# Gas Burners

# RS 28/1 - 38/1

# On - Off Operation

C6505054 - 2915763 (0)

## CONTENTS



**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.

## 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 | | RS 28/1 | RS 38/1 |
|---|---|---|---|
| Output (1) | MBtu/hr<br>kW | 617 - 1320<br>181 - 387 | 880 - 1761<br>258 - 516 |
| Fuel | | Natural gas/ propane gas | |
| - Max delivery | SCFH | 1320 | 1761 |
| - Pressure at maximum delivery (2) | " W.C. | 3.4 | 3.03 |
| Operation | | On/ Off | |
| Standard applications | | Hot 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 | 120/1/60 | |
| Fan motor | rpm<br>W - HP<br>V<br>A | 3400<br>370 - 0.5<br>120<br>5.2 | |
| Motor capacitor | µF | 45 | |
| Ignition transformer | V1 - V2<br>I1 - I2 | 120 V - 1 x 7 kV<br>1.6 A - 23 mA | |
| Electrical power consumption | W max | 600 | 600 |
| Electrical protection | | NEMA 1 | |
| Noise levels (3) | dBA | 70 | 72 |

(1) Reference conditions: Ambient temperature 68 °F (20°C) - Barometric pressure 394" WC - Altitude 329 ft a.s.l.
(2) Pressure at test point 8)(A)p.4, with zero pressure in the combustion chamber, with open gas ring 2)(B)p.8 an maximum burner output
(3) Sound pressure measured in manufacturer's combustion laboratory, with burner operating on test boiler and at maximum rated output.

### Burner models designation:

| Model | Code | Voltage | Flame safeguard |
|---|---|---|---|
| **RS 28/1** | **C9521100** (3782070)<br>**C9621100** (3782072) | 120/1/60<br>120/1/60 | Burner mounted<br>Remote panel |
| **RS 38/1** | **C9522100** (3782170)<br>**C9622100** (3782172) | 120/1/60<br>120/1/60 | Burner mounted<br>Remote panel |

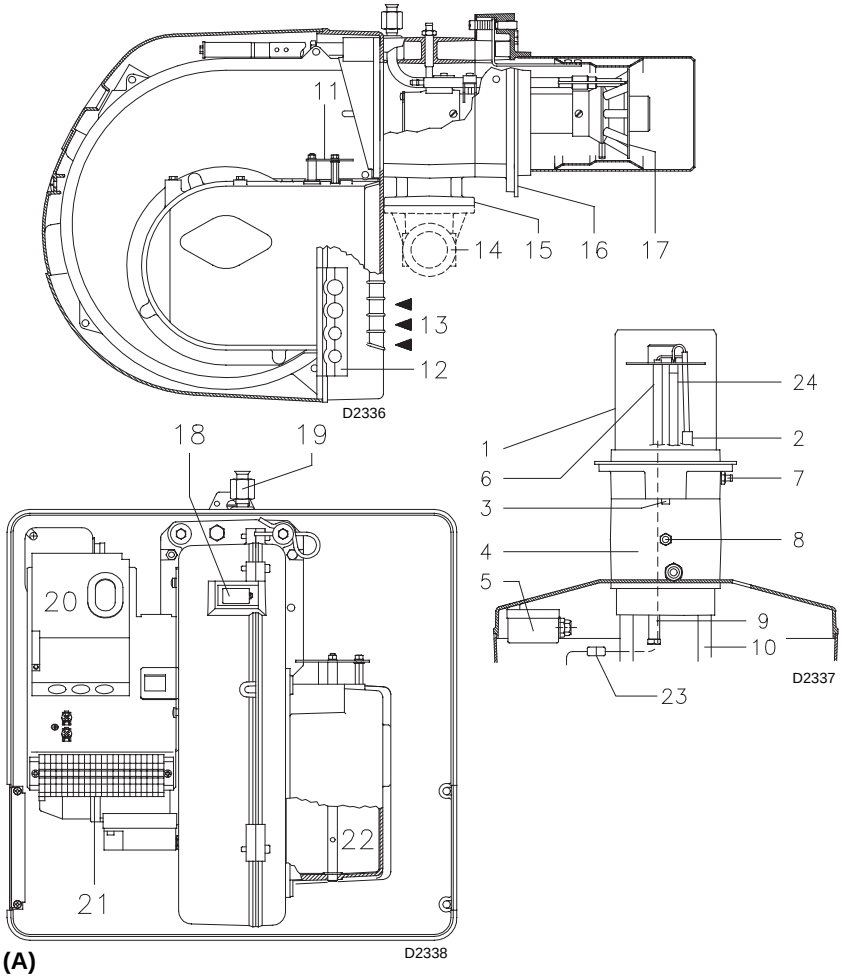
**ACCESSORIES** (optional):

**Kit for lengthening the combustion head**
L = Standard length
L1 = Length obtainable with the kit

| | | | |
|---|---|---|---|
| COD. 3010262 | L = $8^{1}/_{2}$" | L1 = $13^{13}/_{16}$" | • RS 28/1 |
| COD. 3010263 | L = $8^{1}/_{2}$" | L1 = 13 $^{13}/_{16}$" | • RS 38/1 |

**Gas train according to ul standards:** see page 9.

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



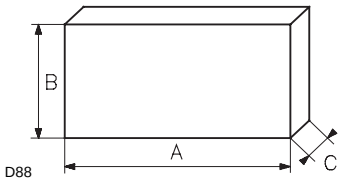

**(A)**

## BURNER DESCRIPTION (A)

1 Combustion head
2 Ignition electrode
3 Screw for combustion head adjustment
4 Sleeve
5 Low air pressure switch (differential operating type)
6 Flame sensor probe (flame rod)
7 Air pressure test point
8 Gas pressure test point and head fixing screw
9 Screw securing fan to sleeve
10 Slide bars for opening the burner and inspecting the combustion head
11 Indexed selector. Opens the fan air damper to the value needed by the burner delivery.
12 Plate with four hole knock-outs for electrical cable routing
13 Air inlet to fan
14 Gas input pipework
15 Gas train connection flange
16 Boiler mounting flange
17 Flame stability disk
18 Flame inspection window
19 Pilot burner attachment
20 Flame safeguard with lock-out pilot light and lock-out reset button
21 Terminal strip for electrical connections
22 Air damper
23 Plug-socket on ionisation probe (flame rod) cable
24 Ignition pilot

**Note**
If the flame safeguard 20)(A) pushbuttom lights up, it indicates that the burner is in lock-out.
To reset, press the pushbuttom.

| inch | A | B | C | lbs |
|---|---|---|---|---|
| **RS 28/1** | $39^{31}/_{32}$“ | $24^{13}/_{16}$“ | $19^{11}/_{16}$“ | 82 |
| **RS 38/1** | $39^{31}/_{32}$“ | $24^{13}/_{16}$“ | $19^{11}/_{16}$“ | 86 |



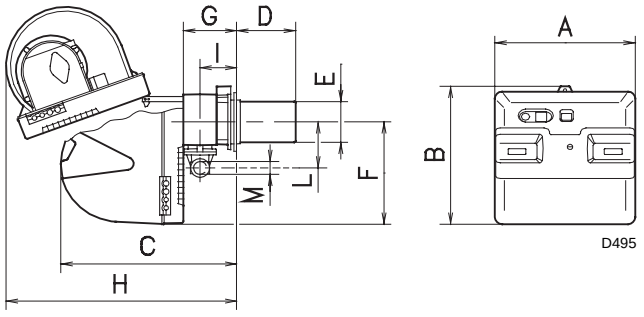

**(B)**

## PACKAGING - WEIGHT (B)

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

## MAX. DIMENSIONS (C)

Approximate measurements.
The maximum dimensions of the burner are given in (C). Note that if you need to examine the combustion head, the burner must be pulled backward on the slide bars and turned upward.
The maximum dimension of the burner, without the cover, when open is given by measurement H.



