

GB Forced draught gas burners

Progressive two-stage or modulating operation



CODE	MODEL	TYPE
3753883	GAS 8 P/M	538 T80
3753884	GAS 8 P/M	538 T80
3754083	GAS 9 P/M	540 T80
3754084	GAS 9 P/M	540 T80
3754185	GAS 10 P/M	541 T80
3754186	GAS 10 P/M	541 T80
3754187	GAS 10 P/M	541 T80
3754188	GAS 10 P/M	541 T80

Declaration of conformity in accordance with ISO / IEC 17050-1

Manufacturer: RIELLO S.p.A.
Address: Via Pilade Riello, 7
37045 Legnago (VR)
Product: Forced draught gas burners
Model: GAS 8 P/M
GAS 9 P/M
GAS 10 P/M

These products are in compliance with the following Technical Standards:

EN 676

EN 12100

and according to the European Directives:

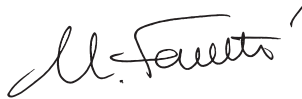
MD	2006/42/EC	Machine Directive
LVD	2006/95/EC	Low Voltage Directive
EMC	2004/108/EC	Electromagnetic Compatibility

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

Legnago, 03.09.2014

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N.B.

Figures mentioned in the text are identified as follows:

- 1)(A) = part 1 of figure A, same page as text
- 1)(A)p.4 = part 1 of figure A, page number 4
- 1) = Part 1 of last figure mentioned

Warning

These instructions are an integral part of the product and should therefore never be detached from the plant. The manufacturer will accept no responsibility whatsoever for damage to persons, animals or property caused by non-observance of the technical requirements contained in these instructions.

1 - GENERAL

1.1 TECHNICAL DATA

MODEL			GAS 8 P/M	GAS 9 P/M	GAS 10 P/M
Type			538 T80	540 T80	541 T80
Output 20°C - 1000 mbar 1)	stage 2°	kW Mcal/h	1163 - 2326 1000 - 2000	1744 - 3488 1500 - 3000	2441 - 5000 2100 - 4300
	stage 1°	kW Mcal/h	581 - 1163 500 - 1000	872 - 1744 750 - 1500	1140 - 2441 980 - 2100
Fuel			NATURAL GAS		
- Net calorific value		kWh/Nm ³ Mcal/Nm ³	8,1 - 10 7 - 8,6	8,1 - 10 7 - 8,6	8,1 - 10 7 - 8,6
- absolute density		kg/Nm ³	0,81 - 0,71	0,81 - 0,71	0,81 - 0,71
- max delivery		Nm ³ /h	286 - 232	429 - 348	615 - 500
- pressure at maximum delivery		mbar	27,8 - 16,5	22,6 - 13,4	37 - 22
Operation			- On-Off (1 stop min each 24 hours) These burners are also fitted for the continuous operation, if they are equipped with the control box LANDIS type LGK 16.335 A27 (interchangeable with the burner control box LANDIS LFL 1.335). - Progressive two-stage (modulating by kit).		
Standard applications			Boilers: steam - water - diathermic oil		
Ambient temperature		°C	0 - 40		

1) Ambient temperature and barometric pressure relating to stated output.

ELECTRICAL DATA

MODEL		GAS 8 P/M	GAS 9 P/M	GAS 10 P/M	GAS 10 P/M
Code		3753883 - 3753884	3754083 - 3754084	3754185 - 3754186	3754187 - 3754188
Electrical supply	V Hz	220V - 380V with neutral ~ +10 - 15% 60 - Three phase	220V - 380V with neutral ~ +10 - 15% 60 - Three phase	220V - 380V with neutral ~ +10 - 15% 60 - Three phase	220V - 380V with neutral ~ +10 - 15% 60 - Three phase
Fan motor IE2	rpm	3520	2920	2920	2920
	kW	4	9.2	15	15
	V	220/380	220/380	220/380	380/660
	A	14.6/8.5	29.1/16.8	46.8/27	26.6/15.4
Ignition transformer	V1 - V2 I1 - I2	230 V - 1 x 8 kV 1.8 A - 30 mA			
Electrical power consumption	kW max	5	12	17	17
Electrical protection		IP 40			

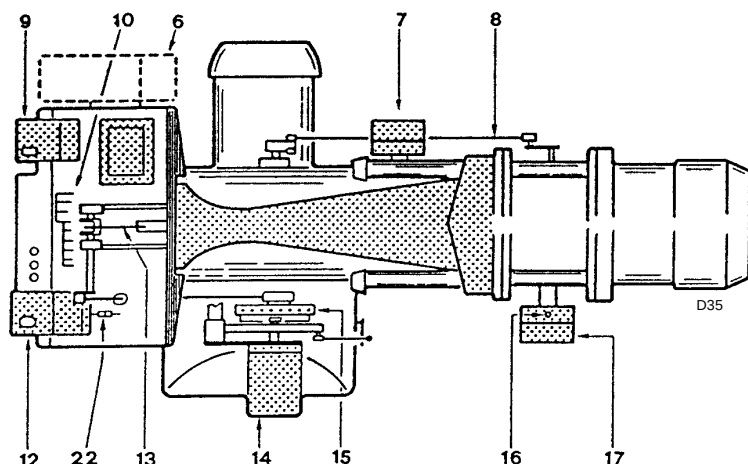
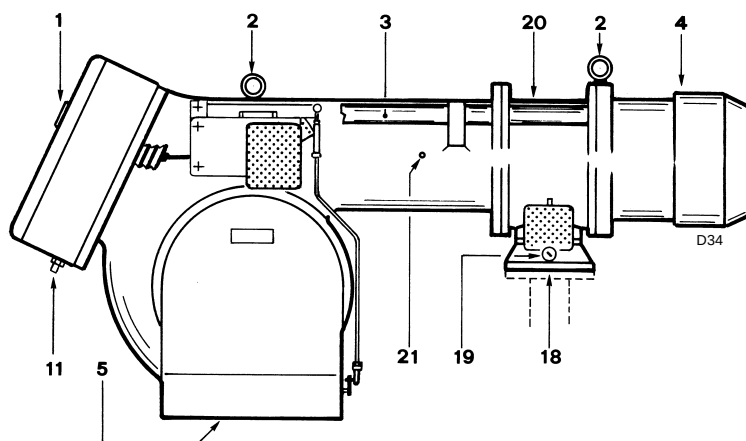
MODEL		GAS 9 P/M	GAS 10 P/M	GAS 10 P/M
Code		3754083 - 3754084	3754185 - 3754186	3754187 - 3754188
Electrical supply	V Hz	220V - 380V with neutral ~ +10 - 15% 60 - Three phase	220V - 380V with neutral ~ +10 - 15% 60 - Three phase	220V - 380V with neutral ~ +10 - 15% 60 - Three phase
Fan motor IE3	rpm	3540	3520	3520
	kW	9.2	15	15
	V	220/380	220/380	380/660
	A	30.5/17.6	49.2/28.4	28.4/16.4
Ignition transformer	V1 - V2 I1 - I2	230 V - 1 x 8 kV 1.8 A - 30 mA		
Electrical power consumption	kW max	10.7	16.9	16.9
Electrical protection		IP 40		

1.2 AVAILABLE MODELS

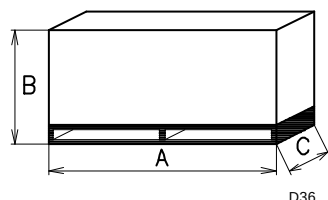
Code	Model	Type	Motor	Electrical supply three phase		Blast tube length mm	Accessories page 5
				V +10 -15 %	Hz		
3753883	GAS 8 P/M	538 T80	0	220-380N	60	391	A1-B1-C-D1-E-F-G
3753884	GAS 8 P/M	538 T80	0	220-380N	60	501	B2-C-D1-E-F-G
3754083	GAS 9 P/M	540 T80	0	220-380N	60	444	A2-B3-C-D2-E-F-G
3754084	GAS 9 P/M	540 T80	0	220-380N	60	574	B4-C-D2-E-F-G
3754185	GAS 10 P/M	541 T80	+	220	60	476	A3-C-D2-E-F-G
3754186	GAS 10 P/M	541 T80	+	220	60	606	C-D2-E-F-G
3754187	GAS 10 P/M	541 T80	+	380N	60	476	A3-C-D2-E-F-G
3754188	GAS 10 P/M	541 T80	+	380N	60	606	C-D2-E-F-G

0 : Motor with direct starting

+: Motor with star-delta starting



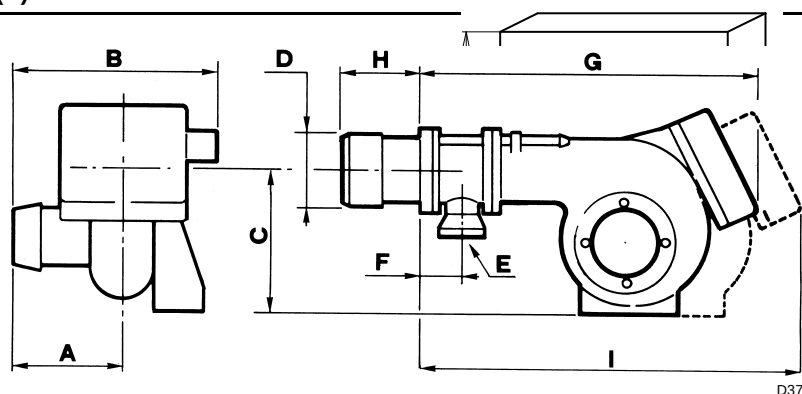
(A)



D36

mm	A	B	C	kg
GAS 8 P/M	1690	880	820	195
GAS 9 P/M	1870	910	920	240
GAS 10 P/M	2040	930	1101	290

(B)



D37

mm	A	B	C	D	E	F	G	H	I
GAS 8 P/M	396	755	467	260	DN 80	158	1090	391	1541
								501	1644
GAS 9 P/M	447	817	496	295	DN 80	168	1200	444	1627
								574	1757
GAS 10 P/M	508	917	525	336	DN 80	203	1320	476	1730
								606	1860

(C)

Before installing the burner, check with your Local Gas Authority that the maximum gas delivery required by the plant is available and that mains pressure and type of gas are compatible with the data given in Table 1.1

1.3 BURNER DESCRIPTION (A)

- 1 Flame viewer
- 2 Lifting rings
- 3 Slide bars for opening the burner and inspecting the combustion head (see note)
- 4 Combustion head (two lengths)
- 5 Air gate valve closed to wait for reduction of loss of heat
- 6 Modulating regulator (optional)
- 7 Air pressure switch
- 8 Gas butterfly valve drive rod
- 9 Motor contact-maker and thermal relay (GAS 8-9 direct starting)
- 10 Terminal strip
- 11 Fair lead (standard equipment) (installer-set electrical equipment)
- 12 Control box with lock out pilot light and lock out reset button
- 13 Combustion head drive rod
- 14 Air-gas control servomotor
- 15 Air setting cam
- 16 Gas pressure test point to sleeve
- 17 Max. gas pressure switch
- 18 Gas butterfly valve (gas input pipework)
- 19 MIN output gas adjustment disc
- 20 Sleeve
- 21 Fan pressure test point
- 22 Plug-socket on servomotor cable

1.4 PACKAGING-WEIGHT (B)

Approximate measurements.

- The burner stands on a wooden base which can be lifted by fork-lifts.
- Outer dimensions of packaging are indicated in (B).
- The weight of the burner with the longest combustion head including packaging is given in (B).

1.5 MAX. DIMENSIONS (C)

Approximate measurements.

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

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

The maximum dimensions of the burner when open are given by measurement I.

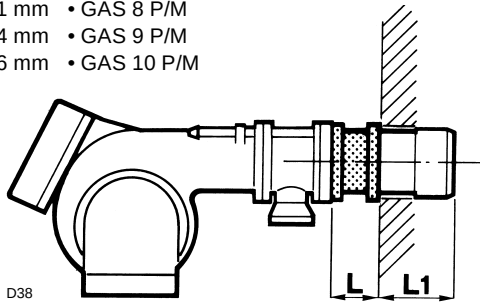
1.6 STANDARD EQUIPMENT

- 1 Gas train connection gasket
- 12 Screws
- 4 Fair leads for electrical cables
- 8 Washers
- 2 Extensions (only for long head models)
- 1 Heat shield
- 1 Motor starter (see 1.2)
- 2 Fair leads for electrical connections to starter
- 1 Instruction booklet

NOTE

Before opening long-headed burners (501-574-606), fit the two extensions supplied as standard equipment with the system on slide bars 3)(A) and support the burner on the wheel-mounted stand supplied as an extra unit, fig.(E)p.5, or other sui-table means.

A1	COD. 3000722	L = 110	L1 = 281 mm	• GAS 8 P/M
A2	COD. 3000723	L = 130	L1 = 314 mm	• GAS 9 P/M
A3	COD. 3000751	L = 130	L1 = 346 mm	• GAS 10 P/M



(A)

B1	COD. 3000875	L = 391 mm	• GAS 8 P/M
B2	COD. 3010029	L1 = 501 mm	• GAS 8 P/M
B3	COD. 3000876	L = 444 mm	• GAS 9 P/M
B4	COD. 3010028	L1 = 574 mm	• GAS 9 P/M
B5	COD. 3010152	L = 476 mm	• GAS 10 P/M
B6	COD. 3010153	L1 = 606 mm	• GAS 10 P/M

(B)

Parametro da controllare Zu überwachender Wert Parameter to be checked Paramètre à contrôler		Sonda - Fühler Probe - Sonde		Regolatore - Regler Regulator - Régulateur	
	Campo - Bereich Range - Plage	Tipo - Typ Type	Codice Code	Tipo - Typ Type	Codice Code
Temperatura Temperatur Temperature Température	- 100...+ 500 °C	PT 100	3010110	RWF40	3010211
Pressione Druck Pressure Pression	0...2,5 bar 0...16 bar	Sonda con uscita Fühler mit Ausgang Probe with output Sonde avec sortie 4...20 mA	3010213 3010214		

• GAS 8 - 9 - 10 P/M

(C)

D1	COD. 3000780	• GAS 8 P/M
D2	COD. 3000781	• GAS 9-10 P/M

mm	A	B	C	D	H		Kg
					MIN	MAX	
D1	300	1050	1000	400	990	1660	153
D2	350	1210	1170	450	1150	1820	198

A technical diagram showing a side view of a burner assembly mounted on a base. Dimensions are indicated: 'A' is the height of the burner head, 'B' is the height of the control valve, 'C' is the distance from the burner head to the control valve, 'D' is the distance from the burner head to the gas inlet pipe, and 'H' is the total height of the assembly. The diagram is labeled 'D39'.

(D)

A technical diagram showing a side view of a burner assembly mounted on a base. A dimension of '1 1/2' is indicated for the height of the burner head. The diagram is labeled 'D40'.

(E)

COD. 3000731	• GAS 8-9-10 P/M
COD. 3010021	• GAS 8-9-10 P/M
COD. 3010030	• GAS 8-9-10 P/M

1.7 ACCESSORIES (optional)

Table 1.2 shows the accessories available for each burner

(A) SPACER

Used to reduce the length of the blast tube in burners with short head 391 - 444 - 476.

L = spacer thickness

L1 = resulting length of blast tube

(B) KIT FOR LPG OPERATION

This kit must be fitted whenever the burner is to be operated on LPG instead of natural gas.

L = kit for short head

L1 = kit for long head

(C) OUTPUT MODULATION REGULATOR KIT

Under modulating operation, the burner automatically adapts to one of an infinite number of firing rates between the low and high flame output positions, thus ensuring stable operating conditions in terms of temperature or pressure.

Two components should be ordered:

- output regulator to install on the burner;
- probe to install on the boiler.

(D) SOUNDPROOFING

The sound attenuating shroud significantly reduces the noise generated by the burner (- 16/20 dBA). The casing is in steel and sound-damping material and fully encloses the burner. The casing is wheel-mounted so that it can be easily removed for burner inspection.

(E) SUPPORT

The support should be fitted to burners with a long head (501 - 574 - 606). It is designed to bear the weight of the burner during head inspection. For burners with a short head, the support is not essential although useful.

The 1" 1/2 pipe of the support should be prepared by the installer to a length appropriate to that of the system.

