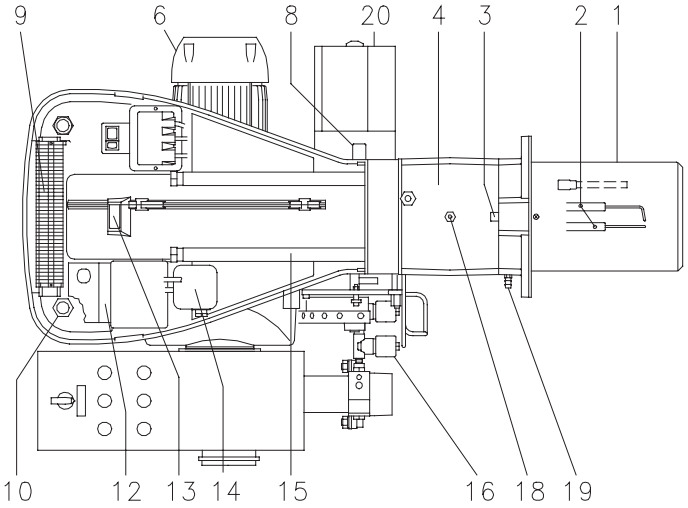
Model	Code	Voltage	Flame safeguard
RLS 70	**C9534000** (3485070)	208-230/460/3/60	Burner mounted
	C9534001 (3485070)	575/3/60	Burner mounted
	C9634000 (3485072)	208-230/460/3/60	Remote panel
	C9634001 (3485072)	575/3/60	Remote panel
RLS 100	**C9535000** (3485270)	208-230/460/3/60	Burner mounted
	C9535001 (3485270)	575/3/60	Burner mounted
	C9635000 (3485272)	208-230/460/3/60	Remote panel
	C9635001 (3485272)	575/3/60	Remote panel
RLS 130	**C9536000** (3485470)	208-230/460/3/60	Burner mounted
	C9536001 (3485470)	575/3/60	Burner mounted
	C9636000 (3485472)	208-230/460/3/60	Remote panel
	C9636001 (3485472)	575/3/60	Remote panel

ACCESSORIES (optional):

- **KIT FOR LENGTHENING THE COMBUSTION HEAD**
  L = Standard length
  L1 = Length obtainable with the kit
  Code **3010267** L = 9 27/32" L1 = 15 5/32" • RLS 70
  Code **3010268** L = 9 27/32" L1 = 15 5/32" • RLS 100
  Code **3010269** L = 9 27/32" L1 = 15 5/32" • RLS 130
- **KIT FOR LPG OPERATION -** Code **3010305:** The kit allows the RLS 70-100-130 burners to operate on LPG**.**
- **GAS TRAIN ACCORDING TO UL STANDARDS:** see page 11.

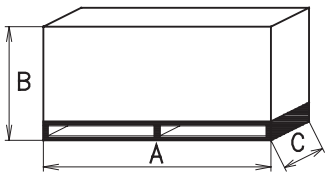
Important:
tThe installer is responsible for the supply and installation of any required safety device(s) not indicated in this manual.



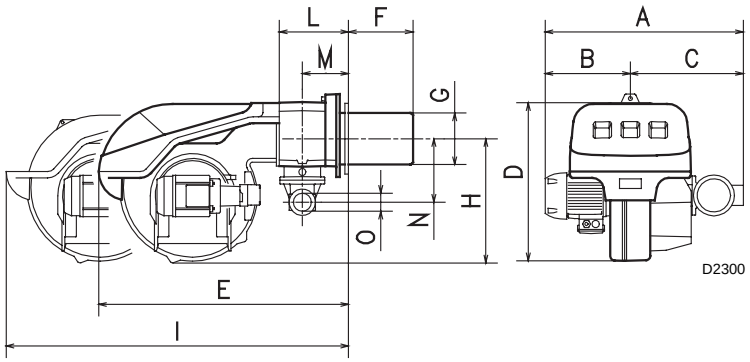


(A) D2299

inch	A	B	C	lbs
RLS 70	$46^{27}/_{32}$“	$29^{1}/_{8}$“	$27^{1}/_{4}$“	159
RLS 100	$46^{27}/_{32}$“	$29^{1}/_{8}$“	$27^{1}/_{4}$“	165
RLS 130	$46^{27}/_{32}$“	$29^{1}/_{8}$“	$27^{1}/_{4}$“	170



(B) D36



D2300

RLS	A	B	C	D	E	F	G	H	I	L	M	N	O
70	$27^{1}/_{2}$“	$11^{3}/_{8}$“	$16^{1}/_{8}$“	$21^{27}/_{32}$“	$33^{3}/_{32}$“	$9^{27}/_{32}$“	$7^{1}/_{16}$“	$16^{15}/_{16}$“	$45^{23}/_{32}$“	$8^{7}/_{16}$“	$5^{9}/_{32}$”	$8^{23}/_{32}$“	2“
100	$28^{7}/_{8}$“	$12^{25}/_{32}$“	$16^{1}/_{8}$“	$21^{27}/_{32}$“	$33^{3}/_{32}$“	$9^{27}/_{32}$“	$7^{1}/_{16}$“	$16^{15}/_{16}$“	$45^{23}/_{32}$“	$8^{7}/_{16}$“	$5^{9}/_{32}$”	$8^{23}/_{32}$“	2“
130	$28^{7}/_{8}$“	$12^{25}/_{32}$“	$16^{1}/_{8}$“	$21^{27}/_{32}$“	$33^{3}/_{32}$“	$9^{27}/_{32}$“	$7^{7}/_{16}$“	$16^{15}/_{16}$“	$45^{23}/_{32}$“	$8^{7}/_{16}$“	$5^{9}/_{32}$”	$8^{23}/_{32}$“	2“

(C)

BURNER DESCRIPTION (A)

1 Combustion head
2 Ignition electrodes
3 Screw for combustion head adjustment
4 Sleeve
5 Relay for oil / gas selection
6 Fan motor
7 Motors contactors and thermal cut-out with reset button
8 UV scanner
9 Terminal strip
10 Knockouts for electrical connections by installer
11 Oil / gas selector switch
12 Flame safeguard
13 Flame inspection window
14 Low air pressure switch (differential operating type)
15 Slide bars for opening the burner and inspecting the combustion head
16 Safety solenoid valve
17 Low and high fire oil valves
18 Gas pressure test point and head fixing screw
19 Air pressure test point
20 Servomotor.
When the burner is not operating the air damper is fully closed in order to reduce heat loss.
21 Pump motor
22 Low oil pressure switch
23 Pilot attachment
24 Pump
25 Gas input connection
26 Boiler mounting flange
27 Flame stability disk
28 Screw securing fan to sleeve

Two types of burner failure may occur:
Flame relay lock-out: if the flame relay 12)(A) pushbutton lights up, it indicates that the burner is in lock-out. To reset, press the pushbutton.
Motor trip: release by pressing the pushbutton on the thermal overload 7)(A).

PACKAGING - WEIGHT (B) - Approximate measurements

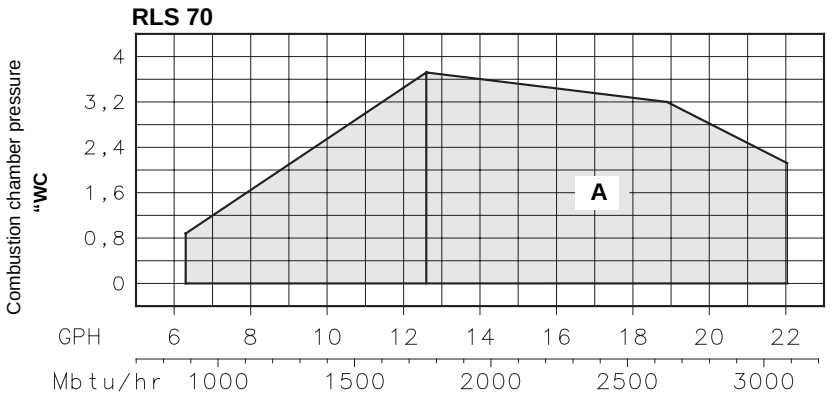
- The burners are skid mounted. Outer dimensions of packaging are indicated in (B).
- The weight of the burner complete with packaging is indicated in Table (B).

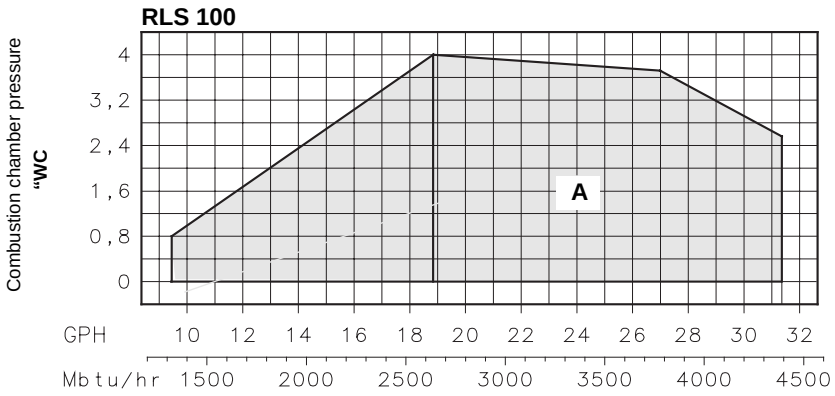
MAX. DIMENSIONS (C) - Approximate measurements

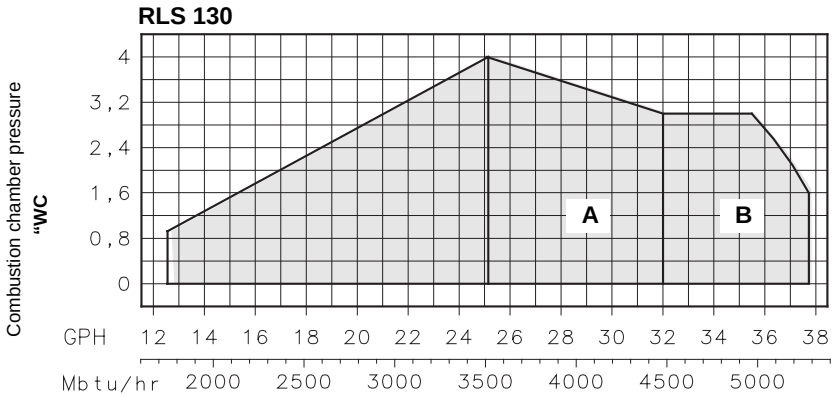
The maximum dimensions of the burners are given in (C).
Inspection of the combustion head requires the burner to be opened and the rear part withdrawn on the slide bars.
The maximum dimension of the burner when open, without casing, is give in measurement I.