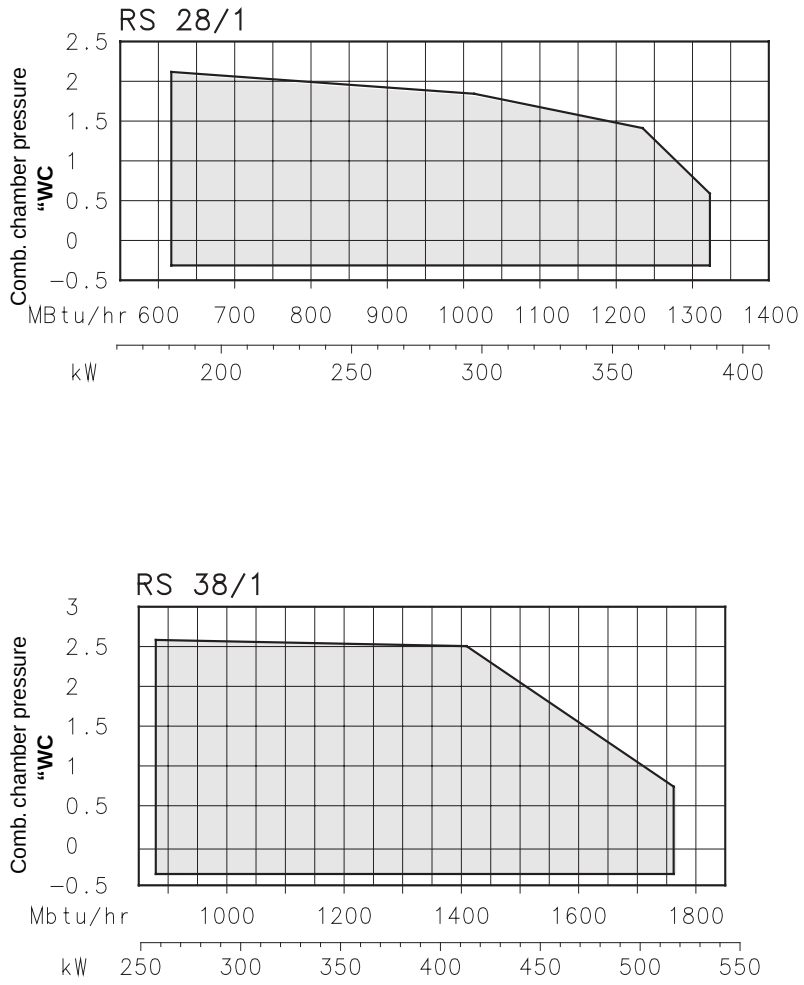

| RS | A | B | C | D (1) | E | F | G | H | I | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **28/1** | $18^{23}/_{32}$“ | $18^{21}/_{32}$“ | $22^{13}/_{16}$“ | $8^{1}/_{2}$-$13^{13}/_{16}$“ | $5^{1}/_{2}$“ | $13^{27}/_{32}$“ | $6^{7}/_{16}$“ | $31^{7}/_{8}$“ | $4^{1}/_{4}$“ | $6^{5}/_{8}$“ | $1^{1}/_{2}$” |
| **38/1** | $18^{23}/_{32}$“ | $18^{21}/_{32}$“ | $22^{13}/_{16}$“ | $8^{1}/_{2}$“-$13^{13}/_{16}$“ | $5^{1}/_{2}$“ | $13^{27}/_{32}$“ | $6^{7}/_{16}$“ | $31^{7}/_{8}$“ | $4^{1}/_{4}$“ | $6^{5}/_{8}$“ | $1^{1}/_{2}$” |

(1) Blast tube: short-long (obtainable with kit)

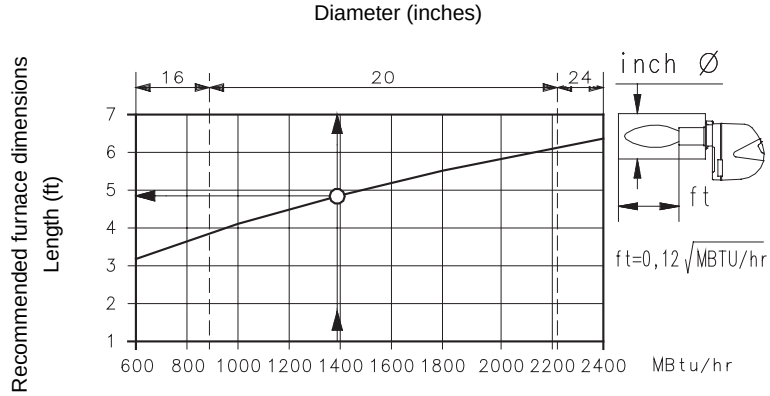
## STANDARD EQUIPMENT

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: $^{3}/_{8}$ W x 1”
1 - Instruction booklet
1 - Spare parts list

**(C)**




**(A)** D2339




**(B)** D2918

## FIRING RATES (A)

The burner delivery must be selected within the area of the adjacent diagram.

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

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

Consult Appendix on page 18 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 1388 MBtu/hr:
diameter 20 inch - length 4.9 ft.

