

Installation & Maintenance Manual

PG Series Micro Modulating

Gas Burner

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IMPORTANT INFORMATION

SAFETY

It is essential that the following instructions and adjustments are carried out by qualified engineers that are experienced in forced draught gas burner commissioning. In the UK, it is a legal requirement that these engineers working on a gas installation, as defined in the 'Gas Safety (Installation & Use) Regulations 1994' must also be GAS SAFE registered. Nu-way 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.

EMERGENCY INSTRUCTIONS

P Series Burners are designed and constructed to meet all applicable European Directives.

When used in accordance with the instructions provided, P Series 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 **FUEL AND ELECTRICITY SUPPLIES SHALL BE ISOLATED IMMEDIATELY** and they shall remain isolated until the fault has been identified and rectified.

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

All burner and boiler bodies marketed separately within the European Union must comply with EN676 – Gas Burners, and EN303 – Heating Boilers. Burner adjustments must be made in accordance with the boiler manufacturers' instructions, and these must include flue gas temperatures, average water temperature and CO₂ or O₂ concentration.

GENERAL INFORMATION

INTRODUCTION

This handbook has been produced to enable users to install, commission and use P Series burners safely and efficiently. At each stage the conditions that 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 mechanism are identified. where appropriate, this information is supported by tables and graphs.

Literature on the proprietary components used in P Series burners systems is available on request.

FEATURES

The P Series of fully automatic burner equipment is offered for industrial and air heater applications. This is a versatile range of fully modulating burners with a turndown of up to 7:1 for gas firing and up to 4:1 for oil firing.

P Series burners meet current test authority requirements both in the UK and overseas.

P Series burners are designed for flange mounting to the appliance. All components are pre-wired, input and output circuits being grouped for ease of connection to the power supply and to electrical equipment on the burner head, air damper.

Burner Designation

Each burner is described by a comprehensive code that defines all the important parameters of each individual burner and is an important point of reference for burners in service. In addition to the burner casing size and maximum power output, the code is composed as shown in the Table on Page 7.

Fuel

The PG burner is available for natural gas but, on request, will be supplied for liquefied petroleum gases (LPGs), towns gases or biogas.

Controls

The control panel, housed in a free-standing or wall-mounted cabinet, is a purpose designed and robustly constructed unit that complies with relevant Standards and Codes of Practice and can be tailored to individual customer requirements.

Depending on the burner specification, the control panel incorporates such components as a burner management sequence controller, modulating control gear, a starter for the combustion air fan, starters for boiler feed water pump, and safety devices e.g. low and high water cut-out relays.

Air for combustion can be adjusted to give maximum 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 pressure gas switches. An ultraviolet (UV) cell and automatic burner programming control unit provide continuous flame supervision.

Operating Mode

P Series burners are all fully modulating, offering a standard turndown of up to 7:1 for gas firing and up to 4:1 for oil firing.

To ensure efficient operation of any boiler, two requirements are of paramount importance. The air to fuel ratio must be kept to a minimum whilst being sufficient for complete combustion and the settings for this condition, once arrived at, are accurately repeated. The temperature or pressure of the boiler must be monitored by the control system and the set value, variations from this setpoint must be minimised even when the load changes.

Modulation by Electro-Mechanical Systems

P Series burners can be supplied with a mechanical modulating cam device. This unit is designed specifically for the control of boiler temperature or steam pressure in gas fired heating plant.

The system comprises a reversible motor that is coupled directly to the cam shaft of the modulating unit. Two adjustable cams are mounted on this shaft, one of which operates the air linkage and the other, the modulating oil cam.

The air/fuel ratio is controlled by an SKP75 controller that matches the fuel gas flow to the air flow. The SKP75 is linked to the combustion air system, by a pressure impulse pipe.

Modulation by Electronic Cam System

There is some inherent hysteresis in all mechanical systems that traditionally involve cams and linkages to characterise the air/fuel ratio.

To improve accuracy of the air/fuel ratio, P Series burners are now normally supplied with a system that overcomes all of these problems by utilising independently operated servo motor driven valves for the fuel and air and the latest microprocessor technology.

This Micro Modulation system (MM) provides a programmable and flexible means of optimising combustion quality throughout the load range of the boiler/burner unit whilst ensuring the temperature is accurate to within 1°C and pressure to within 1.5 psi by utilising PID control.

A control module contains a micro computer and power supply. The display panel features touch-sensitive key pad entry, readouts and status indicators, all protected beneath a tamper-proof transparent plastic cover.

During commissioning, the paired values for fuel and air are entered into the memory of the module. Up to 15 positions in the load index of the burner's fuel delivery range are entered from maximum down to the minimum start position. This guarantees operation at the air/fuel ratios set during commissioning.

By removing the inherent hysteresis of traditional mechanical systems, combustion quality and fuel efficiency are greatly improved.

The MM system may be expanded by adding a sampling unit and exhaust gas sampling probe, to measure and display CO₂, O₂, CO and exhaust temperature, together with boiler efficiency. This is the MM Exhaust Gas Analysis Trim System (MM EGA).

This makes very small corrections to the air damper position to ensure that the originally entered commissioning data is adhered to, irrespective of variations in stack pressure or barometric conditions.

SITE CONDITIONS AND SERVICES

Flue and Chimney Requirements

It is import 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 and oil 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.
- it is recommended that each appliance should be exhausted into a separate flue.

Plant Room Ventilation

An adequate dust-free supply of fresh air is required for the burner at both high and low levels in accordance with the appropriate standards.

Existing Appliances

The appliance should be prepared for installation of a P Series 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 should be referred to the manufacturer.

Gas Supply

The pipework, supplying the gas 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 that is anticipated. It is essential that 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 to gas flow.

Natural gas is the usual fuel and has to be supplied at an appropriate pressure.

If the gaseous fuel is town gas, liquefied petroleum gas or biogas, then appropriate information, supplemental to this handbook, will be supplied with the burner.

Gas Boosters

When a gas booster is used, the gas pressure at the booster inlet must not fall below 1 kPa (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.

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, that reduce both pipework stresses and transmitted noise, is essential. 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

A three phase 50Hz electrical supply is required. The power supply provided must comply with all relevant Codes and Standards.

BURNER PACKAGING, ASSEMBLY AND INSTALLATION

Packaging for Transit

All P Series modulating burners are supplied in partly assembled form consisting of the following:

- burner head , air plenum chamber, damper section with modulating air system
- gas train complete with proving system
- combustion air fan
- separate floor or wall-mounted burner control panel

Assembly and Installation

P Series burners are supplied in partly assembled form comprising some or all of the units indicated above, depending upon the type(s) of fuel to be fired.