STANDARD EQUIPMENT

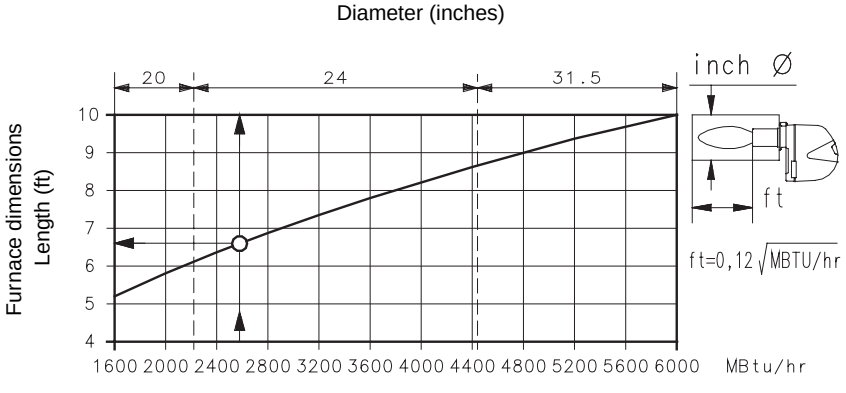
1 - Gas train flange
1 - Flange gasket
4 - Flange fixing screws
1 - Burner head gasket
4 - Screws to secure the burner flange to the boiler: $^{1}/_{2}$ W x $1\,^{3}/_{8}$”
1 - Adaptor G $^{1}/_{8}$“ / $^{1}/_{8}$“ NPT
2 - Flexible hoses
1 - Instruction booklet
1 - Spare parts list







(A) D2301



(B) D2919

FIRING RATES (A)

MAXIMUM OUTPUT must be selected in area A.
In order to increase to area B (RLS 130) it is necessary to perform the calibration of the combustion head as explained on page 6.

MINIMUM OUTPUT must not be lower than the minimum limit shown in the diagram:

RLS 70 = 854 MBtu/hr = 6.1 GPH
RLS 100 = 1330 MBtu/hr = 9.5 GPH
RLS 130 = 1750 MBtu/hr = 12.5 GPH

Important:
The FIRING RATE area values have been obtained considering an ambient temperature of 68 °F, and an atmospheric pressure of 394" WC and with the combustion head adjusted as shown on page 7.

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

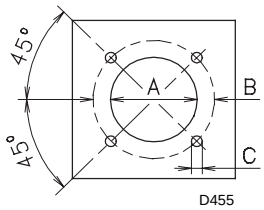
Consult Appendix on page 21 for operation at different ambient temperatures and/or altitudes.

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

inch	A	B	C
RLS 70	$7^{9}/_{32}$“	$10^{27}/_{32}$“ - $12^{25}/_{32}$“	1/2 W
RLS 100	$7^{21}/_{32}$“	$10^{27}/_{32}$“ - $12^{25}/_{32}$“	1/2 W
RLS 130	$7^{21}/_{32}$“	$10^{27}/_{32}$“ - $12^{25}/_{32}$“	1/2 W



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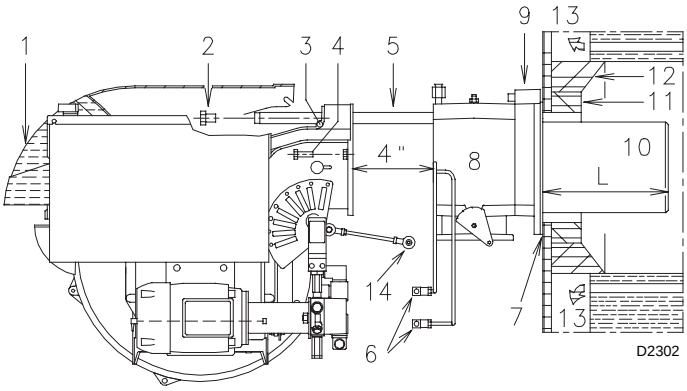

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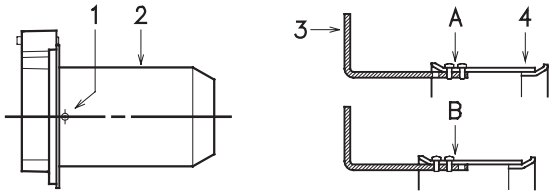
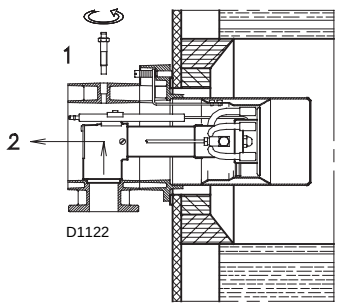


(C)

Nozzle size	GPH			MBtu/hr 174 PSI
	145 PSI	174 PSI	203 PSI	
5.00	6.15	6.79	7.4	951
5.50	6.76	7.46	8.13	1044
6.00	7.4	8.17	8.87	1144
6.50	8.01	8.84	9.61	1238
7.00	8.61	9.51	10.34	1331
7.50	9.22	10.18	11.08	1425
8.00	9.86	10.86	11.82	1520
8.30	10.21	11.27	12.26	1578
8.50	10.47	11.56	12.55	1618
9.00	11.08	12.23	13.29	1712
9.50	11.69	12.90	14.03	1806
10.0	12.3	13.58	14.76	1901
10.5	12.94	14.28	15.49	1999
11.0	13.54	14.95	16.23	2093
12.0	14.76	16.3	17.71	2282
12.3	15.15	16.71	18.16	2339
13.0	16.01	17.64	19.18	2470
13.8	17.0	18.73	20.27	2622
14.0	17.23	19.02	20.65	2663
15.0	18.48	20.37	22.16	2852
15.3	18.83	20.78	22.57	2909
16.0	19.69	21.74	23.63	3044
17.0	20.94	23.09	25.1	3514

(D)



(E)

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 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, it must be greater than the thickness of the boiler door complete with its insulation. The range of lengths available, L (inch), is as follows:

Blast tube 10):	RLS 70	RLS 100	RLS 130
• short	$9^{27}/_{32}$“	$9^{27}/_{32}$“	$9^{27}/_{32}$“
• long	$15^{5}/_{32}$“	$15^{5}/_{32}$“	$15^{5}/_{32}$“

For boilers with front flue passes 13) or flame inversion chambers, insulation material 11) must be inserted between the refractory 12) and the blast tube 10).
This protective insulation must not compromise the extraction of the blast tube.
For boilers having a water-cooled front, the insulation 11)-12)(B) is not required unless it is required by the boiler manufacturer.

SECURING THE BURNER TO THE BOILER (B)

Detach the combustion head from the burner, fig. (B):
- Disconnect the oil pipes by unscrewing the two connectors 6)
- Loosen the 4 screws 3) and remove the cover 1)
- Remove the screws 2) from the slide bars 5)
- Remove the 2 screws 4) and pull the burner back on slide bars 5) by about 4”.
- Disconnect the electrode wires and then pull the burner completely off the slide bars.

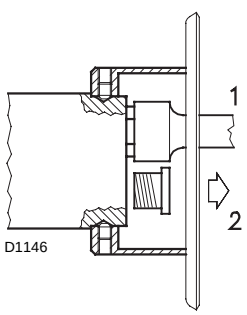
COMBUSTION HEAD CALIBRATION

At this point check, on model RLS 130, whether the maximum delivery of the burner is contained in area A or in area B of the firing rate. See page 5.
If it is in area A then no adjustment is required.
If it is in area B:
- Unscrew the screws 1)(C) and disassemble the blast tube 2).
- Move the fixing of the rod 3)(C) from position A to position B, thereby causing the shutter 4) to retract.
- Now refit the blast tube 2)(C) and the screws 1).

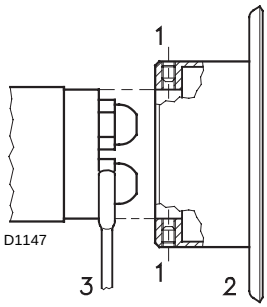
Once this operation has been carried out, secure the flange 9)(B) to the boiler plate, inserting the gasket 7)(B) supplied with the burner. Use the 4 screws, also supplied with the unit, after first protecting the thread with an anti-seize product. Tighten the seal between burner and boiler.

