

## Installation & Maintenance Manual

### **Series NG fully automatic gas burner Models NG125/NG150 : High/Low**

Gas Burner

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## **IMPORTANT - SAFETY**

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It is essential that the following instructions and adjustments are carried out by qualified engineers that are experienced in blown gas burner commissioning. In the U.K. it is a legal requirement that these engineers should also be CORGI registered. The manufacturer cannot be held responsible for any consequential damage, loss or personal injury as a result of customers failing to follow these instructions, or as a result of misuse. Your attention is drawn to the **Emergency Instructions** on Page 10.

## **EUROPEAN BOILER EFFICIENCY DIRECTIVE (B.E.D.)**

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All burners and boiler bodies marketed separately should comply with EN267 (oil burners) or EN676 (gas burners) and EN303-1 (boiler bodies).

Burner adjustments must be made in accordance with boiler manufacturers' instructions. and these must include flue gas temperatures, average water temperature, and CO<sub>2</sub> or O<sub>2</sub> concentration.



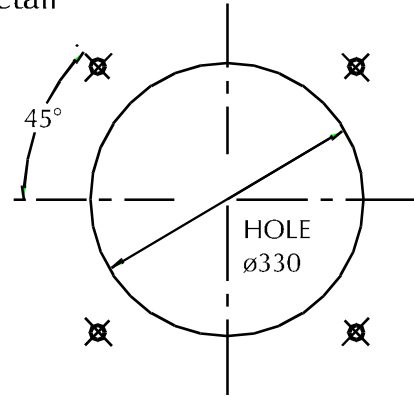
# BURNER & COMPONENT IDENTIFICATION FOR NG125 & NG150 BURNERS

Standard Burner Arrangement Shown

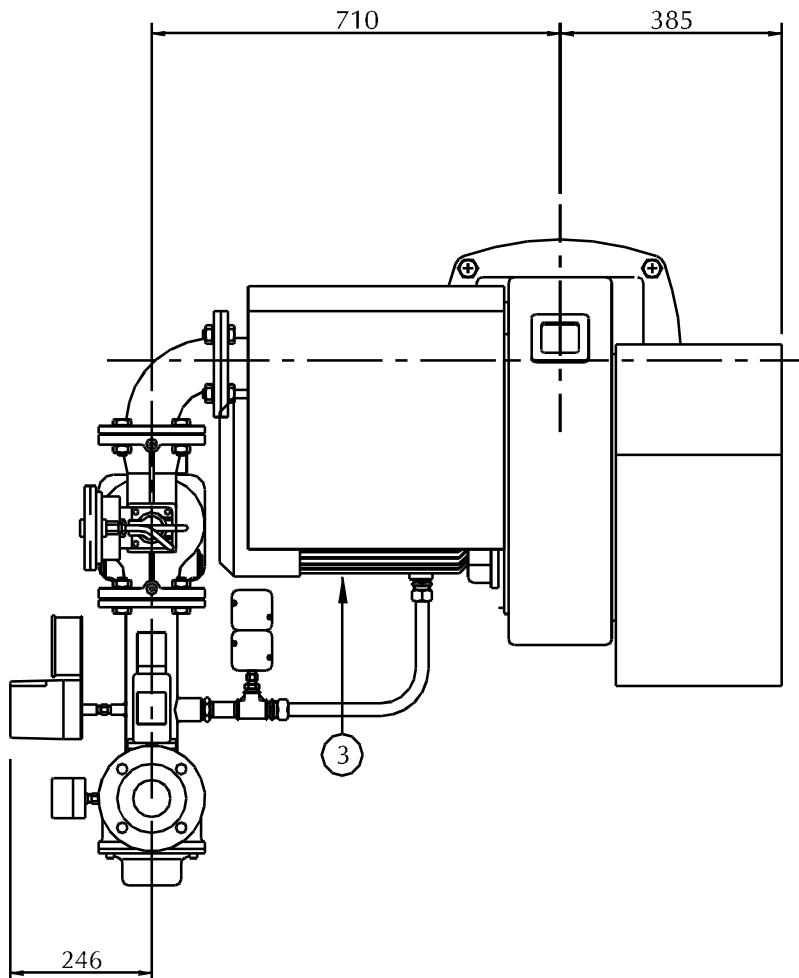
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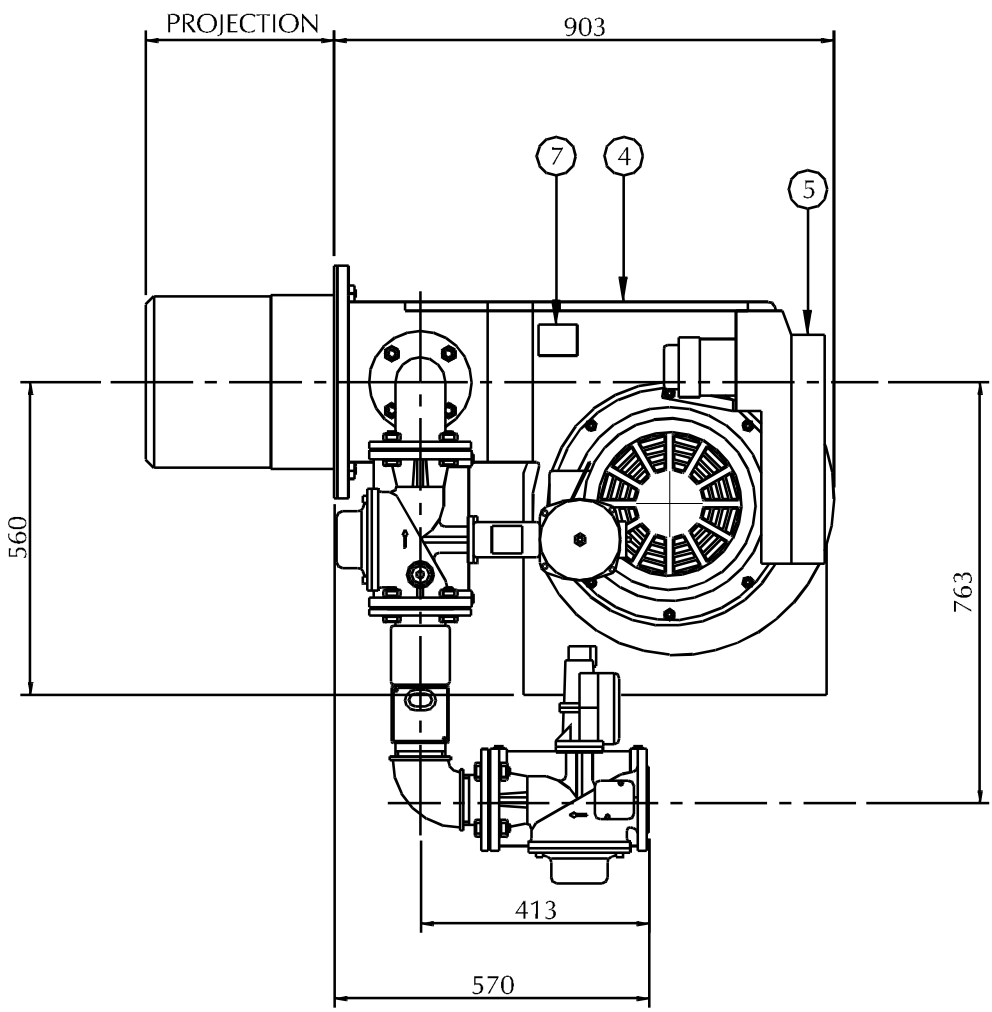
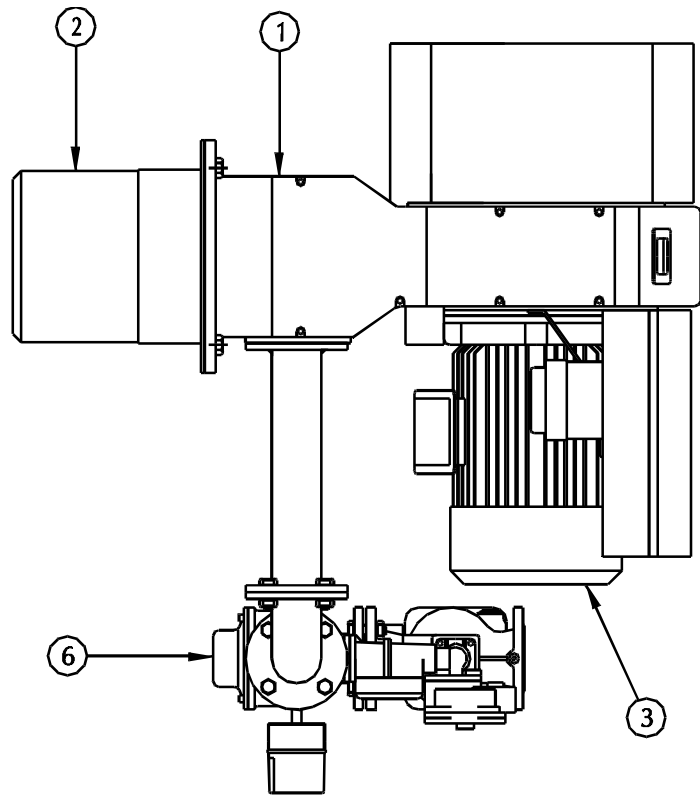
Item	Description
1	Burner Casing
2	Flame Tube
3	Fan Motor
4	Air Inlet
5	Control Panel
6	Gas Train
7	Air Pressure Switch

Burner Mounting Detail



4 HOLES M20 EQUISPACED  
ON 454 mm PCD





## INTRODUCTION

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This manual has been produced to enable users to install, commission and use NG burners safely and efficiently. At each stage the conditions which should be met and the adjustments and other actions which should be carried out are detailed and the locations of the various components and adjustment mechanisms are identified. Where appropriate, this information is supported by tables and graphs. Literature on the proprietary components used in NG burner systems is available on request.

## FEATURES

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Developed through extensive field experience in the UK and overseas markets, the NG series meets the current and future test authority requirements in these markets and sets new standards in efficient and reliable operation. NG burners are designed for flange mounting to the appliance front plate and they are delivered ready to install with a pre-wired packaged control system and plug-in gas train.