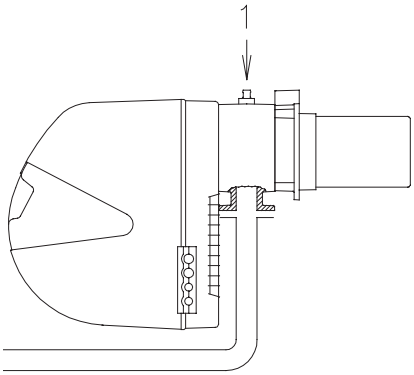
**RS 28/1**

| MBtu/hr | kW | Δp (“ WC) |
|---|---|---|
| | | 1 |
| 625 | 183 | 0.98 |
| 699 | 205 | 1.22 |
| 795 | 233 | 1.57 |
| 891 | 261 | 1.85 |
| 986 | 289 | 2.17 |
| 1078 | 316 | 2.48 |
| 1174 | 344 | 2.76 |
| 1232 | 361 | 2.95 |
| 1320 | 387 | 3.43 |

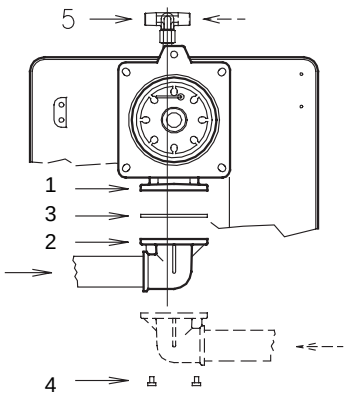
**RS 38/1**

| MBtu/hr | kW | Δp (“ WC) |
|---|---|---|
| | | 1 |
| 871 | 255 | 1.02 |
| 986 | 289 | 1.22 |
| 1099 | 322 | 1.46 |
| 1211 | 355 | 1.69 |
| 1327 | 389 | 1.89 |
| 1440 | 422 | 2.13 |
| 1552 | 455 | 2.36 |
| 1665 | 488 | 2.6 |
| 1761 | 516 | 2.83 |

**(A)**




**(B)** D2340




D2293

**(C)**

## GAS PRESSURE

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

Column 1
Pressure loss at combustion head.
Gas pressure measured at test point 1)(B), with:
- Combustion chamber at 0” WC
- Gas ring 2)(B)p.8 adjusted as indicated in diagram (C)p.8.

Calculate the approximate output of the burner thus:
- 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 - RS 28/1:**
- Natural gas
- Gas ring 2)(B)p.8 adjusted as indicated in diagram (C)p.8.
- Gas pressure at test point 1)(B) = 2.36” WC
- Pressure in combustion chamber = 0.79” WC

  2.36 - 0.79 = 1.57” WC

An output of 795 MBtu/hr shown in Table RS 28/1 corresponds to 1.57” WC pressure, column 1.
This value serves as a rough guide, the exact flow rate must be measured at the gas meter.

To calculate the required gas pressure at test point 1)(B), set the 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 - RS 28/1:**
- Required burner output: 795 MBtu/hr
- Natural gas
- Gas ring 2)(B)p.8 adjusted as diagram (C)p.8.
- Gas pressure at burner output of 795 MBtu/hr taken from table RS 28/1, column 1= 1.57” WC
- Pressure in combustion chamber = 0.79” WC

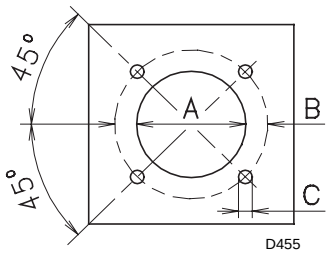
  1.57 + 0.79 = 2.36” WC

  pressure required at test point 1)(B).

## GAS PIPING

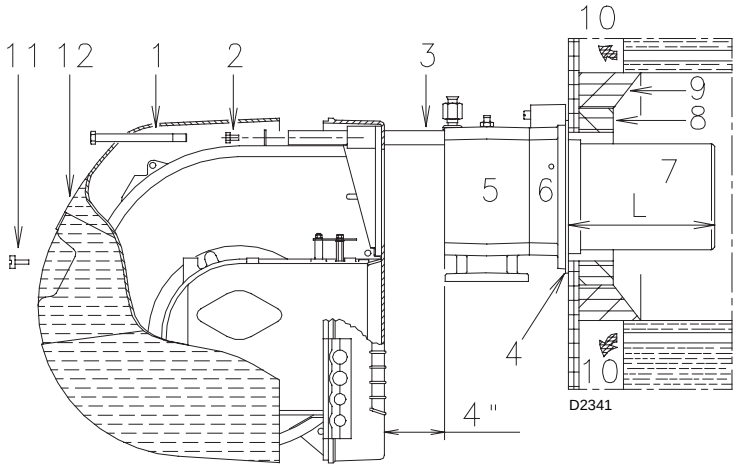
- The main gas train must be connected to the burner head 1)(C), using flange 2), gasket 3) and bolts 4) supplied with the burner.
- The gas train can enter the burner from the right or left side, depending on which is the most convenient, see fig.(C).
- Safety shut-off valves 8)-9)(B) must be as close 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 connection 5)(C) and can enter the burner from the right or left side.

| inch | A | B | C |
|---|---|---|---|
| RS 28 /1 | $6^{9}/_{32}$“ | $8^{13}/_{16}$“ | $^{3}/_{8}$ W |
| RS 38 /1 | $6^{9}/_{32}$“ | $8^{13}/_{16}$“ | $^{3}/_{8}$ W |



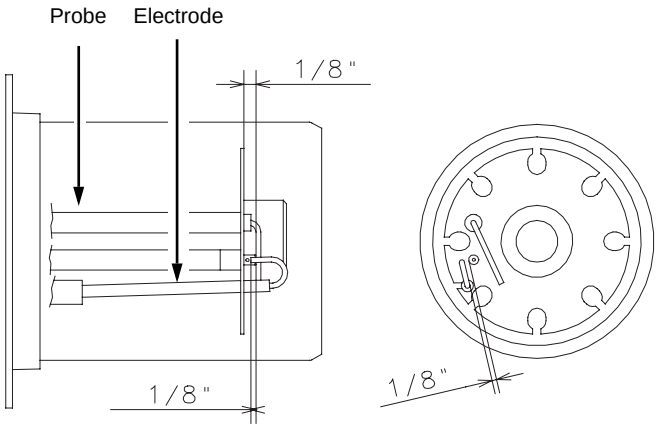

D455

**(A)**



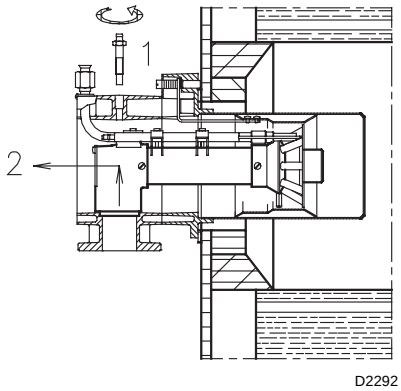

D2341

**(B)**




D2342

**(C)**




D2292

**(D)**


MB - Burner terminal strip

D2317

**(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 burner head gasket supplied with the burner.

### BLAST TUBE LENGTH (B)

The length of the blast tube must be selected according to the indications provided by the manufacturer of the boiler, and 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 7): | RS 28/1 | RS 38/1 |
|---|---|---|
| • short | $8\ ^{1}/_{2}$” | $8\ ^{1}/_{2}$” |
| • long (with kit) | $13\ ^{13}/_{16}$” | $13\ ^{13}/_{16}$” |

For boilers with front flue passes 10) or flame inversion chambers, protective insulation 8) must be inserted between the boiler refractory 9) and the blast tube 7).
This protective insulation must not compromise the extraction of the blast tube.
For boilers having a water-cooled front the insulation 8)-9)(B) is not required unless it is required by the boiler manufacturer.