NOZZLE SELECTION

Both nozzles must be chosen from among those listed in Table (D).
The first nozzle determines the delivery of the burner in low fire.
The second nozzle combines together with the 1st nozzle to determine the total firing rate at high fire.
The total firing rates of low and high fire must be contained within the value range indicated on page 3.
Use nozzles with a 60° spray angle at the recommended pressure of 174 PSI.
The two nozzles have equal deliveries rates

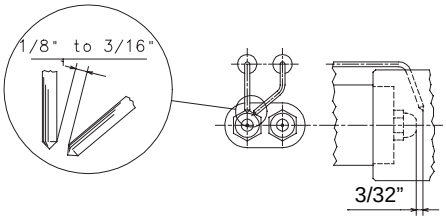


(A)



(B)

ELECTRODE POSITION (for OIL operation)



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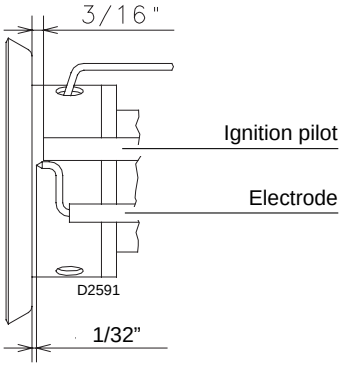

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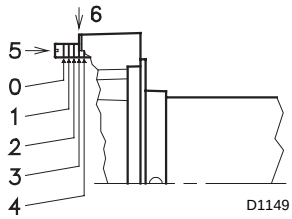

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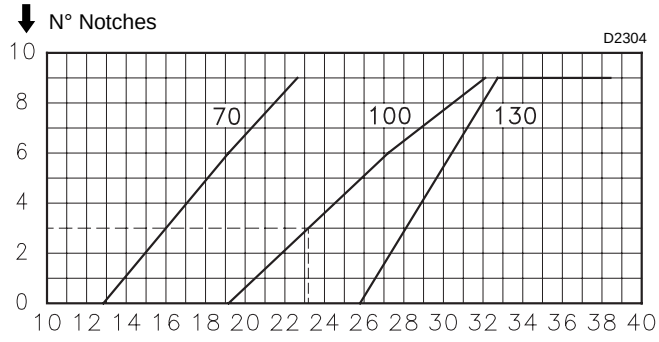

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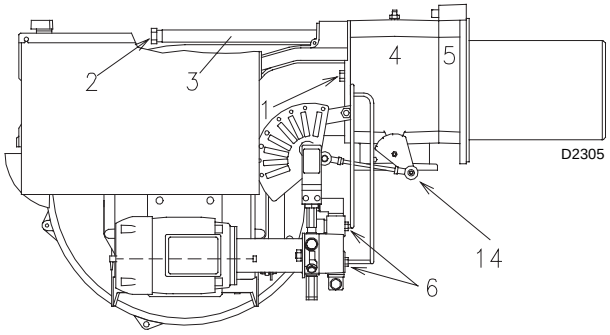


(G)

MB - Burner terminal strip

(H)

D2317

NOZZLE ASSEMBLY

Remove screw 1)(E) and extract the nozzle assembly 2)(E) (see page 6). Install both nozzles 1)(A), after having removed the plastic plugs 2)(A), fitting the wrench through the central hole in the flame stability disk or loosen screws 1)(B), remove disk 2)(B) and replace the nozzles using the wrench 3)(B).
Do not use any sealing products such as gaskets, sealing compound, or tape. Be careful to avoid damaging the nozzle sealing seat. The nozzles must be screwed into place tightly but carefully.
The nozzle for low fire operation is the one lying beneath the firing electrodes Fig. (C).

Make sure that the electrodes are positioned as shown in Figure (C).
Refit the burner to the slide bars 3)(G) at approximately 4" from the sleeve 4) - burner positioned as shown in fig. (B)p. 6 - insert the ignition electrode cables and then slide the burner up to the sleeve so that it is positioned as shown in fig. (G).
Refit screws 2)(G) on slide bars 3).
Secure the burner to the sleeve by tightening screws 1).
Connect the oil pipes again by screwing on the two connectors 6)(B)p.6.

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

ADJUSTMENTS BEFORE FIRST FIRING (light-oil operation)

• Combustion head setting
The setting of the combustion head depends exclusively on the maximum delivery of the burner.
Turn screw 5)(E) until the notch shown in diagram (F) is level with the front surface of flange 6)(E).

Example: Burner RLS 100
maximum burner delivery = 23.1 GPH.
If diagram (F) is consulted it is clear that for this delivery, the combustion head must be adjusted using notch 3, as shown in fig. (E).

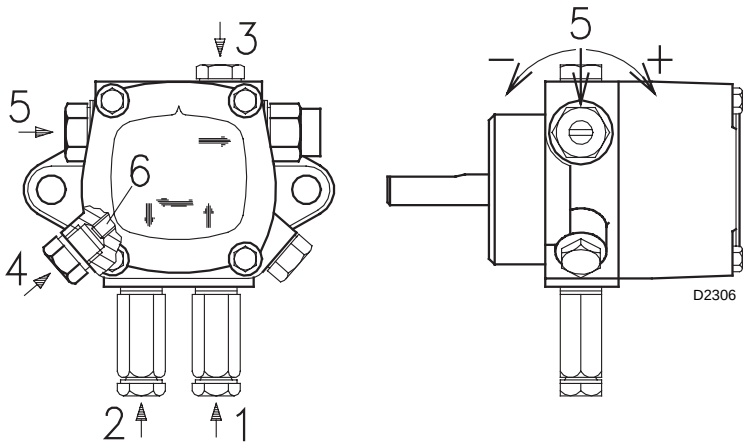
• Pump adjustment
No settings are required for the pump, which is set to 174 PSI by the manufacturer. This pressure must be checked and adjusted (if required) after the burner has been ignited.
The only operation required in this phase is the application of a pressure gauge on the appropriate pump attachment.

• Air damper adjustment
The first time the burner is fired leave the factory setting unchanged for both low and high fire operation.

• Ignition pilot adjustment
Place the pilot and electrode as shown in fig. (D).
The pilot works correctly at pressures ranging from 6 - 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. (H), this way the main valve will not be energized.
- 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**".

PUMP
SUNTEC AJ6 CC



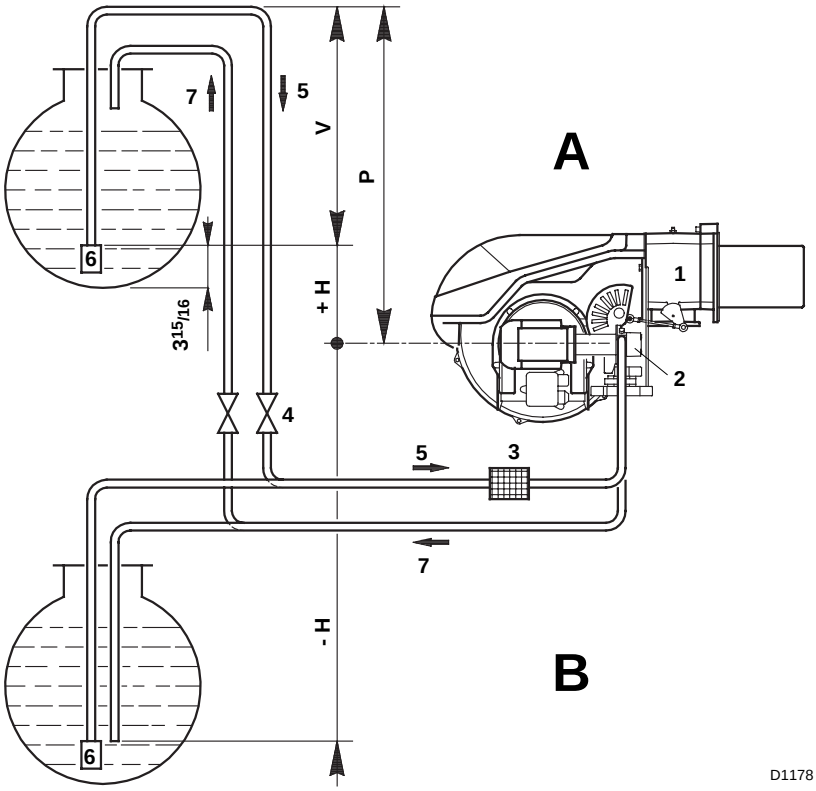
		AJ6 CC
A	GPH	52.5
B	PSI	145 - 290
C	PSI	6.5
D	cSt	2.8 - 75
E	°F - °C	140 - 60
F	PSI	29
G	PSI	174
H	inch	0.006

(A)

PUMP (A)

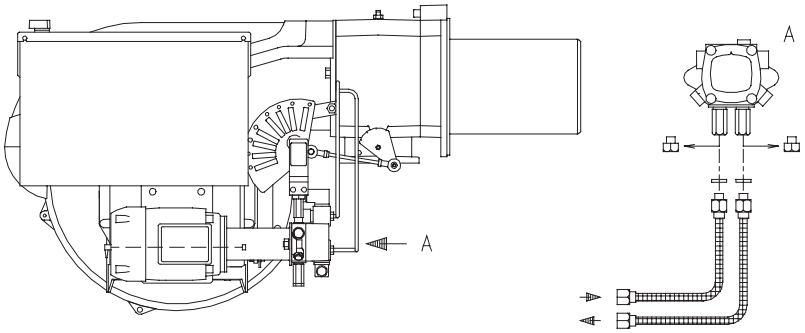
1	- Suction	1/4” NPT
2	- Return	1/4” NPT
3	- Pressure gauge attachment	G 1/8”
4	- Vacuum gauge attachment	G 1/8”
5	- Pressure regulator	

A - Min. delivery rate at 174 PSI pressure
B - Delivery pressure range
C - Max. suction
D - Viscosity range
E - Max fuel oil temperature
F - Max. suction and return pressure
G - Pressure calibration in the factory
H - Filter mesh width



+ H - H ft	L ft RLS 70 - 100 - 130 Ø inch		
	1/2"	9/16"	5/8"
+ 13	234	454	493
+ 10	204	401	493
+ 6.6	174	349	493
+ 3.3	145	296	493
+ 1.6	132	270	493
0	118	243	451
- 1.6	105	217	405
- 3.3	92	191	359
- 6.6	63	138	266
- 10	33	86	174
- 13	-	33	82

(A)



(B)

FUEL SUPPLY (A)

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

The tank higher than the burner **A**

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

The tank lower than the burner **B**

Pump suction pressures higher than 6.5 PSI must not be exceeded because at higher levels gas is released from the fuel, the pump starts making noise and its working life-span decreases.