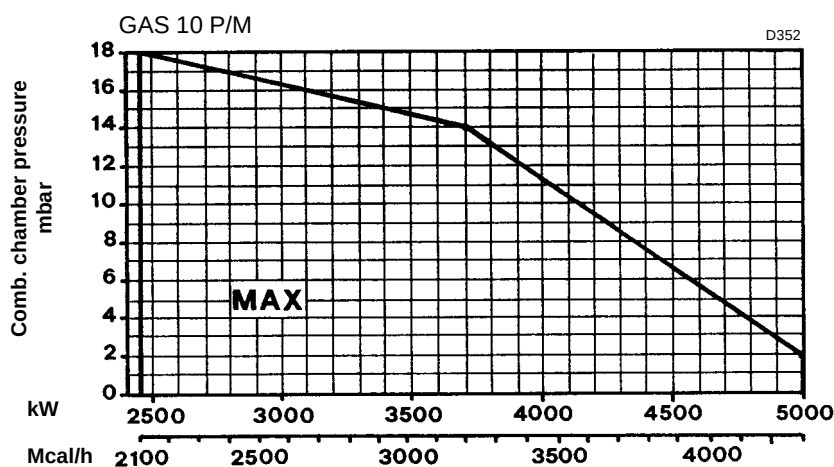
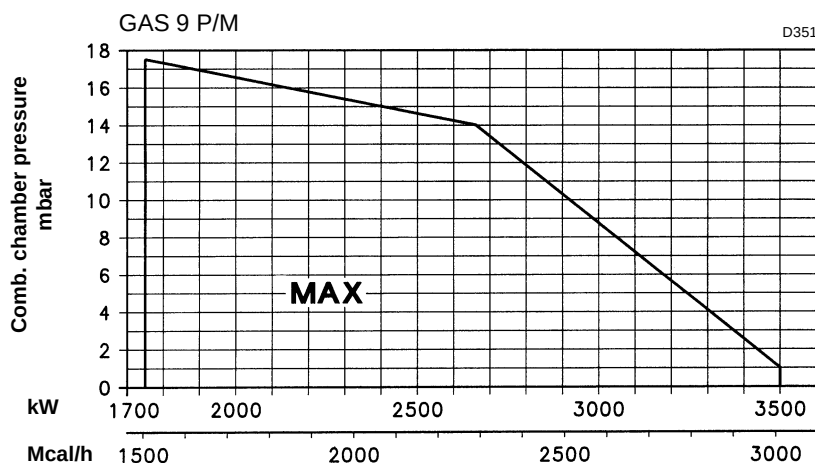
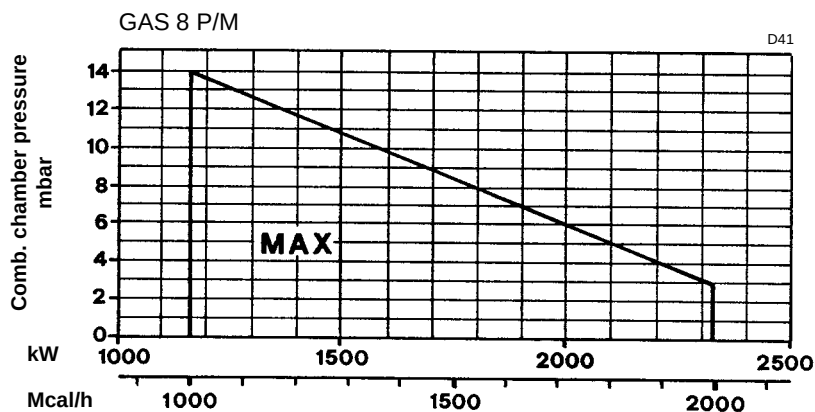
The base is fitted with a wheels.

(F) KIT POTENTIOMETER

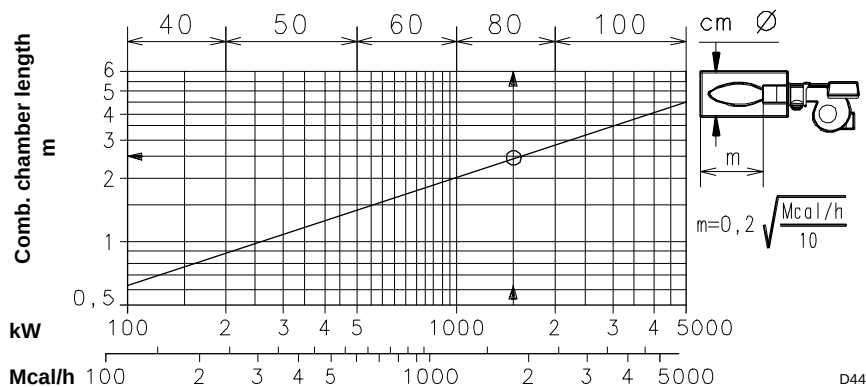
The kit consists of a potentiometer with a scale of values of 0 - 1000 W equivalent to a travel of 0 - 100 %, with tripolar connection, to be installed inside servomotor 14)(A)p.4. It is used to signal the position of the servomotor for indications or feedback to various instruments.

(G) KIT CONTINUOUS VENTILATION

The kit comprises a small three-way solenoid to be installed between the air pressure switch 7)(A)p.4 and the fan. It allows the burner to fire again when it has remained under continuous ventilation following flame cut-out.



(A)



(B)

1.8 FIRING RATES (A)

During operation, burner output varies between:

- **MINIMUM OUTPUT** in stage 1 and
- **MAXIMUM OUTPUT** in stage 2.

MINIMUM OUTPUT (MIN) is selected from the range of values given above the graphs.

Example:

an output of between 581 and 1163 kW (equivalent to 500 and 1000 Mcal/h) may be selected for GAS 8 P/M.

The pressure in the combustion chamber need not be known in stage 1.

MAXIMUM OUTPUT (MAX) is selected from the range given in the graphs to the side.

This range is referred to as the **FIRING RATE** and provides maximum burner output as a function of combustion chamber pressure.

The operating point is given by plotting a vertical from the required output and a horizontal from the corresponding combustion chamber pressure. The meeting point between the two lines gives the operating point, which must lie within the **FIRING RATE**.

Example:

for GAS 8 P/M the range is defined by:

- the 1163 - 2326 kW output axis
- the 0 +14 mbar comb. chamber pressure axis
- the maximum pressure in combustion chamber curve.

If the burner generates an output of 2000 kW at a combustion chamber pressure of 6 mbar, the operating point is found on the maximum pressure curve. This curve incorporates margins of safety and therefore the entire **FIRING RATE** range may be used.

Important:

the **FIRING RATES** have been obtained at an ambient temperature of 20°C and a barometric pressure of 1000 mbar.

- Burner output should be adapted to boiler output in the maximum setting range, i.e. within the **FIRING RATE**.

- The burner can also operate when there is a negative pressure in the combustion chamber.

1.9 TEST BOILER (B)

Firing rates (A) were set in relation to special test boilers in accordance with the methods defined in DIN 4788 and UNI 8042 standards.

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

Example: output 1500 Mcal/hour:

diameter = 80 cm; length = 2.5 m.

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

1.10 GAS PRESSURE

Gas pressure in relation to maximum burner output is indicated by the curves in figure (A)p.7.

They represent the drop in pressure of the combustion head. Curves:

1 = Natural gas PCI10 kWh/Nm³-8,60 Mcal/Nm³

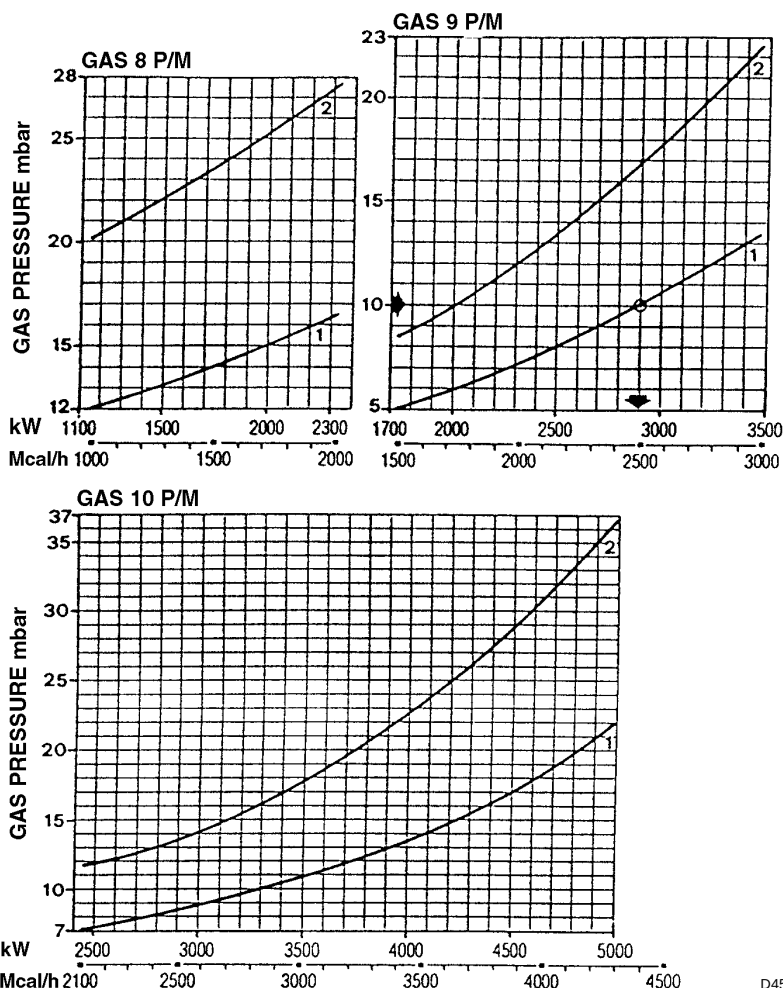
absolute density - 0,71kg/Nm³

2 = Natural gas PCI8,1 kWh/Nm³-7,00 Mcal/Nm³

absolute density - 0,81kg/Nm³

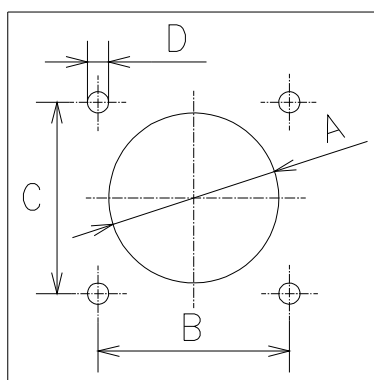
Curves were calculated under the following conditions:

- Pressure measured at test point 16)(A)p.4
- Combustion chamber at 0 mbar
- Combustion head set as per 2.4 and 5.1
- Burner operating at maximum output (servomotor at end of travel: 130°)

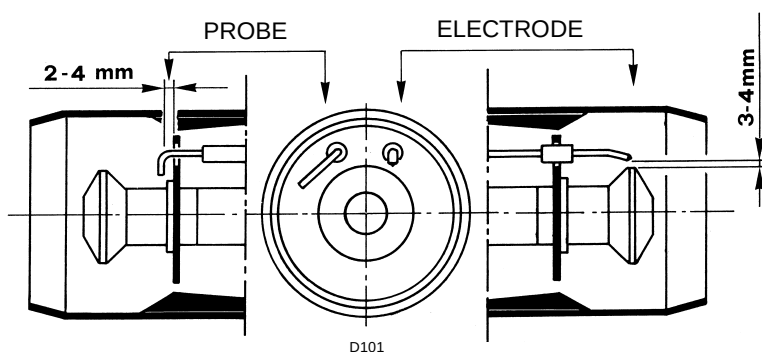


(A)

mm	A	B	C	D
GAS 8 P/M	265	260	260	M16
GAS 9 P/M	300	260	260	M18
GAS 10 P/M	350	310	310	M20



(B)



(C)

If the approximate maximum output at which the burner is operating must be known, record the type of gas which was used, its pressure at test point 16)(A)p.4 and the pressure in the combustion chamber and then proceed as follows: subtract combustion chamber pressure from gas pressure and then refer to graph relating to the considered burner.

Example:

- Burner GAS 9 P/M
- Natural gas PCI 10 kWh/Nm³ (curve 1)
- Gas pressure at test point 16)(4A) =13 mbar
- Pressure in combustion chamber=3 mbar

$13 + 3 = 10 \text{ mbar}$
which corresponds, for GAS 9, to a maximum output of 2900 kW.

This reading is an initial approximation.

Effective delivery should be read at the meter.

If instead the gas pressure required at test point 16)(A)p.4 must be known, set the maximum output at which the burner is to operate, record the type of gas used and chamber pressure and then proceed as follows:

add the pressure in the combustion chamber to the pressure indicated in graph (A); both pressures correspond to maximum burner output.

Example:

- Burner GAS 9 P/M
- Max required output 2900 kW
- Natural gas PCI 10 kWh/Nm³ (curve 1)
- Gas pressure at output of 2900 kW,
GAS 9 P/M graph = 10 mbar
- Pressure in combustion chamber = 3 mbar

$10 + 3 = 13 \text{ mbar}$
is the pressure required at test point 16)(4A).

2 - INSTALLATION

Installation should only be performed by qualified personnel in conformity with the standards and regulations in force where the burner is to be installed.

- Remove the packaging and make sure the burner is in good condition. If there is any doubt, inform the distributor.
- Collect all packaging elements and store them in a suitable place.

2.1 BOILER PLATE (B)

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

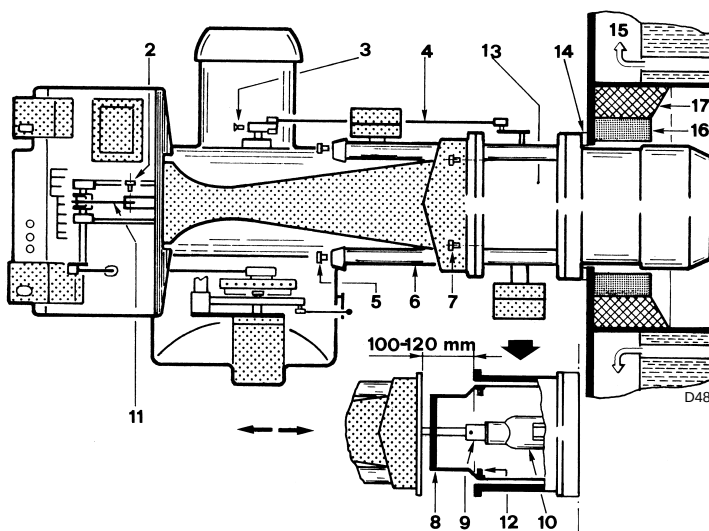
2.2 BLAST TUBE LENGTH

The length of the blast tube should be selected in relation to indications provided by the boiler manufacturer and, in any case, should be greater than the thickness of the boiler door complete with refractory material.

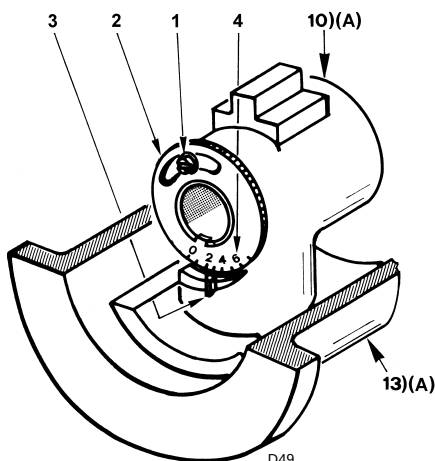
Three different blast tube lengths are available:

- Long head (see 1.2);
- Short head (see 1.2);
- Short head plus spacer (see 1.7).

