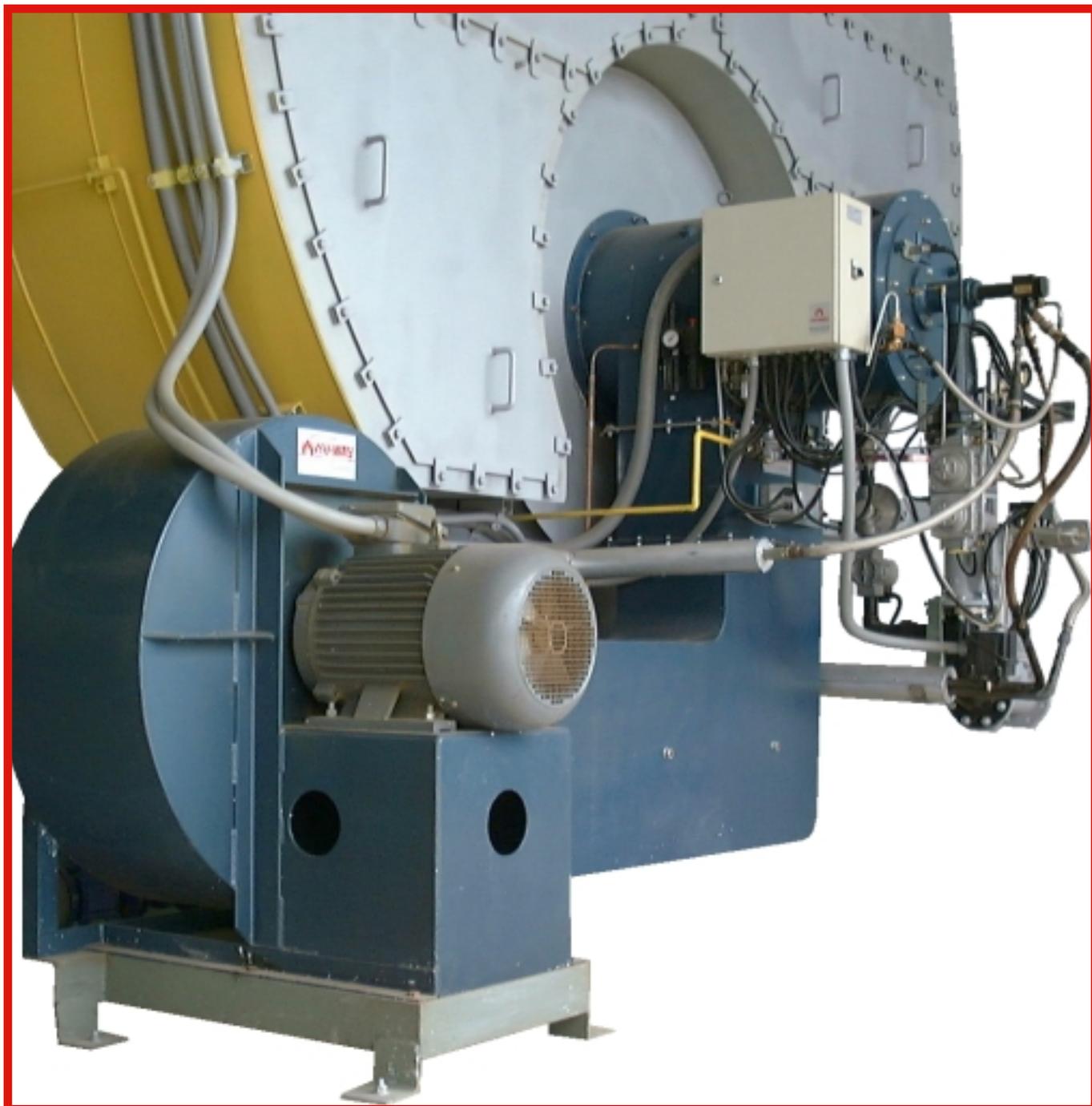




HANDBOOK

P Series Automatic Dual Fuel Burner Fully Modulating



Microprocessor MM Mk.6 Controller With EGA

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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 and pressure jet oil 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 CORGI 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 burners 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 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 mechanisms are identified. Where appropriate, this information is supported by tables and graphs.

Literature on the proprietary components used in P Series burner 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 3:1.

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 and oil pumping and heating unit for PO and PDF units.

Larger sizes of PO and PDF burners can be supplied with air/steam oil atomisation in place of the usual pressure jet.

This technique, for larger thermal ratings, reduces emissions, increases turndown and prolongs oil pump life because lower oil pressures can be used.

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 B.7.

Burner Capacity

The burner output (based on the gross calorific value) is shown on the Burner Specification Sheet on Page C.2 Technical Details.

Fuel

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

The PO is available in two forms, to use distillate or residual fuel oils.

The PDF burner is usually supplied for distillate or residual fuel oils and natural gas but can be supplied to fire LPG, towns gas or biogas with either of the two fuel oils.

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, a fuel selector switch (for the dual fuel range), modulating control gear, a starter for the combustion air fan, starters for fuel pumps and 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 programming control unit provide continuous flame supervision.

Operating Mode

P Series burners are all fully modulating offering a standard turndown of 3 to 1.

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 correct amounts of fuel and air fired to achieve the set value, variations from this set point must be minimised even when the load changes.

Modulation By Electro-Mechanical Systems

P Series burners can be supplied with a Landis and Staefa RWF40 modulating controller. This unit is designed specifically for the control of boiler temperature or steam pressure in oil- and 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 SKP70 controller that matches the fuel gas flow to the air flow. The SKP70 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, 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 P.I.D. control.

A control module contains a micro computer and power supply. The display panel features touch-sensitive key pad data 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. Upto 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 M.M. 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 M.M. Exhaust Gas Analysis Trim System (M.M.E.G.A.).

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 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 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 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 to gas flow.

Natural gas is the usual fuel and has to be supplied at an appropriate pressure, these pressures are presented on the Burner Specification Sheet on Page C.2 Technical Specifications

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.

Oil Supply

In addition to the oil system supplied with the burner, there are some requirements for the main oil storage and supply system that supplies oil to the burner system.

Main Oil Storage Tank

Residual fuel oils must be maintained at all times at the temperature specified by the fuel supplier. The Table on Page B.8 shows the temperatures and pressures for Class D, E, F and G oils.

Oil Deliveries

It is good practice to shut down boilers whilst the delivery of oil is made and allow 30 minutes for oil sediment to settle out before re-starting the burners.

Ring Main System

The oil from the tank must be supplied to the burner from a pumped ring main system. A typical system is shown on Page B.9.

The inlet pressure of the oil will depend upon the type of oil. Oil must be handled and delivered at the temperatures and pressures shown in the Table on the Burner Specification Sheet on Page C.2 Technical Specification.

The ring main pumps and pipe size must be designed to at least 1.25 times the total swept volume of the burner pump(s) it supplies. Oil supply pipes must be constructed and installed to comply with local conditions and appropriate Codes and Standards. All pipework must be supported firmly, and in the case of residual oils, lagged, traced and thermostatically controlled. (The minimum pipe size is 1.5 inch BSP).

Galvanised steel pipe should not be used.

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 flow rate that is anticipated.

The final connection to the oil pump inlet port should be made using the flexible pipe supplied with the burner.

Precautions For Residual Oil

If heavy oils are heated to too high a temperature, then lighter fractions will vaporise and this will cause premature wear to the pump.

It is essential to filter heavy fuel oil before the burner inlet. The filtration system should be selected according to the individual features of the installation but the diagram on Page B.9 gives some basic guidelines. The ring main pressure should be measured at the pump vacuum gauge port to allow for any pressure drop caused by the filters.

For residual oil burners the pipework should be insulated, trace heated and thermostatically controlled.

Electrical Power Supply

A three phase 50 Hz electrical supply is required. Power requirements are listed on the Burner Specification Sheet on Page C.2 Technical Specification. 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 and air plenum chamber
- damper section with modulating air system
- gas train complete with proving system
- modulating oil system as appropriate
- combustion air fan
- floor mounted burner control panel
- a pumping and heating unit, or pumping unit only for distillate oil burners, is supplied as a separate component inclusive of flexible pipes to make all necessary oil connections.