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

Key

H = Pump/Foot valve height difference
L = Piping length
Ø = Inside pipe diameter
1 = Burner
2 = Pump
3 = Filter
4 = Manual on/off valve
5 = Suction line
6 = Foot valve
7 = Return line

HYDRAULIC CONNECTIONS (B)

The pumps are equipped with a by-pass that separates return line and suction line. The pumps are installed on the burner with the by-pass closed by screw 6), see diagram page 18.

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

Damage to the pump seal will occur immediately if it is run with the return line closed and the by-pass screw inserted.

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

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

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

Install the hoses where they cannot be stepped on or come into contact with hot surfaces of the boiler and where they do not hamper the opening of the burner.

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

PUMP PRIMING

- **Before starting the burner, make sure that the tank return line is not clogged. Obstructions in the line could cause damage to the pump seal.** (The pump leaves the factory with the by-pass 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.
- For self-priming to take place, one of the screws 3) of the pump (See fig.(A) page 8) must be loosened in order to bleed off the air contained in the suction line.

RLS 70 Δp (“ WC)

MBtu/hr	1	2
1750	2.17	0.08
1950	2.20	0.08
2140	2.24	0.12
2329	2.28	0.12
2519	2.32	0.12
2708	2.36	0.16
2897	2.40	0.16
3094	2.44	0.16

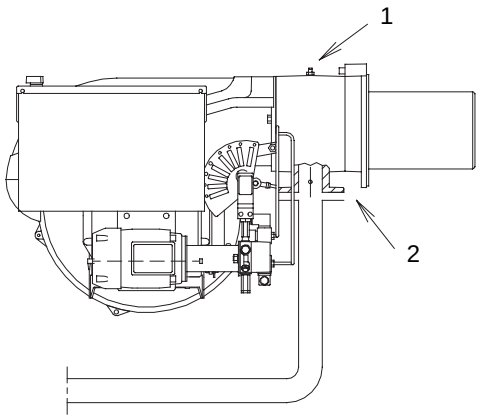
RLS 100 Δp (“ WC)

MBtu/hr	1	2
2646	3.15	0.16
2878	3.27	0.16
3125	3.39	0.20
3371	3.50	0.20
3616	3.62	0.24
3863	3.70	0.28
4109	3.82	0.31
4396	3.94	0.31

RLS 130 Δp (“ WC)

MBtu/hr	1	2
3500	3.66	0.39
3825	3.74	0.43
4128	3.82	0.51
4431	3.90	0.59
4734	4.09	0.67
5037	4.29	0.71

(A)



(B)

D2309

GAS PRESSURE

The adjacent tables show minimum pressure losses along the gas supply line depending on the maximum burner output.

Column 1
Pressure loss at combustion head.
Gas pressure measured at test point 1)(B), with:
- Combustion chamber at 0” WC
- Burner operating at maximum output
- Natural gas

Column 2
Pressure loss at butterfly valve.

Calculate the approximate high fire 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 for the burner in question.
- Read off the corresponding output on the left.

Example - RLS 100
- Maximum output operation
- Natural gas
- Gas pressure at test point 1)(B) = 4.41” WC
- Pressure in combustion chamber = 0.79” WC

4.41 - 0.79 = 3.62” WC

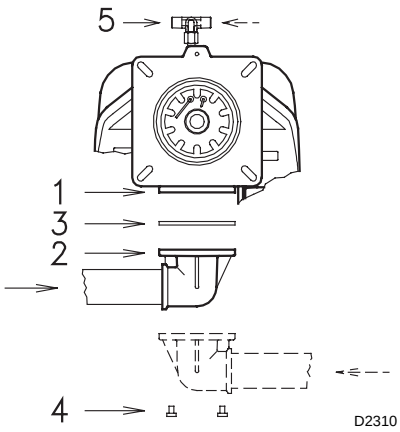
A maximum output of 3616 MBtu/hr shown in Table RLS 100 corresponds to 3.62” WC pressure, column 1, natural gas.
This value serves as a rough guide, the effective delivery must be measured at the gas meter.

To calculate the required gas pressure at test point 1)(B), set the maximum output required from the burner:
- find the nearest output value in the table for the burner in question.
- Read off the pressure at test point 1)(B) on the right in column 1.
- Add this value to the estimated pressure in the combustion chamber.

Example - RLS 100
- Maximum required burner output: 3616 MBtu/hr
- Natural gas
- Gas pressure at burner output of 3616 MBtu/hr, taken from table RLS 100, column 1, natural gas = 3.62” WC
- Pressure in combustion chamber = 0.79” WC

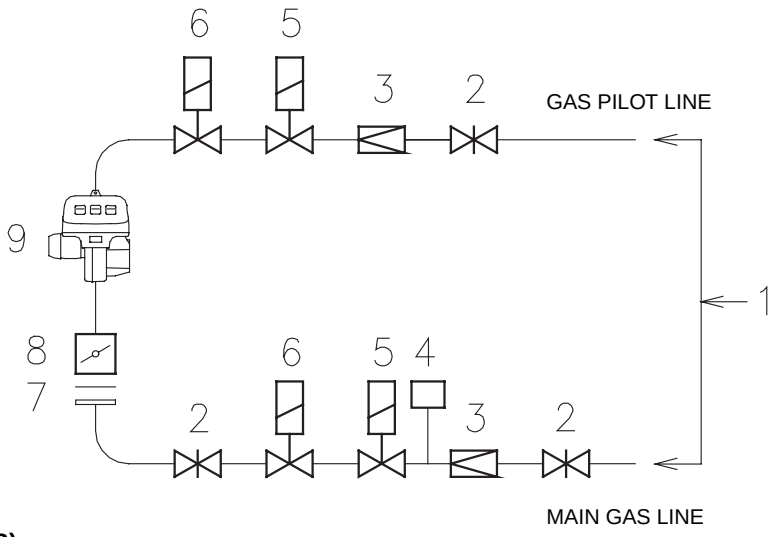
3.62 + 0.79 = 4.41” WC

pressure required at test point 1)(B).



(A)

TYPICAL UL SCHEMATIC GAS PIPING



(B)

GAS LINE

- 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 main gas train can enter the burner from the right or left side, see fig. (A).
- Gas safety shut-off valves 5)-6)(B) 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.

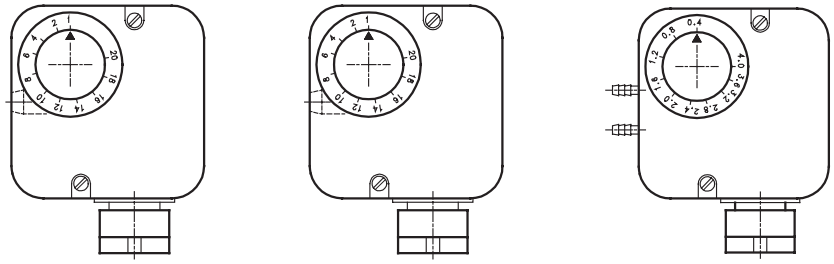
Note

See the accompanying instructions for the gas train lay out.

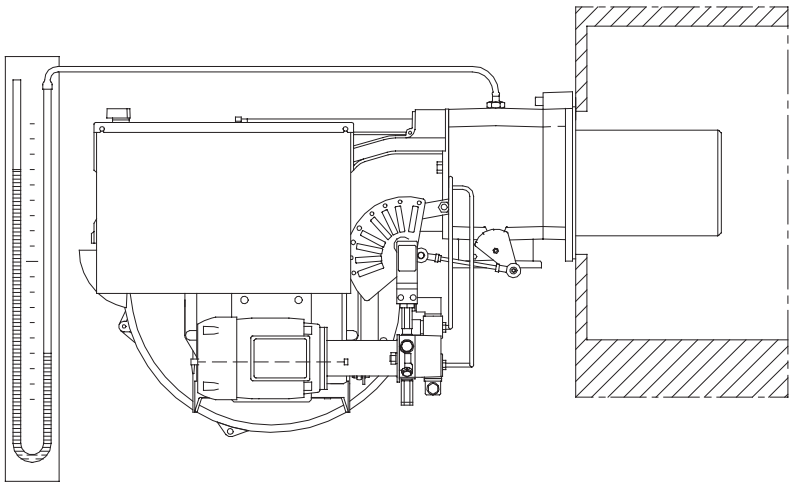
KEY TO LAYOUT (B)

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

LOW GAS PRESSURE SWITCH HIGH GAS PRESSURE SWITCH AIR PRESSURE SWITCH



(A) **(B)** **(C)**



(D) D2312

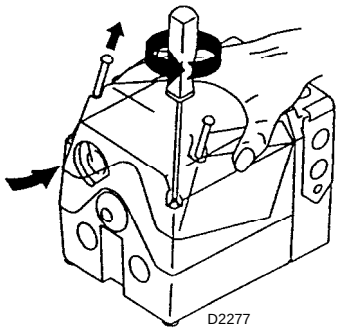
ADJUSTMENTS BEFORE FIRST FIRING

Adjustment of the combustion head has been illustrated on page 7.