### SECURING THE BURNER TO THE BOILER (B)

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

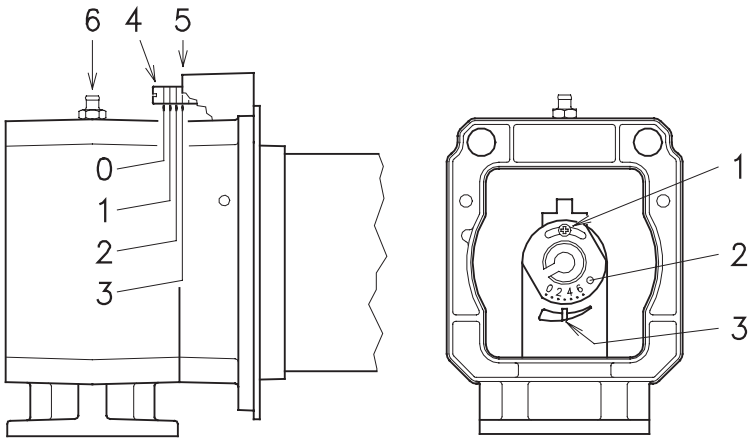
Now detach the combustion head from the burner, fig.(B):
- remove screw 11) and withdraw the cover 12)
- Remove the screws 2) from the slide bars 3)
- Remove screw 1) and pull the burner back on slide bars 3) by about 4”.
  Disconnect the wires from the probe and the electrode and then pull the burner completely off the slide bars, after removing the split pin from the slide bar 3).

Secure the flange 6)(B) to the boiler plate, inserting the gasket 4)(B). Use the 4 screws, also supplied with the unit, after first protecting the thread with an anti-seize product.
The seal between burner and boiler must be airtight.

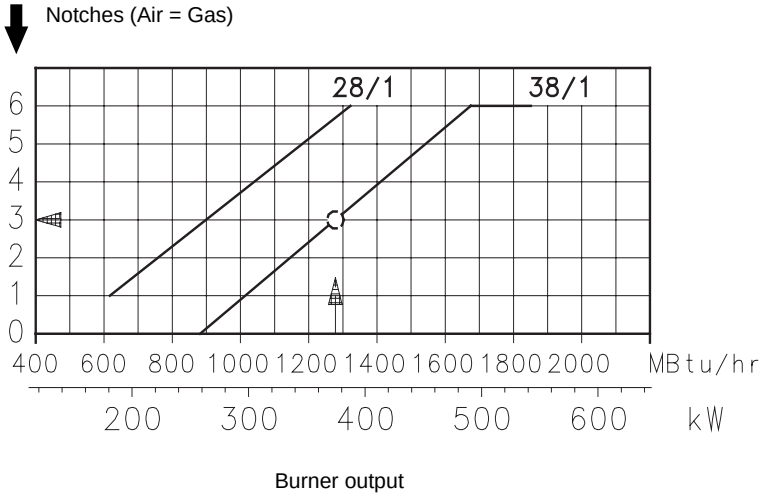
If you noticed any irregularities in positions of the probe or ignition electrode during the check mentioned above, remove screw 1)(D), extract the internal part 2)(D) of the head and proceed to set up the two components correctly.

### IGNITION PILOT ADJUSTMENT

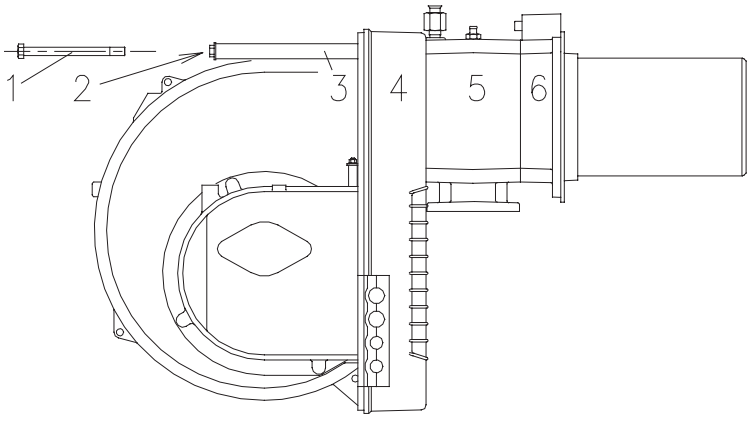
Place the pilot and electrode as shown in fig. (C).
The pilot works correctly at pressures ranging from 5 - 12” WC.
**Important**
To set the pilot without main burner operation, proceed as follows:
- Move the jumper from terminals "**30-V11**" to terminals "**30-VP**", as given in fig. (E), this way the main valve is cut out.
- With the burner in the manual position, hold the air damper in the minimum position and make the setting.
- When the setting is correct, replace the jumper on “**30-V11**”.




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




**(C)** D2343




**(D)** D2344

## COMBUSTION HEAD ADJUSTMENT

(For PROPANE operation see page 14).

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

It is therefore essential to establish this value before proceeding to set up the combustion head. There are two adjustments to make on the head: Air and gas .

In diagram (C) find the notch to use for adjusting the air and the gas, and then proceed as follows:

**Air adjustment (A)**

Turn screw 4)(A) until the notch identified is aligned with the front surface 5)(A) of the flange.

**Gas adjustment (B)**

Loosen screws 1)(B) and turn ring 2) until the notch identified is aligned with index 3).

Tighten the screw 1) fully down.

**Example RS 38/1:**

burner output = 1276 MBtu/hr.

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

**Note**

Diagram (C) shows the ideal settings for the combustion head. If the gas mains pressure is too low to reach the pressure indicated on page 6, and if the ring 2)(B) is not fully open, it can be opened wider by 1 or 2 notches.

Continuing with the previous example, page 6 indicates that for burner RS 38/1 with output of 1276 MBtu/hr (374 kW) a pressure of approximately 1.8” WC is necessary at test point 6)(A). If this pressure cannot be reached, open the ring 2)(B) to notch 4 or 5.

Make sure that the combustion characteristics are satisfactory and free of pulsations.

Once you have finished setting up the head, refit the burner 4)(D) to the slide bars 3) at approximately 4” from the sleeve 5) - burner positioned as shown in fig.(B)p.7 - insert the flame detection probe (flame rod) cable and the ignition electrode cable and then slide the burner up to the sleeve so that it is positioned as shown in fig.(D).

Refit screws 2) on slide bars 3).