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 front plate and appliance must be prepared; the details of the drilling arrangements are shown on Page B.8.

The chimney, flues, 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 front plate.
- 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 front plate protection, except where extensions have been expressly specified by the appliance manufacturer.
- 3 Fit the damper section to the burner head using the fasteners and gasket provided.
- 4 Position the combustion air fan and connect the damper section 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).
- 5 For PG and PDF 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.
- 6 For PO and PDF burners, place the pumping and heating unit (or pumping unit) in the desired position.
- 7 Connect the flexible oil pipes from the oil inlet and return to the pumping (and heating) unit, and the main oil supply pipework.
- 8 Locate the control panel in the desired position and make the necessary connections between the burner head, pumping (and heating) unit 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.

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 5 mm w.c.).

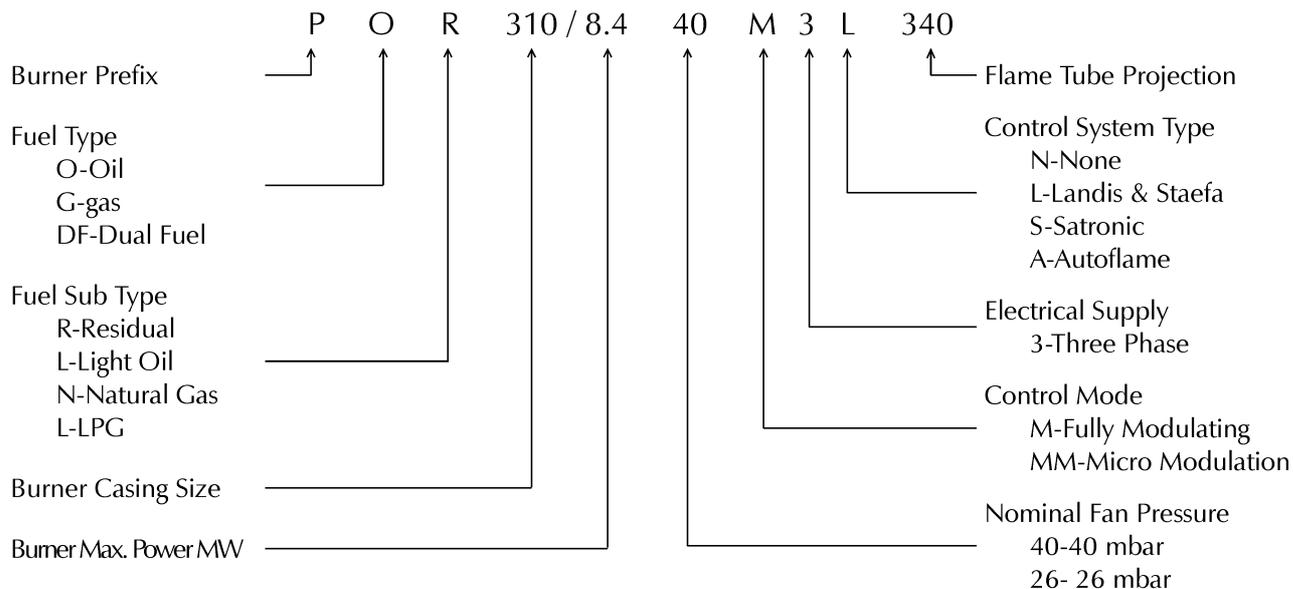
Should the over-fire draught exceed this value, then steps should be taken to reduce it to or below this level.

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

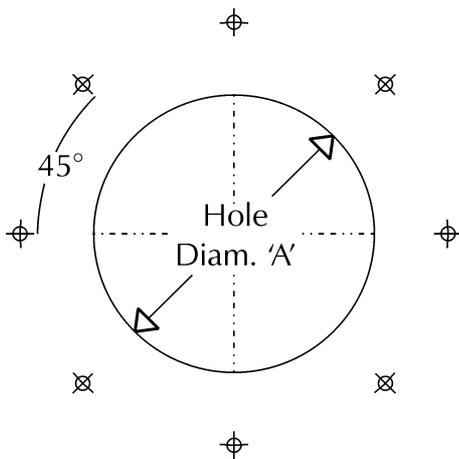


	Comment	Option
BURNER PREFIX	All burners in this series are prefixed 'P'.	P
FUEL TYPE	The fuel on which the burner is designed to operate is identified as :	'O' : Oil 'G' : Gas 'DF' : Dual fuel
FUEL SUB-TYPE	The standard fuel sub-types which can be specified are:	'L' : Light oil 'R' : Residual oil 'N' : Natural gas 'L' : Liquefied petroleum gas
CASING SIZE	Obtained from the Burner Specification Sheet.	
MAXIMUM POWER	Obtained from the Burner Specification Sheet.	
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 fully modulating controls, as shown by the code 'M'.	M
ELECTRICAL SUPPLY	In standard form, 'P' series burners require 415 volt, 3 phase (4 wire), 50 Hz electrical supplies, which are designated by the code '3'. Other requirements should be discussed with Nu-way's Technical Department.	3
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 & Staefa 'S' : Satronic 'A' : Autoflame
FLAME TUBE PROJECTION	The flame tube projection on Nu-way 'P' series burners is matched to the individual application.	Manufactured to specified length

OIL HANDLING TEMPERATURES AND PRESSURES

Fuel Handling Temperatures (°C)					Fuel Delivery Pressures	
Fuel Class	Viscosity (Seconds)	Minimum From Tank	Burner Inlet	Atomising	kg/cm ²	psi
D	35	Minimum 5 Recommended			0.35 to 0.70	5 to 10
E	200	16	16	82	4 to 5	57 to 71
F	960	30	43	110		
	1500	36	65	118		
G	3500	50	82	132		
	4200	55	86	140		

BURNER MOUNTING DETAIL



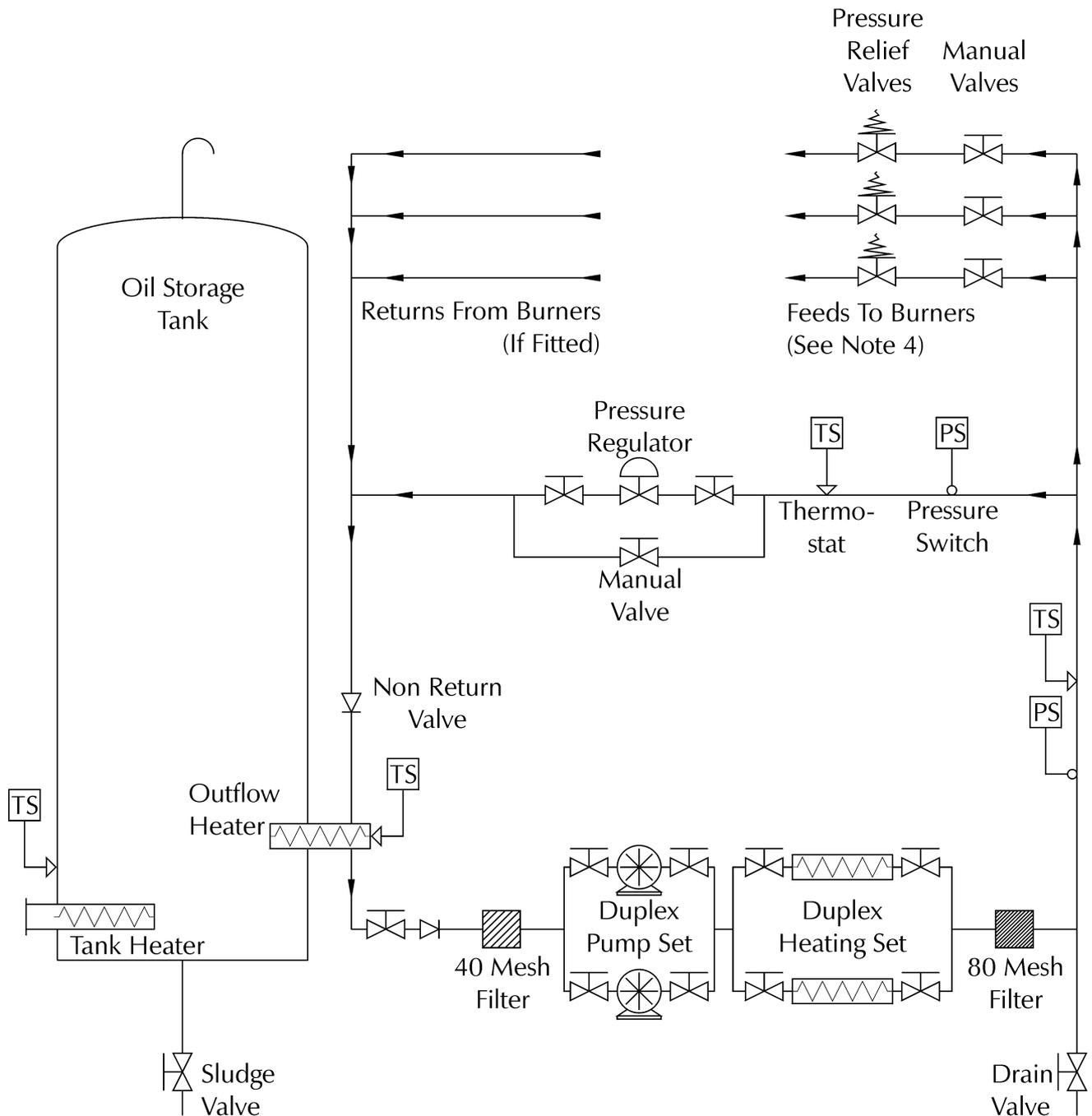
8 Holes tapped M12
equispaced on 'B' mm PCD