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 upper limit 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 MAX. burner power using the tables on page 10.

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.



(A)

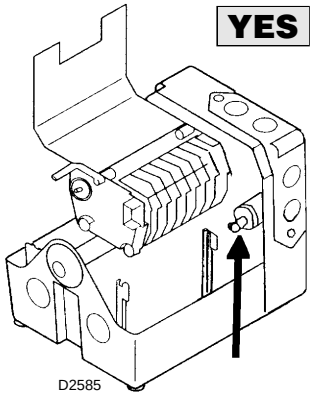
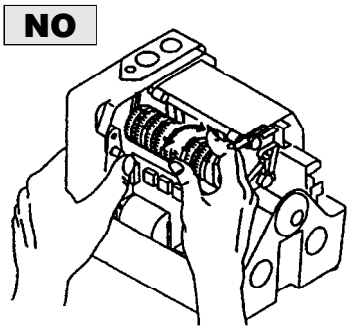
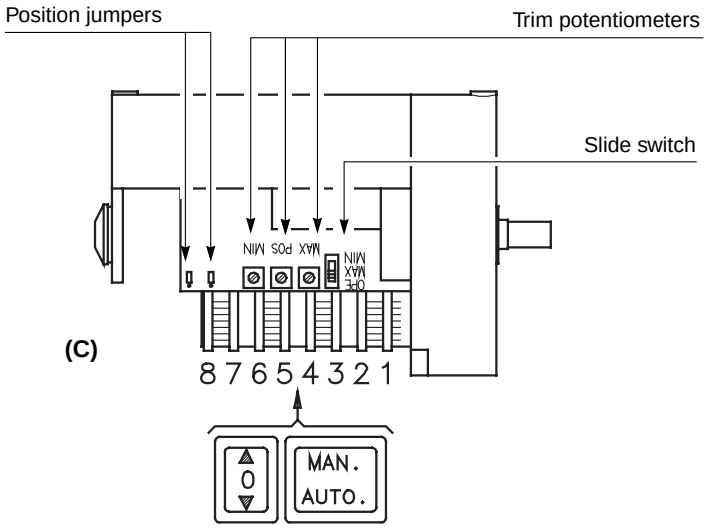


Figure above shows how the servomotor is released to manually check there is no binding though its motion.



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

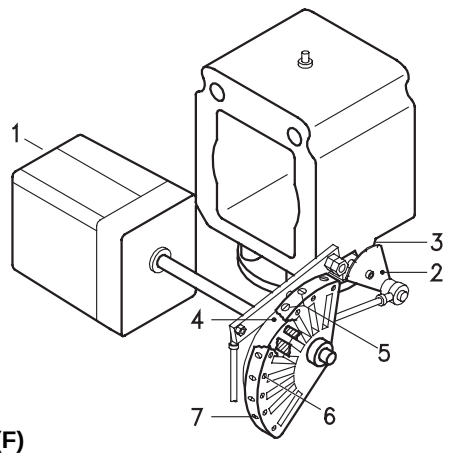
(B)



(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, just 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 POTENTIOMETERS FUNCTIONS

Cam 1: 130° (GAS only)
Limits rotation towards maximum for gas.

Cam 2: 0° (GAS and OIL)
Limits rotation towards minimum, air damper closed on stand by.

Cam 3: 20° (GAS only)
Limits gas ignition regulation.

Cam 4: 120° (OIL only)
Limits rotation towards maximum, high fire.

Cam 5: 30° (OIL only)
Regulates ignition position and low fire.

Cam 6: 110° (OIL only)
Regulates the valve control position high fire.
It must always be ahead of cam 5.

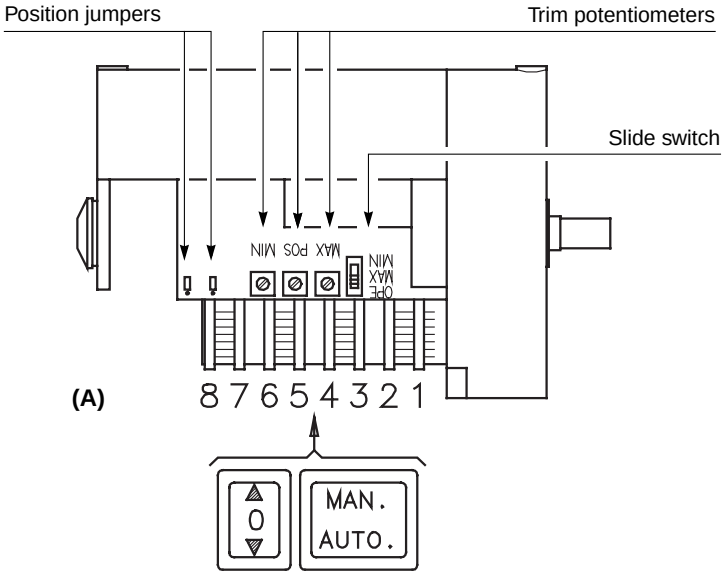
Cams 7 - 8: not used

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

Trim potentiometer MIN (gas only)
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 POTENTIOMETERS.

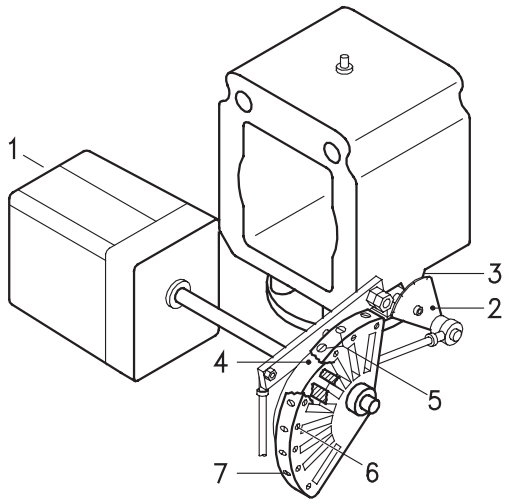
When the settings are complete, place the slide switch on OPE (operate).



(A)

(B) (C)

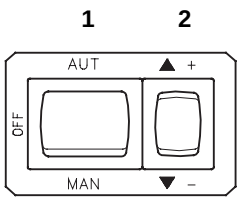
D2593



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



D791

(E)

BURNER STARTING

Turn the selection switch 11)(A), page 4 to the OIL position.

FUEL OIL ADJUSTMENT

Perform a visual setting (without taking a smoke test), which will be perfected after setting the gas.
Close the remote controls, with the servomotor switch in fig. (C) in the AUTO position and the switch in fig. (E) in the AUT position.
After firing, turn the switch (C) to MAN position.
The servomotor should be placed at app. 30° (cam 5); if not, use the button (B) "decrease output" to stop cam 5 (low fire position). Adjust cam 5 in opening and closing, according to needs.
Use the button (B) "increase output" until it stops (app. 120°, cam 4 - high fire position).
Adjust cam 4.
Attention: do not exceed 130°, this would cause mechanical problems in the variable profile cam 4)(D).
If you go below 110° (set on cam 6) the oil valve closes, therefore set cam 6 at app. 10° before setting cam 4.

GAS ADJUSTMENT

Turn the selector switch 11)(A) page 4, to the gas position.
Close the operation controls, 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 in fig. (E) in the AUT position.

MAXIMUM OUTPUT

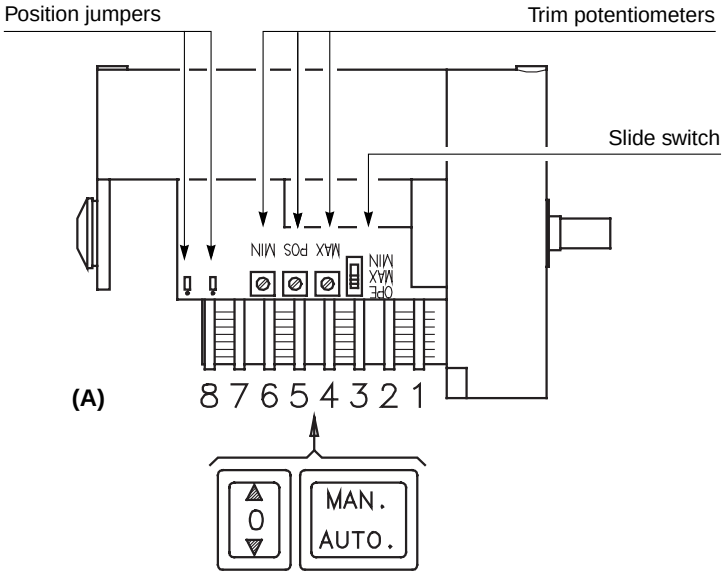
Using button (B), "increase output" until it stops, app. 130° (cam 1).
Place the slide switch on MAX and set the relative MAX trim potentiometer (setting must be very near to 130°) to exploit as far as possible the variable profile cam 4)(D) and have the gas butterfly valve on maximum opening, graduated sector 2) on index 3) fig. (D).
The setting of the gas flow must be made at the gas 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).

Important

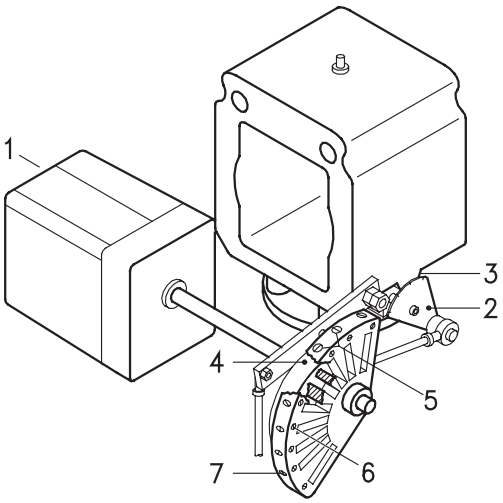
The gas output must be higher than the oil output; if not the stroke of the servomotor cannot be increased above 130°.