### Burner Capacity

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NG125 (2 Models)	2900 to 3650 kW.
NG150 (3 Models)	3650 to 4350 kW

### Controls And Safety Systems

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NG burners are fitted with a combustion air flow control system and an air/gas ratio controller which together ensure smooth starting and optimum operating efficiency. An air pressure switch provides safe shutdown if the combustion air supply becomes insufficient for complete combustion and the burner's additional safety systems include high and low gas pressure switches and a valve proving system. Continuous flame supervision is provided by an ultraviolet (UV) cell and automatic programming control unit.

### Operating Mode

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In standard form NG burners are fitted with control systems which provide two-stage (high/low) operation over a turndown range of 2:1. Fully modulating systems with a turndown range of 2.5:1 can be supplied on request - please refer to the modulating gas burner supplement.

### Fuel

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NG burners are normally configured for natural gas. Systems suitable for other fuels - for example Towns Gas or Liquefied Petroleum Gas (LPG) - can be supplied on request.

### Weight

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319 kg approx.

## SITE CONDITIONS AND SERVICES

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### Flue And Chimney Requirements

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It is important that:

- The flue pipe from the appliance and the joint between this flue and the chimney are sealed to prevent leakage of combustion products.
- The flue pipe from the appliance does not protrude into the chimney beyond the inside wall.
- The top of the flue or chimney shall be higher than any roof within a radius of 10 metres.
- Checks are made to ensure that the chimney is suitable for gas fired appliances and that the proposed installation complies with all Local Authority and other regulations covering such installations.
- If more than one appliance is connected to a common flue or chimney the cross-section of this flue or chimney should be adequate for the total volume of combustion products from the appliances.

### Plant Room Ventilation

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The burner must be supplied with dust free air at sufficient rates for all firing conditions, in accordance with the appropriate Standards.

### Existing Appliances

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The appliance should be prepared for installation of the NG burner by thorough cleaning, including the removal of all adhering tar, scale and dirt. An inspection should also be carried out to ensure that the appliance is in good condition. Any doubt about the suitability of the appliance for gas firing shall be referred to the appliance manufacturer.

### Combustion Chamber Conditions

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When the burner is fitted to an appliance designed to work under balanced or negative combustion chamber pressure conditions the over-fire draught must not exceed 0.25 mbar.

## Gas Supply

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The gas supply pipework to the burner must be appropriate to local conditions and must be constructed and installed in compliance with appropriate Codes and Standards. It shall be of sufficient size to satisfy the pressure and volume flow requirements of the burner under all firing conditions. Checks should be made to ensure that all meters and other components are appropriately rated for the maximum gas flow rate anticipated.

It is essential that a 90° manual isolation valve is fitted upstream of the gas control train to allow the burner to be isolated for maintenance. The size of this valve should not be less than that of the burner control train in order to avoid any restriction in gas flow.

## Gas Boosters

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When a gas booster is used the gas pressure at the booster inlet must not fall below 10 mbar under any conditions. A low gas pressure switch must be fitted on the upstream side of the booster to prevent it starting if the supply pressure is insufficient. An additional pressure switch should be used to monitor the pressure downstream of the booster and prevent the burner going to high fire if the pressure is insufficient.

The booster should be installed as near to the burner as possible. It should be positioned on a firm, flat, horizontal surface using anti-vibration mountings. All connecting pipework should be well supported and accurately positioned in order to avoid stressing the booster casing. The use of flexible connectors, which reduce both pipework stresses and transmitted noise, is strongly recommended. The gas supplier should be asked to recommend the size of pipework between the meter and the booster to ensure that the required pressure and flow are available.

## Electrical Power Supply

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A three-phase 50 Hz supply is required. Power requirements are listed in the Table on Page 8. The power supply provided must comply with all relevant Codes and Standards.

## UNPACKING AND ASSEMBLY

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To safeguard against damage in transit, NG burners are supplied in partly assembled form, comprising two units:

- The burner body, complete with control package and flame tube assembly.
- The gas control train.

To assemble the burner:

- Fit the gas control train to the burner body using the gasket supplied, ensuring that the gasket is fitted correctly with all holes corresponding with those on the burner flange.
- Connect the air inlet/impulse pipe from the SKP7x air/gas ratio controller to the left side of the burner body.
- Connect the multi-pin plug on the gas valve train to the socket on the rear of the control package.

Note: In some circumstances it may be advisable to fit the burner casing to the appliance before attaching the gas control train.

## INSTALLATION

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### General

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Ensure that the appliance is suitable for the heat input of the burner. If there is any doubt in this area reference shall be made to the appliance manufacturer. Detailed burner performance data are presented in the *Appendix* of this handbook.

### Fitting To The Appliance

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If the burner is to be fitted to a new appliance refer to the appliance manufacturer's recommendations.

If the burner is to be fitted to an existing appliance a mounting flange must be provided as detailed in the Section on *Burner & Components Identification*. Ensure that the joint between the burner and the mounting flange is sealed effectively using the gasket provided.

The flame tube should not extend beyond the inner face of the appliance combustion chamber unless extensions are specified by the appliance manufacturer, for example in the case of reverse flame boilers.

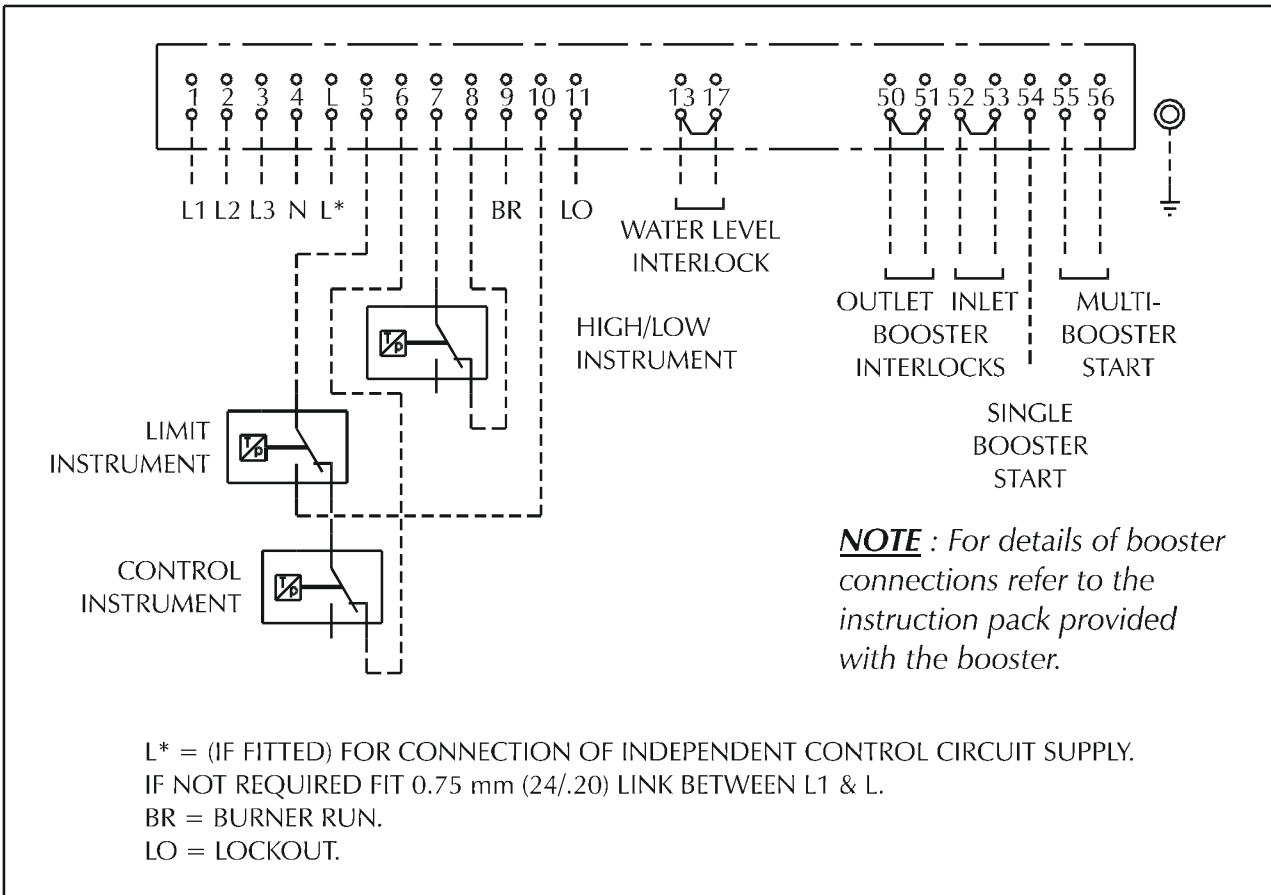
### Electrical Power Connection

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Connect a three-phase, 50 Hz electrical supply to the burner, observing all applicable Codes and Standards. The electrical connections required are shown on Page 8 and in the wiring diagram contained in the instruction pack attached to the burner. These diagrams also show the external auxiliary control connections which must be made.

# ELECTRICAL DATA

## Electrical Connections



## Electrical Power Requirements

	Units	NG125		NG150		
		-36	-41	-36	-41	-44
Mains Supply	V±10%	415	415	415	415	415
Frequency	Hz	50	50	50	50	50
Burner Motor	kW	11	11	11	11	15
Start Current	A	72	72	72	72	92
Full Load Current	A	22.8	22.8	22.8	22.8	29.7

If the burner is supplied as part of a packaged appliance/burner unit refer to the appliance manufacturer's instructions.

## BURNER CONTROL AND OPERATION

All personnel concerned with commissioning and/or operation of NG burners shall familiarise themselves with the information presented in this Section.



Air Regulator

The flow of combustion air into the burner is controlled by an adjustable air damper located inside the air inlet cover on the right hand side (in all cases, such descriptions refer to the system as viewed from the rear) of the burner. The damper is controlled by a three-position servo motor. The high and low fire positions are adjustable. A fully closed position is provided to prevent air flowing through the appliance when the burner is not in operation.

Air Diffuser

The air diffuser is fitted to the front of the burner assembly, within the flame tube (refer to the Appendix). This diffuser controls the combustion air flow and creates a pressure drop across the burner head, promoting good fuel/air mixing and flame stability.

The air pressure switch is located on the left side of the burner casing. Its function is to ensure that combustion air flow is adequate under all operating conditions. Air flow failure at any stage beyond the first few seconds of the pre-purge sequence will result in burner lockout.