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

Burner Model	'A' (mm)	'B' (mm)
PO160	360	610
PO250 (5.1-6.0)	360	672
PO250 (6.2-7.3)	385	672
PO310	410	672
PO400	435	672
PO490 (12.1-12.8)	435	672
PO490 (13.2-14.3)	465	672
PO575	535	772
PO660	535	772

Burner Model	'A' (mm)	'B' (mm)
PDF160	360	610
PDF250 (5.1-6.0)	360	672
PDF250 (6.2-7.3)	385	672
PDF310	410	672
PDF400	435	672
PDF490	465	672
PDF575	535	772
PDF660	535	772

TYPICAL PUMPED OIL RING MAIN



Notes:

- 1 Duplex pumps and heaters are recommended for continuity and serviceability.
- 2 Line heaters are recommended for Class F and G fuels, but are not normally necessary for Class E fuel.
- 3 Pre-heating Class D fuel is not normally required, but a minimum temperature of 5 °C should be maintained and all exposed pipework must be lagged.
- 4 If a shut-off valve is fitted in the supply line to the burner oil pump inlet then a pressure relief valve **MUST** also be fitted to prevent damage should the shut-off valve be inadvertently left closed during the burner start-up cycle. The relief valve must be set at 0.70 kg/cm² (10 psi) above the normal supply pressure.



TECHNICAL SPECIFICATION

BURNER SPECIFICATION SHEET

The information contained on this sheet describes the burner as supplied by Nu-way. If the burner is modified after delivery then this sheet should be updated as necessary.

Designation :	<input type="text"/>	Capacity :	<input type="text"/>	MW
Specification No. :	<input type="text"/>	Serial No. :	<input type="text"/>	
Fuel 1 :	<input type="text"/>	Fuel 2 :	<input type="text"/>	

Components :

Modulation Controller :	<input type="text"/>		
Burner Sequence Controller :	<input type="text"/>		
Fuel Modulating Motor :	<input type="text"/>		
Air Modulating Motor :	<input type="text"/>		
Air/Gas Ratio Controller :	<input type="text"/>		
Fuel Gas Valve Proving System :	<input type="text"/>		
Oil Atomising Method :	<input type="text"/>		
Oil Pump Manufacturer :	<input type="text"/>	Model :	<input type="text"/>
Oil Pre-heater Type :	<input type="text"/>		

Electrical Power Requirements :

Fan Motor Power :	<input type="text"/>	kW	<input type="text"/>	hp
Fan Motor Current Start :	<input type="text"/>	Amps		
Fan Motor Current Run :	<input type="text"/>	Amps		
HRC Fuse :	<input type="text"/>	Amps		
Oil Pump :	<input type="text"/>	kW	<input type="text"/>	hp
Pre-heater :	<input type="text"/>	kW		

Fuel Pressure And Temperature Requirements (At Burner Inlet) :

Fuel 1 :	Pressure :	<input type="text"/>	psi	Temp.	<input type="text"/>	°C
Fuel 2 :	Pressure :	<input type="text"/>	psi	Temp.	<input type="text"/>	°C

Other Services

Steam Atomiser:	Flow :	<input type="text"/>	Pressure :	<input type="text"/>	psi
Steam Pre-heater :	Flow :	<input type="text"/>	Pressure :	<input type="text"/>	psi
Atomising Air :	Flow :	<input type="text"/>	Pressure :	<input type="text"/>	psi

Comments :

BURNER AND COMPONENT

IDENTIFICATION

The general arrangement of a PDF burner employing Microprocessor MM Mk. 6 modulation is shown in the diagram Burner and Component Identification on Page C.8. An enlarged view of the burner head casing is shown in the diagram on Page C.9.

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 P Series burners should familiarise themselves particularly with the information presented in this section.

Air Controls

Air Damper

To control the air for combustion PDF burners have an adjustable multi-blade damper located in a rectangular section attached directly to the burner casing (diagrams on Pages C.8 and C.9). 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 C.22) 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 Sensor

The air pressure sensor is located on the rear of the burner casing and is connected to the burner controller. Its function is to monitor the combustion air pressure so that the burner control system can 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

PDF burners with an Microprocessor MM Mk. 6 modulating system, are supplied with a gas train (see diagram Gas Control Train Schematic on Page C.10). The train is normally a separate unit that needs to be connected to the burner body.

The supplied gas train comprises :

- a combined safety shut-off valve and governor
- a gas pressure sensor connected to the microprocessor burner control system
- a safety shut-off valve
- a flow control valve actuated by the microprocessor burner 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 C.10 as 'Manual Gas Isolation Valve (Not Supplied By Nu-way)'.

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 D).

Gas Pressure Sensor

The provision of a low gas pressure safety interlock is required by European Standard EN 676 'Automatic Forced Draught Burners for Gaseous Fuels' and is fitted to all burners where necessary. The low gas pressure sensor 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 sensor setting must be made during commissioning. The sensor also monitors the pressure in the test space between the two shut-off valves during the valve proving check which is carried out prior to every burner ignition.

Valve Proving System

When the burner is required to start, the Autoflame controller initiates the valve proving system option, and in the event of a gas leak, prevents burner start-up.

The Microprocessor MM Mk 6 controller is designed to provide automatic gas valve proving (leakage test) based on the pressure proving principle (see diagram on Page C.10). The pressure is monitored by a pressure sensor connected to the test space between the main valves. The sensor comes pre-wired as part of the gas train harness.

When the appliance 'calls for heat', the MM Mk. 6 controller 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 at the start of the test cycle. The sequence of operation is as follows:

- The first step of the proving sequence is to open the downstream gas valve (V2) thus venting any gas that is in the test space via the fuel flow control valve. After 14 seconds valve (V2) closes (the time the valve remains open is adjustable over the range 3 to 15 seconds by setting Option 134 on the Autoflame controller). The test space is now at atmospheric pressure.
- Both valves remain closed for 10 seconds (the test duration is adjustable over the range 10-30 seconds by setting Option 132 on the microprocessor controller) whilst the microprocessor controller monitors the pressure switch to verify 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 and the valve proving sequence can continue.
 - If the valve (V1) is leaking, pressure will build up in the test space and this will be detected by the pressure sensor. The microprocessor controller will go to lock-out.
- This first main safety valve (V1) opens, thus pressurising the test space between the valves. After 14 seconds valve (V1) closes (the time the valve remains open is adjustable over the range 3 to 15 seconds by setting Option 134 on the Autoflame controller).
- Both valves remain closed for 10 seconds (the test duration is adjustable over the range 10-30 seconds by setting Option 132 on the microprocessor controller) whilst the controller monitors the pressure sensor to verify that there is no fall in pressure in the test space.

- If there is a fall in pressure, the microprocessor controller will lock-out and the downstream main gas valve (V2) should be checked as it may be leaking.
- If there is no fall in pressure then the system is gas tight. The microprocessor controller will now proceed with the start-up sequence.