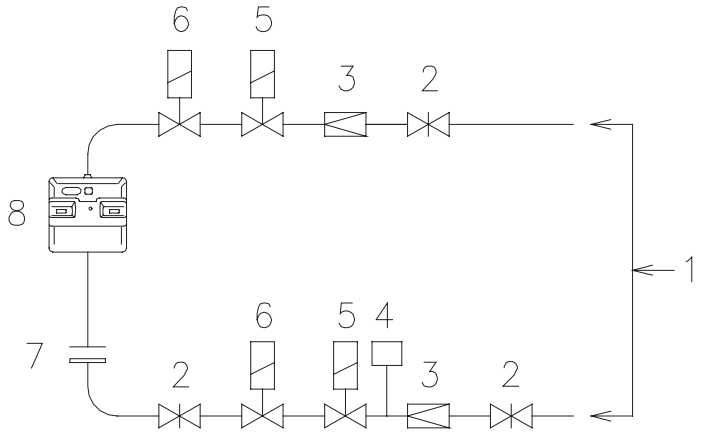
Secure the burner to the sleeve by tightening screw 1) and then refit the split pin into one of two slide bars 3).

Connect gas train and pilot train as shown in fig. (C) page 6.

**Important**

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

TYPICAL UL SCHEMATIC GAS PIPING




**(A)** D2345

## GAS PIPING

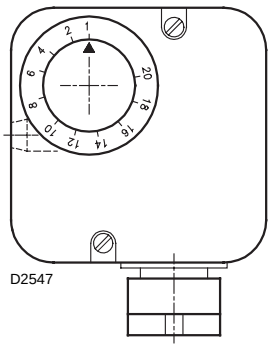
**KEY (A)**

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

**Note**

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

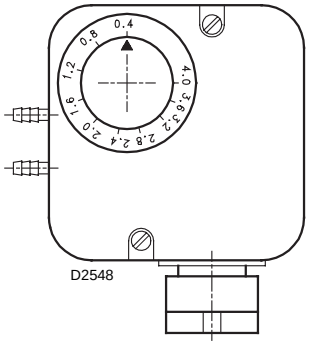
LOW GAS PRESSURE SWITCH




D2547

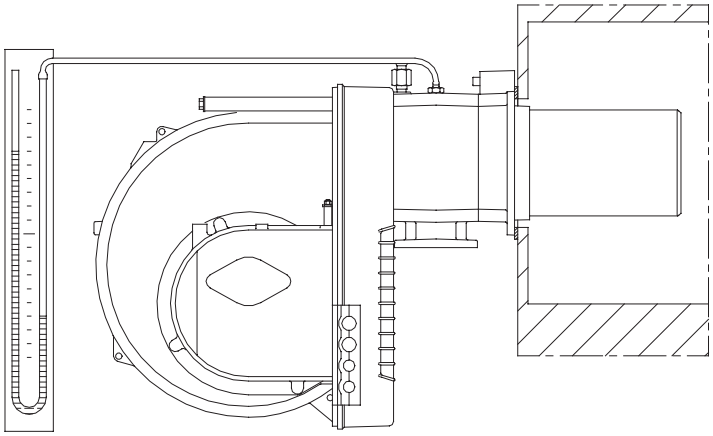
**(A)**

AIR PRESSURE SWITCH




D2548

**(B)**



**(C)**

D2346

## ADJUSTMENTS BEFORE FIRST FIRING

Adjustment of the combustion head, and air and gas deliveries has been illustrated on page 8.
In addition, the following adjustments must also be made:

- Open manual valves on the gas train.
- Adjust the low gas pressure switch to the start of the scale (A).
- Adjust the air pressure switch to the zero position of the scale (B).
- Purge the air from the gas line.
- Fit a U-type manometer (C) to the gas pressure test point on the sleeve.
  The manometer readings are used to calculate burner input using the tables on page 6.
- Fan air damper: leave at the factory setting.

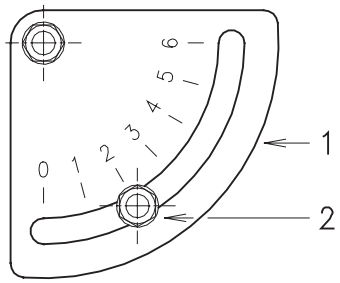
Before starting up the burner it is good practice to adjust the gas train so that ignition takes place in conditions of maximum safety, i.e. with gas delivery at the minimum.

## BURNER STARTING

Close the control circuit.
As soon as the burner starts check the direction of rotation of the fan blade, looking through the flame inspection window 18)(A)p.4.

## BURNER FIRING

Having completed the checks indicated in the previous heading, the burner pilot should fire. If the motor starts but the flame does not appear and the flame safeguard goes into lock-out, reset and wait for a new firing attempt.
Pilot adjustment has been illustrated on page 7.
Having adjusted the pilot, reconnect the main valve and ignite the main flame.
Once the burner has fired, now proceed with set up.




**(A)** D593

## BURNER CALIBRATION

The optimum calibration of the burner requires an analysis of the flue gases at the boiler outlet.

Adjust successively:
1 - First firing output
2 - Maximum output of the burner
3 - Air pressure switch
4 - Low gas pressure switch

### 1 - FIRING OUTPUT

Pilot adjustment has been illustrated on page 7.

### 2 - MAXIMUM OUTPUT

The maximum output of the burner must be set within the firing rate range shown on page 5.

Adjusting gas delivery

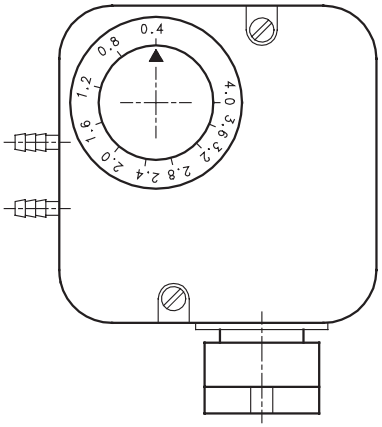
Measure the gas delivery at the meter.
A guideline indication can be calculated from the tables on page 6, simply read off the gas pressure on the U-type manometer, see fig.(C) on page 10, and follow the instructions on page 6.

- If delivery needs to be reduced, reduce outlet gas pressure and, if it is already very low, slightly close adjustment valve (if installed).
- If delivery needs to be increased, increase outlet gas pressure.

Adjusting air delivery

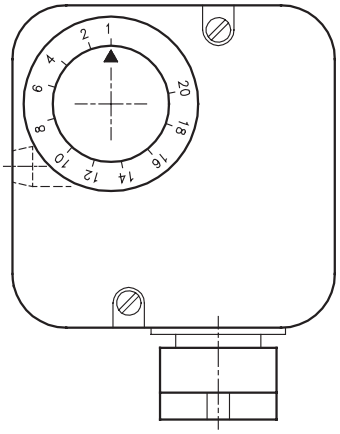
Adjust the fan air damper by using the indexed selector 1)(A) after having loosened the nut 2)(A).