Gas Controls

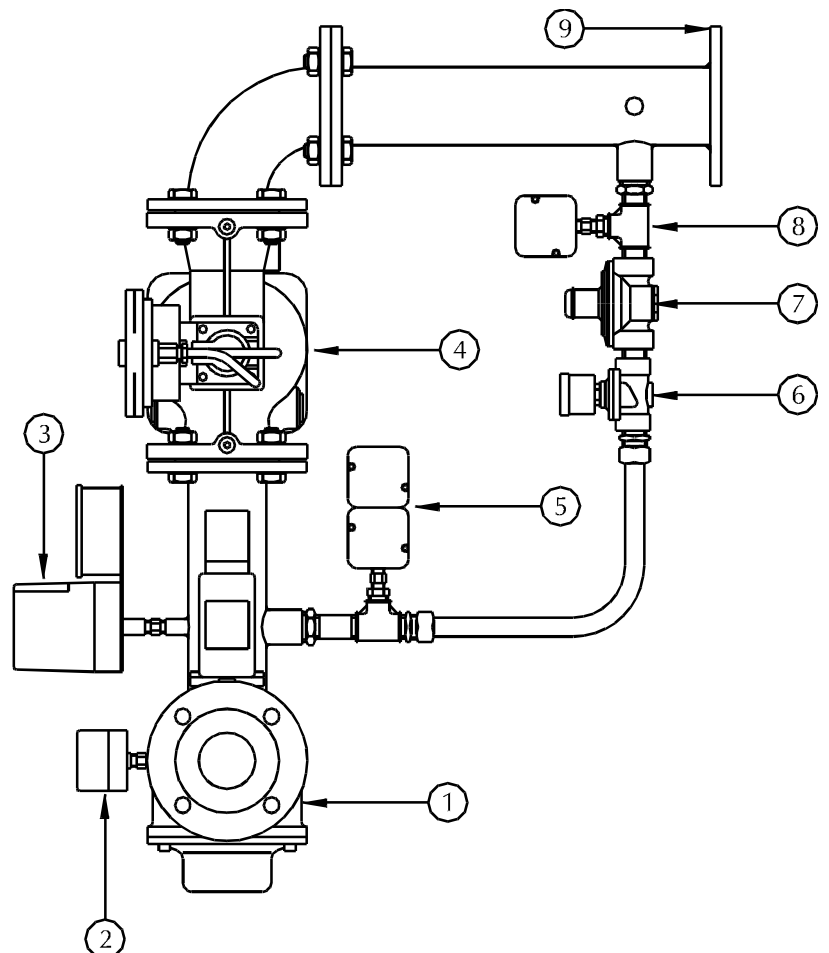
The gas train fitted is shown below.

Gas Nozzle

The gas nozzle is fitted to the front of the burner assembly, within the flame tube (refer to the Appendix). The gas ports in this nozzle are sized in accordance with the rating of the burner and the gas to be used.

**GAS TRAIN (VIEW AS INSTALLED FROM REAR OF BURNER)**

Item	Description
1	Main Safety Valve
2	Low Gas Pressure Switch
3	Pressure Proving System
4	Combined Valve & Regulator
5	Min/Max Pressure Switch
6	Start Gas Solenoid Valve
7	Start Gas Governor
8	High Gas Pressure Switch
9	Burner Connection Flange



Standard Arrangement Shown

### High Gas Pressure Switch

A high gas pressure switch is fitted to ensure that any increase in gas supply pressure above the level needed to maintain the set conditions results in a safe burner shutdown. In this event a fault will be indicated on the air/gas ratio controller. The pressure switch is factory set to the maximum value. Final adjustment of the setting of this switch is described in the Section on *Commissioning*.

### Low Gas Pressure Switch

Provision of a low gas pressure switch is required by European Standard EN 676 - *Automatic forced draught burners for gaseous fuels*. This pressure switch is fitted to all burners which carry the CE marking but it may not be fitted to non-CE marked burners.

The low gas pressure switch monitors inlet gas pressure and ensures that any decrease in gas pressure below the value needed to maintain satisfactory combustion results in a safe burner shutdown. Final adjustment of the setting of this switch is described in the Section on *Commissioning*.

### Gas Valve Train

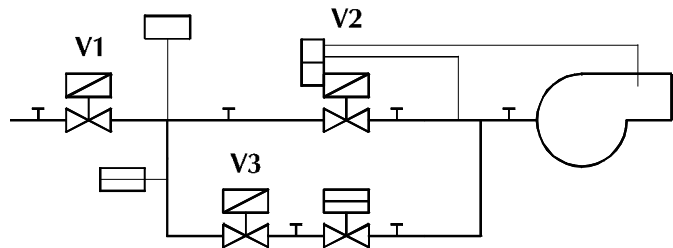
In addition to the pressure switches noted above, the gas control train includes an air/gas ratio controller, automatic safety shut-off valves and a governor in the start gas line. The upstream safety shut-off valve is of the slow acting type and the speed of its initial opening can be varied.

### Air/Gas Ratio Controller

The air/gas ratio controller varies the gas pressure in response to changes in combustion air pressure to ensure that the air/gas ratio remains constant over the operating range of the burner. A separate gas pressure governor is not necessary. Three impulse pipes (all factory supplied) are connected to the air/gas ratio controller. The first is connected to the burner body and supplies air pressure to the ratio controller. Note that in installations with negative air pressure in the combustion chamber, this pipe must always be under positive pressure. A second pipe connected to the gas line downstream of the valve set provides gas pressure to the ratio controller whilst the third pipe is vented to atmosphere.

### Valve Proving System

A valve proving system, as shown schematically below, is standard on all NG125 and NG150 burners.



When the burner operating sequence is initiated, the burner control box energises the proving system, which then carries out the following checks.

- \* Valves V1, V2 and V3 are initially closed. The proving system then opens V3 (in the start gas line) and then closes it after 2 seconds.
- \* V1, V2 and V3 remain closed for 23 seconds while the minimum side of the gas pressure switch checks for an increase in pressure. If no increase occurs there is no leakage past V1 and the sequence continues.
- \* V1 is opened for 2 seconds and then closed. V1, V2 and V3 again remain closed for 23 seconds while the maximum side of the gas pressure switch checks for a decrease in pressure. If no decrease occurs there is no leakage past V2 or V3 and the burner operating sequence will continue.

### Control Panel

The programming burner controller, ignition transformer, contactors and other items are located in an enclosure mounted on the left side of the burner. The front panel of this enclosure carries the burner On/Off switch and two neon indicator lights. The amber light indicates "BURNER ON" and the red light is illuminated when the burner stops as a result of "EXCESS TEMPERATURE" in the appliance.

### Flame Monitor

In standard configuration, NG burners are fitted with continuous flame supervision systems which use ultraviolet (UV) cells to detect the presence of the flame.

## BURNER OPERATING SEQUENCE

After the pressure proving cycle described above, the NG burner operating sequence (refer to the controller sequence diagram below) continues with a pre-purge period on full air. Gas is then supplied to the burner at start rate and ignition initiated. Start gas flame proving is followed by establishment of the main flame, at which point the burner controller will continue to its normal operating position and the operation of the burner will be controlled by the pressure and/or temperature requirements of the appliance.

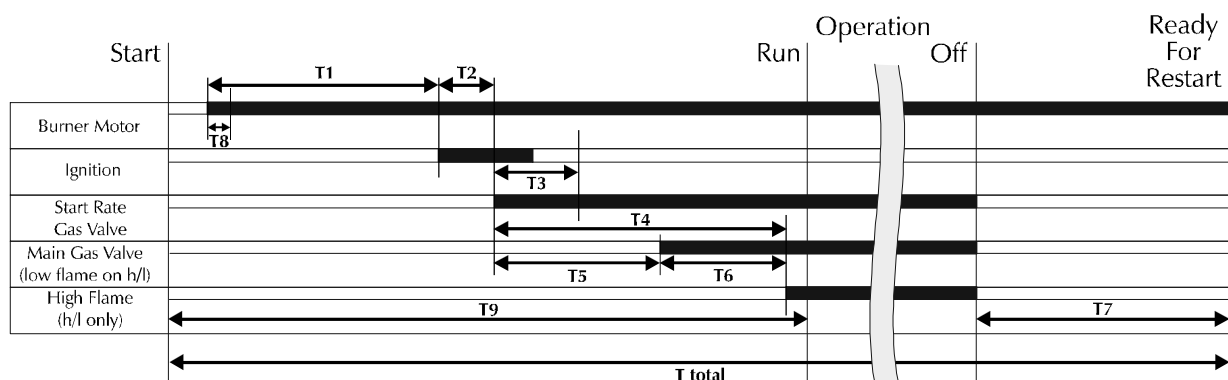
## COMMISSIONING

### Safety

It is essential that commissioning shall be undertaken only by suitably qualified and experienced personnel. In the case of NG burners, commissioning engineers should be experienced in commissioning forced draught gas burners.

In the UK, it is a legal requirement that commissioning engineers must be CORGI registered.

### SEQUENCE DIAGRAM AND TIMING CHART



Time (s)	Controller Type		Description
	TMG740-3 MOD43-35	LFL 1.333	
T1	40	40	Pre-purge
T2	4	6	Pre-ignition
T3	3	3	Safety Lockout Time
T4	Not Applicable to High/Low Operation		Delay Start Rate To Main Flame - Single Stage
T5	9	12	Delay Start Rate To Main Flame - Multi-Stage
T6	6	12	Delay Between Main Flame Low & Main Flame High (Two Stage Burners)
T7	10	18	Post-purge
T8	8	12	Air Pressure Switch Interlock
T9	80	91	Total Start Time
T total	90	106	Total Cycle Time Of Controller

**NOTE :** The pre-purge times shown refer to the control box only. The air damper control will extend the total burner purge time up to a maximum of 127 seconds depending on the firing rate and air requirements of the appliance.

Nu-way can accept no responsibility for consequential loss, damage or injury which results from a failure to follow the commissioning instructions provided or from commissioning procedures being undertaken by unqualified personnel.