Note : the valve proving times in the sequence described above are factory pre-set. Under no circumstances should these times be adjusted without a thorough knowledge and understanding of the local standard or code of practice under which the burner is required to operate.

The Microprocessor MM Mk. 6 controller undertakes this test cycle every time the burner is required to start-up on gas firing.

Safety Shut-off Valve

This valve shuts off the fuel gas flow to the burner.

Flow Control Valve

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

Gas Nozzle

The gas and fuel oil nozzles that are fitted to the front of the burner assembly, within the flame tube, are shown on the diagram Burner Head on Page C.22. The ports in these nozzles are sized in accordance with the thermal rating and the fuels to be fired.

Oil Controls

The components **vary according to whether distillate or residual oil is fired**. In all cases a two-pipe system is essential to ensure that the oil pump remains primed during periods of gas firing. The oil must be supplied and maintained at the temperature and pressure given in the Table on Page B.8.

Burners with the Microprocessor MM Mk. 6 modulating system are supplied with an oil system (see diagrams on Page C.12 Distillate Oil Control Train Schematic and on Page C.13 Residual Oil Control Train Schematic) consisting of :

- pumping/heating set
- oil manifold block

- oil valve (normally-closed; for distillate fuel oil)
- inner gun assembly housing the oil nozzle
- oil solenoid valve (tip shut-off)
- motorised spill control valve
- non-return valve

Pumping Set For Class D Fuel

The pump unit is free standing and comprises :

- oil pump
- motor
- oil filter(s)
- air bottle

The unit is assembled for floor mounting (see diagrams Distillate Oil Pumping Set on Page C.14 and Oil Pumps on Page C.11). This unit is designed to deliver the oil volume and pressure for the required burner output.

Filter(s) are an integral part of the burner oil supply system. The filter(s) should be checked regularly as failure to do so may result in a drop in oil pressure to the system.

Pumping/Heating Set For Class E, F and G Fuels

The pump unit is free standing and comprises :

- oil pump
- motor
- hot oil filter
- cold oil filter(s)
- air bottle
- isolation valve (for residual fuel oil)
- return thermostat
- oil pre-heater tank with thermometer to record the temperature of the oil at the outlet. The pre-heater contains three thermostats:
 - High limit thermostat
 - Control thermostat
 - Low limit thermostat (reverse acting)

The return thermostat is fitted in the return oil line and will override the burner firing controls and start the burner oil pump in order to maintain the correct oil temperature in the nozzle and burner pipework.

The thermostats should be set to the temperatures specified in the Table forming part of diagram Residual Oil Pumping Set on Page C.15.

The unit is pre-assembled on a base plate for floor mounting (see diagrams Residual Oil Pumping Set on Page C.15 and Oil Pumps on Page C.11). This unit is designed to deliver the oil volume at temperature and pressure for the required burner output.

The pump should not be started when the oil is cold and viscous as this can lead to damage to the pump and couplings. The oil must be supplied and maintained at the temperature and pressure given in the Table on Page B.8.

Filter(s) are an integral part of the burner oil supply system. The filter(s) should be checked regularly as failure to do so may result in a drop in oil pressure to the system.

Oil Manifold

The oil manifold block is located on the burner casing and incorporates pressure gauges to measure pump and spill pressures.

Solenoid Valve

For burners designed for distillate oil firing there is a solenoid valve which is 'normally-closed' and is located between the manifold block and the oil lance (see diagram on Page C.12).

There is no solenoid valve fitted when the system is designed to fire residual oil (see diagram on Page C.13).

Inner Assembly Gun

The oil inner assembly gun is located in the middle of the head casing assembly of the burner. Its primary function is to carry oil from the oil pump to the nozzle and to recirculate the oil back through the spill regulating valve.

The spill-back atomiser utilises a spring loaded orifice shut-off needle that is closed by the spring of the actuating piston of the burner lance. This guarantees a reliable shut-off under any condition. This piston is driven by the supply pressure, via a branch pipe, and controlled by a solenoid valve. The needle opens by means of a spring and moves to the correct position governed by a fixed stop on the needle itself.

During the pre-purge period the needle holds the orifice closed and the fuel oil circulates through the lance and the atomiser under the set supply and return pressure. When the solenoid is actuated, immediate oil atomisation and ignition are achieved.

Oil Nozzle

P Series pressure jet burners use a Fluidics atomizing nozzle as shown in diagram Fluidics Oil Nozzle on Page C.7.

The primary function of the nozzle is to spray oil in a suitable pattern into the combustion air stream at a rate commensurate with the appliance's thermal rating.

Oil Solenoid Valve (tip shut-off)

This valve operates the needle that releases oil to the burner tip.

Motorised Spill Control Valve

This valve regulates, via the modulating controller, the spill pressure to give the appropriate oil flow rate over the burner's operating range.

An fuel valve operated by a servo-motor is used.

Non-return Valve

This valve allows flow in one direction only.

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.

Burner Sequence Control

The burner start-up sequence is controlled directly by the Microprocessor MM Mk. 6 controller.

Flame Monitor

All P Series burners are fitted with continuous flame supervision systems employing ultraviolet (UV) or photo-electric (PE) cells to detect the presence of a flame.

Modulating Control And Operation

The burner employs a microprocessor controller which performs both start-up sequence and modulation control. Detailed information of this system will have been provided separately with the burner.

The control module contains a micro-computer and power supply. The display panel has touch sensitive key pad entry, readout and status indicators, all protected beneath a tamper-proof protective cover (see diagram Burner Modulation Controller : MM Mk. 6 on Page C.18).

The fuel and air flows are each controlled by separate servo-motors (see diagram Positioning Motor on Page C.19) driven by the modulation controller.

One motor positions the air damper and the other operates a pair of linked fuel valves by which it is possible to control the input of gas and oil. During commissioning it is necessary to adjust the potentiometers in these positioning motor assemblies.

The position of each servo-motor is monitored by a voltage dividing system enabling digitised information to be encoded into the control module's memory. The relative positions of the air and fuel motors are checked constantly by the system at the rate of 50 times per second.

The burner controller displays angular positions of the air damper motor and fuel valve motor. 'Required' and 'Actual' boiler temperatures or pressures are also displayed.

During commissioning the Microprocessor MM Mk. 6 must be set at high flame, low flame and a number of intermediate positions.

The commissioning procedure is provided in the Section D, Commissioning. The burner controller manual, issued separately with the burner, should be consulted for further information if required.

Exhaust Gas Analyser (EGA)

The EGA system expands the capabilities of the burner controller by measuring and displaying O₂, CO₂, CO, NO, SO_x, exhaust temperature and boiler efficiency.

The data are fed back to the controller which uses the information to trim the air damper position. This ensures that the air/fuel ratios set for each rating during commissioning are maintained during normal operation despite variations in stack pressure, barometric conditions and fuel properties.

The EGA module can be connected to an energy management system to track and record the information generated by the analyser.

Data Transfer Interface (DTI)

A further option is the DTI which is a data acquisition system that can collect the operational data from up to 10 MM modules on one site. The data can be transmitted via an RS 232/422 link to a local computer or building management system using the MODBUS protocol. Alternative DTI firmware allows the DTI to integrate the rest of the combustion management system with other control systems.

WinPCDTI software brings control of the combustion management system to a PC, providing on/off control as well as temperature and pressure set-point adjustment of the burners. The PC can be local or connected remotely by modem. Alarm conditions can be defined and, if triggered, the software can advise of the condition via a pager.

Temperature Detector

The temperature detector (shown in the diagram on Page C.20) is specific to the burner control system and is available in various ranges.

Pressure Detector

The pressure detector (shown in the diagram on Page C.21) is specific to the burner control system and is available in various ranges.

BURNER OPERATING SEQUENCE

The operating sequence of P Series Burners begins with checks on external interlocks, shut -off valve proving and a check for no flame, a pre-purge period on full air is then initiated.

When gas is selected, this fuel is supplied to the burner at start rate and ignition initiated. Start gas flame proving is followed by establishment of the main flame, after which the burner modulates to high fire.

When oil is selected, on completion of the pre-purge period the appropriate oil valve or valves open, ignition is initiated and low fire is established when the burner modulates to high fire.