Make sure that the appliance is suitable for the heat input of the burner. If there is any doubt in this area, reference should be made to the appliance manufacturer.

Fitting to the Appliance

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

If the burner is to be fitted to an existing appliance, the burner frontplate and appliance must be prepared; the details of the drilling arrangements are shown on page 8.

The chimney, flues and passageways and heat transfer surfaces on the existing appliances must be cleaned. An inspection should be carried out to ensure that the appliance is in good condition. Any doubt about the suitability of the appliance should be referred to the manufacturer.

To assemble the burner:

1. Fit the burner head to the prepared appliance frontplate.
2. Ensure that the joint between the burner and the mounting flange is sealed effectively using the gasket provided. The flame tube should not generally extend beyond the inner face of the furnace brickwork or the frontplate protection, except where extensions have been expressly specified by the appliance manufacturer.
3. Position the combustion air fan and connect to the damper using the fasteners and gasket provided. Depending on the appliance layout it may be necessary for the customer to provide a connecting duct section between the damper and the fan scroll (not supplied by Nu-way).
4. For PG burners fit the gas valve train to the burner head using the gasket provided, ensuring that the gasket is fitted correctly with all holes corresponding to those on the burner flange. Note: In some circumstances it may be advisable to fit the burner casing to the appliance before attaching the gas control train. It is recommended that lifting gear should be employed if necessary.
5. Locate the control panel in the desired position and make the necessary connections to the burner head and other auxiliary appliance controls.

Reference must be made to the wiring diagrams that are supplied with the burner (electrical connection diagrams do not form part of this handbook); all electrical wiring must comply with all applicable Codes and Standards.

All screen cables as specified in Autoflame manual.

Air Supply

A floor-mounted fan provides the air supply for the system, although the fan can be suspended for the smaller sizes of burner. The flange on the rectangular outlet is drilled for bolting onto the air damper section of the burner unit. For safety, a wire mesh guards the circular inlet of the fan. The motor unit is enclosed, air-cooled and mounted on a rigid base. The fan orientation/burner mounting positions would have been specified by the customer when the order was placed.

Combustion Chamber Conditions

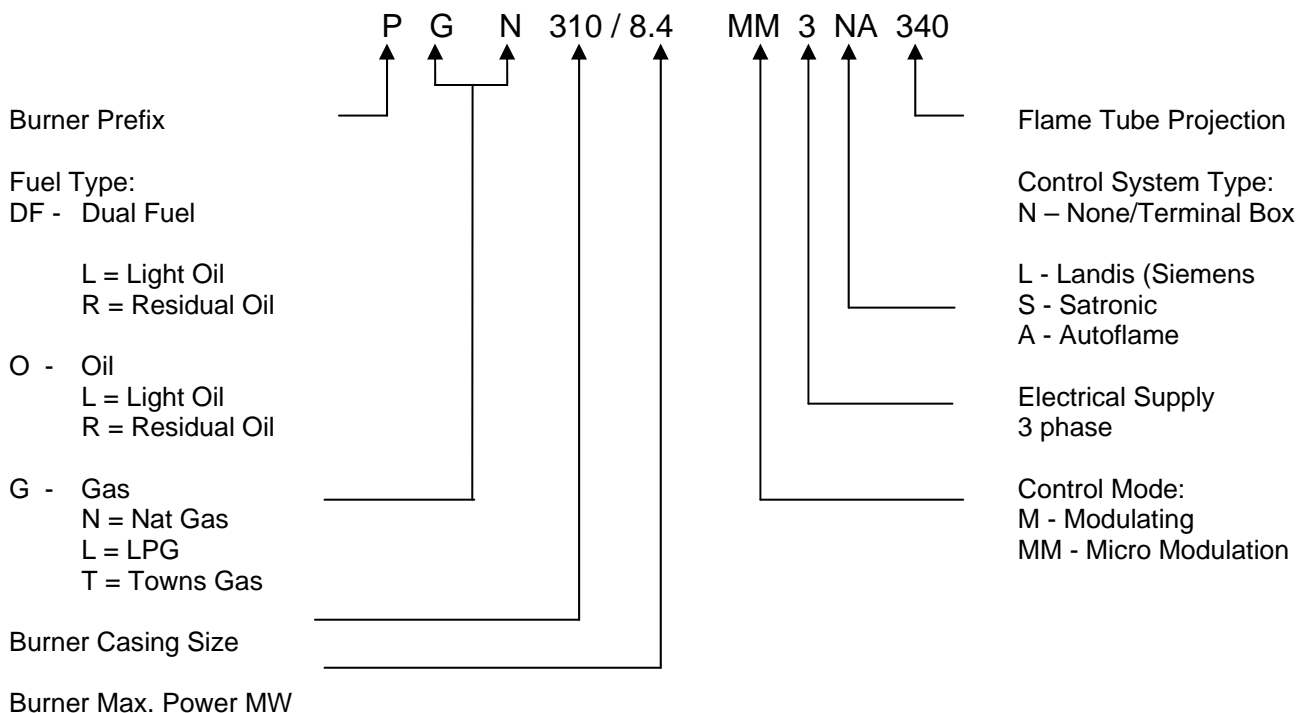
When the burner is fitted to an appliance designed to work under balanced or negative combustion chamber conditions, the over-fire draught must not exceed 0.05 kPA (0.2 inches water column, 0.5 mbar or 5mm w.c.) Should the over-fire draught exceed this value, then steps should be taken to reduce it to or below this level.

Electrical Power Supply

Connect the power supply to the burner observing all applicable Codes and Standards. Reference should be made to the wiring diagrams provided in the instruction pack that is supplied with all P Series burners and to those wiring diagrams in the appliance manufacturer's instructions.

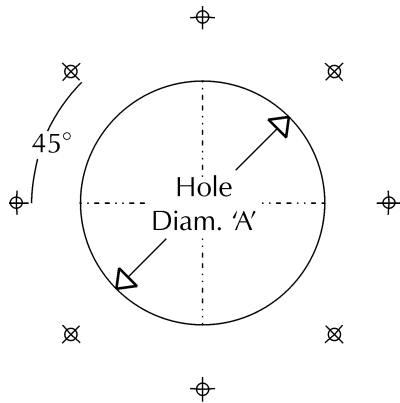
All external auxiliary control circuits should be connected with reference to the appropriate wiring diagram. All systems and circuits should be checked to ensure that correctly rated fuses are used.