## In An Emergency

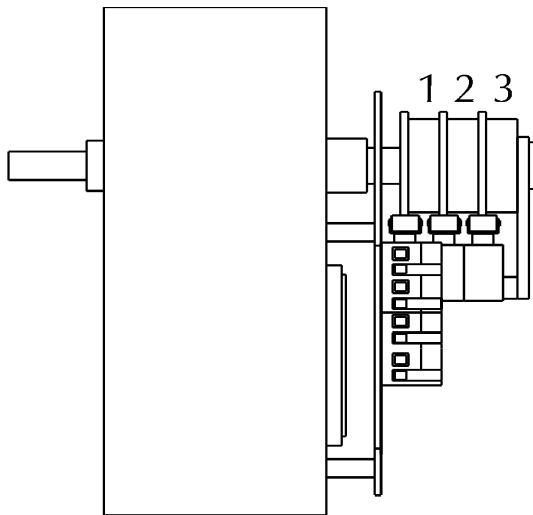
NG burners are designed and constructed to meet all essential requirements of the Gas Appliance Directive 90/396/EEC. When used in accordance with the instructions provided, NG burners are unlikely to produce a hazardous condition. If, however, such a condition should arise in connection with the burner, the appliance or any instrument, machine or service in the vicinity of the burner, the **GAS AND ELECTRICITY SUPPLIES SHALL BE ISOLATED IMMEDIATELY** and they shall remain isolated until the fault has been identified and rectified.

## Inspection

Before commissioning is begun it is important to:

- Check that the electrical wiring is complete and complies with all applicable Codes and Standards.
- Ensure that the fuses are fitted and are of the correct ratings.
- Check electrical earthing.
- Verify that the gas supply pipework is correctly sized and that it has been checked for leakage.
- Ensure that the manual gas isolation valve at the inlet to the gas train is operable, fully closed and leak tight.
- Make all personnel involved in the commissioning aware of the location of the emergency gas and electricity isolation points.
- Check that fittings such as purge and test points are available.
- Establish that the appliance is in an appropriate and safe condition to be fired; for example, that there is water in the boiler.
- Set the appliance controls to call for heat.
- Check the appliance's ventilation and flueing arrangements.

## AIR DAMPER SETTING

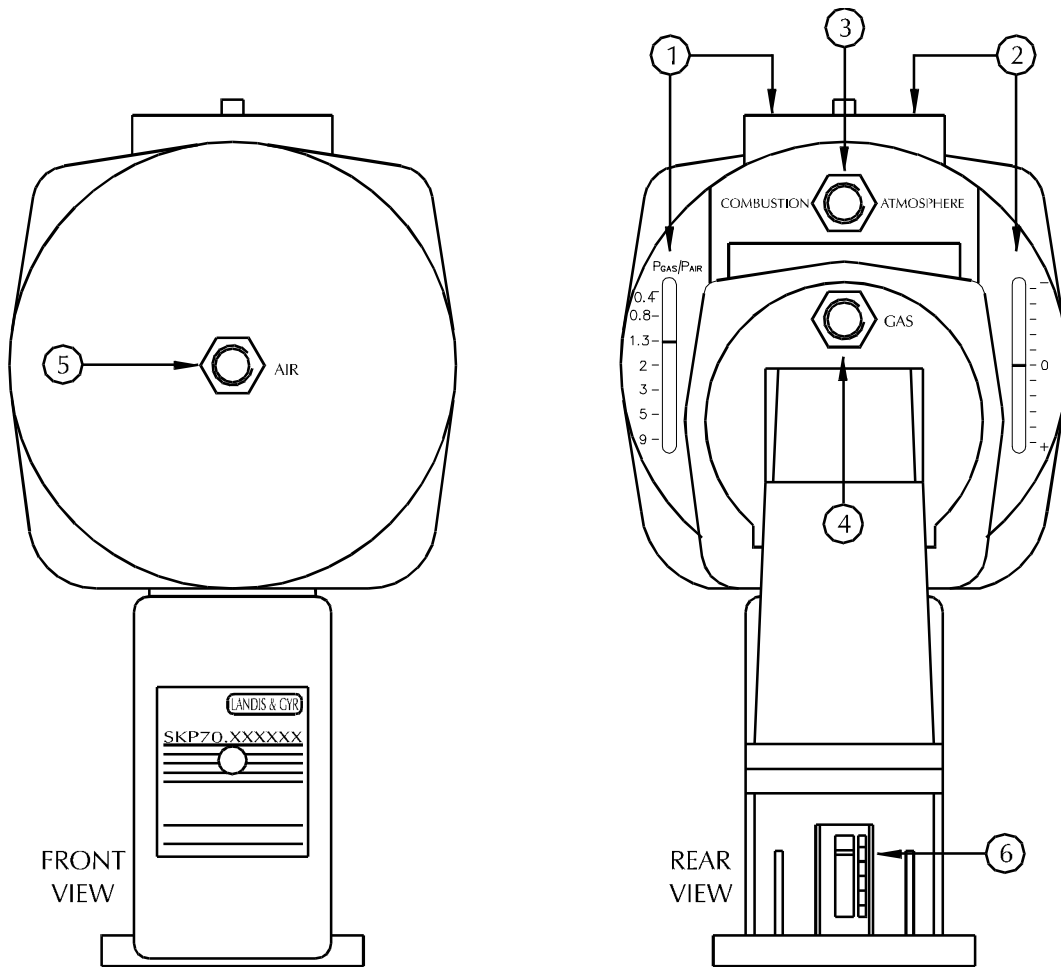


Cam	Function	Initial Setting
1	Full Air Shut Off (Factory Set)	0 Deg
2	Low Fire Air	15 Deg
3	High Fire Air	60 Deg

### NOTES :

- 1 The full air shut off cam (1) is factory set and under normal circumstances should not require further adjustment.
- 2 Setting of low and high fire air flow is by manual adjustment of cams 2&3. A scale is provided at the end of the cam stack for guidance and adjustments are made using the screw adjusters situated within the cam disk body.
- 3 The internal electrical connections are detailed on the inside of the motor lid for reference and fault finding. The motor will traverse 90° within a maximum of 30 seconds.

# AIR/GAS RATIO CONTROLLER



Item	Function
1	Adjustment and indication of the gas/air ratio (High Fire Setting)
2	Adjustment and indication of the parallel displacement of the characteristic (Low Fire Setting)
3	Vented to atmosphere
4	Connection to the gas line
5	Connection to the combustion air supply at the burner head
6	Indication of the valve stroke

- Ensure that any warning notices appropriate to the commissioning procedure are in position.
- Ensure that all necessary tools and test equipment are available and ready for use. Essential items include a manometer or other approved pressure measuring instrument and a means of analysing the flue products for carbon dioxide (CO<sub>2</sub>), oxygen (O<sub>2</sub>) and carbon monoxide (CO).
- Check that all relevant documentation is available, including, where appropriate:
  - The agreed plant performance specification.
  - Plant drawings and pipework layouts.
  - Electrical logic and wiring diagrams.
  - Certificates confirming satisfactory completion of procedures such as soundness testing, purging and electrical safety tests.

- Commissioning, operating and maintenance instructions for the plant.
- Establish that the operation of plant other than that being commissioned will not have an adverse effect on the operation of the plant to be commissioned and similarly, that the operation of the plant to be commissioned will not have an adverse effect on other plant.
- Confirm that the operation of adjacent plant and machinery will not constitute a hazard to the personnel involved in commissioning.

## Initial Settings

To prepare the burner for commissioning:

- 1 Remove the cover from the air damper motor which is located in the top section of the air inlet cover. Access is gained by removing the six screws retaining the top plate and the four screws retaining the cover plate in the top right face of the air inlet cover. Check the cam positions and adjust as necessary, referring to the settings shown on Page 12.
- 2 Remove the small plate on top of the governor section of the air/gas ratio controller. Referring to the diagram on Page 13, set the air/gas ratio on scale (1) to 0.8 by adjusting screw (1), anti-clockwise to increase, clockwise to decrease. Set the ratio on the remaining scale to half a division on the positive side of '0' by adjusting screw (2) in the same way; anti-clockwise to increase, clockwise to decrease.
- 3 Remove the cap from the start gas governor and set the adjusting screw approximately half way between the maximum and minimum settings, turning the screw clockwise to increase the setting and anti-clockwise to decrease it. Replace the cap. Never adjust the governor to its maximum setting.
- 4 Set the ignition electrode gap to 2.5 to 3 mm.

## Burner Dry Run

The following procedure should be followed. It is important that a complete and flawless dry run be completed before gas is supplied to the system.

- 1 Check that the gas and electrical power supplies to the burner are turned off.
- 2 Check that the manual gas isolation valve is closed.

- 3 Check that the gas pipework between the plant isolation valve and the safety shut-off valves has been tested for soundness and purged in accordance with an appropriate Procedure, for example IGE/UP/1 *Soundness testing and purging on industrial and commercial premises*.
- 4 Ensure that the flame detection system detects the presence of a simulated flame or, where permissible, an independent flame source.
- 5 Remove the control panel cover and remove the low fire hold link. On the terminal strip, remove the wire link between terminals 52 and 53 (if a gas booster is fitted, remove the wire from terminal 52) and fit a temporary link between terminals 52 and 62. Replace the cover.
- 6 Remove the cover from the low gas pressure switch and fit a temporary link between terminals 2 and 3. Replace the cover.
- 7 Set the air pressure switch to minimum.
- 8 Establish the electrical supply to the burner and momentarily switch on the burner. Observe the rotation of the combustion air fan motor, which should be anti-clockwise viewed from the motor end. If the direction of rotation is incorrect refer to the Section of this handbook on *Fault Finding*.
- 9 If the fan rotation is correct switch on the burner. The gas pressure proving system will lock out.
- 10 The burner motor will begin to run:
  - (a) Immediately if the system was switched off during normal operation.
  - (b) On pressing the reset button on the control box.

If at this stage the burner goes to lockout refer to the Section on *Fault Finding*.

- 11 The burner will proceed through its ignition sequence. Check that an ignition spark is present. If there is no spark and the burner goes to lockout the air pressure switch may require adjustment - refer to the Section on *Fault Finding*.
- 12 The ignition spark will cease and the system will go to lockout. Switch off the burner and the electrical supply to the burner.

- 13 Remove the control panel cover and replace the low fire hold link. Remove the temporary link between terminals 52 and 62 and replace the booster wire (terminal 52) or the link between terminals 52 and 53 as appropriate. Replace the cover. Remove the temporary link fitted to the low gas pressure switch and replace the cover.
- 14 The burner's safety systems have now been proven and commissioning can proceed to the next stage.