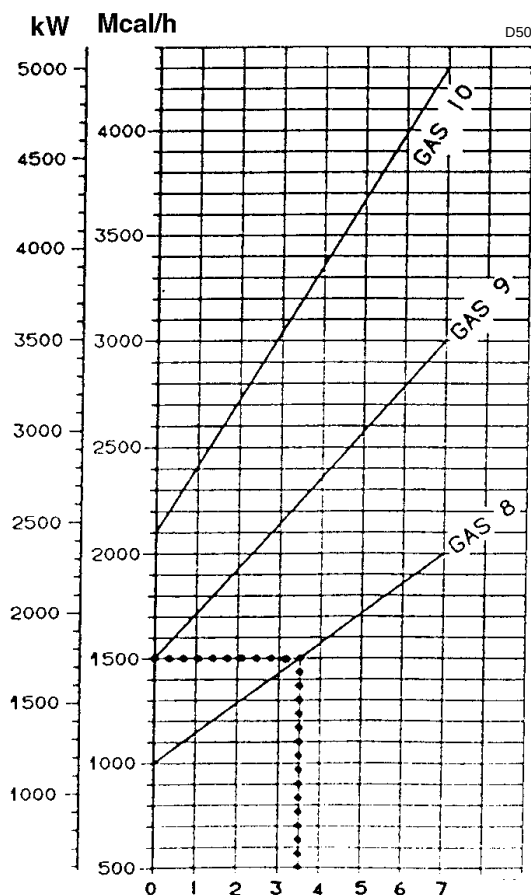
For boilers with front flue passes as shown in 15)(A)p.8 or a flame inversion chamber, the space between the front plate quarl 17) and the burner blast tube must be properly sealed with an appropriate refractory material 16). Afterwards, it must still be possible to pull out the blast tube.



(A)



(B)



(C)

NOTCHES ON LOCK RING 2(B)

2.3 SECURING THE BURNER TO THE BOILER (A)

- Detach the combustion head, as follows:
 - Remove screws 5)(A) from the two slide bars 6).
 - Detach head drive rod 11) by removing pin 2).
 - Detach the gas throttle valve control rod 4) by removing screw 3).
 - Remove screws 7), which secure the fan housing to the combustion head.
 - Withdraw the burner by about 100-120 mm.
 - Detach drive fork 8) by removing screws 12).
 - At this stage, slide the burner fully out from slide bars 6); the gas pipe 9) will also slide out of elbow 10) together with the burner.
- Before securing the combustion head to the boiler, make sure the probe and the electrode are correctly positioned, as shown in (7C). If positioning is incorrect, disassemble elbow 10)(A) from sleeve 13).

Do not rotate the probe but leave it in position as shown in (C)p.7; positioning the probe near the firing electrode could damage the control box amplifier.

- Secure the blast tube to the boiler plate (B)p.7, installing the burner heat shield 14)(A) supplied as standard equipment. To do this, use the four standard-issue screws, having first protected the threads with an anti-grip product (high temperature grease, compounds, graphite). The burner-boiler installation must be hermetically sealed.
- Adjust the combustion head as described in 2.4.
- Mount the fan housing on to slide bars 6)(A) and gas pipe 9) onto elbow 10).
- Leave the burner open by about 100-120 mm.
- Refit fork 8) securing it with screws 12).
- Close the burner
- Tighten screws 7) which secure the fan housing to the combustion head
- Fit stops to slide bars 6) with screws 5)
- Re-connect push-rods 4) and 11).

2.4 SETTING THE COMBUSTION HEAD

Combustion head adjustment depends solely on the MIN and MAX output provided by the burner. Therefore, before setting the combustion head, these two values must be set.

If preset MIN and MAX outputs become slightly varied during final commissioning, the head does not require adjustment.

Two head adjustments are required:

- a **fixed gas setting**, performed with the burner open while it is being mounted on the boiler (see 2.3).
- a **variable setting** of both gas and air, performed with the burner closed (See 5.1 for description)

Fixed gas adjustment (B - C)

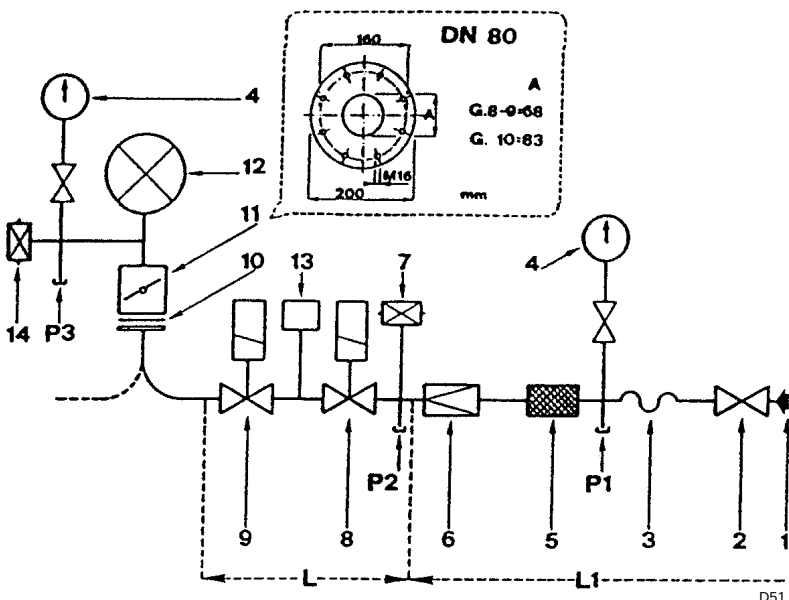
- Slacken screw 1)(B).
- Turn lock ring 2) so that indicator 3) lines up with the required notch 4).
- Lock screw 1).

Selection of the required notch should be made on graph (C) on the basis of the MAX output at which the burner is expected to operate.

Example:

GAS 8 MAX heat output 1.500 Mcal/h.

NOTCH: 3.5



(A)

BUTTERFLY VALVE 11)(A) PRESSURE LOSS in mbar, with maximum opening and 2 types of gas:

1 = Natural gas	PCI 10 kWh/Nm ³ - 8,60 Mcal/Nm ³
	absolute density - 0,71 Mcal/Nm ³
1 = Natural gas	PCI 8,1 kWh/Nm ³ - 7,00 Mcal/Nm ³
	absolute density - 0,81 Mcal/Nm ³

GAS 8 P/M

kW	1	2
1150	0,59	0,99
1300	0,75	1,26
1450	0,93	1,56
1600	1,14	1,92
1750	1,36	2,28
1900	1,60	2,69
2050	1,86	3,12
2200	2,15	3,61
2350	2,45	4,12

GAS 9 P/M

kW	1	2
1800	1,41	2,37
2000	1,74	2,92
2200	2,11	3,54
2400	2,51	4,22
2600	2,94	4,94
2800	3,42	5,75
3000	3,92	6,59
3200	4,46	7,49
3400	5,04	8,46
3500	5,33	8,96

GAS 10 P/M

kW	1	2
2500	1,08	1,81
2800	1,35	2,27
3100	1,65	2,77
3400	1,99	3,34
3700	2,35	3,95
4000	2,75	4,62
4300	3,18	5,34
4600	3,64	6,11
4900	4,13	6,94
5000	4,30	7,22

2.5 GAS LINE

- The gas meter must have a delivery greater than that of the burner(s).
- The pipework between the meter and the burner must have a cross-section appropriate to the maximum throughput required. Between burner OFF and burner ON conditions, there should not be a difference in pressure greater than 0,5 mbar measured in P1.
- Pipework and couplings, which are internally protected against corrosion, must be checked and cleaned prior to their installation.
- Gas solenoids 8)-9)(A) must be as close as possible to the burner to ensure gas reaches the combustion head within the safety time range of 2 s.
- The gas train must be held by a special support unit to avoid it being exposed to or exerting mechanical stresses.
- It must also be possible to disconnect the gas train at one point to allow the boiler hatch to be opened.
- The gas train may be installed to the left or right of the burner.
- When several burners are fed in parallel by the same gas line, every gas train must be fitted with its own pressure governor.
- All gas train components must comply with legislation in force.
- Components carrying gas should be installed in relation to the flow-direction arrow marked on each component.
- No unnecessary fittings should be installed in the gas pipework, particularly down-line from filter 5)(A).

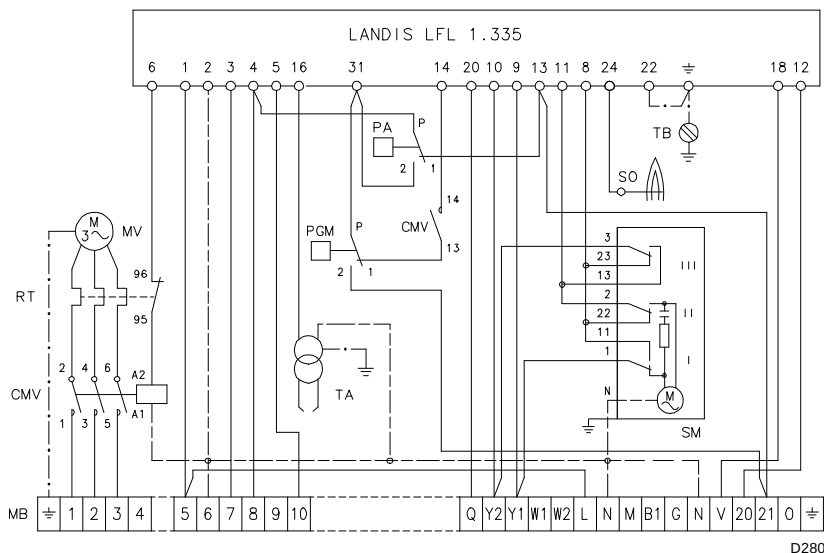
GAS TRAIN (A)

Supplied on request by Riello (part L)
To UNI-CIG 8042 standards.

Key (A)

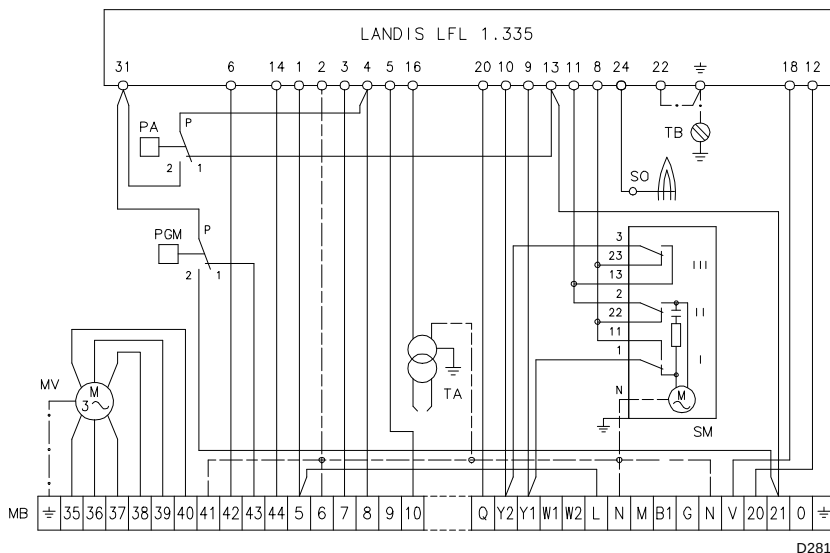
- Gas input pipe
 - Manual valve
 - Vibration damping joint
 - Pressure gauge with pushbutton cock (as required by DIN 4788 standards)
Fitted by installer.
 - Filter
 - Pressure governor (vertical)
 - Minimum gas pressure switch
 - Safety solenoid VS (vertical)
 - Adjustment solenoid VR (vertical)
Two adjustments:
- ignition delivery (fast-acting)
- maximum delivery (slow-acting)
 - Standard issue burner gasket
 - Gas adjustment butterfly valve
 - Burner sleeve 20)(A)p.4
 - Gas valve 8)-9) leak detection control device
 - Maximum gas pressure switch (supplied with the burner)
- P1 - Mains pressure measurement
P2 - Adjustment pressure measurement
P3 - Combustion head pressure measurement
L - Optional gas train
L1 - Gas train fitted by installer

GAS 8 - 9 P/M DIRECT MOTOR STARTING



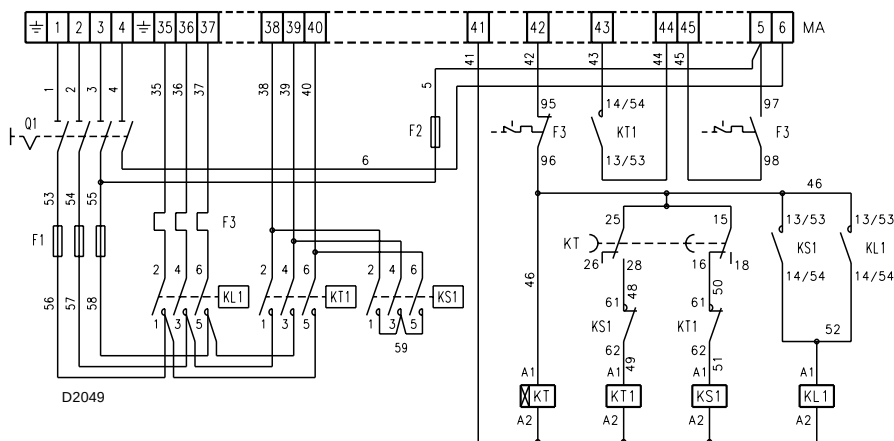
(A)

GAS 10 P/M START - DELTA MOTOR STARTING



(B)

STAR-DELTA STARTER



(C)

2.6 ELECTRICAL EQUIPMENT factory-set

LAYOUT (A)

GAS 8 - 9 P/M Burners with direct motor starting

These models leave the factory preset for a **380 V** operating voltage.

For a **220 V** operating voltage, change the motor connection (from star to delta) and the calibration of the thermal relay, see layout (E)p.12.

LAYOUT (B)

GAS 10 P/M Burner with star-delta motor starting

These models leave the factory preset for an operating voltage of **380 V** or **220 V**, depending on the version ordered. See 1.2.

Key to layouts (A - B)

- CMV - Motor contactor
- LFL - Landis control box
- MB - Burner terminal strip
- MV - Fan motor
- PA - Air pressure switch
- PGM - Max. gas pressure switch
- RT - Thermal relay
- SM - Servomotor
- SO - Ionisation probe
- TA - Ignition transformer
- TB - Burner ground (earth) connection

GAS 8-9-10 P/M burners meet EEC directive n. 76/889 - DM 9-10-80 for radio interference protection.

LAYOUT (C)

Star-delta starter

- F1 - Power line fuses
- F2 - Control devices fuse
- F3 - Thermal relay - Factory calibration at:
GAS 10:16,7A for 380 V - 29 A for 220 V
- MA - Starter terminal strip
- KL1 - Line Contact-maker
- KS1 - Star Contact-maker
- KT1 - Delta Contact-maker
- KT - Timer Relay for switching from star to delta.
Factory calibration at 10 s.
- Q1 - Disconnecting switch with interlock

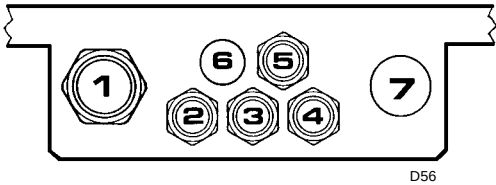
2.7 ELECTRICAL EQUIPMENT installer-set

- The burner must be correctly connected to an efficient earthing (ground) system. Do not use gas pipes as earth. Make sure this vital safety feature is observed. When in doubt, arrange for qualified personnel to perform a check.
- Do not confuse neutral with phase
- When connecting the burner to the supply mains, avoid plug-socket connections.
- Do not touch the equipment with wet hands or bare feet.
- Do not pull or stretch electrical cables.
- Keep cables away from sources of heat.
- Cable lengths must allow the burner and boiler hatch to be opened
- Electrical connections should only be performed by qualified personnel in conformity with standards and regulations for electrical appliances in force in the place where the burner is to be installed.