AIR PRESSURE SWITCH

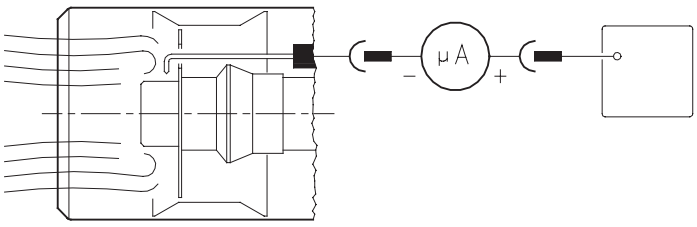



**(A)** D2548

LOW GAS PRESSURE SWITCH




**(B)** D2547




D795

**(C)**

**3 - 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, 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 this way the air pressure switch operates as differential pressure switch.

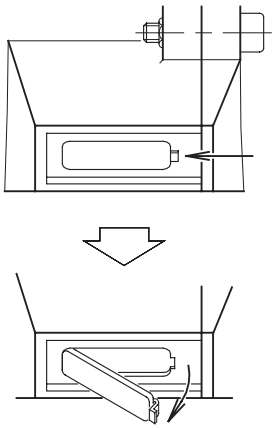
**4 - LOW GAS PRESSURE SWITCH (B)**

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 (B).
With the burner operating, increase adjustment pressure by slowly turning the relative dial clockwise until the burner locks out.
Then turn the dial anti-clockwise by 0.8" WC and repeat burner starting to ensure it is uniform.
If the burner locks out again, turn the dial anti-clockwise again by 0.4" WC.

**FLAME PRESENT CHECK (C)**

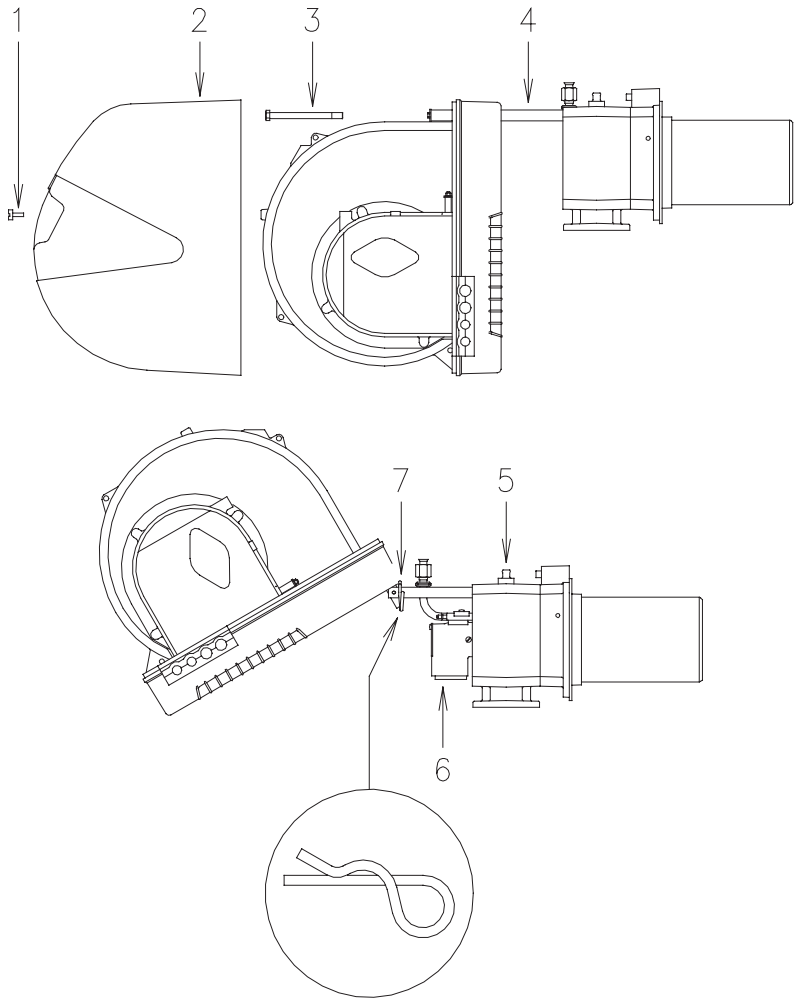
The burner is fitted with an ionisation (flame rod) system which ensures that a flame is present. The minimum current for plant operation is 6 µA (see maufacturers specifications).
The burner provides a much higher current, so that controls are not normally required. However, if it is necessary to measure the ionisation current, disconnect the plug-socket 23)(A)p.4 on the ionisation probe cable and insert a direct current microamperometer with a base scale of 100 µA.
Carefully check polarities!

FLAME INSPECTION WINDOW



**(A)** D484

OPENING THE BURNER




**(B)** D2348

## 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 6)(B).

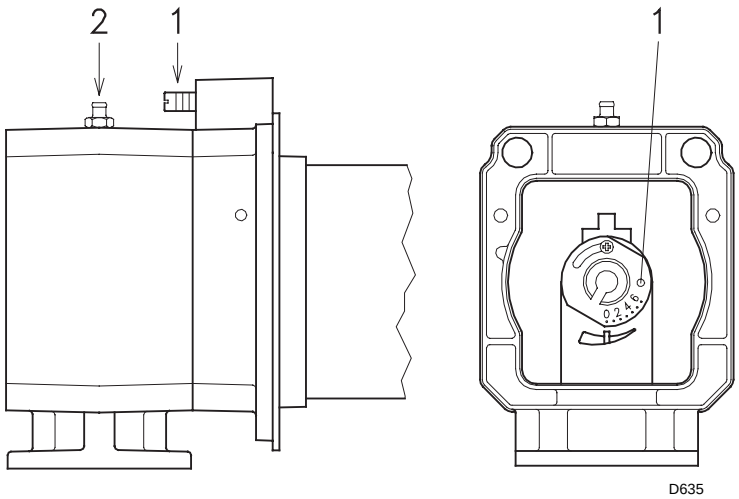
**Burner**
Check that the graduated sector that controls the air damper is secured by the nut 2)(A)p.11.
The tightness of the screws that fasten the cables to the burner terminal strip must also be checked.
Clean the outside of the burner.

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

**TO OPEN THE BURNER (B):**
- switch off the electrical power.
- Remove screw 1) and withdraw cover 2).
- Remove screw 3), the split pin 7) and pull the burner back by about 4" on the slide bars 4). Disconnect the probe and electrode leads and then pull the burner fully back.
- Turn the burner as shown in the figure and fit the split pin 7) into one of the slide bar holes so that the burner remains in position.

Now extract the gas distributor 6) after having removed the screw 5) and disconnecting the pilot gas line.

**TO CLOSE THE BURNER (B):**
- remove the split pin 7) and 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 screw 3), the split pin 7) and pull the probe and electrode leads gently out until they are slightly stretched.
- Connect the pilot gas line.