### Burner Live Run

The instructions in this section are presented as a continuous sequence. No separate set of actions (for example, checking the flame signal) should be followed in isolation without paying particular attention to any safety precautions such as isolating the electrical supply to the burner which should precede such actions. At all stages the operation of the burner should be checked against the programming controller sequence diagram on Page 11.

Before proceeding, check again that:

- The electrical wiring is complete and complies with all relevant Codes and Standards.
- All fuses are fitted and are of the correct ratings.
- The gas supply pipework is correctly installed and has been leak tested. If, at any time during commissioning, there is a **SMELL OF GAS** the gas and electricity supplies must be isolated and the leak sealed before proceeding.
- The appliance is in an appropriate and safe condition to be fired.
- The appliance controls are set to call for heat.

#### Gas Supply Pressure

The main gas safety valve is capable of withstanding gas inlet pressures up to 200 mbar. For NG 125 and NG 150 burners it is essential that the inlet gas pressure shall not be less than **45 mbar** and not be more than **100 mbar** in order to maintain good control characteristics of the air/gas ratio controller. Before proceeding with commissioning:

- 1 Fit a manometer or other approved pressure measuring instrument to the pressure test point on the upstream side of the first safety shut-off valve.
- 2 Open the manual gas isolation valve at the inlet to the gas train.
- 3 Check that the gas pressure is adequate.

#### Establishing The Start Gas Flame

- 1 Remove the control panel cover and remove the pilot check link. Replace the cover.
- 2 Establish the electrical supply to the burner and switch on the burner.
- 3 Check the operation of the valve proving system by following the procedure described in the Section on *Routine Safety Checks*.
- 4 The burner controller will run through its sequence, initiating the ignition spark and opening the start gas safety shut-off valve.
- 5 The start gas flame will be established and the UV cell will begin monitoring. The burner will operate continuously at start gas rate.
- 6 Confirm the leak tightness of the pipework downstream of the start gas safety shut-off valve.
- 7 Switch off the burner. Switch on the burner and allow the ignition sequence to be repeated, confirming that the start gas flame is reliable
- 8 Switch off the burner and the electrical power supply to the burner. Remove the control panel cover and replace the pilot check link. Replace the cover.

#### Setting Main Flame Rates And Air/Gas Ratios

From this point the commissioning process is concerned with setting the main and start gas flow rates to appropriate values and ensuring that the combustion quality of the system is within acceptable limits. During this process:

**AFTER EACH ADJUSTMENT** check the flue gas analysis and gas flow rate.

**ALWAYS** use approved and calibrated test equipment.

**NEVER** rely on visual observation of the flame as a guide to combustion quality.

- 1 Fit a manometer or other approved pressure measuring instrument to the gas pressure test point nearest to the burner head. The relationship between the pressure at this point and burner heat input is shown in the graphs in the *Appendix*. This information is provided only as a guide and it should not be used in conjunction with pressure measurements as a substitute for accurate measurement of gas flow rate using, for example, a gas meter.
- 2 Ensure that the flue gas analysis equipment is functioning.

- 3 Close the manual gas isolation valve at the inlet to the gas train to an opening of approximately 20%.
- 4 Set the gas inlet pressure switch to its minimum value.
- 5 Remove the control panel cover and remove the low fire hold link. Replace the cover.
- 6 Establish the electrical supply to the burner and switch on the burner.
- 7 The burner controller will run through its sequence, initiating the ignition spark and opening the start gas safety shut-off valve. The start gas flame will be established and the UV cell will begin monitoring.
- 8 The main gas control valve will open and low fire will be established. Open the upstream manual valve slowly until it is fully open, observing the CO level.
- 9 If the CO level is too high (see below) reset the low fire adjusting screw (2) on the air/gas ratio controller (refer to the diagram on Page 13) until an acceptable figure is achieved. In extreme cases the adjustment on screw (2) may be exhausted without achieving an acceptable CO level. In this event, reset the high fire adjusting screw (1) until an acceptable CO level is achieved.
- 10 Confirm the leak tightness of the pipework downstream of the main gas safety shut-off valve using a proprietary detection fluid.
- 11 Switch off the burner and the electrical power supply to the burner.
- 12 Remove the control panel cover and refit the low fire hold link. Replace the cover.
- 13 Establish the electrical supply to the burner and switch on the burner. The burner controller will run through its sequence. Low fire will be established, expanding to main flame. Monitor the flame visually during the transition from low to high fire. If the flame becomes more intense and compact this indicates an excess of combustion air. If the flame becomes large and shapeless this indicates an excess of fuel. Either condition is acceptable at this stage provided that the flame is stable and the commissioning process continues immediately. If in doubt, switch off the burner and adjust screw (1) on the air/gas ratio controller appropriately before restarting the burner.
- 14 With the burner running on high fire measure the flue CO<sub>2</sub> level and adjust screw (1) to bring the level to between 9.5 and 10%. Note that at this stage the burner may be overfiring the appliance and producing excessively high levels of CO.
- 15 Switch off the burner and the electrical power supply to the burner. Remove the control panel and remove the low fire hold link. Replace the cover. Establish the electrical supply to the burner and switch on the burner. Allow the burner controller to run through its cycle until the burner is running on low fire.
- 16 Adjust the low fire adjusting screw (2) to bring the CO<sub>2</sub> level to between 9.0 and 9.5%.
- 17 Changing the low fire setting on the air/gas ratio controller will have a slight effect on the high fire setting. It may therefore be necessary to repeat steps 14 to 16 several times in order to achieve acceptable levels of CO<sub>2</sub> at both firing rates.
- 18 With the burner running on high fire check the gas flow rate with an appropriate instrument, ensuring that the instrument has been calibrated before use. If the flow rate is to be measured using the main site gas meter or a supplementary meter ensure that all other gas appliances served by that meter are isolated. If it is necessary to adjust the gas flow rate this can be done by varying the air damper opening.
- 19 Check the gas flow rate with the burner running on low fire. The low fire rate should not be less than 50% of the high fire rate (2:1 turndown). The gas rate can be adjusted by varying the low fire position of the air damper. Care should be taken not to exceed the limits of the burner performance envelope shown in the *Appendix*.
- 20 Analyse the flue products on both high and low fire. In both cases appropriate figures are:
 

Carbon dioxide (CO <sub>2</sub> )	: 9 to 10%
Oxygen (O <sub>2</sub> )	: 3 to 5%
Carbon monoxide (CO)	: Less than 93 parts per million (ppm), dry air-free.

#### Setting The Start Gas Rate

- 1 Switch off the burner and the electrical power supply to the burner.
- 2 Remove the control panel cover and remove the pilot check link. Replace the cover.



- 3 Establish the electrical supply to the burner and switch on the burner. Allow the burner to light and establish the start gas flame.
- 4 Check the gas flow rate. The appropriate rate is 25% of the low rate for the main flame. The start gas rate should never be set at a level higher than 33% of the main flame.
- 5 If it is necessary to adjust the start gas rate, turn the adjusting screw in the start gas pressure governor clockwise to increase the gas rate and anti-clockwise to reduce it. Make small adjustments and check the gas rate after each change.
- 6 Switch off the burner and the electrical power supply to the burner. Remove the control panel cover and replace the pilot check link.

#### Checking The Flame Signal

- 1 Disconnect the flame signal check link.
- 2 Connect a DC ammeter across the terminals.
- 3 Establish the electrical supply to the burner and switch on the burner. Allow the burner to light and operate normally.
- 4 Observe the reading on the ammeter at all firing levels including start gas. A steady reading in excess of 7 microamps is satisfactory. Lower readings may cause intermittent burner lockout and indicate a need for adjustment of the burner settings - refer to the Section on *Fault Finding*.
- 5 Switch off the burner and the electrical power supply to the burner. Disconnect the ammeter and replace the flame signal check link. Replace the control panel cover.

#### Setting The Air Pressure Switch

- 1 Remove the air pressure switch cover.
- 2 Fit a manometer or other approved pressure measuring instrument to the pressure switch to enable a comparison to be made between the pressure switch indicator and the measured pressure.
- 3 Remove the control panel cover and remove the low fire hold link. Replace the cover.
- 4 Establish the electrical supply to the burner and switch on the burner. Allow the burner to proceed through its sequence until it is operating on low fire.
- 5 Turn the adjusting dial on the pressure switch clockwise slowly until the flame is extinguished and the burner goes to lockout.

- 6 Turn the dial one division anti-clockwise and reset the burner. If lockout occurs again, turn the dial a further division anti-clockwise and reset the burner. Repeat this process until the burner lights and runs satisfactorily.
- 7 Turn the adjusting dial a further two divisions anti-clockwise.
- 8 Switch off the burner and the electrical power supply to the burner. Remove the manometer. Replace the pressure switch cover.
- 9 Remove the control panel cover and replace the low fire hold link. Replace the cover.

#### Setting The High Gas Pressure Switch

- 1 Remove the cover from the high gas pressure switch.
- 2 Establish the electrical supply to the burner and switch on the burner. Allow the burner to proceed through its operating sequence until it is operating on high fire.
- 3 Turn the adjusting dial on the pressure switch anti-clockwise slowly until the switch trips, causing the pressure switch indicating light to be illuminated and the burner to shut down.
- 4 Turn the adjusting dial one division clockwise.
- 5 Refit the cover and reset the pressure switch by pressing the button on the cover. The burner will restart.

#### Setting The Low Gas Pressure Switch

- 1 Switch off the burner and the electrical power supply to the burner.
- 2 Remove the cover from the low gas pressure switch.
- 3 Establish the electrical supply to the burner and switch on the burner. Allow the burner to proceed through its operating sequence until it is operating on high fire.
- 4 Turn the adjusting dial on the pressure switch clockwise slowly until the switch trips, causing the burner to shut down. Turn the adjusting dial anti-clockwise slowly until the burner restarts and main flame is established.
- 5 Repeat step (4) above.
- 6 Turn the dial a further two divisions anti-clockwise.
- 7 Switch off the burner and the electrical power supply to the burner. Replace the pressure switch cover.

## Final Checks

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- 1 Check that all covers have been replaced and that all locking devices are secure.
- 2 Check the operation of the appliance control instruments and safety interlocks.
- 3 Ensure that the appliance controls are set to safe limits.
- 4 **COMMISSIONING IS NOW COMPLETE.**
- 5 Establish the electrical supply to the burner and switch on the burner. Allow the burner to proceed through its operating sequence until it is operating on high fire. The burner will now operate normally until:
  - (a) It is switched off by the appliance controls.
  - (b) It is switched off manually.
  - (c) There is an electrical power failure. In this event the burner will restart and run normally when power is restored. No manual intervention is required.