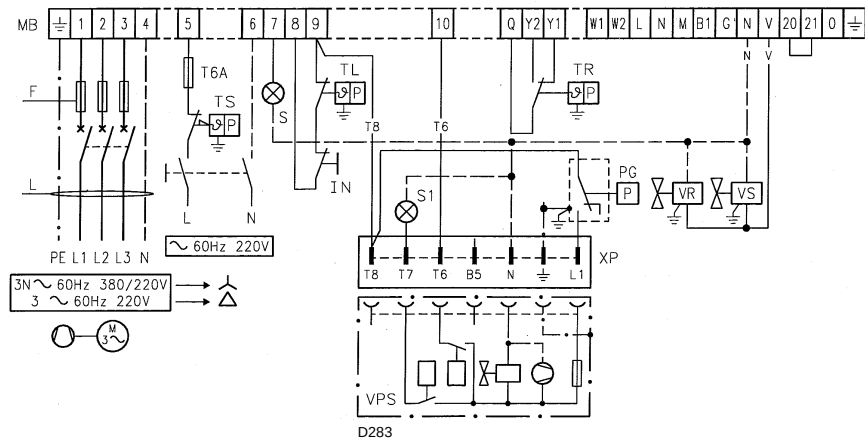
IMPORTANT

The installer must be sure to make all the electrical connections indicated in the plant diagrams, shown on pages. 11 and 12

CABLE SECURING



(A)
GAS 8 - 9 P/M - ELECTRICAL CONNECTION OF BURNER BY INSTALLER
with direct motor starting and VPS gas valve leak detection control



Cable section

		GAS 8 P/M		GAS 9 P/M	
		220 V	380 V	220 V	380 V
F	A gG/gL	40	25	50	40
L	mm ²	4	2,5	6	4

(Cable section when not indicated: 1,5 mm²)

CABLE SECURING (A)

All cables to be connected to the burner terminal strip 10)(A)p.4 should pass through fair leads 11)(A)p.4. The fair leads and precut holes can be used in various ways. One example is given below:

- 1 - Three-phase power supply Pg 29 (from mains or from star-delta starter)
- 2 - Single-phase power supply Pg 13,5
- 3 - Control devices TR - TL or probe RWF40 Pg 13,5
- 4 - Gas train Pg 13,5
- 5 - Spare fair lead Pg 13,5
- 6 - Fair lead fitting hole, RWF40 Pg 13,5
- 7 - Fitting hole for fair lead, if required Pg 29

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

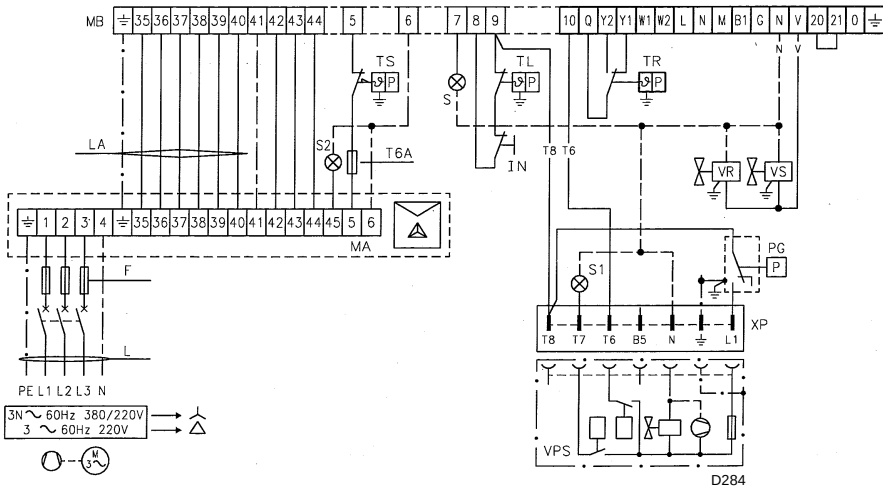
LAYOUT (B)
Electrical connections GAS 8-9 P/M burners
· with direct motor starting
· with VPS gas valve leak detection control
Leak control for valves 8) and 9)(A)p.4 is performed whenever the burner fires.

- KEY TO LAYOUTS (B - C)**
- MB - Burner terminal strip
 - PC - Gas pressure switch for leak detection control
 - PG - Min. gas pressure switch
 - S - Remote lock-out signal
 - TR - High-low mode load control system: controls operating stages 1 and 2
 - TL - Limit load control system: shuts down the burner when the boiler temperature or pressure exceeds the maximum preset value.
 - TS - Safety load control system: operates when TL is faulty
 - VR - Adjustment valve
 - VS - Safety valve

N.B.
The TR and TL load controls are not required when the regulator RWF40 is connected, as their function is performed by the regulator RWF40 itself.

(B) **(C)**

with star - delta motor starting and VPS gas valve leak detection control

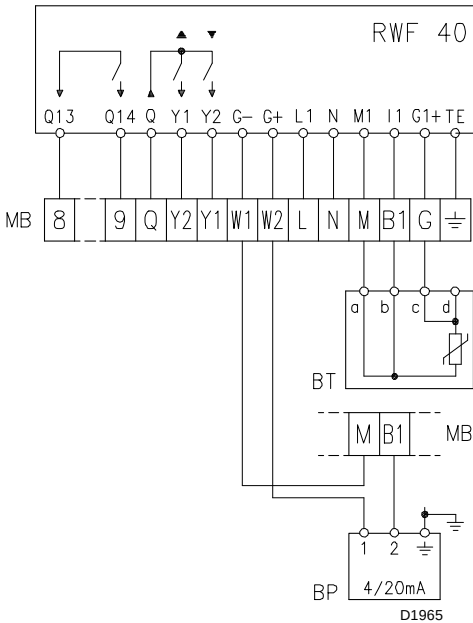


Cable section

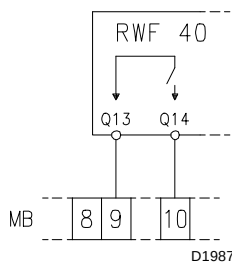
		GAS 10 P/M	
		220 V	380 V
F	A gG/gL	63	40
L	mm ²	10	6
LA	mm ²	6	4

(Cable section when not indicated: 1,5 mm²)

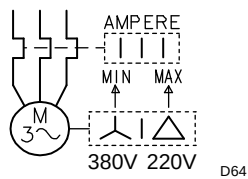
GAS 8 - 9 - 10 P/M - ELECTRICAL CONNECTION OF RWF40 BY INSTALLER



CALIBRATION OF THERMAL RELAY BY INSTALLER



(C) (D)



Electrical connection GAS 10 P/M burner

- **with star-delta motor starting**
The two fair leads supplied are for starter input-output electrical connections.
- **with VPS gas valve leak detection control**
Leak control for valves 8) and 9)(A)p.9 is performed whenever the burner fires.

KEY TO LAYOUTS (A - B - C - D)

- MA - Star-delta starter terminal strip
- MB - Burner terminal strip
- PC - Gas pressure switch for leak detection control
- PG - Min. gas pressure switch
- S - Remote lock-out signal
- S1 - Motor trip signal
- TR - High-low mode load control system:
controls operating stages 1 and 2
- TL - Limit load control system:
shuts down the burner when the boiler temperature or pressure exceeds the maximum preset value.
- TS - Safety load control system:
operates when TL is faulty
- VR - Adjustment valve
- VS - Safety valve

N.B.

The TR and TL load controls are not required when the regulator RWF40 is connected, as their function is performed by the regulator RWF40 itself.

LAYOUT (C)

Connection of regulator RWF40 and related probe to GAS 8-9-10 P/M burners (modulating operation)

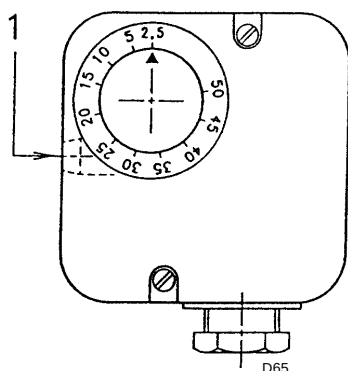
LAYOUT (E)

Calibration of thermal relay 9)(A)p.4

This is required to avoid motor burn-out in the event of a significant increase in power absorption caused by a missing phase.

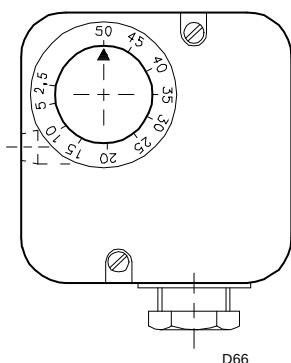
- If the motor is star-powered, 380 V, the cursor should be positioned to "MIN".
- If it is delta-powered, 220 V, the cursor should be positioned to "MAX".

If the scale of the thermal relay does not include rated motor absorption at 380 V, protection is still ensured.



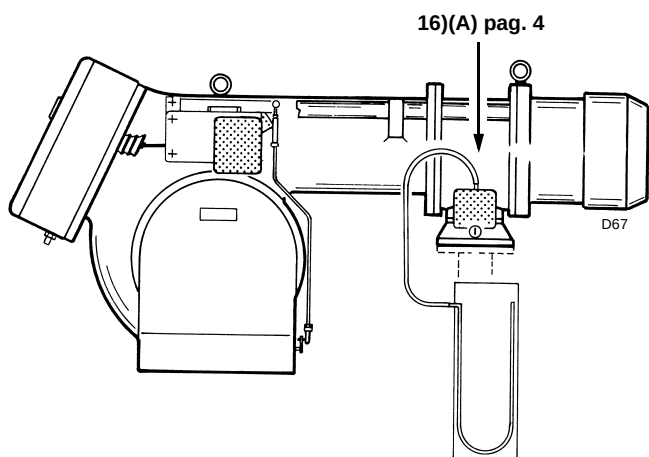
(A)

MAX GAS PRESSURE SWITCH 17)(A) pag. 4



(B)

U-TYPE MANOMETER



(C)

3 - CONTROLS AND CALIBRATIONS BEFORE FIRING

3.1 BOILER

Make sure that:

- water or diathermic oil is available
- the water circuit valves are open
- the stack is not obstructed and is of dimensions and construction conforming to required standards
- the burner is closed and securely fixed to the boiler.

3.2 GAS LINE

- Make sure that all pipework up-line from the gas train is properly sealed as required by local regulations by placing the system under pressure with air.
- Make sure that the pressure governor calibration range (spring colour) comprises the pressure P1 required by the burner (see 5.3).
- Open the manual valves located up-line of the solenoid 8)(A)p.9.
- Calibrate minimum gas pressure switch 7)(A)p.9 to the start of the scale (A).
- Calibrate maximum gas pressure switch 17)(A)p.4 to the end of the scale (B).
- Do not change the gas butterfly, 18)(A)p.4, which must be closed (indicator to 0°) when the burner is OFF.
- Bleed air from the gas pipework by opening screw 1)(A) on minimum gas pressure switch 7)(A)p.9.
It is advisable to discharge the air bled from the system through a plastic pipe leading outside the building until gas is smelt.
- Fit a "U"-type manometer (C) on the gas pressure test point of sleeve 16)(A)p.4.
This will provide an approximate indication of MAX. burner delivery, referring to graphs, page 7.

BURNER OUTPUT

The output levels to which the burner must be calibrated are:

- Firing output
- Minimum output
- Intermediate outputs
- Maximum output

Before firing the burner, it is good precautionary practice to precalibrate it at low output levels, to ensure that firing takes place in maximum safety conditions.

Pressure governor 6)(A)p.9

- Unscrew screw 1) which compresses spring 2) of regulator (A)p.17 but do not remove it, so that minimum gas output pressure is obtained: position B (A)p.17.

Safety solenoid 8)(A)p.9

- Fully open the safety solenoid delivery regulator 8)(A)p.9. If it is partially closed, this would cause an unnecessary loss of load.

Firing output

must be 20-30% lower than the maximum output of the plant.

Calibrate as follows:

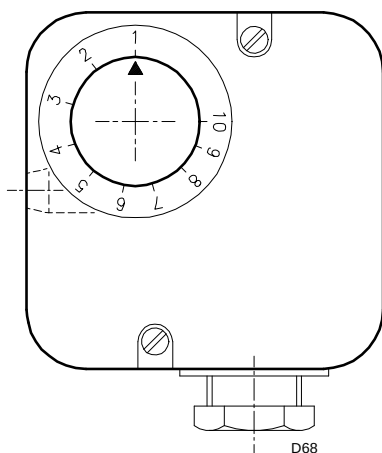
- Fully tighten the screw of solenoid 9)(A)p.9 which regulates firing delivery and then unscrew it by 1 - 1,5 turns.

Maximum output

should be temporarily calibrated as follows:

- Fully tighten the knob of solenoid 9)(A)p.9 which regulates total delivery and then unscrew it by 4-5 turns.

The final calibration of maximum, minimum and intermediate output is described at point 5.4.



(A)

3.3 COMBUSTION AIR

- The boiler room must be equipped with the prescribed ventilation outlets to free air. It is suggested that combustion tests be taken at Max. delivery with the room aired only by the outlets which will feed air to the burner and then repeat the measurements with doors and windows open. The results of this combustion test under the two different conditions must not change. If the boiler room houses several burners and/or exhaust systems, the test should be performed with all systems operating simultaneously.

- The air which enters the fan must not be at a temperature greater than 60°C and must be free of solid impurities. Cloths and paper must be kept away from the fan. Even dust may be harmful in the long term. Dust which settles on the fan wheel blades may lead to a reduction in fan output and cause dirty combustion. Dust may also settle on the flame stability disc in the combustion head giving rise to a poor quality gas-air mixture.

- Calibrate air pressure switch 7)(A)p.4 to the start of the scale (A).

- Do not change the settings of the air gate valve and the combustion head.

3.4 ELECTRICAL SYSTEMS

- The GAS 8-9-10 P/M burners have been type-approved for intermittent operation. This means they should compulsorily be stopped at least once every 24 hours to enable the control box to perform checks of its own 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 TL (page 11-12) to provide for burner shut-down at least once every 24 hours. These burners are also fitted for the continuous operation, if they are equipped with the control box LANDIS type LGK 16.335 A27 (interchangeable with the burner control box LANDIS LFL 1.335).

- Make sure that the power supply voltage indicated on the burner information plate is the same as the mains supply available.

- Connect two lamps or testers in parallel to the two solenoids 8)-9)(9A) to control when voltage reaches the system.

GAS 8 - 9 P/M Burners with 220 V power supply, direct motor starting:

Connect the delta motor and calibrate thermal relay 9)(A)p.4 as indicated in layout (E)p.12.

GAS 8 - 9 P/M Burners with 380 V power supply, direct motor starting:

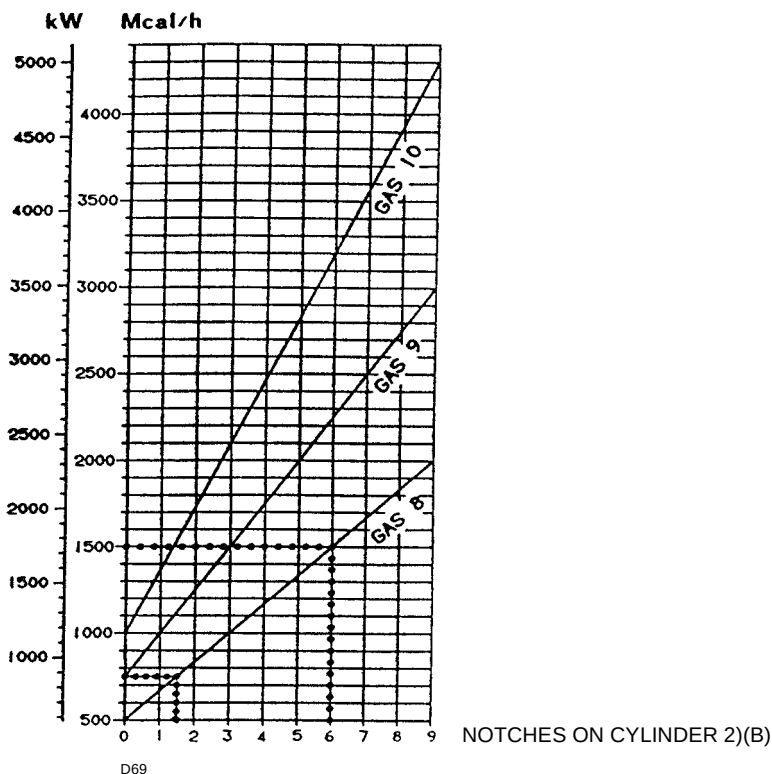
Check that the motor is connected in star format and that thermal relay 9)(A)p.4 is calibrated as indicated in layout (E)p.12.