BURNER DESIGNATION CODE



	Comment	Option
BURNER PREFIX	All burners in this series are prefixed 'P'	P
FUEL TYPE	The fuel on which the burner is designed to operate is identified as:	'O' : Oil 'G' : Gas 'DF' : Dual Fuel
FUEL SUB TYPE	The standard fuel sub types which can be specified are:	'L' : Light oil 'R' : Residual oil 'N' : Natural gas 'L' : LPG 'T' : Towns Gas
CASING SIZE	Obtained from the Burner Data Plate	
MAXIMUM POWER	Obtained from the Burner Data Plate in MW (GCV)	
NOMINAL FAN PRESSURE	There are two standard options which may be specified for burner fan pressure, according to the appliance resistance (mbar). Please consult Nu-way's Technical Department for resistances greater than 15 mbar.	Resistance up to 7.5 mbar : '26'
		Resistance up to 15 mbar : '40'
CONTROL MODE	All Nu-way 'P' series burners are fitted with modulating controls, as shown by the code 'M' or 'MM'.	M - Modulating MM - Micro Modulating
ELECTRICAL SUPPLY	In standard form, 'P' series burners require 415V, 3ph (4 wire), 50Hz electrical supplies, which are designated by code '3'. Other requirements should be discussed with Nu-way's Technical Department.	3 = 3 phase
BURNER MANAGEMENT SEQUENCE CONTROL SYSTEM TYPE	In order to ensure that individual customer needs are matched precisely by the 'P' series burner specification, Nu-way use not only several different types of burner management sequence controller but also systems based on programmable logic controllers.	'N' : None 'L' : Landis (Siemens) 'S' : Satronic 'A' : Autoflame
FLAME TUBE PROJECTION	The flame tube projection on Nu-way 'P' series burners is matched to the individual application,	240mm 340mm 430mm 610mm

BURNER MOUNTING DETAIL



8 Holes tapped M12
equispaced on 'B' mm PCD

Burner Model	'A' (mm)	'B' (mm)
PG160	360	610
PG250	385	672
PG310	435	672
PG400	435	672
PG490	465	672
PG575	535	772
PG660	535	772

TECHNICAL SPECIFICATION

BURNER and COMPONENT IDENTIFICATION

The general arrangement of a PG burner employing Microprocessor modulating control is shown in the diagram Burner and Component Identification on page 12.

These diagrams are for illustrative purposes only and actual components supplied may vary from those shown.

BURNER CONTROL and OPERATION

All personnel concerned with commissioning and/or operation of PG Series burners should familiarise themselves particularly with the information presented in this section.

Air Controls

Air Damper

To control the air for combustion PG burners have an adjustable multi-blade damper located in a rectangular section attached directly to the burner casing (diagrams on pages 12 & 13). This damper is driven directly by a servo motor and must be set during commissioning.

Air Diffuser

An air diffuser (shown in the diagram Burner Head on page 15) is fitted to the front end of the inner assembly and is located within the flame tube. It directs the combustion air flow and creates a pressure drop across the burner head, promoting good air/fuel mixing and flame stability.

Air Pressure Switch

The air pressure switch is located on the rear of the burner casing, its function is to ensure that the combustion air flow is adequate under all operating conditions.

An air flow failure at any stage beyond the first few seconds of the pre-purge period will result in a safe burner shutdown.

Gas Controls

PG burners with the Microprocessor modulating system, are supplied with a gas train (see Gas Control Train Schematic on page 14). The train is normally a separate unit that needs to be connected to the burner body.

The supplied gas train comprises:

- a low gas pressure switch
- a safety shut-off valve
- a valve proving system
- a combined safety shut-off valve and pressure governor
- a flow control valve actuated by the modulating control system

Upstream Manual Gas Valve

The manual valve in the fuel gas supply immediately upstream of the burner gas train, this valve is not supplied by Nu-way. It **MUST** be supplied and installed by the customer and is shown on the diagram on page 14 as 'Manual Gas Isolation Valve (Not Supplied by Nu-way)'.

Low Gas Pressure Switch

The provision of a low gas pressure switch is required by European Standard EN676 'Automatic Forced Draught Burners for Gaseous Fuels' and is fitted to all burners where necessary. The low gas pressure switch monitors inlet gas pressure and ensures that any decrease in pressure below the value needed to maintain satisfactory combustion results in a safe burner shutdown. The switch must be set during commissioning.

Safety Shut-off Valve

This valve automatically opens and shuts off the fuel gas flow to the burner, and is controlled by the burner programmer (sequencer controller).

Valve Proving System – (Siemens LDU11)

When the burner operating sequence is initiated, the burner control box energises the valve proving system, and in the event of a gas leak, prevents burner start-up.

The Siemens LDU11 control unit is designed to provide automatic gas valve proving (leakage test) based on the pressure proving principle (see diagram on page 14). The system comprises the control unit, which is fixed to a bracket/terminal box assembly close to the main valve block, and a dual pressure switch, which is connected to the test space between the main valves. The unit comes pre-wired as part of the gas train harness.

When the appliance 'calls for heat', a signal, via the burner sequence control box, energises the valve proving system; this carries out a series of tests before the burner can start. The two actuated valves (V1 and V2) in the main fuel line are closed when this signal is received. The sequence of operation is as follows:

- The first step of the proving sequence is to open the downstream gas valve (V2), this vents any gas that is in the system via the gas flow control valve. After five seconds valve (V2) closes.
- Both valves remain closed for 22.5 seconds whilst the LDU11 unit checks that there is no build-up in pressure in the line between the valves. If there is no rise in pressure this proves that the first valve (V1) is gas tight and that no gas is passing; the valve proving system will now continue its sequence. If the valve on the pressure side is leaking, pressure will build up and the low gas switch will signal the LDU11 unit to go to lockout (the program indicator then stops and indicates 'Test 1').
- This first main safety valve (V1) opens for five seconds, which pressurises the line between the valves, and then closes. Both valves remain closed for 27.5 seconds whilst the LDU11 unit and high gas pressure switch check for a fall in pressure between the valves.
If there is a fall in pressure, the proving system will lock out and the downstream main gas valve (V2) should be checked as it may be leaking. (The program indicator then stops and indicates 'Test 2').
- If there is no fall in pressure then the system is gas tight. The pressure proving system will now allow the burner to continue its normal operation.

The LDU11 unit carries out the low and high pressure checks between the two gas valves prior to commencement of each firing cycle.

If the pressure increases excessively during the first test phase or decreases excessively during the second test phase, the control unit inhibits burner start-up and goes to lockout. The lockout reset button lights up and signals a fault. A program indicator, which stops whenever a fault is signalled, indicates which valve is leaking.