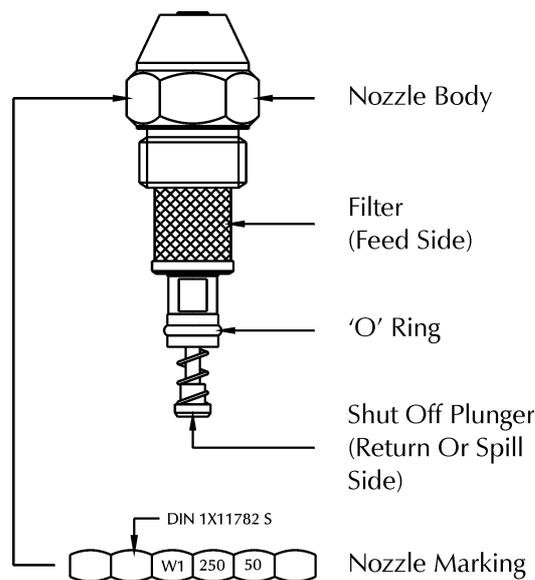
In both cases, the burner controller will then continue to its normal operation during which it :

- continues to supervise the control functions and is therefore able to shutdown the burner safely should this be necessary.
- modulates the burner firing rate in response to the pressure and/or temperature requirements of the appliance.

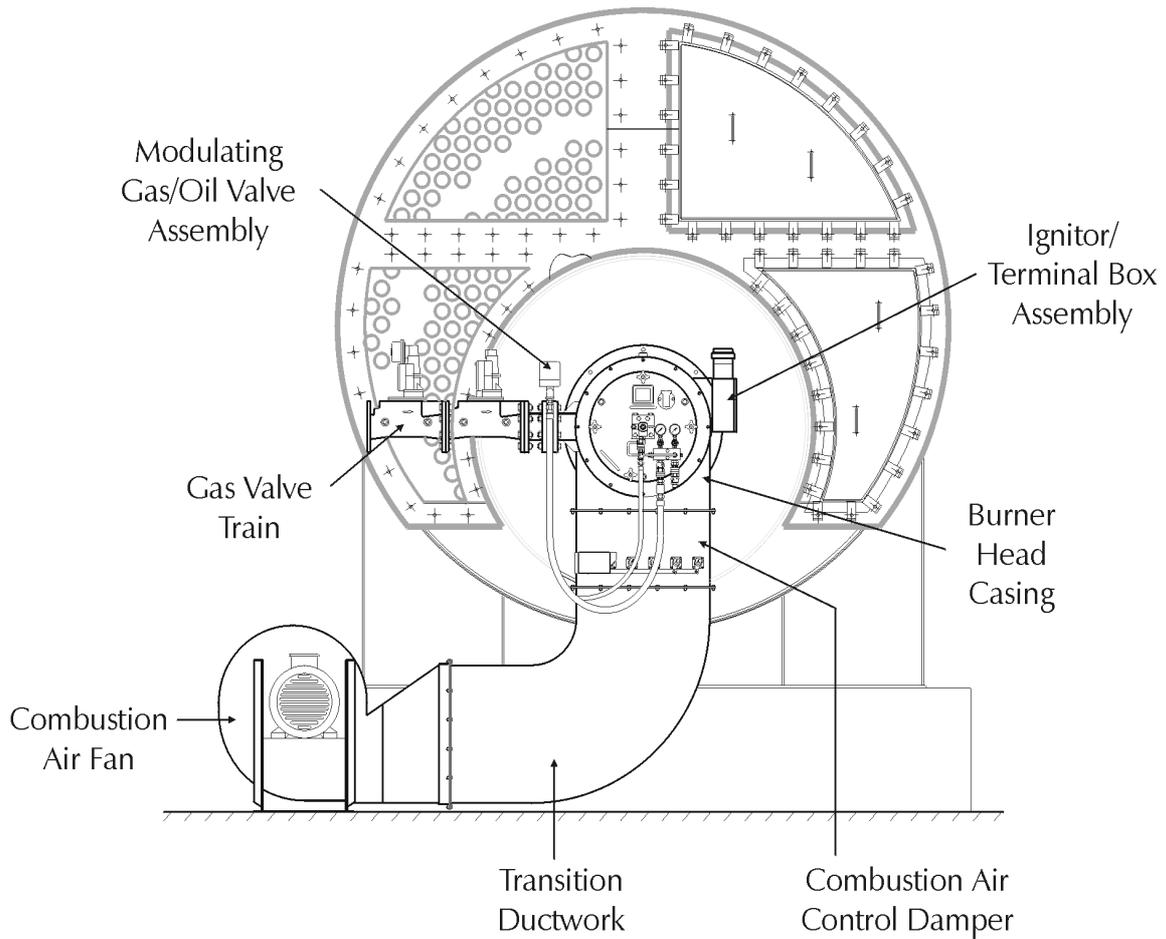
COMBUSTION HEAD DETAILS

The combustion head and inner assembly are shown in the diagram Burner Head on Page C.22.