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 (gas only) 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.

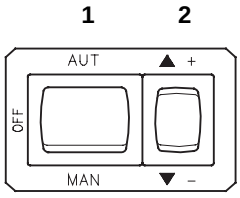


(A) **(B)** **(C)** D2593



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



D791

(E)

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 15 and manually turn cam 4)(D) to check the cam is not binding during rotation.

Definitive fuel-oil adjustment
Setting is made only by adjusting the servomotor cam: cam 4 for high fire oil and cam 5 for low fire oil.
Do not change the profile of cam 4)(D), which has already been set for gas.

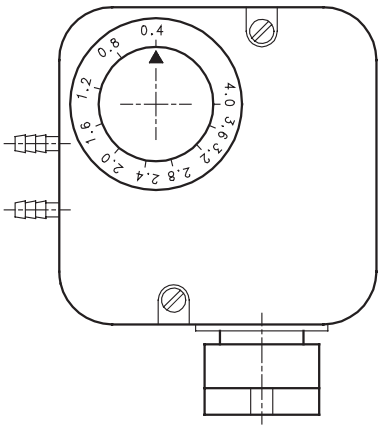
Turn the selection switch 11)(A) page 4 to OIL.
Turn the burner on with switch C) on AUTO and the slide switch on OPE.
After firing, turn the switch 1)(E) to MAN position, use button 2)(E) to "decrease output" until cam 5 stops, which had previously been set and then make the definitive setting for low fire oil, opening or closing the cam to obtain optimum combustion.
Use button 2)(E) "increase output" until cam 4 stops, which had previously been set, and make the definitive setting for high fire oil, opening or closing the cam for optimum combustion.

N.B.
Cam 4 must not be set above 130° (it must not exceed cam 1, gas maximum).
Cam 6, which commands the high fire oil valve, must always be ahead of cam 4.

GAS COMBUSTION CHECKS

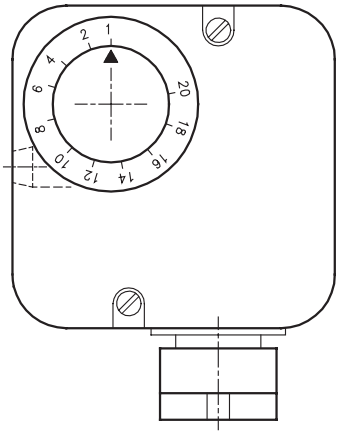
CO_2
It is better to set the burner with CO_2 not higer than 10% (with natural gas). In this way avoiding a loss of calibration setting (for example draft variation) that could cause combustion with little air and the production of CO.
CO
It must be not higher than 400 PPM.

AIR PRESSURE SWITCH



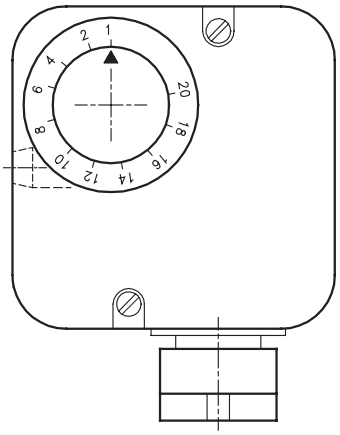
(A) D2548

HIGH GAS PRESSURE SWITCH



(B) D2547

LOW GAS PRESSURE SWITCH



(C) D2547

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 prevent 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 such a manner the air pressure switch operates as differential pressure switch.

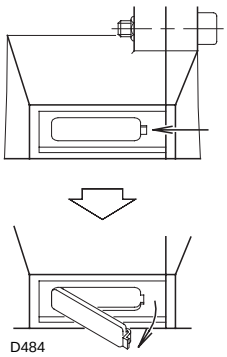
HIGH GAS PRESSURE SWITCH (B)

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)

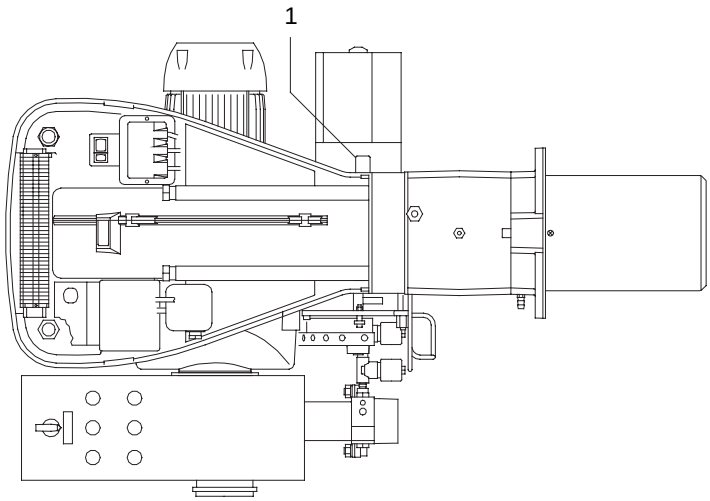
Adjust the low gas pressure switch after having performed all the other burner adjustments with the pressure switch set at the start of the scale (C).
With the burner operating at MAX output, increase adjustment pressure by slowly turning the relative dial clockwise until the burner locks out.
Then turn 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 INSPECTION WINDOW



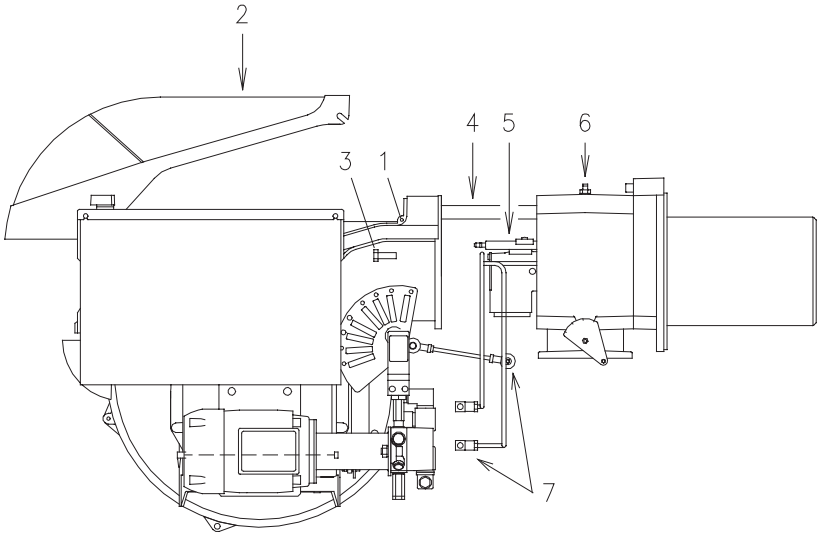
(A)

UV SCANNER



(B) D2432

OPENING THE BURNER



(C) D2433

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 7)(C).

Nozzles (fuel oil)
Do not clean the nozzle orifices. The nozzle filters however may be cleaned or replaced as required.
Replace the nozzles every 2-3 years or whenever necessary. Combustion must be checked after the nozzles have been changed.

UV scanner
Clean the glass cover from any dust that may have accumulated. The scanner 1)(B) is held in position by a pressure fit and can therefore be removed by pulling it outward forcefully.

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

Burner
Check for excess wear or loose screws. Also make sure that the screws securing the electrical leads in the burner connections are fully tightened.
Clean the outside of the burner.

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.

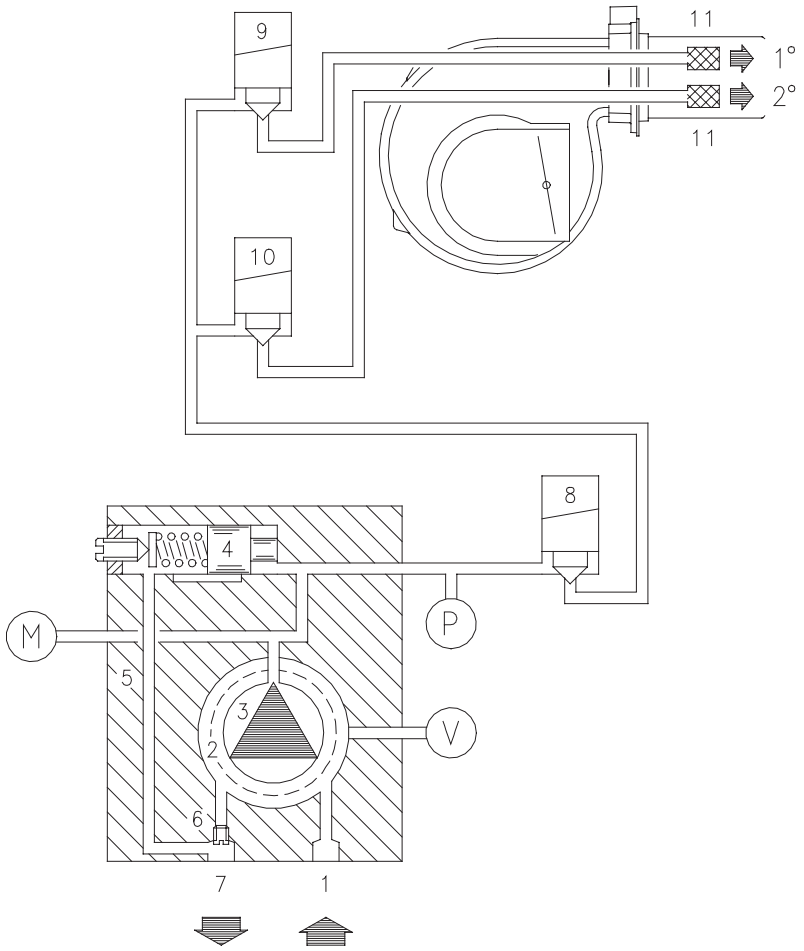
TO OPEN THE BURNER (C):

- Switch off the electrical power
- Loosen screws 1) and withdraw the cover 2)
- Disengage the swivel coupling 7) from the graduated sector.
- Disconnect the light-oil pipes.
- Remove screws 3) and pull the burner back by about 4” on the slide bars. Disconnect the electrode leads and then pull the burner fully back.