The control unit has to be reset manually, either on the unit itself or by a remote re-setting if this has been fitted (do not press the reset button for more than 10 seconds).

Valve Proving System (Autoflame) – Built into Autoflame burner programmer/sequence controller.

Combined Safety Shut-off Valve and Governor

A combined safety shut-off valve and governor is the first valve in the gas train that is supplied by Nu-way. This valve is used to shut off the gas flow and to control the gas pressure. It must be set during commissioning (see Commissioning Section).

Manual Gas Valve

This is a manual shut-off valve to isolate the main fuel flow.

Flow Control Valve

The valve is controlled by the modulation control system (the valve positions over the burner input range must be set during Commissioning), checking the position of the control valve is carried out continuously to ensure that the desired gas flow is maintained.

Gas Nozzle

The gas nozzles that are fitted to the front of the burner assembly, within the flame tube, are shown on the diagram Burner Head on page 15. The ports in these nozzles are sized in accordance with the thermal rating and the fuels to be fired.

Control Panel

The control panel is a separate unit, free-standing or wall-mounted, that is positioned adjacent to the burner unit. The panel design depends upon whether the boiler is for water heating or steam raising. The sequence controller, relays, indicating lamps, panel isolating switch, etc, are contained within this unit.

The burner is also fitted with an ignitor/terminal box on the side of the burner casing. This is a junction for all electrical components that are held in the free-standing control panel.

Connections must be made between the control panel and the terminal box and complies with applicable Codes & Standards, all screen cable as per specified in Autoflame manual.

Burner Sequence Controller (Programmer)

The burner sequence controller, together with the flame monitoring system, provide a safe light-up sequence for the burner.

Flame Detector

All PG Series burners are fitted with continuous flame supervision systems employing an ultraviolet (UV) cell to detect the presence of a flame.

Modulating Control and Operation

The burner employs a microprocessor modulating controller. Detailed information of this system is provided with this manual.

BURNER OPERATING SEQUENCE

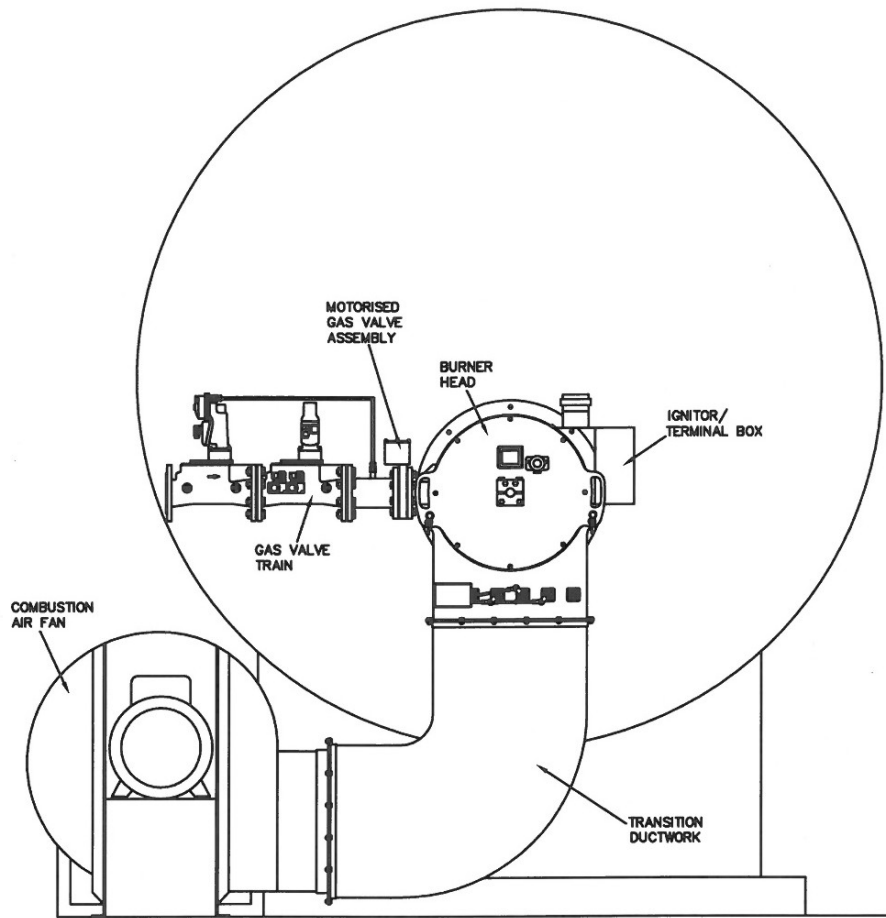
The typical operating sequence is as follows:

1. Check external interlocks are satisfied
2. Check for 'no flame'
3. Pre-purge
4. Ignition On
5. Pilot fuel On/Flame Detection
6. Ignition Off
7. Main fuel On (low fire)
8. Release to modulation
9. The burner will stop (lockout) if no flame is detected from Step 5 to 8.

COMBUSTION HEAD DETAILS

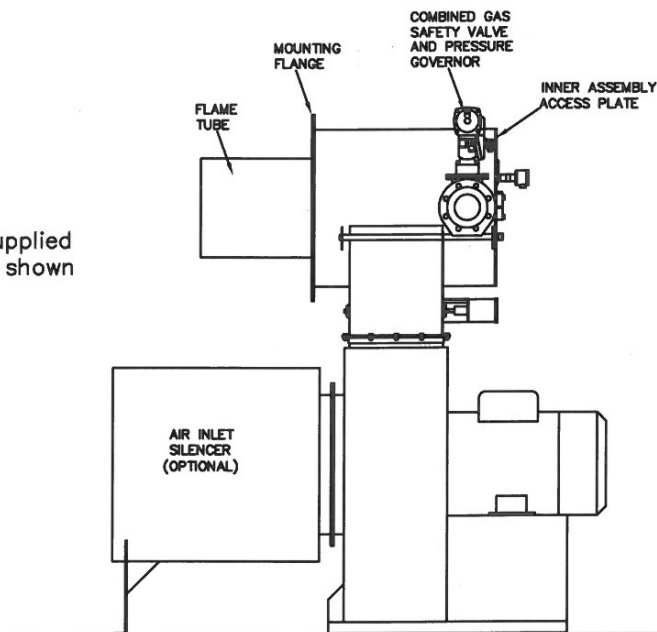
The combustion head and inner assembly are shown in the diagram Burner Head on page 15.