FLUIDICS OIL NOZZLE



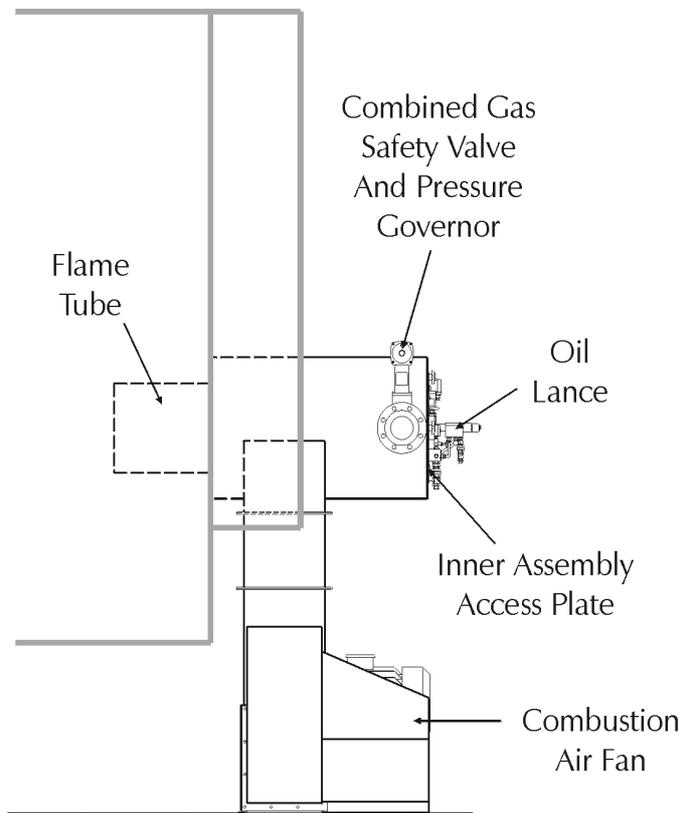
BURNER AND COMPONENT IDENTIFICATION



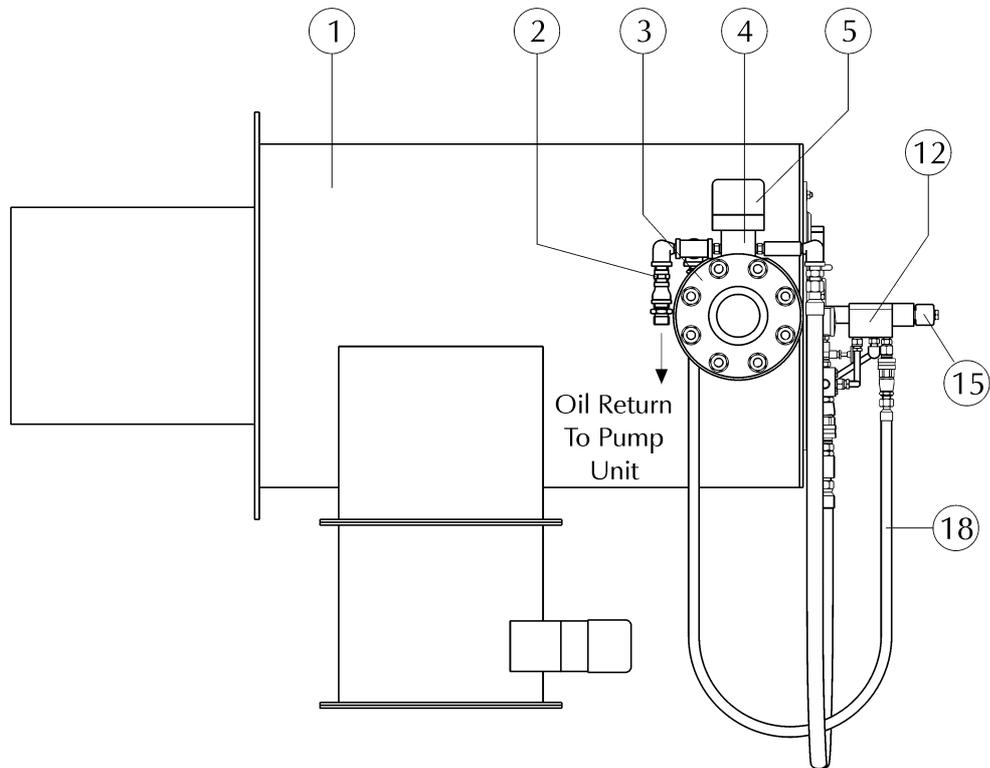
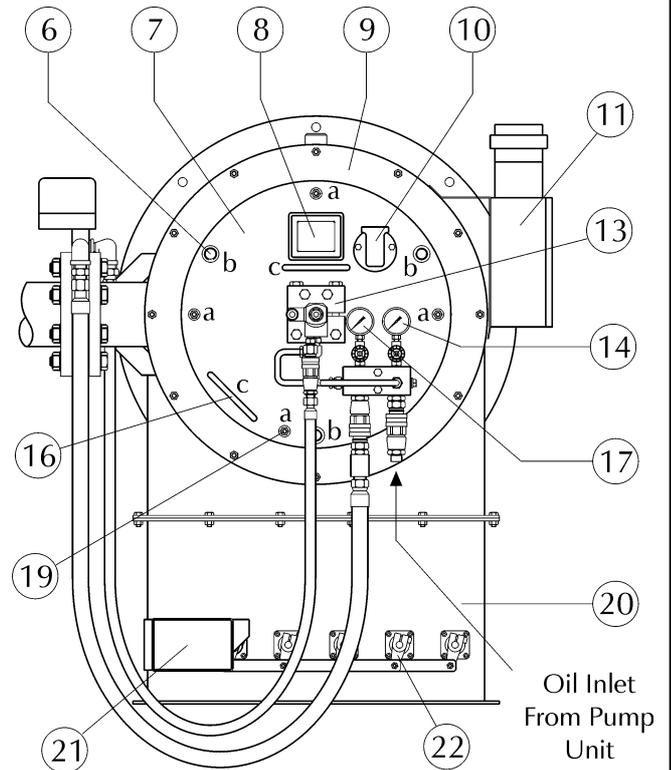
This diagram is for illustrative purposes only.

Actual components supplied may vary from those shown.

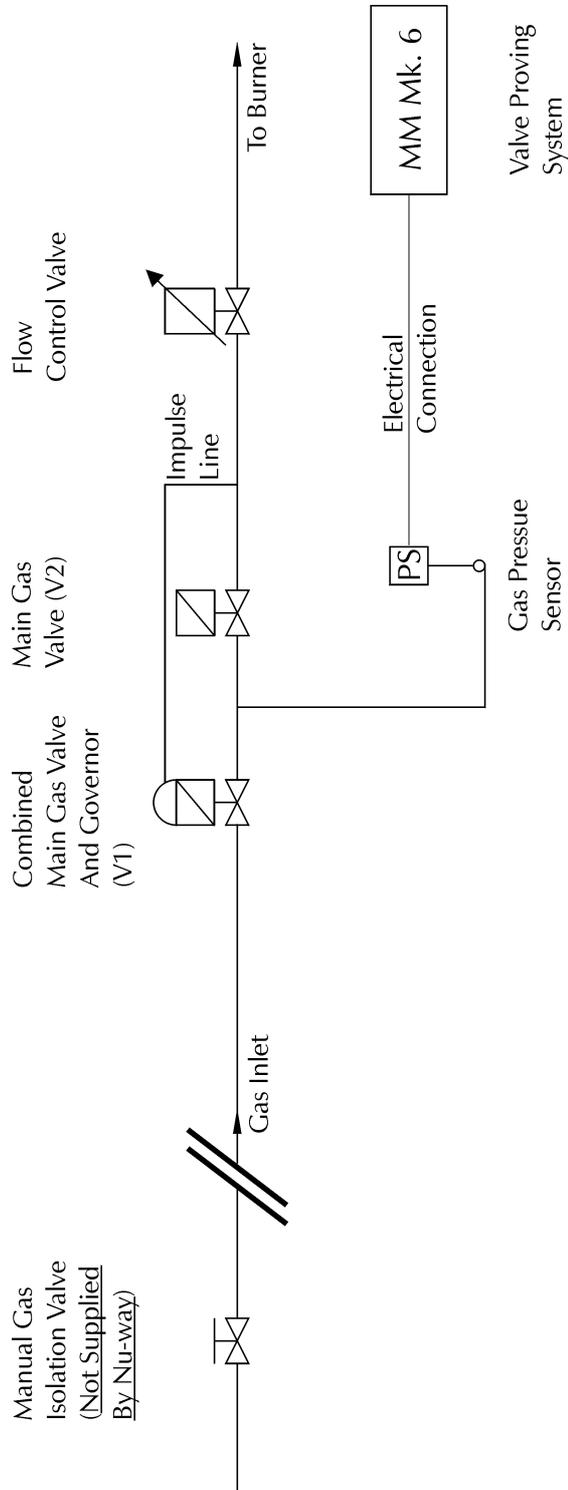
Please refer to the Burner Specification Sheet and the drawings elsewhere in this manual for details of the components supplied.



Item	Component
1	Burner Head Casing
2	Oil Non-Return Valve
3	Gas Control Valve (Autoflame)
4	Oil Spill Return Valve
5	Fuel Control Servomotor
6	Guide Rod Socket (3x'b')
7	Inner Assembly Backplate
8	Sight Glass
9	Backplate Adaptor Ring
10	U.V. Cell Holder
11	Ignitor And Terminal Block Assembly
12	Spill-back Oil Lance
13	Burner Lance Clamp Block
14	Inlet Oil Pressure Gauge
15	Nozzle Tip Shut-off Solenoid
16	Backplate Withdrawal Handles
17	Spill-back Oil Pressure Gauge
18	Nozzle Tip Shut-off Bleed Line
19	Backplate Retaining Nuts (4x'a')
20	Air Damper Unit
21	Air Damper Servomotor
22	Air Control Vane