GAS 10 P/M Burner with star-delta motor starting:

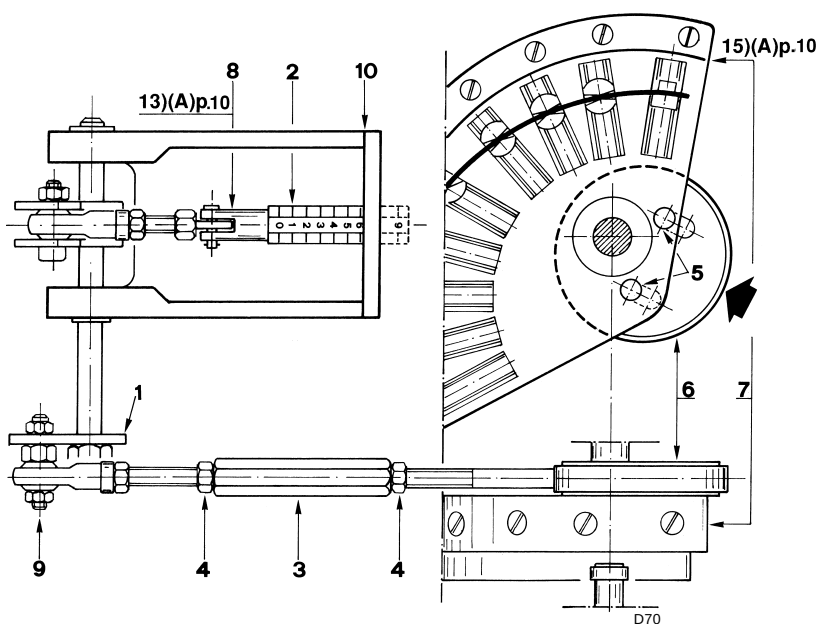
Check that the thermal relay and timer are calibrated as indicated in layout (C)p.10.

3.5 BURNER STARTING

- Close load controls and burner isolating switch.
- As soon as the burner starts, check the direction of rotation of the motor. Make sure that the lamps or testers connected to the solenoids indicate that no voltage is present. If voltage is present, then immediately stop the burner and check electrical connections.
- Make sure that the burner starting programme takes place in accordance with phases and times indicated at point 6 (page 22).



(A)



(B)

4 - BURNER FIRING

Having completed the checks indicated at point 3 above, the burner should fire. If the motor starts but the flame does not appear and the control box goes to lock-out, reset and wait before attempting to start the system again.

If firing is still not achieved, it may be that gas is not reaching the combustion head within the safety time period of 2 seconds.

Therefore, unscrew by half a turn the screw which regulates firing delivery on solenoid 9)(A)p.9 and then, if firing still does not occur, increase the gas output pressure on the governor (A)p.17 by tightening 1-2 turns the screw 1) which compresses spring 2).

The arrival of gas at the sleeve is indicated by U-type manometer (C)p.13. Burner firing and the increase between MIN and MAX delivery must be smooth, without knocks or pulsations.

Once firing has occurred, stop the burner and proceed to perform complete calibration.

5 - BURNER CALIBRATION

5.1 SETTING THE COMBUSTION HEAD

Fixed gas adjustments should already have been performed as described in paragraph 2.4. The variable gas and air adjustments must now be made. These adjustments depend exclusively on the MIN. and MAX. outputs at which the burner is expected to operate.

Gas-air variable adjustment (A - B)

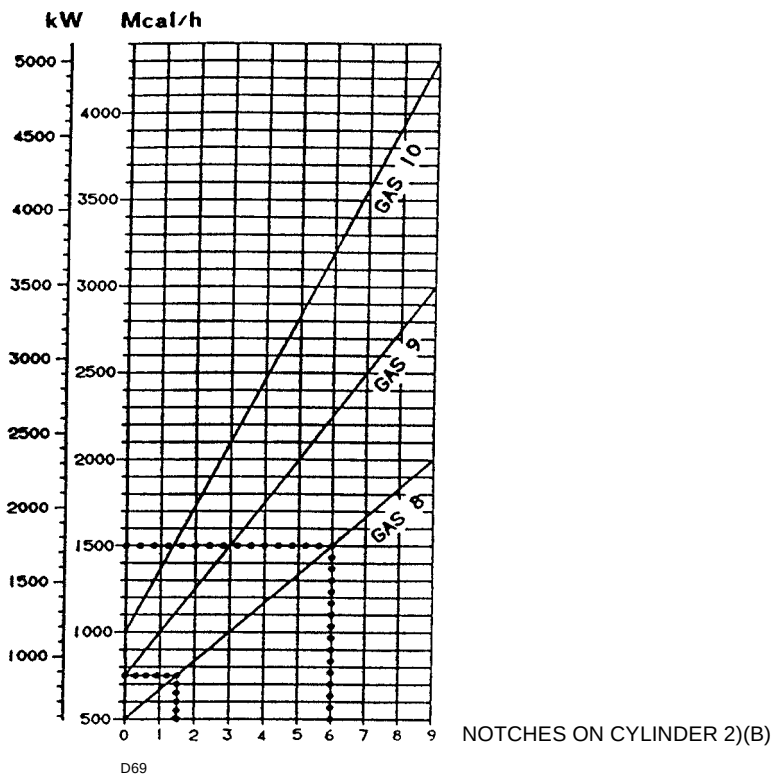
This adjustment consists of a forwards-backwards movement of two shutters mounted inside the combustion head. These two shutters, driven by the servo-motor 14)(A)p.4 together with the gas butterfly valve and the air gate valve, modify the gas and air outlet cross-sections. When the burner changes from MAX. to MIN. output, the two shutters reduce the outlet cross-sections and maintain gas and air pressures at optimal values. This ensures highly efficient combustion even at low settings. The opposite occurs when changing from MIN. to MAX. outputs.

The position of the two shutters is indicated by the notches on the graduated cylinder 2)(B) with reference to surface 10). Notch 0: minimum aperture; notch 9: maximum aperture. The control levers operate at the same time on both the two shutters. The control levers are factory-calibrated to a maximum travel of 9 notches (movement of cylinder 2) between notch 0 and notch 9), in relation to the maximum variation in output of the burner in operation: i.e. about 1-4.

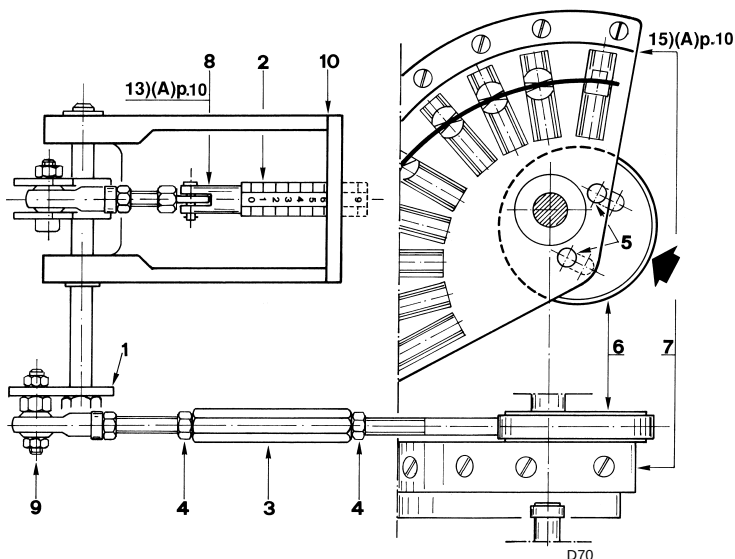
To obtain a lower MIN-MAX ratio, the lever system must be re-calibrated so that cylinder 2) travel takes place between the notches relating to desired outputs, which can be read from graph (A).

For example, with the GAS 8 P/M model, a variation in output between 750 MIN and 1.500 MAX Mcal/h, the cylinder 2) must move from notch 1,5 (MIN) to notch 6 (MAX), representing a travel of 4,5 notches.

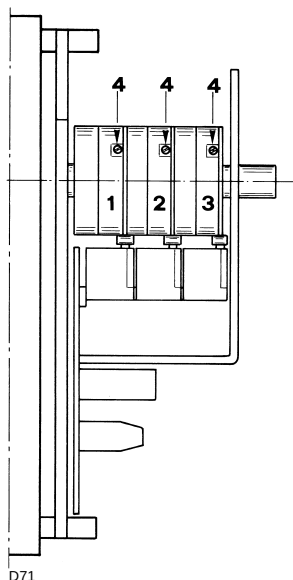
In order to obtain a variation in cylinder travel, it should be borne in mind that the control con-rod 1)(B) of drive rod 8) has one slot; moving the ball-joint 9) outwards on the slot shortens the travel of cylinder 2) to 4 notches.



(A)



(B)



(C)

Proceed as follows (burner OFF):

- Calculate from graph (A) the notches for the desired MIN and MAX outputs and then for related travel of cylinder 2)(B): notch MAX $\pm$ notch MIN.
- Release the variable profile cam 2)(C)p.18 from the servo-motor by pressing lever 9)(C)p.18.
- Manually turn cam 2) from 0° to 130° referring to surface 10)(C)p.18.
- Check the travel of cylinder 2)(B), checking against reference surface 10)(B).
- If the travel is greater than that indicated on graph (A), slacken the securing nut of ball joint 9)(B), move the ball joint along the slot in small steps until, with full rotation between 0 - 130° of cam 2)(C)p.18, the travel required in relation to surface 10)(B) is found.
- Lock the ball joint securing nut.

If, even with ball joint 9)(B) at the end of the slot, the desired reduction of travel is not obtained, proceed as follows:

- Manually return the servo-motor to 0°.
- Slacken the socket head screws 5) which secure the servo-motor shaft cam.
- Press ring 6) in the direction of the arrow in order to reduce eccentricity and thus the travel of shaft 8).

Once the desired travel is obtained, position the servo-motor to 0°. Check whether the notch of cylinder 2) on reference surface 10) coincides with the desired MIN value.

If it does not line up:

- Slacken nuts 4).
- Rotate the hex. sleeve 3) to shorten or lengthen the rod until the minimum value notch lines up with surface 10).
- Lock the nuts 4).

Check by means of manual rotation of cam 2)(C)p.18 between 0° and 130° that there is no "sticking" in movements and that the MIN e MAX notches correspond with the values indicated in graph (A).

5.2 SETTING THE SERVOMOTOR (C)

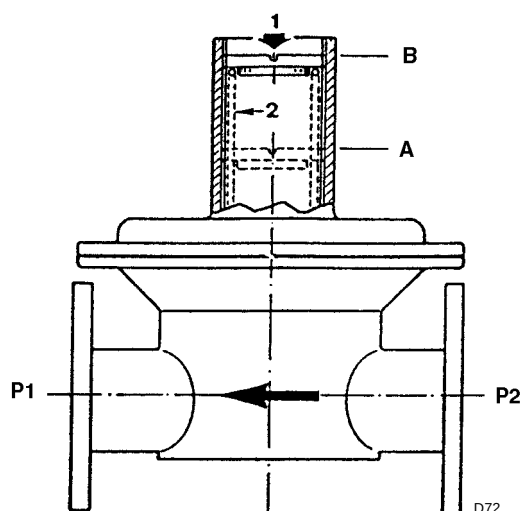
Servo-motor 14)(A)p.4 simultaneously regulates the air gate valve via the variable profile cam, the gas butterfly valve and the movement of the shutters mounted inside the combustion head. A rotation of 130° is made in 37 s.

It is fitted with three adjustable cams operating three contacts, which are factory-set as follows:

- Blue Cam 1): 0°
Restricts rotation to minimum.
When the burner is OFF, the air gate valve is closed.
- Red Cam 2): 130°
Restricts rotation to maximum.
- Black Cam 3): 20°
This is the firing and MIN output position.

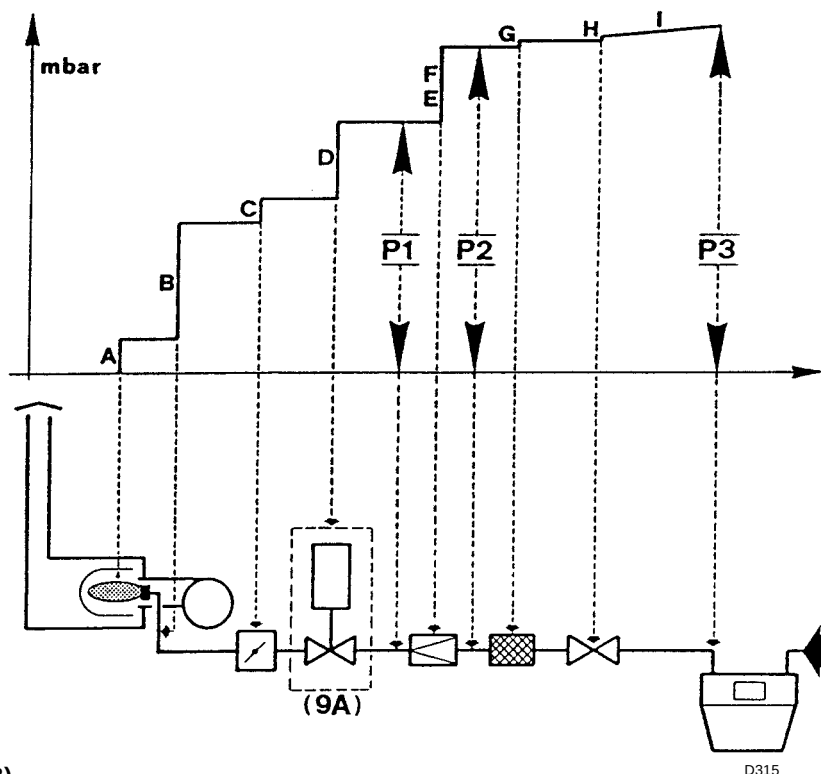
Cams 1) and 2) must not be modified.
Cam 3) may be rotated between 10 and 30°, as explained below.

Each cam is fitted with a screw 4) which regulates the contact action point.



(A)

LOSS OF LOAD



(B)

EXAMPLE: MAXIMUM GAS DELIVERY = 100 Nm³/hDROP IN PRESSURE WITH 100 Nm³/h

mbar	
A	= 3
B	= 10
C	= 2
D	= 7
G	= 1
H	= 0,5
I	= 0,5
P3	= 30

$$\dot{y}P = P2 - P1$$

$$P2 = P3 - I - H - G = 30 - 0,5 - 0,5 - 1 = 28 \text{ mbar}$$

$$P1 = A + B + C + D = 3 + 10 + 2 + 7 = 22 \text{ mbar}$$

$$\dot{y}P = P2 - P1 = 28 - 22 = 6 \text{ mbar}$$

$$\dot{y}P/2 = 6 : 2 = 3 \text{ mbar}$$

$$E = 3 \text{ mbar}$$

$$F = 3 \text{ mbar}$$

Data for selecting governor:

- Drop in pressure = 3 mbar
- Gas delivery = 100 Nm³/h

Governor calibration:

Further drop in pressure of 3 mbar

5.3 SETTING GAS PRESSURE

- To increase P1 output pressure, tighten screw 1) on pressure governor (A).

Position A = P1 max.

- To decrease P1 output pressure, unscrew screw 1) on pressure governor (A).

Position B = P1 min.

Governor selection and calibration

- Define the difference between governor upline and downline pressures at MAX burner delivery:

$$\dot{y}P = P2 - P1 \text{ where (B):}$$

$$P2 = P3 - I - H - G$$

$$P3 = \text{mains pressure}$$

$$I = \text{Dp pipework: Max 0,5 mbar}$$

$$H = \text{Dp manual valve: Max 0,5 mbar}$$

$$G = \text{Dp filter: see filter catalogue}$$

$$P1 = A + B + C + D$$

$$A = \text{pressure of combustion chamber.}$$

See boiler catalogue

$$B = \dot{y}p \text{ combustion head.}$$

See graph page 7

$$C = \dot{y}p \text{ butterfly valve 11)(A)p.9 (with maximum aperture). See page 9.}$$

$$D = \dot{y}p \text{ valves (A)p.9 (with maximum aperture)}$$

See valves catalogue

- Then divide the value found for DP by two:

- $\dot{y}P/2$, indicated by E in (B), is therefore the minimum pressure drop of the governor which, together with the maximum delivery of the burner, will help establish the governor required.
- The other $\dot{y}P/2$ value, indicated by F in (B), is the minimum drop in pressure added by the installer, which allows the governor membrane to oscillate and thus keep P1 constant.

In this way, the drop in final pressure $P2 - P1$ must always be at least double the governor's loss of minimum pressure, as indicated in the manufacturer's catalogue.

See example (C).

If mains pressure is very high, select the governor with the maximum $\dot{y}p$ available in the catalogue and then tighten screw 1)(A) to pressure P1 required by the burner. In this case F (loss of load added by the installer) will be greater than E (governor loss of load).