BURNER and COMPONENT IDENTIFICATION



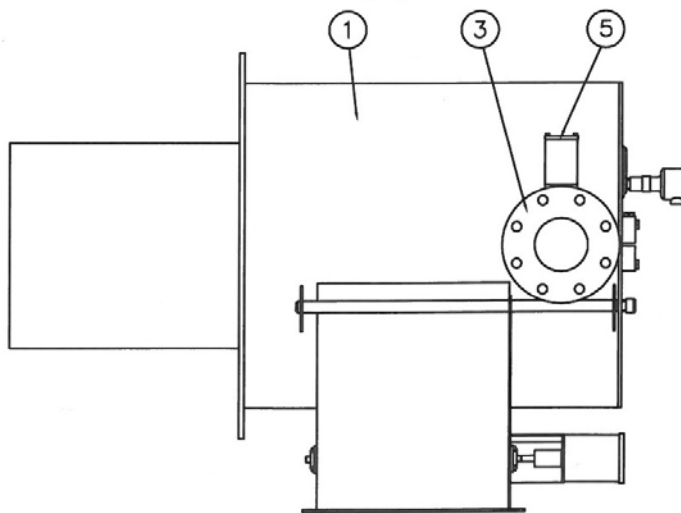
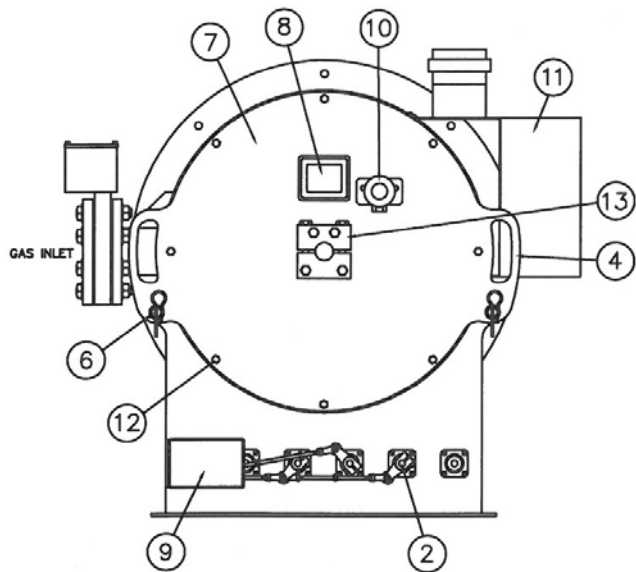
This diagram is for illustrative purposes only

Actual components supplied may vary from those shown

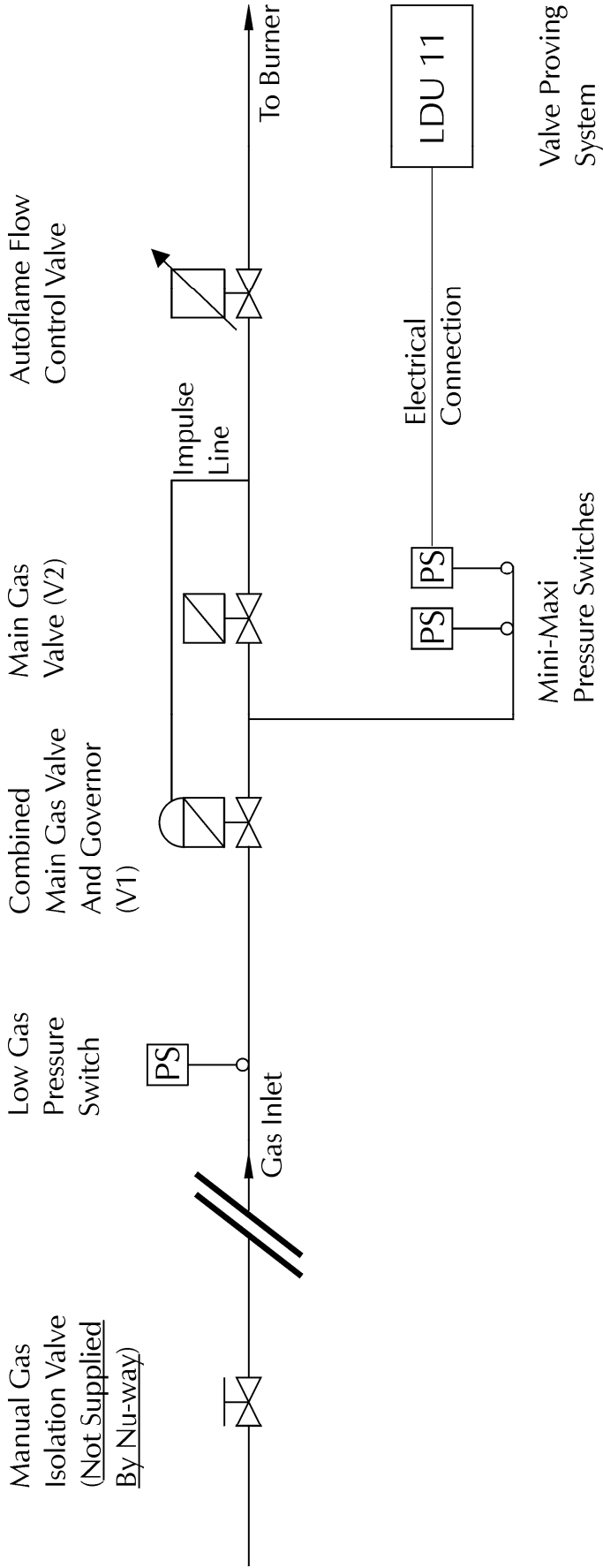


BURNER and COMPONENT IDENTIFICATION

Item	Component
1	Burner Head Casing
2	Air Control Vane
3	Gas Control Valve
4	Backplate Withdrawal Handles
5	Fuel Control Servomotor
6	Guide Bar
7	Inner Assembly Backplate
8	Sight Glass
9	Air Damper Servomotor
10	U.V. Cell
11	Ignitor And Terminal Box Assembly
12	Backplate Retaining Nuts (8 off)
13	Inner Assembly Clamp Block