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

**RS 28/1**

| MBtu/hr | kW | Δp (" WC) |
|---|---|---|
| | | 1 |
| 625 | 183 | 0.98 |
| 699 | 205 | 1.22 |
| 795 | 233 | 1.57 |
| 891 | 261 | 1.85 |
| 986 | 289 | 2.17 |
| 1078 | 316 | 2.48 |
| 1174 | 344 | 2.76 |
| 1232 | 361 | 2.95 |
| 1320 | 387 | 3.43 |

**RS 38/1**

| MBtu/hr | kW | Δp (" WC) |
|---|---|---|
| | | 1 |
| 871 | 255 | 1.02 |
| 986 | 289 | 1.22 |
| 1099 | 322 | 1.46 |
| 1211 | 355 | 1.69 |
| 1327 | 389 | 1.89 |
| 1440 | 422 | 2.13 |
| 1552 | 455 | 2.36 |
| 1665 | 488 | 2.6 |
| 1761 | 516 | 2.83 |

**(C**

## PROPANE OPERATION

The RS 28/1 and 38/1 Models burners can be operated on both natural gas and propane.

### FIRING RATE

It is the same as the one calculated for natural gas, see page 5.

### SETTING THE COMBUSTION HEAD

Adjusting air delivery

Adjust the screw 1)(A) as was done for natural gas, according to the burner output, see page 8.

Gas calibration

Adjust the ring 1)(B) always to the zero position, as shown in Fig.(B), whatever the burner output is.

### GAS PRESSURE

The tables (C) show minimum load losses along the gas supply line in relation to the burner output.

Column 1

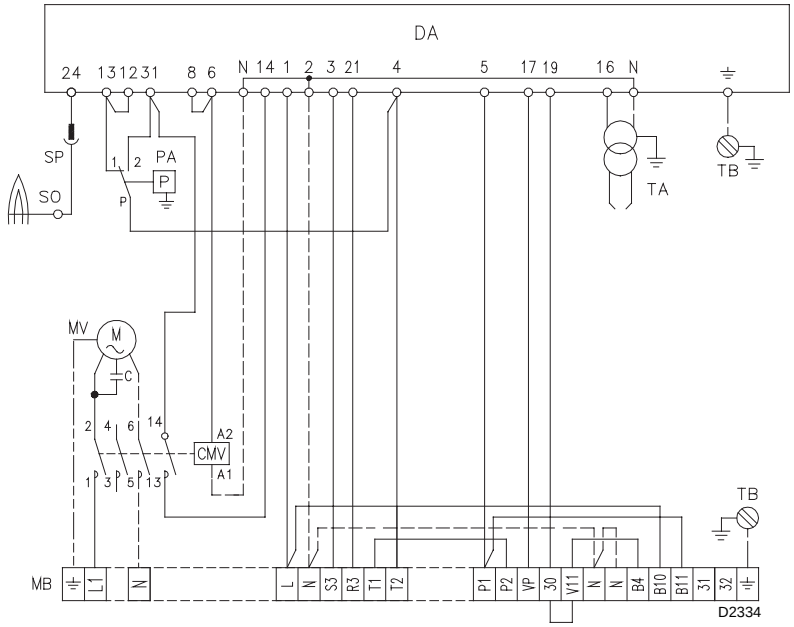
Combustion head load loss.

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

- Combustion chamber at 0" WC
- Gas ring 1)(B) set to zero.

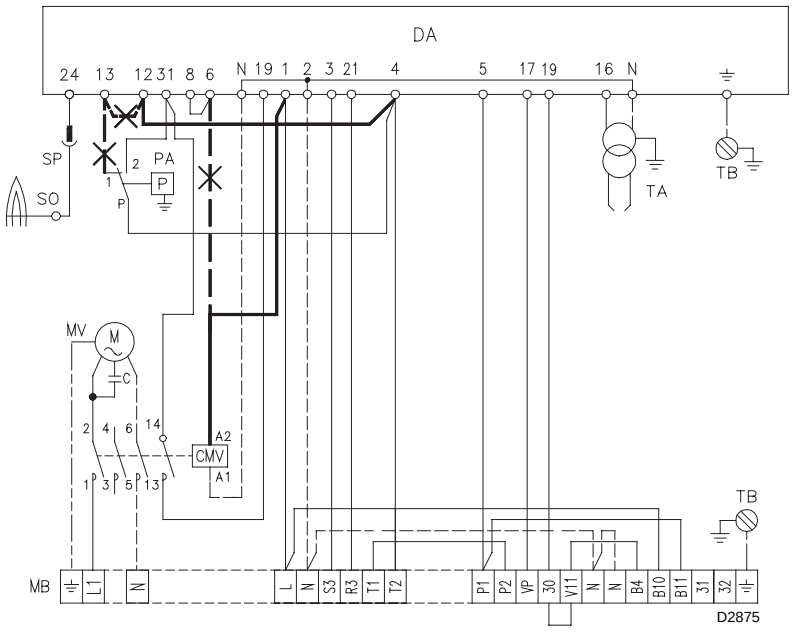
**Factory Wiring Diagram**

**RS 28/1 - RS 38/1 with burner mounted Siemens LFL control**




**Continuous fan operation**

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




**(A)**

## ELECTRICAL SYSTEM

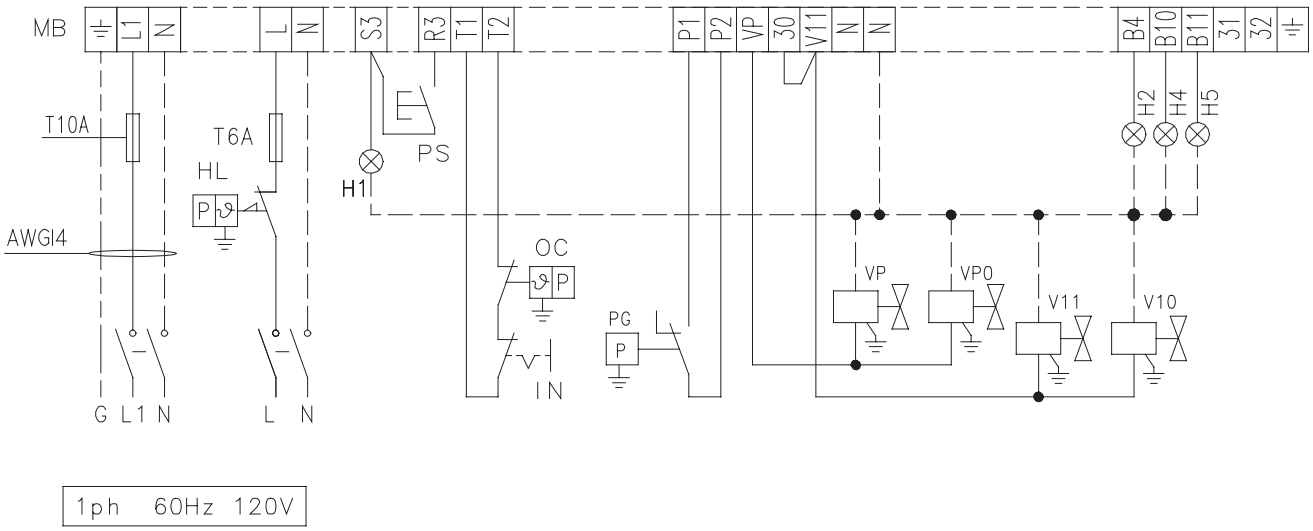
- **ELECTRICAL SYSTEM** as set up by the manufacturer