Now extract the internal part 5) after having removed the screw 6).

TO CLOSE THE BURNER (C):

- 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 leads gently out until they are slightly stretched.
- Re-couple the swivel coupling 7) to the graduated sector.
- Reconnect the light-oil pipes.



(A) D2592

OIL HYDRAULIC SYSTEM LAYOUT (A)

1 Pump suction
2 Filter
3 Pump
4 Pressure regulator
5 Return pipe
6 By-pass screw
7 Pump return
8 Safety solenoid
9 Low fire valve
10 High fire valve
11 Filter
M Pressure gauge
P low oil pressure switch
V Vacuum gauge

OIL PRESSURE SWITCH

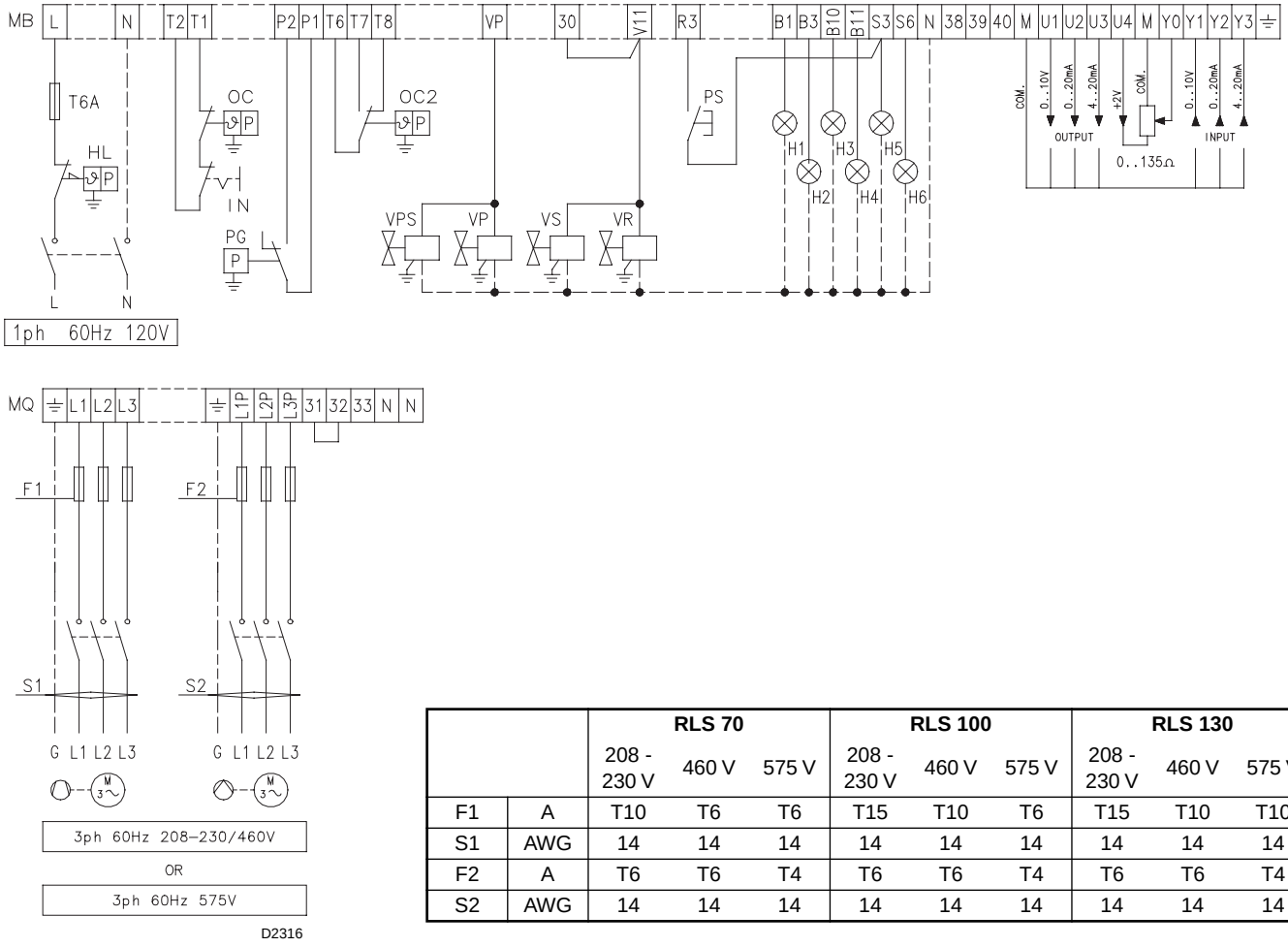
The oil pressure switch 22)(A) page 4 is factory set to 145 PSI (10 bar). If the oil pressure goes down to this value, the pressure switch stops the burner.

Factory Wiring Diagram RLS 70 - 100 - 130

With burner mounted Siemens LFL control
See attached insert for wiring diagram

Field Wiring Diagram RLS 70 - 100 - 130

With burner mounted Siemens LFL control



		RLS 70			RLS 100			RLS 130		
		208 - 230 V	460 V	575 V	208 - 230 V	460 V	575 V	208 - 230 V	460 V	575 V
F1	A	T10	T6	T6	T15	T10	T6	T15	T10	T10
S1	AWG	14	14	14	14	14	14	14	14	14
F2	A	T6	T6	T4	T6	T6	T4	T6	T6	T4
S2	AWG	14	14	14	14	14	14	14	14	14

(A) **(B)**

Fuses and wire size layout (A), see table (B).
Wire size when not indicated: AWG18

Key to layouts (A)

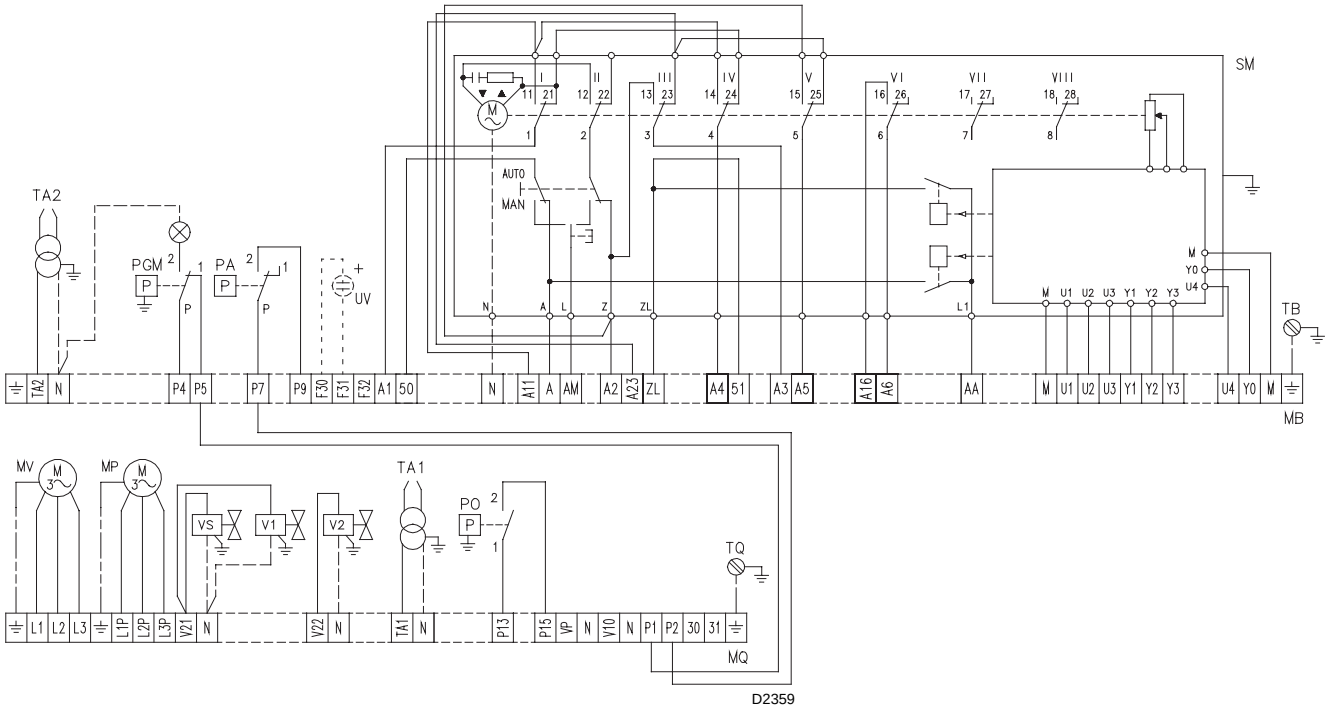
IN - Burner manual stop switch
MB - Burner terminal strip
MQ - Panel terminal strip
H1 - Adjustment valve signal
H2 - Pilot valve signal
H3 - Power on signal
H4 - Permission ok
H5 - Remote lock-out signal
H6 - Remote motor lock-out signal
PG - Low gas pressure switch
PS - Remote lock-out reset
OC2 - 2 stage control
OC - Operating control
HL - High limit.
VP - Pilot valve
VPS - Pilot valve (safety)
VR - Adjustment valve
VS - Safety valve

NOTES

- The setting of the thermal overload must be according to the total burner amperage draw.
- The RLS 70-100-130 burners leave the factory preset for 208-230 V power supply. If 460 V power supply is used, change the fan motor connection from delta to star and change the setting of the thermal overload as well.
- The RLS 70-100-130 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.