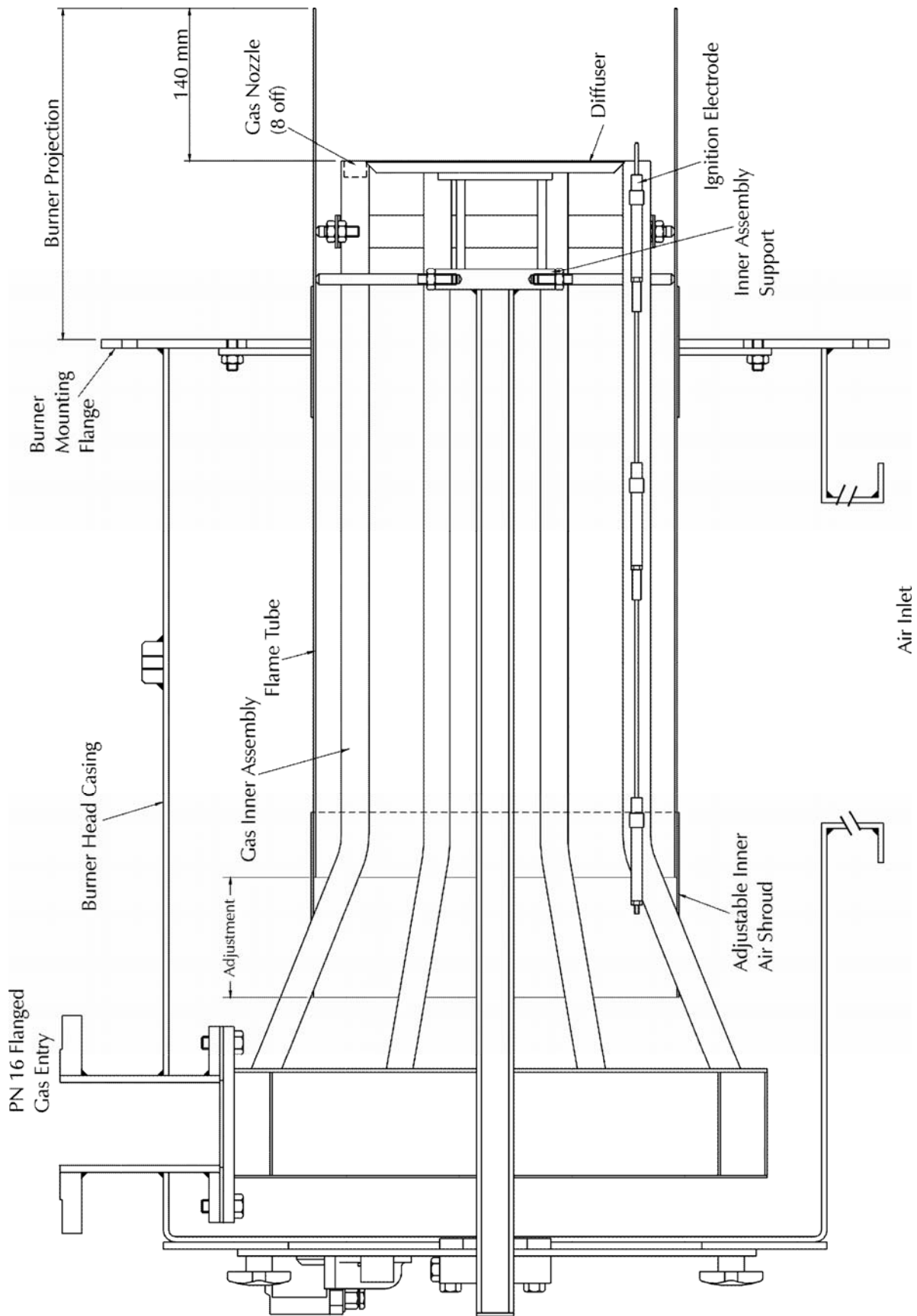


GAS CONTROL TRAIN SCHEMATIC

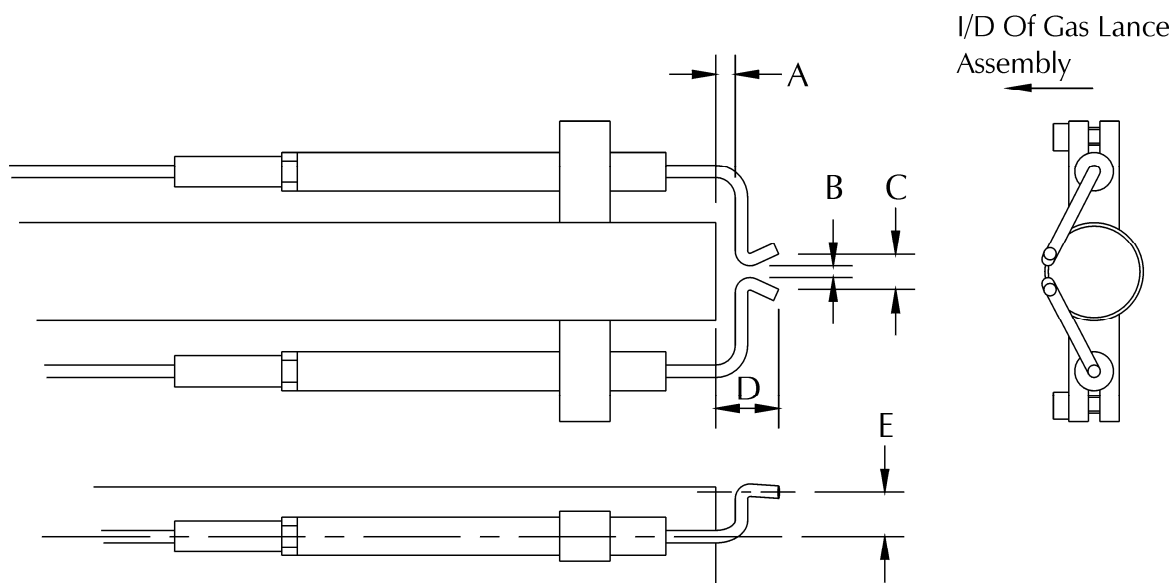


Factory Settings For Min/Max Switches	
Switch	Value
Maximum	50% of the inlet pressure
Minimum	2.5 mbar

BURNER HEAD AND INNER ASSEMBLY



ELECTRODE SETTING DETAIL



Electrode Settings	
A	5 mm
B	3.0 - 3.5 mm
C	6.0 - 6.5 mm
D	16 mm
E	Mean Radius Of Gas Tube wall

COMMISSIONING

Please use these instructions in conjunction with the Autoflame Technical Manual provided with this manual.

INDIVIDUAL SETTING RECORD

This manual contains a commissioning sheet (page 19-20) of essential information that should be completed by the commissioning engineer with individual details of the burner. These details should be verified periodically and changed as adjustments occur.