## On Completing Commissioning

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When commissioning has been completed satisfactorily the commissioning engineer shall prepare a report, which shall contain the following:

- Details of any modifications made to the system, together with revised drawings if necessary.
- Customer and plant details, including any serial numbers.
- Operating levels and settings, including flue gas analysis information.

This report shall be passed to the person responsible for the plant. This responsible person shall ensure that:

- 1 All personnel concerned with operating, supervising and maintaining the plant receive instruction covering:
  - The way in which the plant operates and the locations and functions of the plant's safety systems.
  - The correct light-up and shutdown procedures.
  - Adjustment of operating variables.
  - Checking of plant interlocks.
  - The plant's maintenance requirements.
  - The actions to be taken in the event of a fault condition.

- 2 Clear light-up and shutdown procedures are displayed on the plant and that the pipes, valves and switches involved are clearly marked.
- 3 **CLEAR AND CONCISE EMERGENCY SHUTDOWN PROCEDURES ARE DISPLAYED.**

## ROUTINE SAFETY CHECKS

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**THESE CHECKS SHOULD BE CARRIED OUT ONLY BY APPROPRIATELY QUALIFIED AND EXPERIENCED PERSONNEL.**

### Combustion Air

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Check that the plant room is well ventilated at all times and inspect the burner air inlet frequently to ensure that there is no obstruction to the air flow.

### Flame Detector

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- Remove the UV cell from the burner casing and cover the quartz glass envelope to exclude light. Care should be taken not to touch the glass.
- Establish the electrical supply to the burner and switch on the burner. The burner should go to lockout at the end of the ignition cycle.
- Switch off the burner and the electrical supply to the burner. Replace the UV cell. Establish the electrical supply to the burner and switch on the burner. Reset the lockout.

### Valve Proving System

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- Introduce a gas leak by slackening the screw in the pressure test point between the main valves.
- Establish the electrical supply to the burner and switch on the burner. The valve proving system should lock out through falling gas pressure as the burner runs through its start cycle.
- Re-tighten the screw in the pressure test point and reset the lockout button on the valve proving system.

## ROUTINE MAINTENANCE

**ALWAYS SWITCH OFF THE ELECTRICAL POWER AND GAS SUPPLIES TO THE BURNER BEFORE CARRYING OUT MAINTENANCE.**

### Combustion Air Fan

Remove the burner top cover to gain access to the combustion air fan. Clean the fan blades with a stiff brush, taking care not to damage them. Inspect the burner air inlet frequently and ensure that there is no obstruction to the air flow.

### Burner Inner Assembly

To gain access to the burner inner assembly:

- Remove the two top covers.
- Disconnect the ignition lead.
- Remove the four nuts and washers from the mounting flange studs.
- Disengage the inner assembly from the mounting flange studs and remove the gaskets and shims, noting the number and position of these.
- Rotate the inner assembly 90° and remove through the top of the casing taking care not to damage it.

Clean the air diffuser and gas nozzle with a stiff brush. Clean and reset the ignition electrode and check that it is not cracked or worn. Renew the electrode if necessary. Reverse the order of actions detailed above to replace the inner assembly and prepare the burner for normal operation.

### Replacing The Air/Gas Ratio Controller

If mechanical or electrical failure necessitates replacement of the air/gas ratio controller the burner must be recommissioned to ensure that it is returned to the correct combustion and throughput settings. Replacement of the air/gas ratio controller and the subsequent recommissioning shall be undertaken only by appropriately qualified and experienced personnel.

## FAULT FINDING

Any changes made in control settings as a result of identifying and remedying fault conditions as described below may necessitate partial or complete recommissioning. Recommissioning shall be undertaken only by appropriately qualified and experienced personnel.

## Burner Motor Fails To Start

Possible Reason	Remedy
No power supply to burner	Reinstate power supply
	Check fuses
	Check burner correctly wired
	Check appliance controls calling for heat
	Check burner not locked out
	Check motor overload not tripped
	Check leak detection system
	Tighten pressure test points
Gas control train disconnected	Check and reconnect
Appliance controls incorrectly set	Check and adjust as necessary
Gas supply isolated	Restore supply
Low gas pressure	Check and rectify
Low gas pressure switch incorrectly set	Check and adjust as necessary
Air pressure switch not in start position	Check as below

To check that the air pressure switch is in the “start” position:

- Switch off the electrical power supply to the burner.
- Remove the plug-in assembly from the control box base.
- Using a suitable instrument, check for electrical continuity between the following terminals:  
 Satronic TMG 740 Terminals 16 & 17  
 Landis & Gyr LFL 1.333 Terminals 4 & 13
- If the pressure switch is not in the start position turn the setting dial clockwise fully to the minimum setting. Check again for continuity between the above terminals. If there is no continuity the pressure switch is faulty and should be renewed.

If a gas booster is fitted:

- Ensure that the low inlet gas pressure switch is not locked out.
- Check that the booster drive belt is fitted.
- Verify that the booster motor is rotating correctly.

## Fan Starts And Burner Goes To Lockout

### (1) No Ignition

Possible Reason	Remedy
Air pressure switch settings incorrect	Reset
Ignition electrode setting incorrect	Reset
Cracked electrode insulation	Renew electrode
HT lead disconnected or damaged	Reconnect or renew as necessary
Ignition transformer faulty	Renew
Programming controller faulty	Check and renew if necessary

### (2) No Flame

Possible Reason	Remedy
Gas supply interrupted	Check gas supply to burner
Gas pressure too low	Investigate and remedy
Air flow incorrect for gas flow	Check and adjust as necessary
Valves fail to open	Check wiring, replace valve if faulty
Manual isolation valves closed	Open valve

### Start Gas Flame Failure

Failure of the start gas flame will produce lockout. The cause may be:

- A dirty / wrongly positioned (it must face the flame) glass envelope on the UV cell.
- A fault in the UV cell or its wiring - check and replace if necessary.
- The flame signal check link has been removed - check and replace.
- There is insufficient gas under ignition conditions to allow the flame to be detected adequately - adjust the initial lift of the upstream safety shut-off valve.

### Incorrect Rotation Of Burner Motor

The motor should rotate anti-clockwise as viewed from the motor end. If the direction of rotation is incorrect interchange two phases in the three-phase power supply. If this does not correct the direction of rotation the motor should be renewed.

If it is necessary to change this motor or the combustion air fan the following procedure should be followed.

- Switch off the burner and the electrical power supply to the burner.
- Disconnect the multi-pin plug from the socket on the control system.
- Remove the screw which holds the control system to its mounting bracket.
- Lift the control system from its mounting bracket and rest it on the gas valve train.
- The securing studs, fixing nuts and bolts on the mounting flange are now accessible.

### Main Flame Is Not Established

Possible Reason	Remedy
Gas pressure or flow too low	Check gas supply to burner
Main flame gas valve fails to open	Check wiring, replace valve if faulty
Programming controller faulty	Check and replace if necessary
Main gas manual valve closed	Open valve
Low flame hold link removed	Replace link
Cam stack on air damper motor loose	Tighten
Gas train gasket positioned incorrectly	Reposition
Air setting incorrect	Reset

### Burner Motor Only Runs Continuously

Possible Reason	Remedy
Air control damper motor failed	Renew
Air control damper cam loose	Re-tighten
Microswitch fails to change over	Renew
Damper motor wired incorrectly	Renew

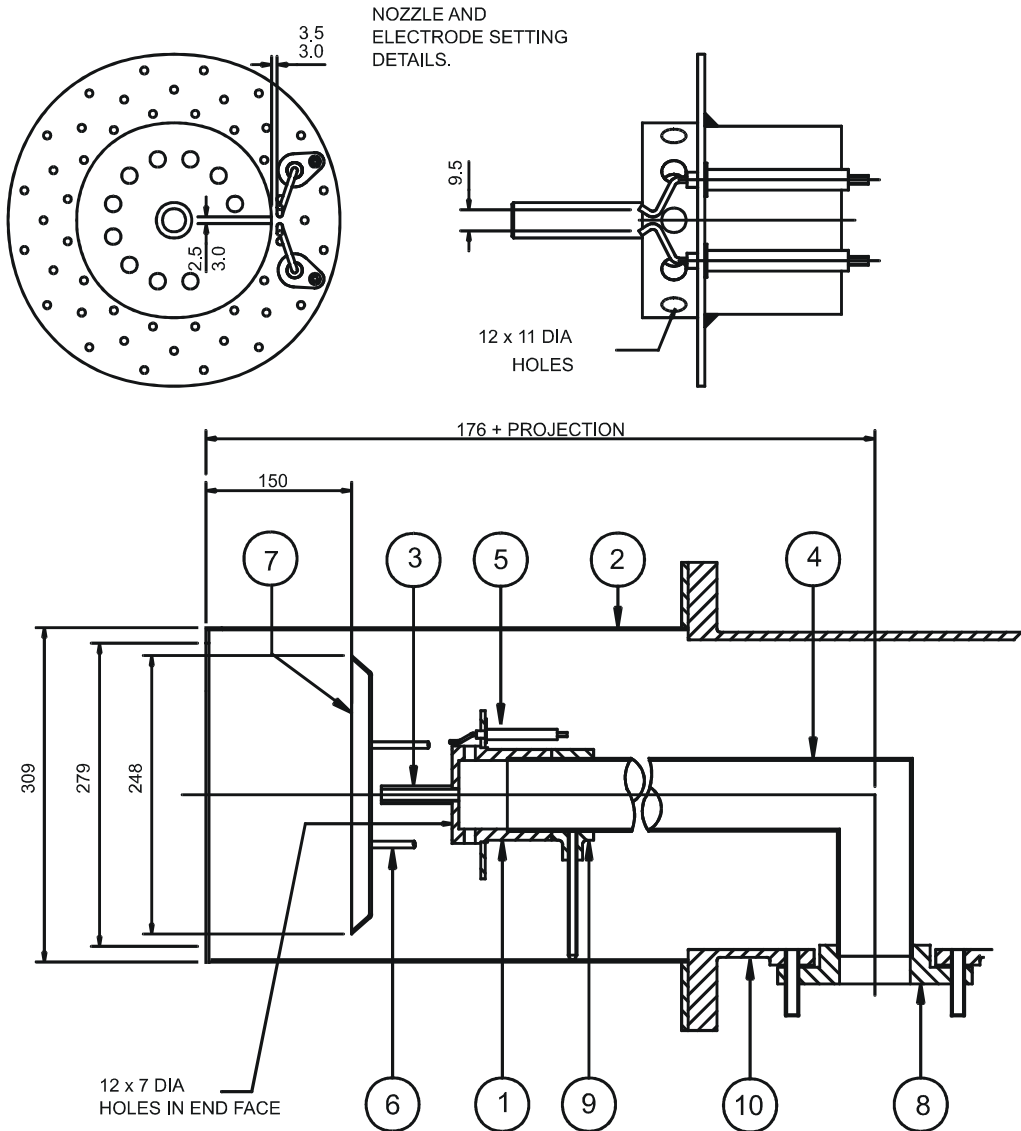
### Spare Parts

For spare parts contact Nu-way's Parts And Components Division at the address and telephone number listed on the rear cover of this manual.