- Governors may be fitted with several springs 2)(A) of different colours; select the spring with the calibration range which includes pressure P1 required by the burner.
- If, before installing the burner, it must be known what minimum mains pressure is needed to obtain maximum output, calculate:

$$P3 = A + B + C + D + E + F + G + H + I$$
 where the letters have the meanings indicated above.
 (Bear in mind that $E = F = \text{min. pressure drop through governor}$).

5.4 SETTING BURNER OUTPUT

The burner must be set to the following output levels:

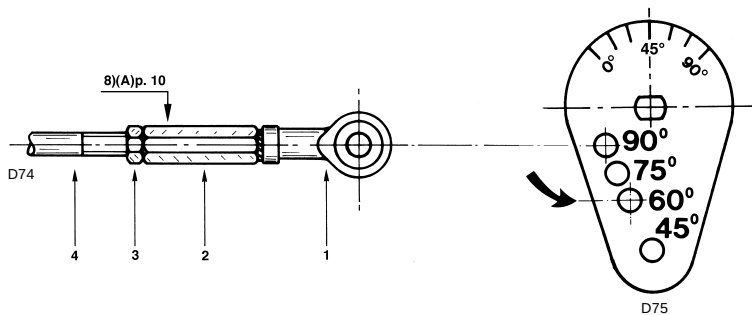
- Firing output
- Minimum output
- Intermediate outputs
- Maximum output

Output at firing is described at point 3.2.

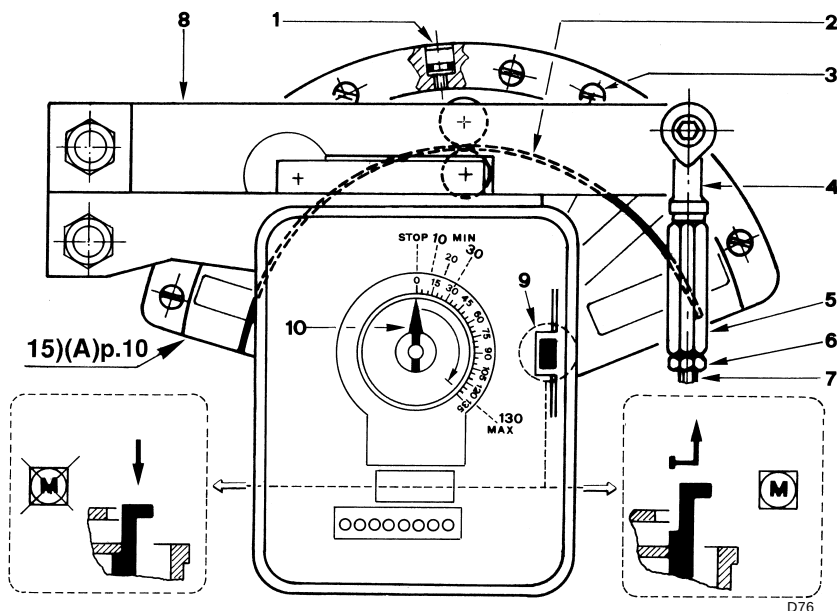
To set other output levels, proceed as follows.

Preliminary calibrations (if required)

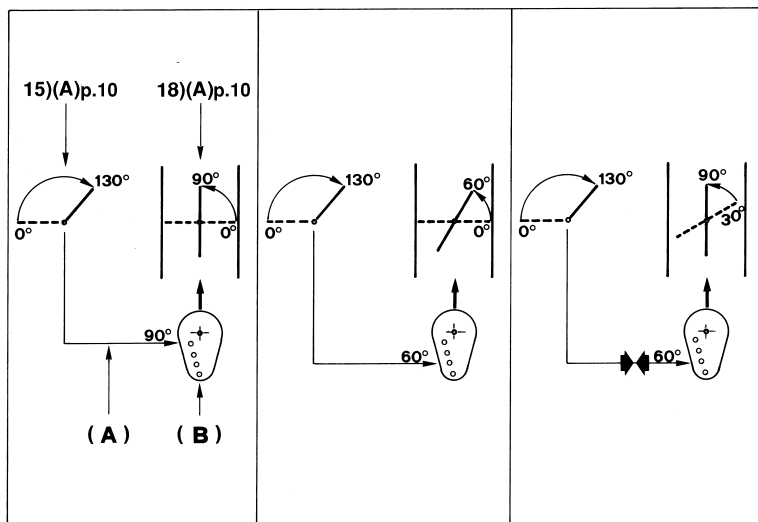
Preliminary calibrations may be required for the arm (B)p.18 of the gas butterfly, arm control linkage (A)p.18 and air gate valve control linkage 7)(C)p.18. Calibration settings depend on the MIN and MAX outputs at which the burner must operate.



(A) (B)



(C)



(D)

(E)

(F)

• The burner is factory-calibrated for a MIN-MAX output ratio of 1:3-1:4. The ball joint 1(A) which drives arm (B) of the gas butterfly valve is positioned at 90°.

In this way, the gas butterfly valve passes through an angle of 90° when cam 2(C) completes its full 130° angle (D).

When the MIN-MAX ratio is about 1:2, ball-joint 1(A) should be moved from the 90° hole to the 60° hole (B) (burner OFF).

In this case, the gas butterfly valve passes through an angle of 60° when cam 2(C) completes its full 130° angle (E).

There are two other holes on arm (B) at 75° and 45°; these positions are useful when the work angle of the butterfly must be reduced when gas pressure is higher up-line from the butterfly.

• If the 1:2 ratio lies in the higher output range (e.g. 40-80% of MAX burner output), not only should the ball-joint be moved from 90° to 60° but linkage (A) should also be **shortened**; rotate the gas butterfly work angle so that maximum aperture is 90°: from 0-60° (E) to 30-90° (F). In this case, the gas butterfly remains partially open with the indicator at about 30° and the burner at rest.

To shorten the linkage, proceed as follows (burner OFF):

- Separate ball-joint 1(A) from the arm (B).
- Slacken nut 3(A).
- Tighten hexagon 2) a few turns.
- Lock nut 3)
- Re-fit ball-joint 1(A) to the arm (B).

• If the 1:2 ratio lies in the lower output range (e.g. 25-50% of MAX burner output), **lengthen** the linkage 7(C) controlling the air gate valve. This avoids giving the cam too curved a profile. Proceed as follows (C) (burner OFF):

- Release ball-joint 4) from lever 8).
- Slacken nut 6).
- Tighten hexagon 5) a few turns.
- Lock nut 6)
- Re-fit ball-joint 4) to lever 8).
- Raise the profile of cam 2) near its starting point by turning screws 1) until the indicator on the gate valve shaft returns to the 0° position, with the servomotor also at 0°.

Perform any of the above calibrations which may be required and then start the burner and as soon as the MIN output flame appears, disengage the servomotor 14(A)p.4 by opening the mobile plug-socket 22(A)p.4 connecting it to equipment 12(A)p.4.

Then regulate MAX, MIN, INTERMEDIATE outputs in this order.

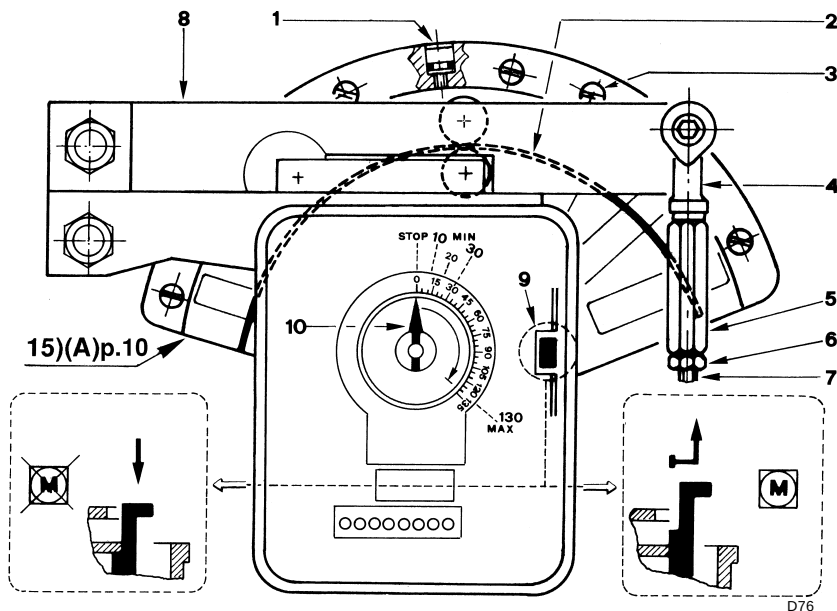
5.4.1 SETTING MAX OUTPUT

MAX output (stage 2) must be selected from the MAX firing rates given on page 6.

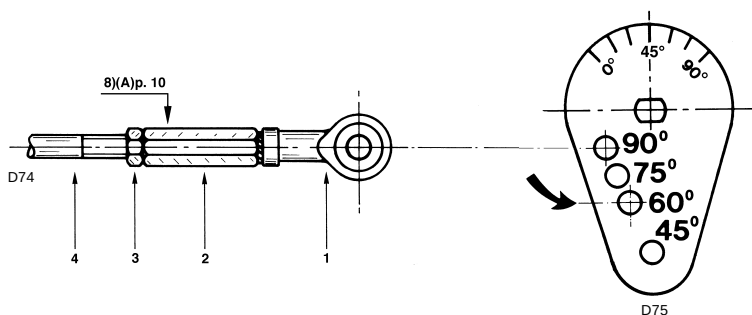
MAX gas adjustment

- Release the variable profile cam 2(C) from the servo-motor by pressing lever 9).
- Turn cam 2) slowly by hand clockwise to 130°, as read on indicator 10).
- Block the variable profile cam 2) to the servo-motor again by pulling lever 9).

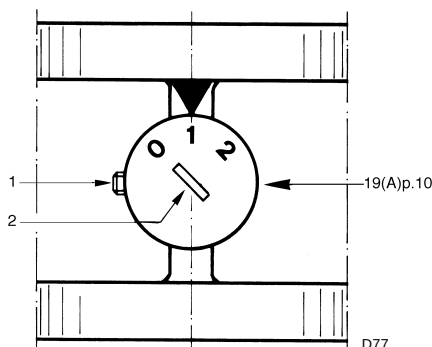
At this point, measure gas delivery.



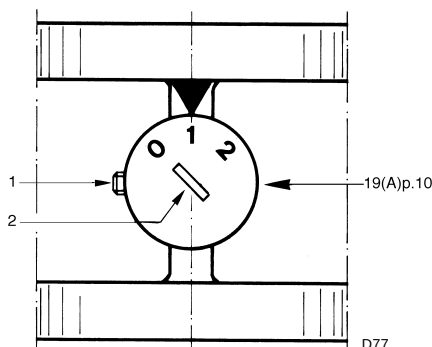
(A)

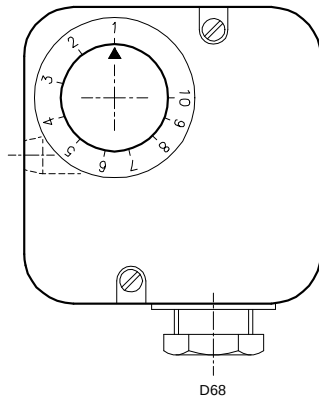


(B)



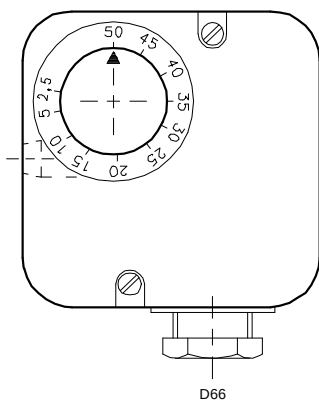
(C)





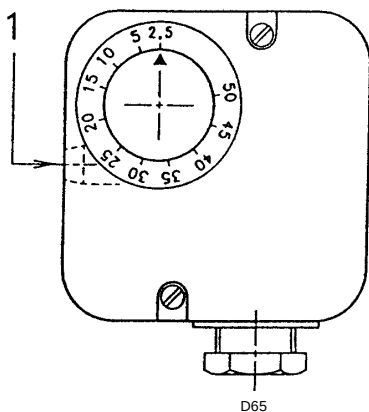
(A)

MAX GAS PRESSURE SWITCH 17)(A) pag. 4



(B)

MIN GAS PRESSURE SWITCH 7)(A) pag. 9



(C)

5.4.3 SETTING INTERMEDIATE OUTPUTS

(required particularly for modulating operation)

Gas

No adjustment is required.

Air

The adjustment is made by acting on intermediate screws 1)(A)p.19 which regulate the profile of the cam, taking care not to move those for minimum and maximum delivery.

Check that combustion is satisfactory in 2-3 intermediate points between MIN and MAX.

Having completed the adjustment, lock screws 1)(A)p.19 using transverse screws 3) and reset the electrical connections of the servomotor by fitting the mobile plug-socket 22)(A)p.4.

5.5 SETTING THE AIR PRESSURE SWITCH (A)

Adjust the air pressure switch 7)(A)p.4 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 knob clockwise until the burner locks out. Then turn the knob anti-clockwise by 1 mbar and repeat burner starting to ensure it is uniform.

If the burner locks out again, turn the knob anti-clockwise again by 0.5 mbar.

N.B.

The efficiency of the pressure switch is checked every time the burner is started. This means that the burner will only start if the air pressure switch is in the correct rest position and that burner firing will only take place if the pressure switch indicates that air is available.

5.6 SETTING MAXIMUM GAS PRESSURE SWITCH (B)

Adjust the maximum gas pressure switch 17)(A)p.4 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 knob anti-clockwise until the burner locks out.

Then turn the knob clockwise by 2 mbar and repeat burner firing.

If the burner locks out again, turn the knob again clockwise by 1 mbar.

5.7 SETTING MINIMUM GAS PRESSURE SWITCH (C)

Adjust the minimum gas pressure switch 7)(A)p.9 after having performed all the other burner adjustments with the pressure switch set at the start of the scale (C).

Operate the burner at the maximum required output. Slowly close manual valve 2)(A)p.9 until the pressure, measured at the pressure switch (C) test point 1), drops by 5-6 mbar in relation to the operation value. Slowly turn the pressure switch knob until the pressure switch itself operates and thus brings the burner to a stop.

Completely open valve 2)(A)p.9.

DIN 4788 (2-90)					kW	
CO	max	= 100 mg/kWh	= 80 ppm	= 0,008%	MIN	MAX
NOx	max	= 200 mg/kWh	= 100 ppm	= 0,01%		MAX
E		= min	10%	max 15%		MAX
E		= min	10%	max 30%		
UNI 8042 (4-88)					kW	
CO	max	= 1200 mg/kWh	= 1000 ppm	= 0,1%	MIN	MAX
E	max			= 23%	MIN	MAX

E = excess air

kW = burner output

(A)

$$E = \frac{CO_2}{CO_2} \frac{MAX}{MEASURED} \geq 1, 1 = 10 \%$$

Example with methane:

CO₂ max = 11,7%

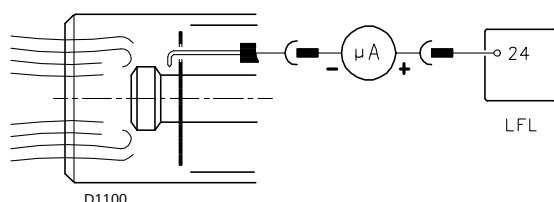
CO₂ measured = 10,5%

$$E = \frac{11,7}{10,5} = 1,11 = 11\%$$

(B)

Family	Name	Type			Net calorific value		Density		CO ₂
		Reference	Volume %	Component	kWh/Nm ³	kWh/Nm ³	relative AIR=1	absolute kg/Nm ³	MAX %
I	Town gas	G 110	50 26 24	H ₂ CH ₄ N ₂	4,09	3520	0,41	0,52	7,6
	Town gas	G 112	59 17 24	H ₂ CH ₄ N ₂	3,46	2976	0,36	0,47	6,0
	Town gas	G 120	47,1 32 20,9	H ₂ CH ₄ N ₂	4,60	3955	0,41	0,53	8,3
	Town gas	-	59 41	H ₂ CH ₄	5,85	5030	0,26	0,34	8,8
	Air-propane	G 130	26,5 73,5	C ₃ H ₈ AIR	6,84	5885	1,14	1,47	13,7
II	Methane	G 20	100	CH ₄	9,97	8570	0,55	0,71	11,7
	Natural gas	G 21	87 13	CH ₄ C ₃ H ₈	12,02	10341	0,68	0,88	12,2
	Natural gas	G 22	65 35	CH ₄ H ₂	7,53	6472	0,38	0,49	10,4
	Natural gas	G 23	92,5 7,5	CH ₄ N ₂	9,22	7927	0,58	0,75	11,5
	Natural gas	G 25	86 14	CH ₄ N ₂	8,57	7370	0,61	0,78	11,4
	Natural gas	G 26	80 7 13	CH ₄ C ₃ H ₈ N ₂	9,78	8409	0,67	0,87	11,8
	Natural gas	G 27	82 18	CH ₄ N ₂	8,17	7027	0,62	0,81	11,4
III	Butane	G 30	100	C ₄ H ₁₀	34,08	29310	2,07	2,67	14,0
	Propane	G 31	100	C ₃ H ₈	25,80	22190	1,55	1,95	13,7
	Propylene	G 32	100	C ₃ H ₆	24,36	20950	1,48	1,90	15,0
	LPG	-	80 15 6	C ₃ H ₈ C ₄ H ₁₀ C ₃ H ₆	26,97	23196	1,62	2,09	13,8

(C)



(D)

5.8 SETTING COMBUSTION

Burner output

MAX burner output must not exceed the output envisaged for the boiler; it should be adjusted in relation to the user's effective heating requirements and selected within the MAX firing rates (A)p.6.