SAFETY

It is essential that commissioning be undertaken only by suitably qualified and experienced personnel. In the case of PG Series burners, commissioning engineers should be experienced in commissioning forced draught, fully modulating dual fuel burners.

In the UK it is a legal requirement that anyone working on gas installations, as defined in the "Gas Safety (Installation & Use) Regulations 1994", is GAS SAFE registered.

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.

It is the commissioning engineer's responsibility to ensure that all settings are in accordance with the appropriate local standards and applicable codes of practice.

EMERGENCY INSTRUCTIONS

PG Series burners are designed and constructed to meet all applicable European Directives.

When used in accordance with the instructions provided, PG Series 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 **FUEL AND ELECTRICITY SUPPLIES SHALL BE ISOLATED IMMEDIATELY** and they shall remain isolated until the fault has been identified and rectified.

INSPECTION

Before commissioning is started 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 and oil pipework is correctly sized and that it has been checked for leakage.
- Ensure that the manual gas isolation valve (page 14) is fitted at the inlet to the gas train and is fully operable, closed and leak tight.
- Check that the multi-pin plug (for the fast acting solenoid and governor) is connected to the control panel.
- Check that the appropriate modulating detector which is supplied loose with each burner, is fitted correctly to the appliance.
- Make all personnel involved in the commissioning aware of the location of the emergency gas, oil and electricity isolation points.
- Check that fittings such as purge and test points are available.
- Check that the appliance's ventilation and flueing arrangements are adequate.
- Ensure that any warning notices are 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 means (which may be permanently installed or provided specifically for commissioning) of measuring the flow rates of gas and of analysing the flue products..
- 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, emergency shutdown 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.
 - 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.

Please refer to the commissioning section in the Autoflame Technical Manual for detailed instructions.

- Check that the Autoflame options and parameters have been set for the site installation:
 - load detector
 - fuel/air profile
 - VSD (if applicable)
 - gas valve proving (if applicable)
 - golden start (i.e. no pilot)

FINAL COMMISSIONING STAGES

Setting the Air Pressure Switch

1. Check that the electrical supply to the control panel is off and that the burner is off.
2. Remove the air pressure switch cover.
3. Fit a manometer or other approved pressure measuring instrument to the pressure switch so that the actual measured air pressure can be compared to the pressure switch dial setting.
4. Check that the Hand/Auto switch is set to hand operation.
5. Switch on electrical supply to the control panel. Switch on the burner, allow the burner to proceed through its sequence until it is operating at low flame.
6. Slowly turn the adjusting dial on the air pressure switch clockwise until the flame is extinguished.
7. The burner will go to lockout.
8. Turn the dial one division anti-clockwise and reset burner lockout. The burner will then continue through its cycle until either the start rate flame is established or burner goes to its lockout position.
If the burner goes to lockout, repeat the procedure (turning the dial one division) once per burner cycle until start flame is established.
9. Allow the burner to cycle to low flame and then turn the adjusting dial a further two divisions anti-clockwise.
10. Switch off the electrical supply to the control panel and to the burner.
11. Replace the air pressure switch cover.
12. Remove the pressure measuring equipment

Final Checks

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 safety controls and any other interlocks are set to safe limits.
4. **COMMISSIONING OF THE BURNER IS NOW COMPLETE.**

On Completing Commissioning

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

1. Details of any modifications made to the system, together with revised drawings if necessary.
2. Customer and plant details, including any serial numbers.
3. 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 PRECISE EMERGENCY SHUTDOWN PROCEDURES ARE DISPLAYED.**

COMMISSIONING SHEET : GAS (1)



The details below are to be completed by the Commissioning Engineer. The completed sheet must then be photocopied and a copy forwarded to the appliance manufacturer.

Gas Commissioning Sheet - Page 1 : Plant Details

Installers Name:		Commissioning Date:	
Address:			
Site Address:			
Appliance:		Type:	Serial No:
Burner:		Size:	Serial No:
Fuel Gas Type:		Spec No:	
Inlet pressure before booster:		mbar/ins wg	Inlet pressure to burner
Boiler Room Ventilation (BS6644)		Satisfactory	Unsatisfactory
Flue Check (Visual) (BS5440)		Satisfactory	Unsatisfactory
COMMENTS:			

COMMISSIONING SHEET : GAS (2)



The details below are to be completed by the Commissioning Engineer. The completed sheet must then be photocopied and a copy forwarded to the appliance manufacturer.

Gas Commissioning Sheet - Page 2 : Performance Details

Firing Rate	High Fire	Intermediate Positions (A maximum of 15 intermediate positions can be entered, in practice 10 are normally sufficient)															Low Fire	Units ¹	
Pressure at Burner	Gas																		mbar or ins wg
	Fan Static																		mbar or ins wg
Combustion Chamber Pressure																			mbar or ins wg
Gas Rate																			m ³ /h or ft ³ /h
Autoflame MM Settings	CH1																		
	CH2																		
	CH5																		
O ₂																			% Dry Basis
CO ₂																			% Dry basis
NO _x																			ppm Dry Basis
CO																			ppm Dry Basis
Flue Temp.																			°C
Ambient Temp.																			°C
Boiler Tem or Pressure																			°C or bar
Efficiency (nett/gross)																			%

¹Note: Where a choice of measurement units is shown, delete those not applicable.

OPERATION AND MAINTENANCE

NORMAL OPERATION

1. Establish the electrical power supply to the control panel.
2. Set the Hand/Auto switch to Auto.
3. Switch on the burner. The burner will go through the ignition sequence and be released to modulation under the control of the Autoflame Micro Modulating Controller.

The burner will now operate normally until:

- It is switched off by the appliance controls
- It is switched off manually
- 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.
- A failure in any of the safety functions monitored by the sequence controller.

ROUTINE SAFETY CHECKS

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

Combustion Air

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

1. Switch off the burner and the electrical supply to the control panel.
2. Remove the UV cell from the burner casing and cover the quartz glass envelope to exclude any UV source. Care should be taken not to touch the glass.
3. Establish the electrical supply to the control panel and switch on the burner. The burner should go to lockout at the end of the ignition cycle.
4. Switch off the burner and the electrical power 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

1. Switch off the burner and the electrical supply to the control panel.
2. Introduce a gas leak by slackening the screw in the pressure test point between the main safety shut-off valves.
3. Switch on the electrical supply to the control panel and switch on the burner. The valve proving system should lock out through failing gas pressure as the burner runs through its start cycle.
4. Re-tighten the screw in the pressure test point and reset the lockout button on the valve proving system.