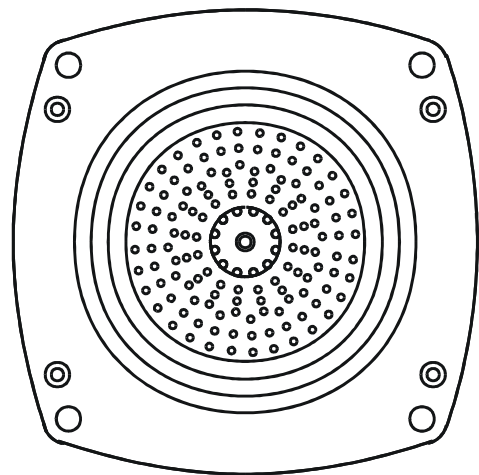
To avoid delays, please provide the burner model and serial numbers.

Combustion Head Details NG125 And NG150

All dimensions are mm.



Item	Description
1	Nozzle
2	Flame tube
3	Start gas tube
4	Inner assembly elbow
5	Electrode
6	Diffuser mtg stud
7	Diffuser
8	Gas train adaptor
9	Centralising assembly
10	Casing

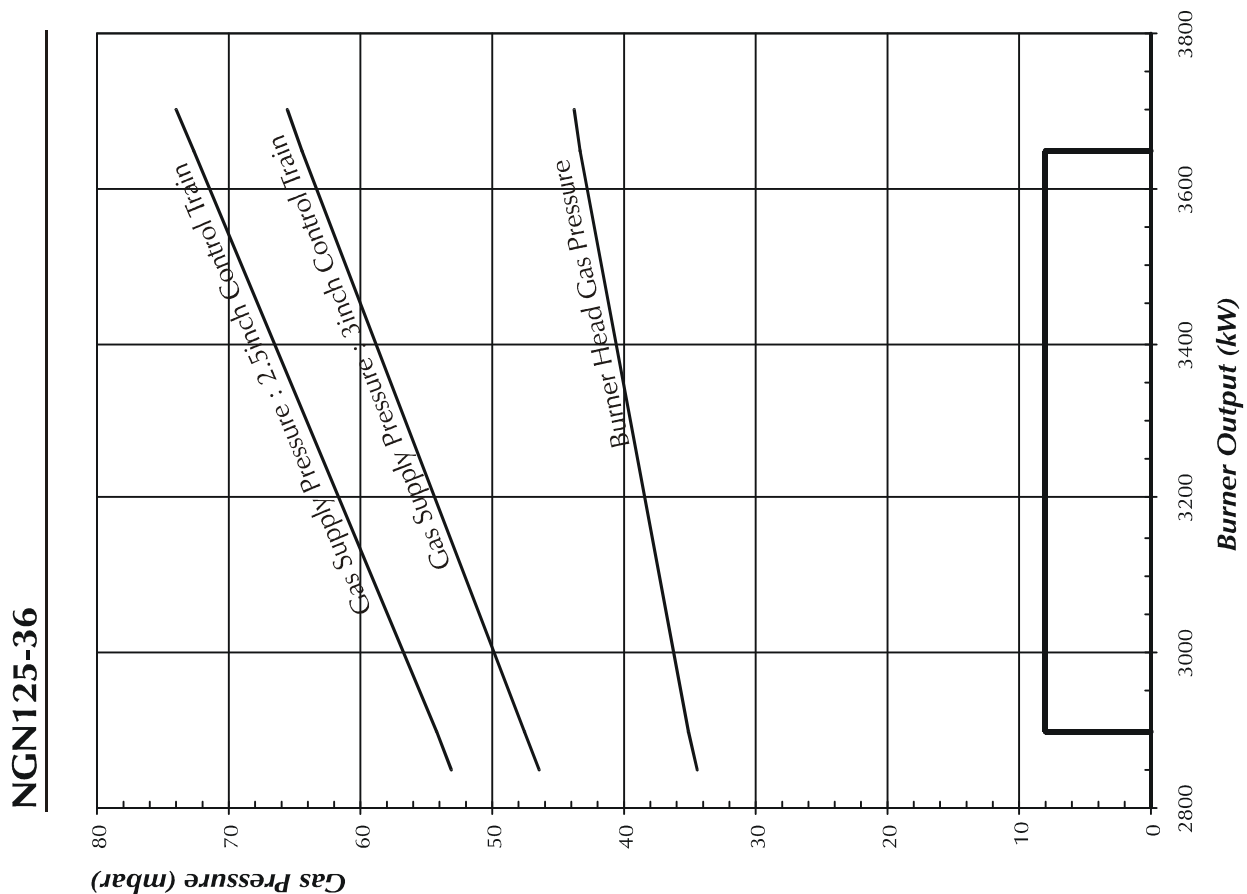


## Burner Performance Envelopes and Supply Pressures

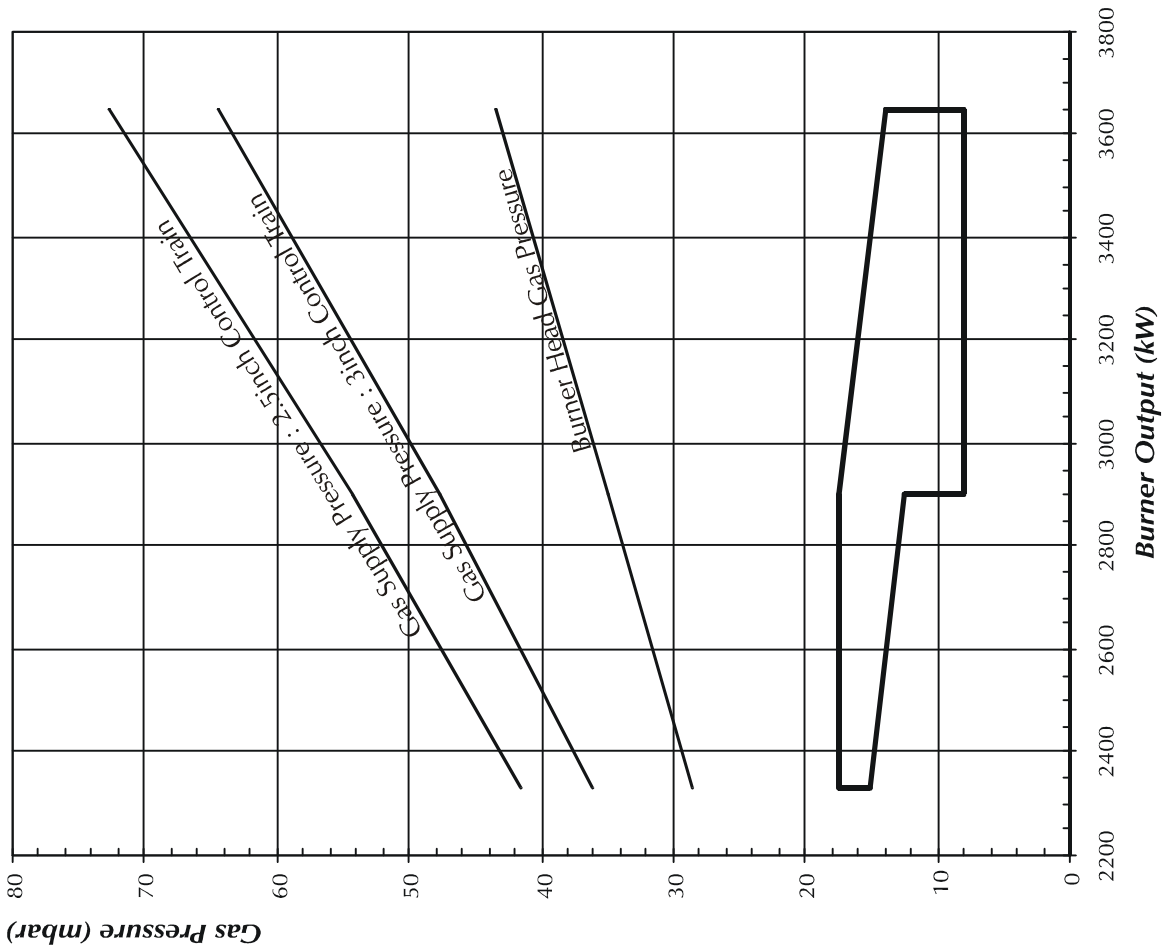
The total minimum gas supply pressure is obtained by summing the combustion chamber resistance and the stated gas supply pressure. A further 2.5 mbar should be added to allow for manufacturing tolerances etc.

The burner head gas pressure curves are supplied as a guide only, and are not intended to replace a full burner commissioning procedure using certified test equipment.