Factory Wiring Diagram RLS 70 - 100 - 130

With remote control panel



(A)

LAYOUT (A)
Burners RLS 70 - 100 - 130
The flame safeguard is in remote panel.
See the internal electrical systems of the remote panel in order to have the complete wiring diagram.

Key to layout (A)

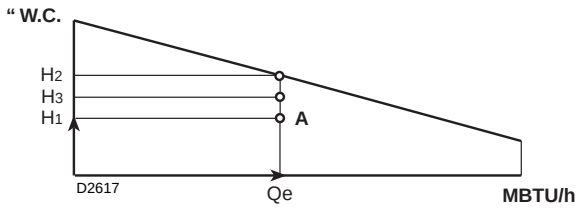
CMP - Pump motor contactor
CMV - Fan motor contactor
DA - LFL Control box
K... - Relay
MB - Burner terminal strip
MP - Pump motor
MQ - Panel terminal strip
MV - Fan motor
PA - Air pressure switch
PO - Oil pressure switch
PGM - High gas pressure switch
RT - Thermal overload (fan motor)
RT1 - Thermal overload (pump motor)
SM - Servomotor
S1 - Oil/gas selector
S2 - Switch for following operations:
MAN = manual
AUT = automatic
OFF
S3 - Button for:
- = power reduction
+ = power increase
TA - Ignition transformer (oil)
TA1 - Ignition transformer (pilot)
TB - Burner ground
UV - UV cell
V1 - 1st stage oil valve
V2 - 2nd stage oil valve
VS - Safety oil valve

APPENDIX - Burner firing rates according to air density

above sea level		average barom. pressure		CORRECTION FACTOR **F**							
				Air temperature **°F (°C)**							
ft	m	" W.C.	mbar	0 (0°C)	41 (5°C)	50 (10°C)	59 (15°C)	68 (20°C)	77 (25°C)	86 (30°C)	104 (40°F)
0	0	399	1013	1,087	1,068	1,049	1,031	1,013	0,996	0,980	0,948
329	100	394	1000	1,073	1,054	1,035	1,017	1,000	0,983	0,967	0,936
658	200	389	989	1,061	1,042	1,024	1,006	0,989	0,972	0,956	0,926
987	300	385	978	1,050	1,031	1,013	0,995	0,978	0,962	0,946	0,916
1316	400	380	966	1,037	1,018	1,000	0,983	0,966	0,950	0,934	0,904
1645	500	376	955	1,025	1,007	0,989	0,972	0,955	0,939	0,923	0,894
1974	600	372	944	1,013	0,995	0,977	0,960	0,944	0,928	0,913	0,884
2303	700	367	932	1,000	0,982	0,965	0,948	0,932	0,916	0,901	0,872
2632	800	363	921	0,988	0,971	0,954	0,937	0,921	0,906	0,891	0,862
2961	900	358	910	0,977	0,959	0,942	0,926	0,910	0,895	0,880	0,852
3290	1000	354	898	0,964	0,946	0,930	0,914	0,898	0,883	0,868	0,841
3947	1200	346	878	0,942	0,925	0,909	0,893	0,878	0,863	0,849	0,822
4605	1400	337	856	0,919	0,902	0,886	0,871	0,856	0,842	0,828	0,801
5263	1600	329	836	0,897	0,881	0,866	0,851	0,836	0,822	0,808	0,783
5921	1800	321	815	0,875	0,859	0,844	0,829	0,815	0,801	0,788	0,763
6579	2000	313	794	0,852	0,837	0,822	0,808	0,794	0,781	0,768	0,743

(A)

The FIRING RATE area values have been obtained considering a surrounding temperature of 68°F (20°C), and an atmospheric pressure of 398" W.C. and with the combustion head adjusted as shown on page 7.
The burner may be required to operate with combustion 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:



(B)

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 (MBtu/hr)

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.

H_3 = H_2 x F (" W.C.)

If H3 is greater than H1, as shown in Fig. (B), the burner delivers 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

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

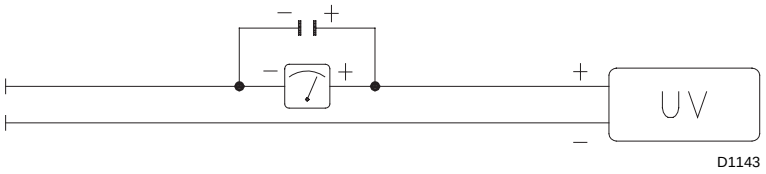
Example, a 5% delivery reduction:

Qr = Q x 0.95

H1r = H1 x $(0.95)^2$

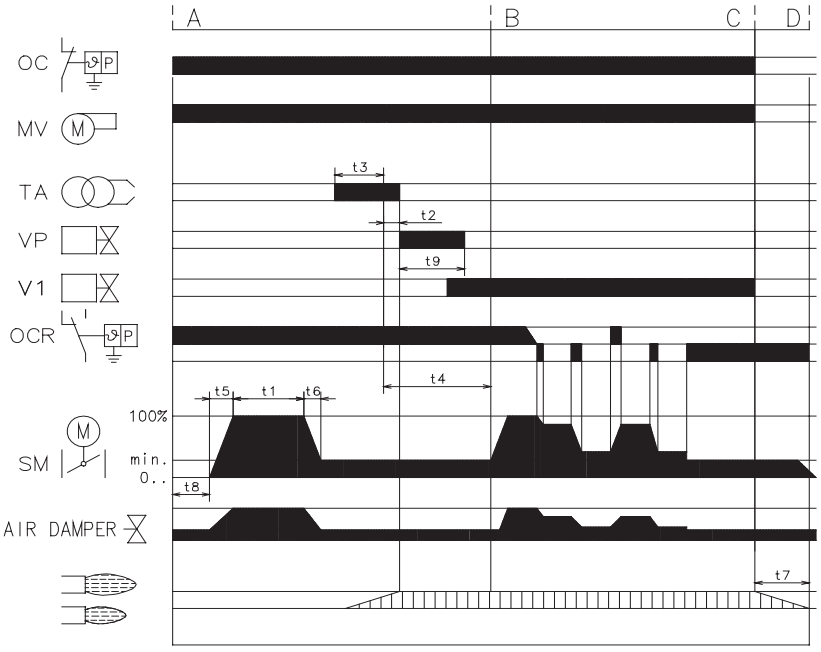
Steps 2 - 5 must now be repeated using the new Qr and H1r values.

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



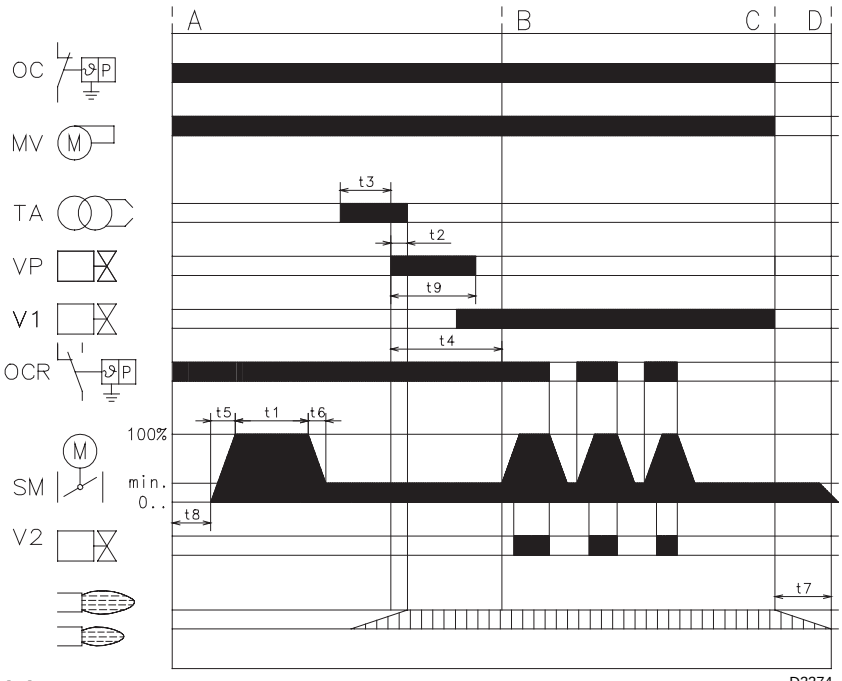
(A)

Full modulation



(B)

High - Low



(C)

FLAME SIGNAL MEASUREMENT

Min value for a good signal: 70 µA.
If the value is lower, it can be due to:
• Worn scanner;
• Low current;
• Bad set up of the burner.
In order to measure the current, use a microammeter of 100 µA c.c., connected to the scanner, as in the diagram, with a capacitor of 100 µF - 1V c.c. at the same level of the instrument. See fig. (A).

OPERATION LAYOUT

See fig. (B).

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

LFL 1.335 Series 01

t1	37.5	**t6**	optional
t2	2.5	**t7**	15
t3	5	**t8**	5
t4	25	**t9**	16
t5	optional		

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
t9 Running time of pilot

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 cam 1 (gas) or cam 4 (oil). 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 cam 3 (gas) or cam 5 (oil). 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 wich 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.

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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