A lower setting of the boiler provides for a lower fume temperature, thus increasing combustion efficiency and saving fuel.

MIN output should be adjusted as low as possible in relation to user requirements and formation of condensate and should be selected within the MIN firing rates (A)p.6.

Emissions into the atmosphere

Test boilers UNI-DIN (6B):

emissions of CO-CO₂-NO_x obtained in laboratory tests with our burners proved to be lower than the limits defined by DIN 4788 and UNI 8042 standards under the operating conditions established by these standards, see (A).

Commercial boilers:

emissions of CO-CO₂-NO_x must not exceed the limits imposed by locally-applicable standards for burner installations.

In particular, make sure that excess air is not less than 10%, to avoid the danger that small changes in the combustion operating environment (variations in flue draught, temperature etc.) could give rise to pollution.

The value of excess air, E, can be calculated as indicated in (B). For maximum CO₂, see (C) or contact your GAS COMPANY.

Measured combustion values can only be relied upon if there is no incoming air between the burner and the flue test point. Check suspect seals with smoke: if the smoke is drawn in, there is an air entry point.

Flue gas temperature

This temperature varies in relation to the output generated. The lower the output, the lower the temperature and the higher the fuel saving. Bear in mind that excessive temperature reduction, however, gives rise to the formation of condensate.

Pressurisation of the combustion chamber

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

Chamber pressure is lowered with reduced burner delivery and higher CO₂ levels.

If chamber pressure is considerably higher than required values, check that the flue passes are not obstructed and that the smoke stack is of the correct size.

Loss of heat from the flue

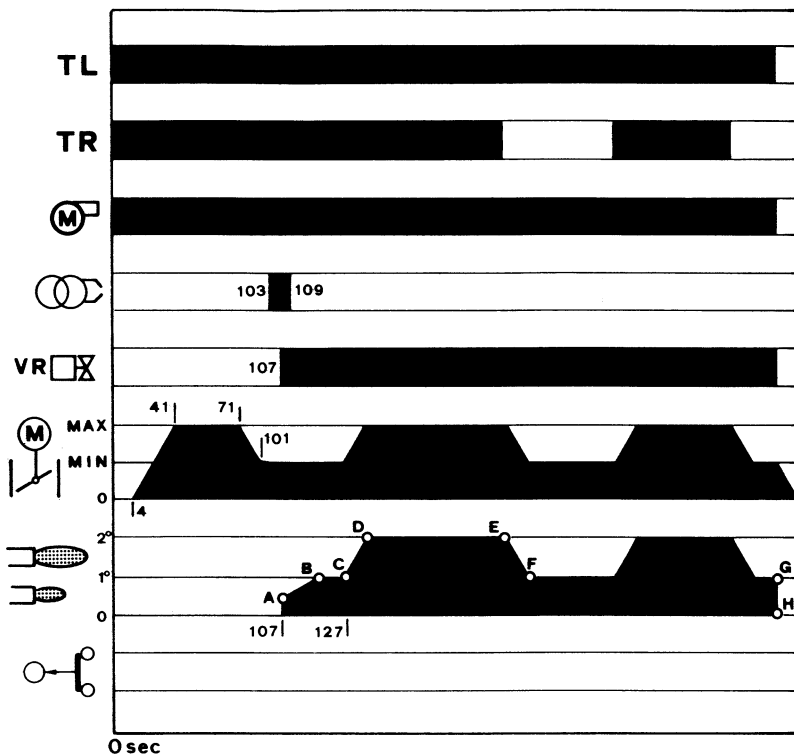
Loss of heat, Q_s, from the flue, is indicated in equation (A)p.26 or graph (B)p.25.

5.9 FLAME PRESENT CHECK (D)

The burner is fitted with an ionisation system which ensures that a flame is present. The minimum current for plant operation is 6 μA. The burner provides a much higher current, so that controls are not normally required. However, if it is necessary to measure the ionisation current, pull out the control box 12)(A)p.4, detach the lead from terminal 24)(A-B)p.10 and connect it in series to a direct current microammeter with a base scale of 100 μA. Carefully check polarities.

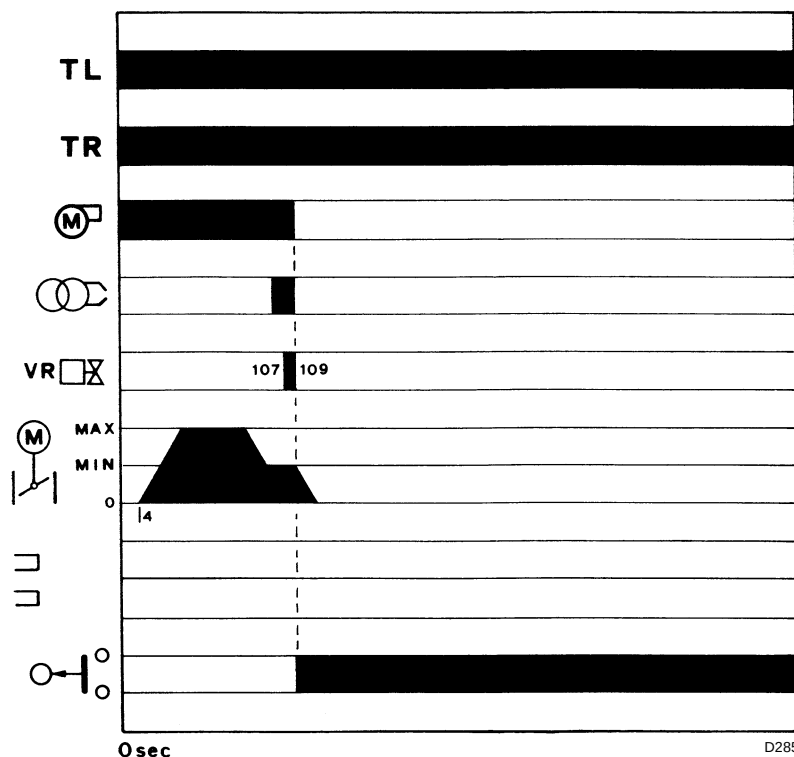
NORMAL FIRING

(n° seconds from instant 0)



(A)

NO FIRING



(B)

6 - OPERATION

Burner starting (A)

- When the load control TL closes, the control box 12)(A)p.4 programmes the starting phase. The following description refers to gas train (A)p.9 in which the adjustment valve 9) opens with two speeds:
 1. rapid aperture
 2. slow aperture controlled by an hydraulic brake
- Time 0s: Load control TL closes. Fan motor starts.
- After 4s: Servomotor starts: 130° rotation to right, until contact is made on cam 2)(C)p.16. The air gate valve is positioned to MAX. output.
- After 41s: Pre-purge stage with air delivery at MAX. output. Duration 30 seconds.
- After 71s: Servomotor rotates to left up to the angle set on cam 3)(C)p.16 (between 10 and 30°).
- After 101s: The air gate valve and the gas butterfly are positioned to MIN. output.(with cam 3)(C)p.16 at 20°).
- After 103s: Ignition electrode strikes a spark.
- After 107s: Safety valve VS (not shown in the graph at the side) and adjustment valve VR (rapid stroke) open. The flame is ignited at a low output level (point A). Delivery is then progressively increased, with the valve opening slowly up to MIN output, 1st stage, point B.
- After 109s: The spark goes out.
- After 127s: The control box starting cycle ends.

Normal operation (A)

- At the end of the starting cycle, the servomotor control then passes to the load control TR for boiler pressure or temperature (point C). The LFL control box continues, however, to check that the flame is present and that air and gas max. pressure switch are in the correct position.
- If the temperature or pressure is low (and the TR load control is consequently closed), the burner progressively increases its output until the MAX. value, 2nd stage is reached (section C-D).
- If subsequently the temperature or pressure increases until TR opens, the burner progressively decreases its output until the MIN. value, 1st stage is reached (section E-F). And so on.
- The burner locks out when demand for heat is less than the heat supplied by the burner in the 1st stage (section G-H). Load control TL opens. The servomotor returns to the 0° angle limited by contact with cam 1)(C)p.16. The gate valve closes completely to reduce thermal dispersion to a minimum.
- Every time output is changed, the servomotor 14)(A)p.4 automatically modifies gas delivery (gas butterfly valve), air delivery (fan gate valve), gas and air pressure (2 shutters in the combustion head).

If the flame accidentally goes out during operation, the system locks out within 1 s.

No firing (B)

If the burner does not fire, the system locks out within 2s of the adjustment valve 9)(A)p.9 opening and 109s after the fan motor has started (with cam 3)(C)p.16 at 20°).

1 $1 \text{ kW} = 860 \text{ kcal/h}$

2 $1 \text{ Mcal} = 1000 \text{ kcal}$

3
$$\text{PB (kW)} = \frac{\text{PC}}{\eta} \cdot \frac{(\text{kW})}{100} \cdot \frac{(\%) }{100}$$

4 $\eta (\%) = 100 - Q_s (\%)$

5
$$Q_N (\text{Nm}^3/\text{h}) = \frac{\text{PB}}{\text{PCI}} \cdot \frac{(\text{kW})}{(\text{kWh}/\text{Nm}^3)}$$

6
$$Q (\text{m}^3/\text{h}) = \frac{Q_N}{f} (\text{Nm}^3)$$

7
$$f = \frac{0,2695 \times (\text{Pb} + \text{Pg})}{(273 + \text{tg})} \cdot \frac{(\text{mbar} + \text{mbar})}{(^{\circ}\text{C})}$$

EXAMPLE

PC = 900 kW	$\eta = 90\%$	PCI = 10 kWh/Nm ³
Pb = 1000 mbar	Pg = 40 mbar	tg = 20 °C

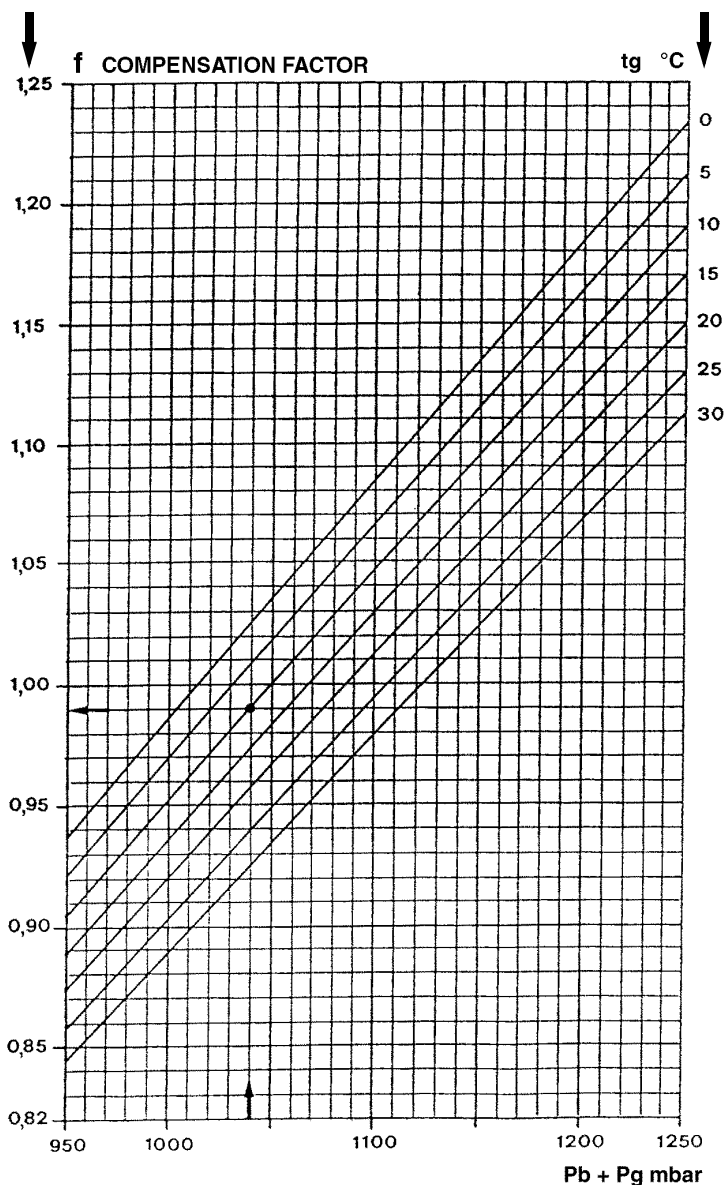
$$\text{PB} = \frac{900}{\frac{90}{100}} = 1000 \text{ kW}$$

$$Q_N = \frac{1000}{10} = 100 \text{ Nm}^3/\text{h}$$

$$f = \frac{0,2695 \times (1000 + 40)}{(273 + 20)} = 0,957$$

$$Q = \frac{100}{0,957} = 104,5 \text{ m}^3/\text{h}$$

(A)



Example: $\text{Pb} + \text{Pg} = 1040 \text{ mbar} \rightarrow \text{tg} = 10^{\circ}\text{C} \rightarrow f = 0,990$

(B)

7 FINAL CONTROLS

- Check burner halts or lock-outs as follows:
detach:

- a lead from the minimum gas pressure switch
- a lead from the maximum gas pressure switch (lock out)
- common lead P of the air pressure switch (lock out)
- the ionisation probe lead; alternatively, place it in short-circuit to earth (ground) (lock out)

open:

- boiler limit load controls (TL)
- boiler safety load controls (TS)

- Check that the mechanical locking systems on the adjustment devices are properly tightened.

- Shut down the burner operating normally, start it again immediately and check that the starting cycle occurs as described in par. 6.

- Before leaving the plant installation, record the measured combustion values on the report form, page 26; this data will be useful in the future.

The high and low firing settings of the burner in the 1st and 2nd stages must be within the firing rates, page 6.

8 GAS DELIVERY MEASURED AT METER (A)

• Boiler and burner outputs, respectively PC and PB, are expressed in kW. They may also be expressed in kcal/h and Mcal/h.

• The ratio between kW and kcal/h is given in [1]

• The ratio between Mcal/h and kcal/h is given in [2]

• Burner output, PB, required for rated boiler output, PC, is given in [3]

• Combustion efficiency, η , is given in [4]

Where: Q_s is the loss of heat from the flue obtained using formula (A)p.26 or graph (B)p.25. With modern boilers, this can be estimated as $\eta=90\%$.

• Standardised gas delivery, Q_N (referred to a temperature of 0°C and a pressure of 1013 mbar), required to obtain burner output is given in [5]

Where: PCI is the net calorific value as shown in table (C)p.21; alternatively, contact your GAS COMPANY.