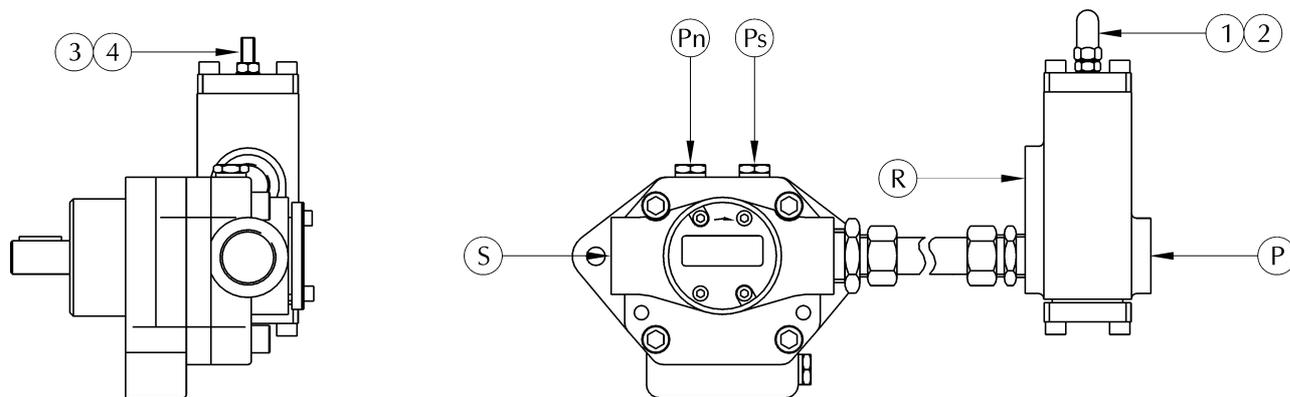


GAS CONTROL TRAIN SCHEMATIC

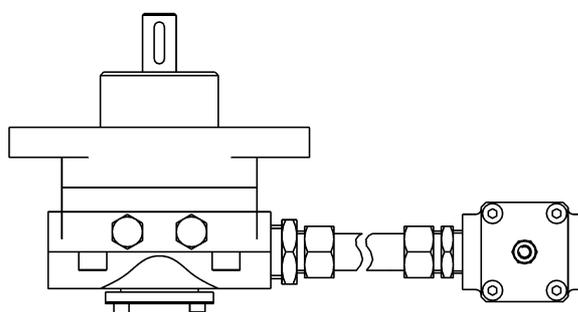


OIL PUMPS

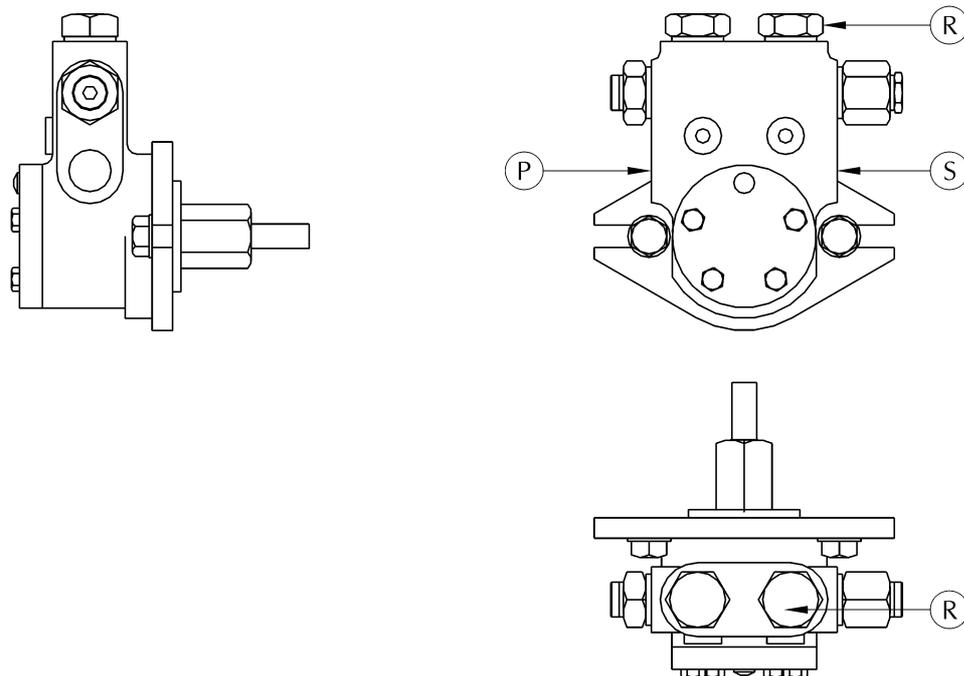
Suntec T Series Oil Pump With TV Pressure Regulator



Pump Connections	
Item	Description
P	Pressure port
R	Return port
S	Suction port
Pn	Vacuum gauge and internal bypass plug
Ps	Pressure gauge
1	Regulator cap nut
2	Washer
3	Regulator screw
4	Locknut