**KEY TO LAYOUTS**

| | |
|---|---|
| C | - Capacitor |
| CMV | - Motor contactor |
| DA | - LFL Control box |
| MB | - Burner terminal srip |
| MV | - Fan motor |
| PA | - Air pressure switch |
| SO | - Ionisation probe (flame rod) |
| SP | - Plug-socket |
| TA | - Ignition transformer |
| TB | - Burner ground |

**Field Wiring Diagram**

**RS 28/1 - RS 38/1 with burner mounted Siemens LFL control**




**(A)** D2335

## ELECTRICAL CONNECTIONS

Set by installer

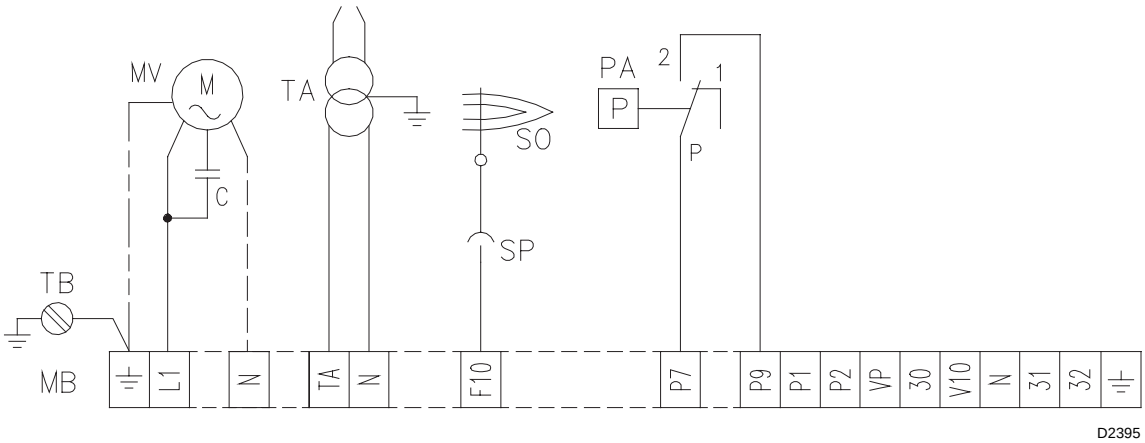
Use flexible cables according to local Regulations.

The RS 28/1 - RS 38/1 Models electrical connections

**Key to layout**

IN - Burner manual stop switch
MB - Burner terminal strip
PG - Low gas pressure switch
PS - Remote lock-out reset
H1 - Remote lock-out signal
H2 - Low fire signal
H4 - Power on signal
H5 - Permission ok
TB - Burner ground
OC - Operating control.
HL - High limit
VP - Pilot valve
VP0 - Pilot valve (safety)
V10 - Safety valve
V11 - Adjustment valve

**Factory Wiring Diagram**
**RS 28/1 - RS 38/1 With flame safeguard in remote panel.**




**(A)**

## ELECTRICAL SYSTEM

**ELECTRICAL SYSTEM** as set up by the manufacturer

**LAYOUT**
**Burner RS 28/1 - RS 38/1**
The flame safeguard is in remote panel.
See the internal electrical systems of the remote panel in order to have the complete wiring diagram.

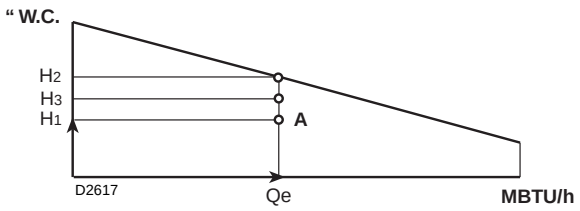
**KEY TO LAYOUTS**
C - Capacitor
CMV - Motor contactor
DA - LFLControl box
MB - Burner terminal srip
MV - Fan motor
PA - Air pressure switch
SO - Ionisation probe (flame rod)
SP - Plug-socket
TA - Ignition transformer
TB - Burner ground

## 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 8.
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

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

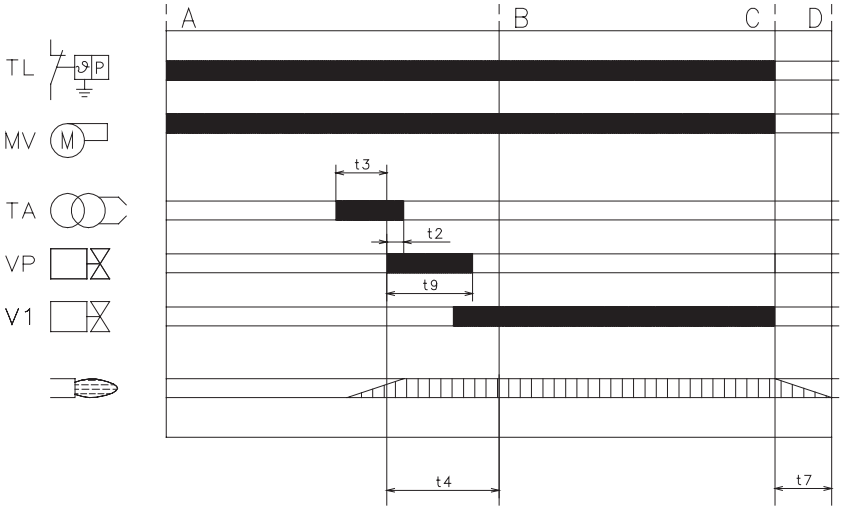
**Example**, a 5% delivery reduction:

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)** D2890

## BURNER OPERATION

### BURNER STARTING

Control device closes.

Fan motor starts.
The air damper is set on maximum adjustment output.
The pre-purge stage follows.

Ignition electrode strikes a spark.

Pilot valve opens. The pilot flame is ignited.

After about 12 s the main flame ignites and starting cycle ends.

### STEADY STATE OPERATION

At the end of the starting cycle, the flame safeguard continues to check that the flame is present and that the air and gas pressure switches are in the correct position.

The burner continues to operate at constant output. If the temperature or pressure in the boiler continues to rise, and opens load control, the burner will stop.

**LFL 1.335** Series 01

| | | | |
|---|---|---|---|
| **t2** | 2 | **t7** | 12 |
| **t3** | 4 | **t9** | 16 |
| **t4** | 20 | | |

**Legend for the times**

**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
**t7** Permissible after-burn time
**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.

## BURNER FAULTS

### 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 tPhe reading mark of the indicator gives the type of disturbance:

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

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

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

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

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

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

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

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

If lock-out occurs at any other moment in time between the start and the pre-ignition 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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