• Gas delivery, Q , measured at the meter is given by [6]

Where: "f" is a compensation factor given by .[7] or by graph (B). The following values are considered:

- Pb = barometric pressure mbar
 - Pg = gas pressure mbar
 - tg = gas temperature °C
- (Pg and tg measured at the meter)

9 THE BURNER DOES NOT OPERATE CAUSES AND REMEDIES

Two types of burner failure may occur:

• CONTROL BOX LOCK OUT:

if the control box 12)(A)p.4 pushbutton lights up, it indicates that the burner is in lock out. To reset, press the pushbutton.

• MOTOR TRIP:

release by pressing the pushbutton on thermal relay 9)(A)p.4 or the starter motor RT (C)p.10, de-pending on burner model.

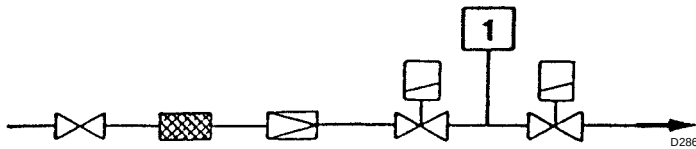
If the failure persists after 2-3 attempts to release it, do not proceed any further; switch off at mains isolator and call in qualified maintenance-repair personnel.

The control box 12)(A)p.4 is fitted with a disc which rotates during the firing programme, which can be seen through the transparent lock-out reset button. When the burner does not fire or comes to a halt following a fault, the symbol which appears behind the reset button indicates the type of problem.

SYMBOL	FAULT	PROBABLE CAUSE	SUGGESTED REMEDY
	The burner does not start	Limit or safety load control open	Adjust or replace
		Stuck in lock out	Reset
		No gas supply	Open the manual valves between meter and train
		No electricity supply	Close switches-Check connections
		Control box fuse blown	Replace (1)
		Contact 1 of servomotor does not operate control box terminals 11-8	Adjust cam 1 or replace servo-motor
		Mains gas pressure insufficient	Contact your GAS COMPANY
		Min. gas pressure switch does not close	Adjust or replace
		Air pressure switch in operating position	Adjust or replace
		Defective control box	Replace
		Defective electric motor	Replace
	The burner does not start and	Flame simulation	Replace control box
	The burner starts but stops	Contact 2 of servomotor does not operate, control	Adjust cam 2 or replace servomotor
	The burner starts but stops almost immediately	Two phase electrical power supply, thermal relay trips	Reset thermal relay when three phase operation returns
	The burner starts and stops in lock out	Max. gas pressure switch does not close	Adjust or replace
		Air pressure switch inoperative due to insufficient air pressure:	Adjust or replace
		- Pressure switch pressure point pipe blocked	Clean
		- Dirty fan	Clean
		- Head wrongly adjusted	Adjust
		- High negative draft in chamber	Ask our technical office
	The burner starts a	Fault in flame detection circuit	Replace control box
	The burner stays in the pre-purge stage	Contact 3 of servomotor does not operate, control box terminals 10-8	Adjust cam 3 or replace servomotor
	After pre-purge the burner goes to lock out and the flame does not appear	The solenoid allows little gas through	Increase
		Gas pressure too low	Increase pressure adjustment on governor
		Ignition electrode wrongly adjusted	Adjust
		Air in pipework	Bleed air
		Incorrect electrical connections for valves or ignition transformer	Repeat connection
		Defective ignition transformer	Replace
		Defective high tension cable	Replace
		Solenoid does not open	Replace coil or rectifier panel
	Burner fires and then goes to lock out	Ionisation probe wrongly adjusted	Adjust
		Faulty electrical connections for probe	Repeat connection
		Insufficient ionisation	Check probe position
		Probe earthed	Withdraw or replace cable
		Max. gas pressure switch operates	Adjust or replace
	The burner repeats the start cycle without lock out	Mains gas pressure is near the value to which the min. gas pressure switch gas is adjusted. The repeated drop in pressure which follows valve opening causes temporary opening of the pressure switch itself, the valve immediately closes and the burner comes to a halt. Pressure increases again, the pressure switch closes again and the firing cycle is repeated. The sequence repeats endlessly.	Reduce operating pressure of minimum gas pressure switch Clean gas filter
	Lock out without symbol indication	Flame simulation	Replace control box
	During operation, the burner stops in lock out	Probe or ionisation cable earthed	Replace worn parts
		Fault on air pressure switch	Replace
		Max. gas pressure switch operates	Adjust or replace
	Lock out when burner stops	Flame remains in combustion head or flame simulation	Eliminate persistence of flame or replace control box

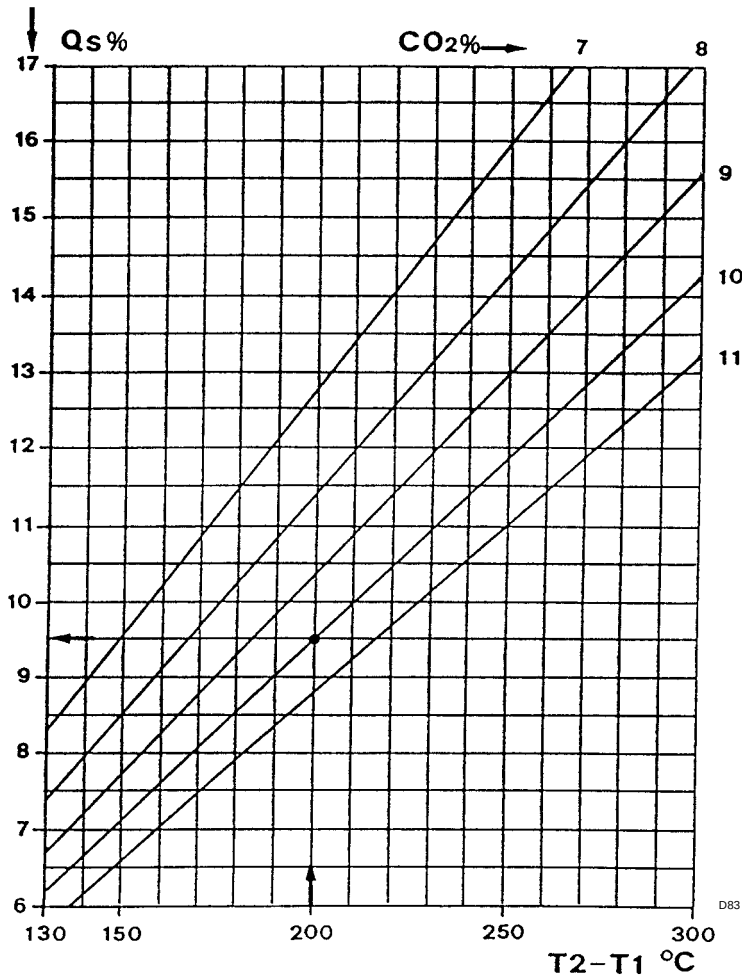
(1) The fuse is located in the rear part of the control box 12)(A)p.4. A pull-out fuse is also available as a spare part which can be fitted after breaking the tang on the panel which holds it in place

- The burner should only be repaired at qualified technical after-sales service centres using only original spare parts.
- It is not permitted to open or tamper with burner components; maintenance work may only be performed on components included in the maintenance programme.
- The only parts which may be replaced are those indicated in the manufacturer's catalogue.

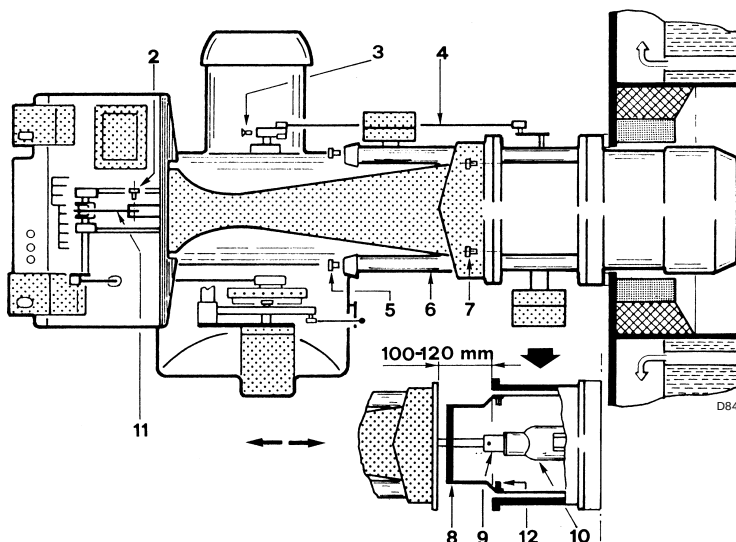


(A)

LOSS OF HEAT



(B)



(C)

10 MAINTENANCE

Maintenance should be performed by qualified personnel at least once a year.

- Check meter-burner pipework for leaks in relation to local regulations,
- Check the efficiency of the gas valve leak detection control device 1)(A), by simulating a failed valve leak detection.
- Measure the combustion values. See report form on page 26.
- Electrically isolate the plant.
- Clean the outside of the burner, especially the air and gas control rod ball joints and cam 15) (A)p.4. The cam should always be greased.
- Replace the gas filter whenever it is dirty.
- Open the burner and make sure that components of the combustion head are in good working order, unaffected by high-temperature operation, free of impurities/foreign matter from the surrounding environment and correctly positioned. When in doubt, disassemble the elbow 10)(C) and check the following:
 - Electrode tip
 - Ionisation probe
 - Flame stability disc
 - Blast tube
 - Gas distributor
 - High voltage cables.
- Check that dust has not accumulated inside the fan and on the impeller blades: this will reduce air delivery and, as a result, give rise to dirty combustion.
- Close the burner, checking that there is no unusual wear or slackened screws in the mobile systems which drive the gate valves, the gas butterfly valve and the combustion head.
- Release cam 2)(A)p.19 by pressing on lever 9) and check by hand that forwards-backwards rotation is smooth.
- Block cam 2) again and connect the plant to the power supply.
- If the combustion features found when beginning maintenance work do not correspond to those noted on the report card for the last maintenance intervention, or if in any case combustion is not optimal, recalibrate the burner.
- Record the final combustion values on the report card, page 26. This data will be useful for subsequent maintenance and control work on the burner.

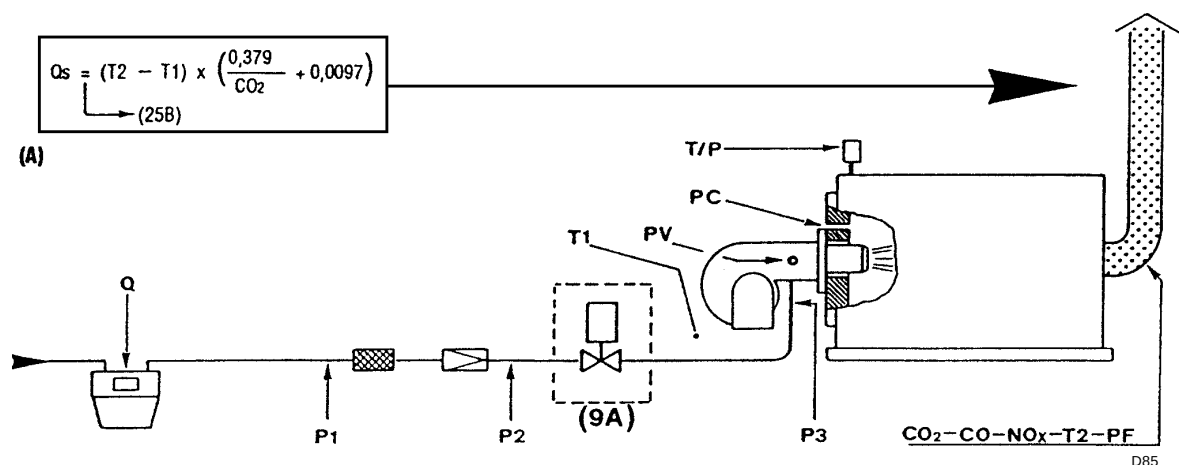
Opening the burner (C)

- Detach head drive rod 11) by removing pin 2).
- Detach gas butterfly valve 4) control rod by removing screw 3).
- Remove screws 7) which secure the fan to the head.
- Withdraw the burner by about 100-120 mm.
- Detach drive fork 8) by removing screws 12).
- Fully withdraw the burner on the slide bars 6); gas pipe 9) also slides out with the burner.

For burners with the maximum length head, fit the two extensions supplied as standard equipment with the system on slide bars 6) and support the burner on the wheel-mounted stand supplied as an extra unit, fig. (E)p.5, or other suitable means.

11 TABLE

BURNER	MODEL	TYPE	CODE
BOILER	COMPANY	MODEL	kW



Q	=	Delivery	CO	=	Carbon monoxide	PV	=	Fan pressure
P1	=	Mains pressure	NO _x	=	Nitrogen monoxide	T/P	=	Temperature or pressure
P2	=	Adjustment pressure	T2	=	Temperature	PC	=	Pressure of the combustion chamber
P3	=	Combustion head pressure	PF	=	Pressure +/- in smoke stack	Q _s	=	Loss of heat
CO ₂	=	Carbon dioxide	T1	=	Temperature	kW	=	Burner output

kW	GAS				FLUE GAS					AIR		BOILER		SMOKE STACK
	Q	P1	P2	P3	CO ₂	CO	NO _x	T2	PF	T1	PV	T/P	PC	Q _s
	m ³ /h	mbar	mbar	mbar	%	ppm	ppm	°C	mbar	°C	mbar	°C/bar	mbar	%
MIN														
MAX														

kW	GAS				FLUE GAS					AIR		BOILER		SMOKE STACK
	Q	P1	P2	P3	CO ₂	CO	NO _x	T2	PF	T1	PV	T/P	PC	Q _s
	m ³ /h	mbar	mbar	mbar	%	ppm	ppm	°C	mbar	°C	mbar	°C/bar	mbar	%
MIN														
MAX														

kW	GAS				FLUE GAS					AIR		BOILER		SMOKE STACK
	Q	P1	P2	P3	CO ₂	CO	NO _x	T2	PF	T1	PV	T/P	PC	Q _s
	m ³ /h	mbar	mbar	mbar	%	ppm	ppm	°C	mbar	°C	mbar	°C/bar	mbar	%
MIN														
MAX														

kW	GAS				FLUE GAS					AIR		BOILER		SMOKE STACK
	Q	P1	P2	P3	CO ₂	CO	NOx	T2	PF	T1	PV	T/P	PC	Qs
	m ³ /h	mbar	mbar	mbar	%	ppm	ppm	°C	mbar	°C	mbar	°C/bar	mbar	%
MIN														
MAX														

kW	GAS				FLUE GAS					AIR		BOILER		SMOKE STACK
	Q	P1	P2	P3	CO ₂	CO	NOx	T2	PF	T1	PV	T/P	PC	Qs
	m ³ /h	mbar	mbar	mbar	%	ppm	ppm	°C	mbar	°C	mbar	°C/bar	mbar	%
MIN														
MAX														

kW	GAS				FLUE GAS					AIR		BOILER		SMOKE STACK
	Q	P1	P2	P3	CO ₂	CO	NOx	T2	PF	T1	PV	T/P	PC	Qs
	m ³ /h	mbar	mbar	mbar	%	ppm	ppm	°C	mbar	°C	mbar	°C/bar	mbar	%
MIN														
MAX														

kW	GAS				FLUE GAS					AIR		BOILER		SMOKE STACK
	Q	P1	P2	P3	CO ₂	CO	NOx	T2	PF	T1	PV	T/P	PC	Qs
	m ³ /h	mbar	mbar	mbar	%	ppm	ppm	°C	mbar	°C	mbar	°C/bar	mbar	%
MIN														
MAX														

kW	GAS				FLUE GAS					AIR		BOILER		SMOKE STACK
	Q	P1	P2	P3	CO ₂	CO	NOx	T2	PF	T1	PV	T/P	PC	Qs
	m ³ /h	mbar	mbar	mbar	%	ppm	ppm	°C	mbar	°C	mbar	°C/bar	mbar	%
MIN														
MAX														

kW	GAS				FLUE GAS					AIR		BOILER		SMOKE STACK
	Q	P1	P2	P3	CO ₂	CO	NOx	T2	PF	T1	PV	T/P	PC	Qs
	m ³ /h	mbar	mbar	mbar	%	ppm	ppm	°C	mbar	°C	mbar	°C/bar	mbar	%
MIN														
MAX														

The logo consists of the word "RIELLO" in a bold, red, sans-serif typeface.

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