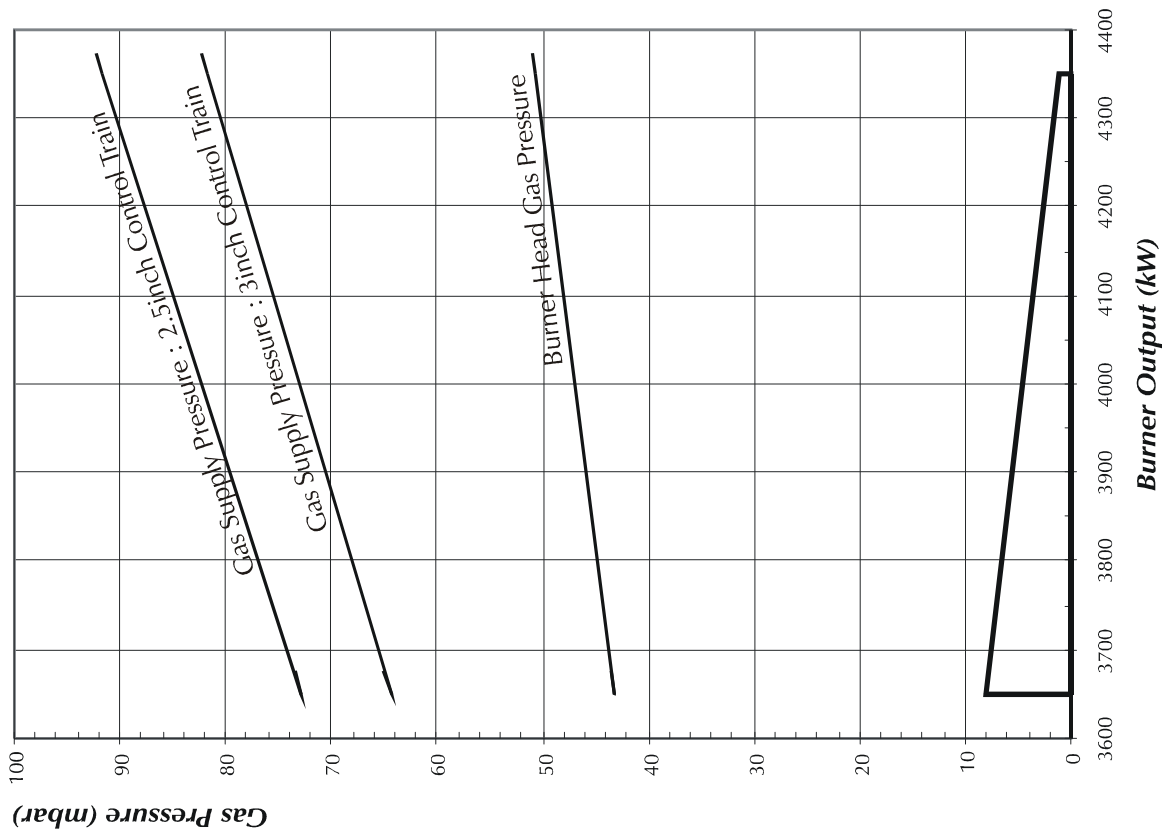
The burner outputs are based on the gross calorific value of natural gas (38.56MJ/m<sup>3</sup>).



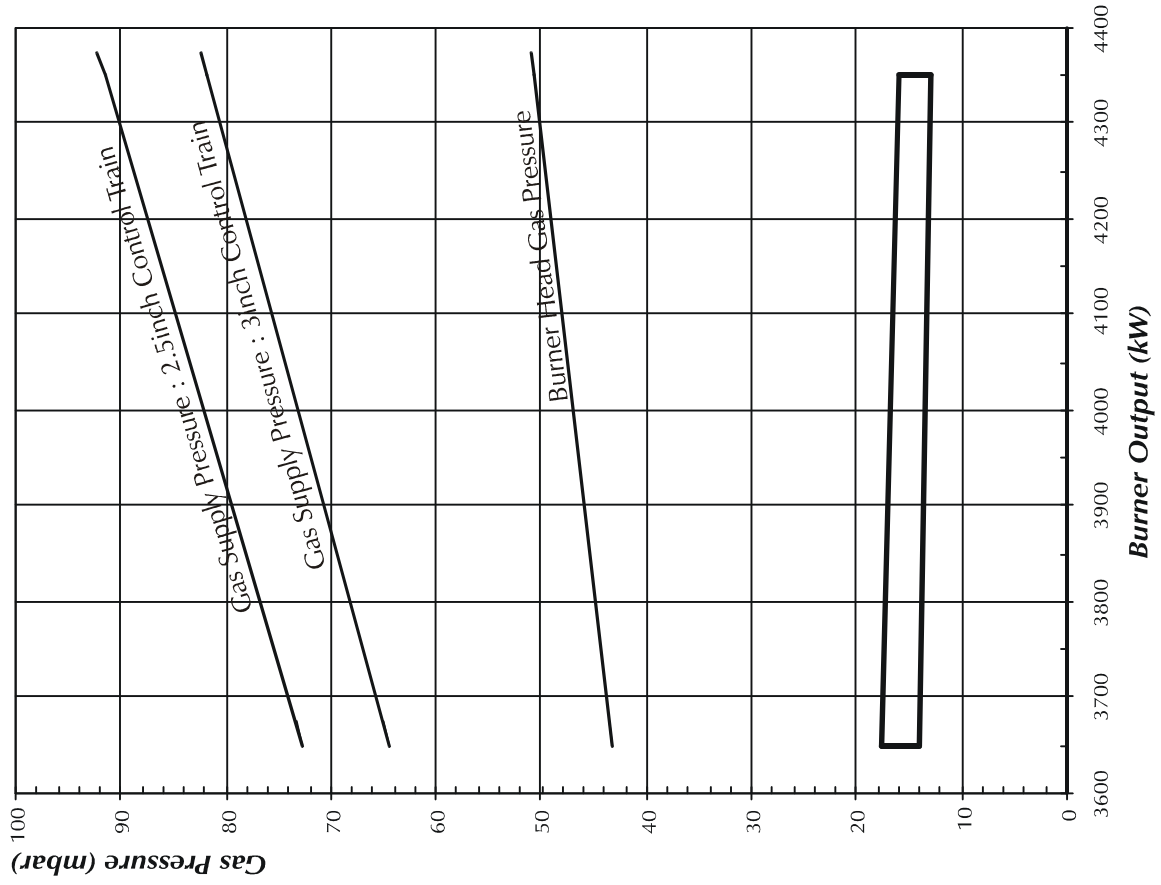
**NGN125-41**



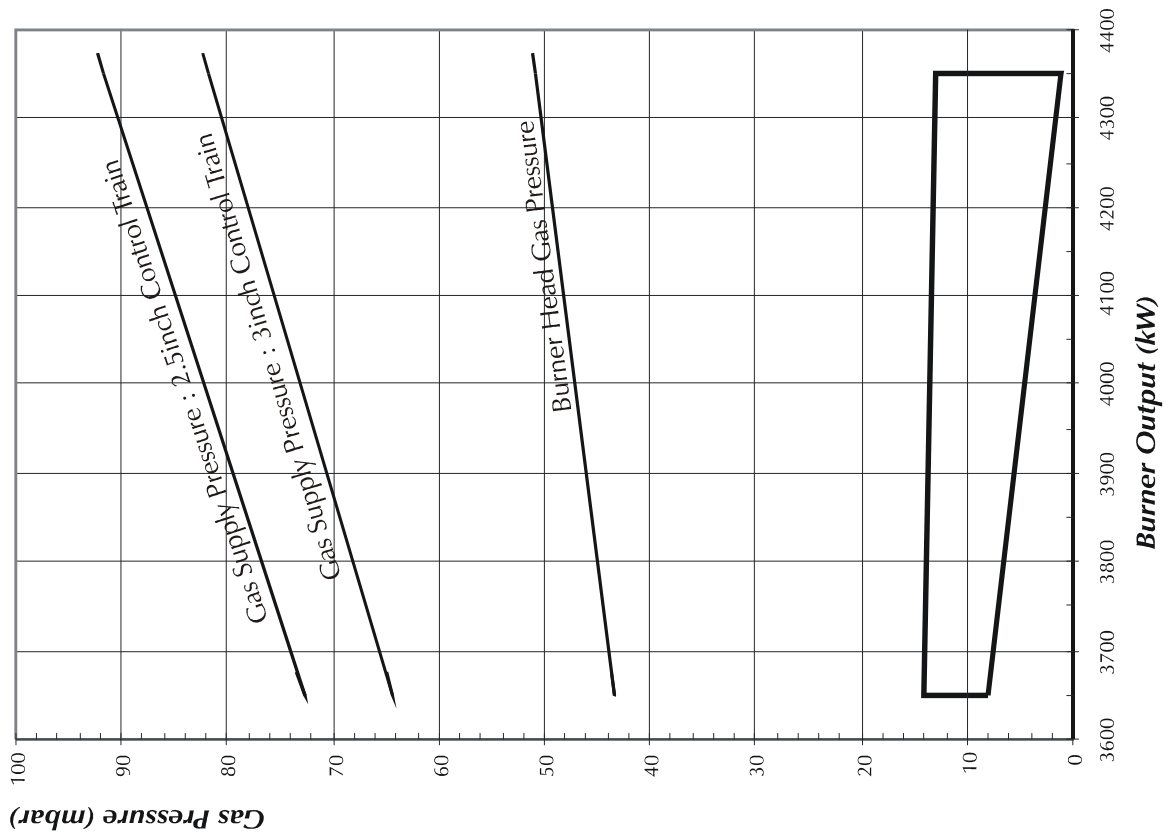
**NGN150-36**



**NGN150-44**



**NGN150-41**





# COMMISSIONING SHEET

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The details below are to be completed by the Commissioning Engineer

Installer's Name : \_\_\_\_\_

Address : \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Site Address : \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Appliance :    Type : \_\_\_\_\_ Size : \_\_\_\_\_ Serial No. : \_\_\_\_\_

Burner :        Type : \_\_\_\_\_ Size : \_\_\_\_\_ Serial No. : \_\_\_\_\_

Commissioning date : \_\_\_\_\_

Guarantee Expiry date : \_\_\_\_\_

Gas type : \_\_\_\_\_

Gas Pressure upstream of main gas governor :

a) Standing : \_\_\_\_\_ mbar      b) Running : \_\_\_\_\_ mbar

Gas pressure at burner head	_____ mbar	_____ in.w.g.
Gas rate	_____ m <sup>3</sup>	_____ ft <sup>3</sup> /ht
Heat input	_____ MJ/hr	_____ Btu/h
CO	_____ %	_____ %
CO <sub>2</sub>	_____ %	_____ %
Gross flue gas temperature	_____ °C	_____ °F
Ambient temperature	_____ °C	_____ °F
Nett flue gas temperature	_____ °C	_____ °F
Efficiency	_____ %	_____ %

# BURNER MODIFICATION RECORD

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DATE	DETAILS OF MODIFICATION



Enertech Limited,  
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