Low Gas Pressure Switch

1. Switch off the burner and the electrical power supply to the control panel.
2. Remove the cover from the low gas pressure switch.
3. Take a careful note of the pressure switch setting.
4. Switch the Hand/Auto switch to Hand.
5. Establish the electrical supply to the control panel and switch on the burner. Allow the burner to proceed through its operating sequence and inch to high fire.
6. Turn the adjusting dial on the pressure switch clockwise slowly until the switch trips, causing the burner to shut down.
7. Return the adjusting dial on the pressure switch to the original setting noted above. The burner will re-start.
8. Switch off the burner and the electrical power supply to the control panel. Replace the pressure switch cover.

Combustion Air Pressure Switch

1. Check that the electrical supply to the control panel and the burner are off.
2. Remove the air pressure switch cover.
3. Take a careful note of the pressure switch setting.
4. Fit a manometer or other approved pressure measuring instrument to the pressure switch so that the actual measured air pressure can be compared to the pressure switch dial setting.
5. Check that the Hand/Auto switch is in Hand operation.
6. Switch on the electrical supply to the control panel. Switch on the burner, allow the burner to proceed through its sequence until it is operating at low flame.
7. Slowly turn the adjusting dial on the air pressure switch clockwise until the flame is extinguished.
8. The burner will go to lockout.
9. Return the adjusting dial on the pressure switch to the original setting noted above and reset the lockout. the burner will re-start.
10. Switch off electrical supply to the control panel and to the burner.
11. Replace the air pressure switch cover.
12. Remove the pressure measuring equipment.

ROUTINE MAINTENANCE

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

Combustion Air Fan

Access the fan blades as follows:

1. Remove the ring of nuts on the air inlet side of the fan unit.
2. Remove the plate containing the air inlet.
3. Clean the fan blades with a stiff brush, taking care not to damage them. Inspect the burner air inlet and ensure that there is no obstruction to the air flow.
4. Replace the plate and retaining nuts.

Burner Inner Assembly

Air Diffuser

Remove the burner air diffuser plate for inspection and cleaning as follows:-

1. Remove the UV cell from its holder and secure to a safe place.
2. Loosen and remove the 8 nuts and washers securing the backplate to the burner casing.
3. Pull the backplate assembly rearwards, guiding the inner tube until the diffuser is clear of the burner head casing taking care not to damage HT cable, disconnect if necessary.
4. Clean the diffuser of any deposits using a stiff brush.

Gas Inner Assembly

Remove the gas inner assembly for inspection and cleaning as follows:-

1. Remove the backplate and diffuser assembly as described previously.
2. Disconnect the 2 High Tension leads for the gas ignition electrodes, and secure to a safe place.
3. Remove the 4 bolts securing the gas inner assembly manifold ring to the inner gas stub pipe.
4. Carefully break the joint, removing the gasket to a safe place.
5. Slightly lift and pull the complete gas inner assembly backwards until clear of the burner casing.

Gas Ignition Electrodes

Clean and check the electrodes are not cracked or worn. Renew if necessary.

Check the settings of the ignition electrodes and reset if necessary, details are shown on page 16.

Gas Nozzles

Carefully clean any deposits from the gas spikes and nozzle inserts.

Check nozzle inserts for tightness.

Re-assemble the inner assemblies in reverse order.

Replace all covers and secure all fittings. The burner is now ready for operation. Switch on the electrical and fuel supplies to the burner.

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.

Error Checking, Fault Analysis & Identification Codes

The "Error Checking" software, which is included in every MM/EGA module, continually interrogates the system for component or data handling failure. This intensive self-checking program is inflicted on all peripherals such as positioning motors and load detectors as well as the main MM system hardware.

Any error identified by the system is indicated by "ERROR" being displayed with the relevant error number.

A full list of error codes is described in the MM Technical Manual that accompanies this handbook.

Incorrect Rotation of the Fan Motor

The fan motor rotates in the direction of the arrow printed on the Nu-way nameplate mounted on the fan casing. If the direction rotation is incorrect, interchange any two phases.

Fan Motor Fails to Start

Check:

- the electricity supply is available
- the burner is correctly wired
- the fuses are correctly sized and not blown
- the motor overload is not tripped
- the sequence controller is not locked out
- the gas control train is correctly fitted
- the gas supply is available
- the gas supply pressure is high enough to satisfy the low gas pressure switch
- there are no gas leaks in the main control train causing a failure of the valve proving check
- the appliance controls are calling for heat
- the combustion air pressure switch is not in the start position (see procedure below)
- if a gas booster is fitted, that the low inlet gas pressure switch is not locked out, that the booster drive belt is fitted and that the booster motor is rotating correctly.

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

1. Switch off the burner and the electrical power supply to the control panel.
2. Remove the plug-in sequence controller from the base.
3. Using a suitable instrument, check relevant terminals for continuity. Continuity indicates that the switch is in the correct position for starting.
4. 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 terminals. If there is no continuity the pressure switch is faulty and should be renewed.

Fan Motor Starts and Burner goes to Lockout

If there is no ignition spark check:

- the combustion air pressure switch is correctly set
- the ignition electrodes are in good condition and correctly set
- the HT lead is not disconnected or damaged
- the ignition transformer is not faulty
- the burner sequence controller is not faulty

If there is an ignition spark but no start flame when gas firing check that:

- the fuel pressure is available and at the correct pressure
- the air flow settings are correct
- the solenoid valves open at the appropriate time in the sequence. If they fail to open check the wiring and the valves.
- the glass envelope on the UV cell is clean and correctly orientated (it must face towards the flame).
- the UV cell and wiring are not faulty
- the burner sequence controller is not faulty

Start Flame Failure

Failure of the start flame during the start flame proving period will cause the sequence controller to go to lockout. If this occurs, check:

- the glass envelope on the UV cell is clean and correctly orientated (it must face towards the flame)
- the UV cell and wiring are not faulty
- the flame detector current is adequate and stable
- the burner sequence controller is not faulty
- there is sufficient fuel under ignition conditions to enable the flame to be detected adequately

Main Gas Flame is Not Established

Check that:

- the fuel pressure and flow rate are adequate
- the fuel valves are open at the appropriate time in the sequence
- the burner sequence controller is not faulty
- the manual isolation valves are open fully and there are no partial blockages in the control train
- the Autoflame controller is set up and commissioned correctly

Fan Motor Only Runs Continuously

Check that:

- the air valve positioning motor is correctly wired and working

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.

BURNER SERVICE RECORD

This sheet to be completed and signed by the Service engineer following each service/adjustment

Date	Details of Service	Signature

Enertech Limited,
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