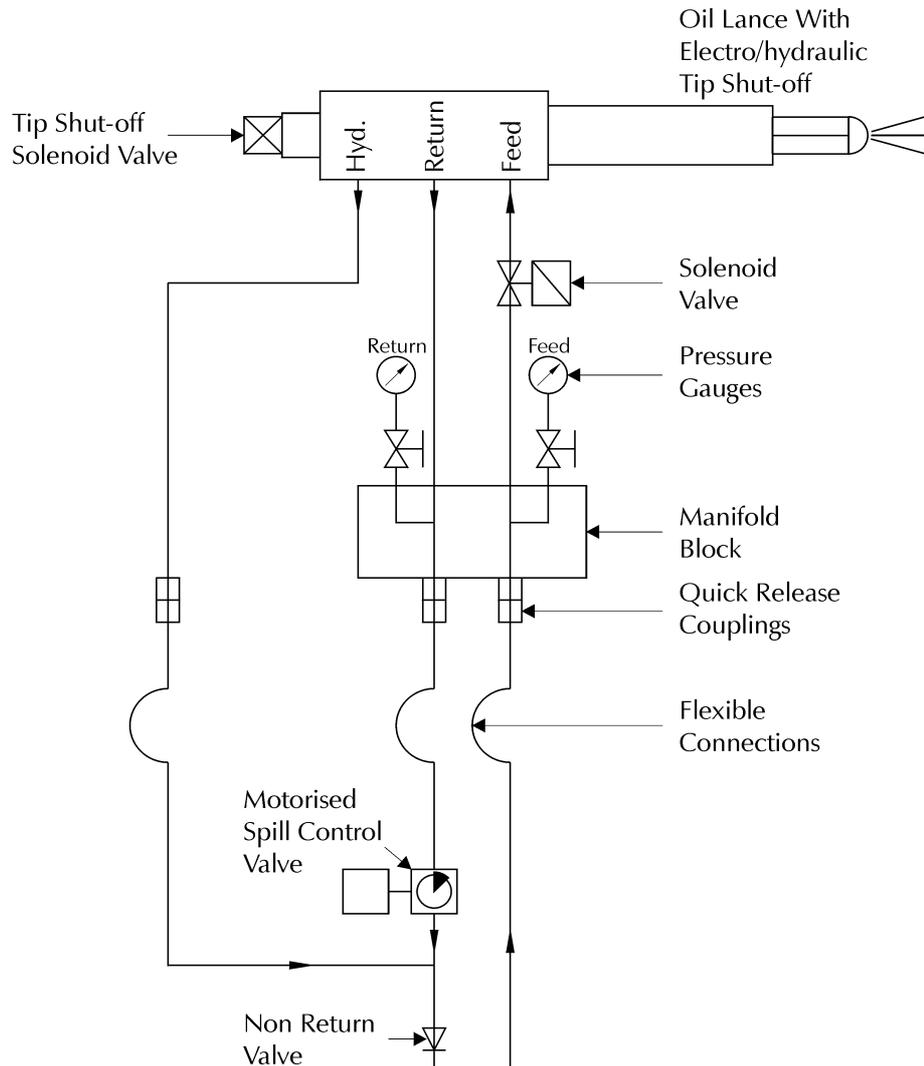


Safag Oil Pump

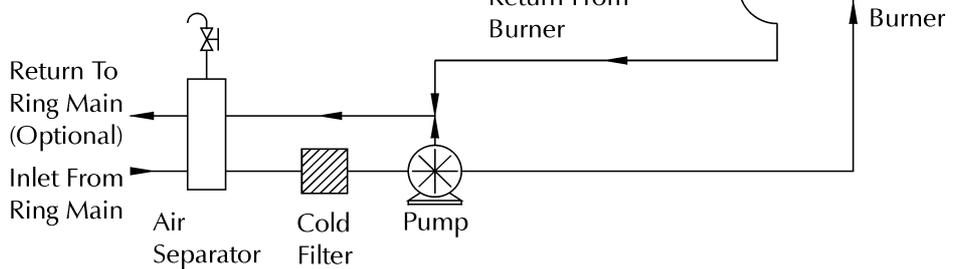


DISTILLATE OIL CONTROL TRAIN SCHEMATIC

Burner Mounted Components



Pumping Set Components



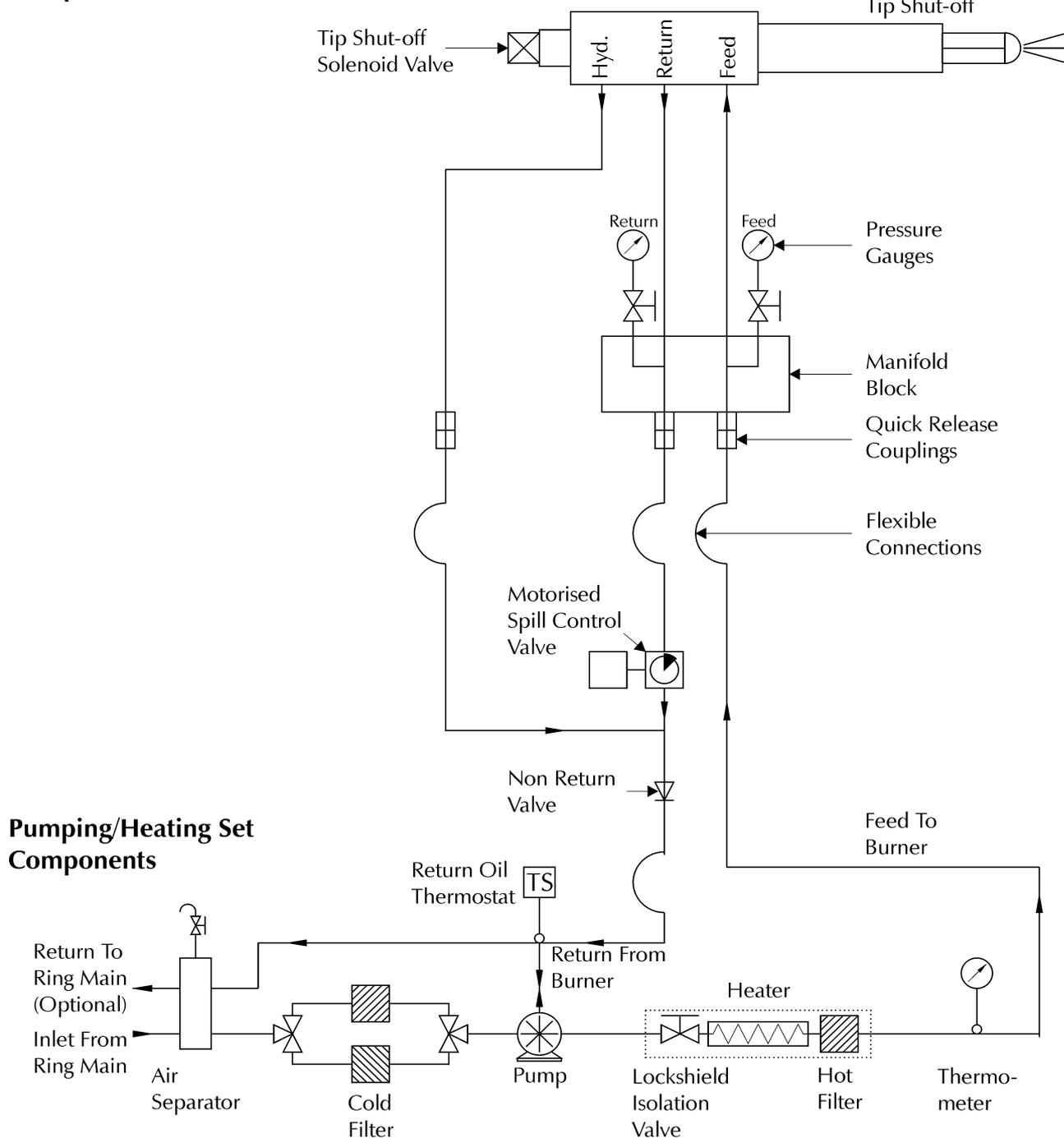
Notes:

- 1 All interconnecting pipework must have a minimum bore of 19 mm (3/4") and must be pressure rated for 42 kg/cm².
- 2 Pipework connections between the burner oil system and the separate pumping set are not supplied by Nuway.
- 3 Connections to the ring main on the air separator bottle are 1" BSP

RESIDUAL OIL CONTROL TRAIN SCHEMATIC

Burner Mounted Components

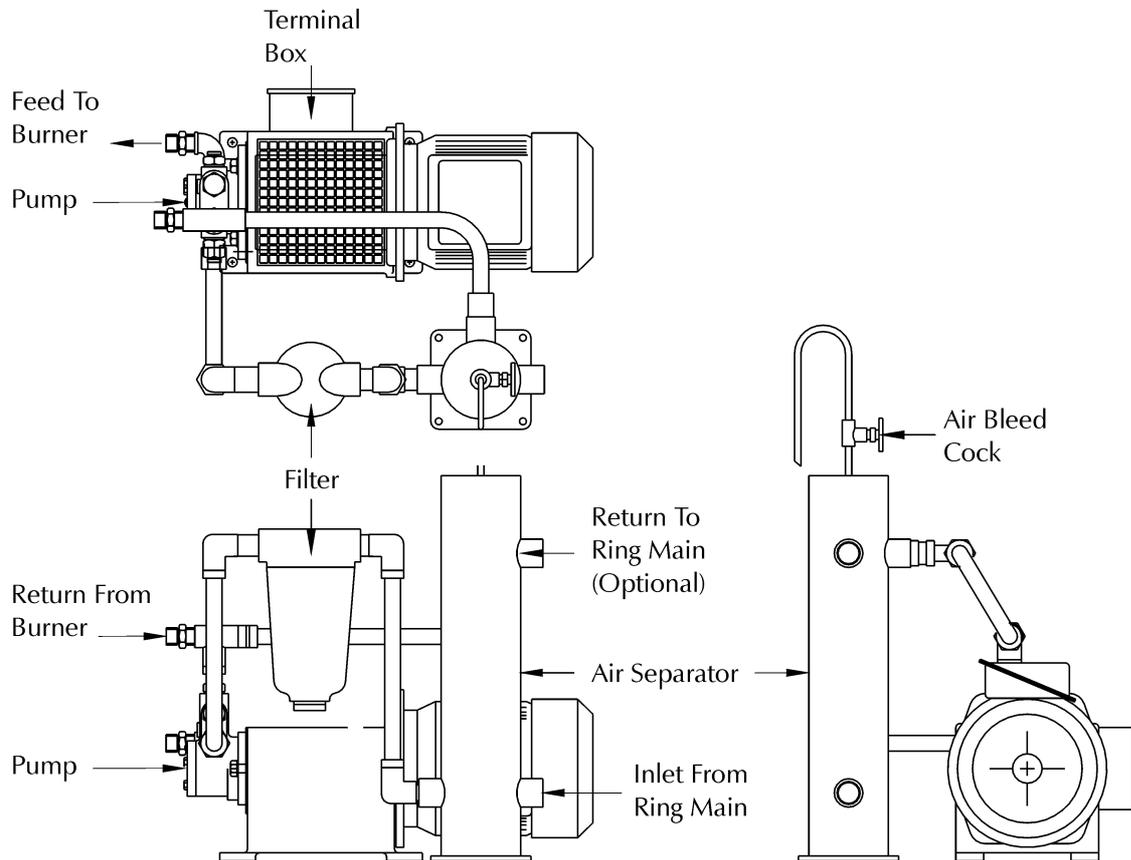
Oil Lance With
Electro/hydraulic
Tip Shut-off



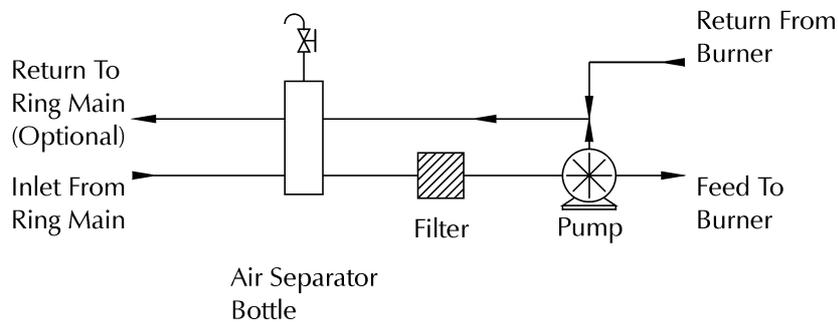
Notes:

- 1 All interconnecting pipework must have a minimum bore of 19 mm (3/4") and must be pressure rated for 42 kg/cm².
- 2 On residual fuel oil burners this pipework must be maintained at the burner atomising temperature and in the case of class F and class G fuels must also be trace heated.
- 3 Pipework connections between the burner oil system and the separate pumping/heating set are not supplied by Nuway.
- 4 Connections to the ring main on the air separator bottle are 1" BSP

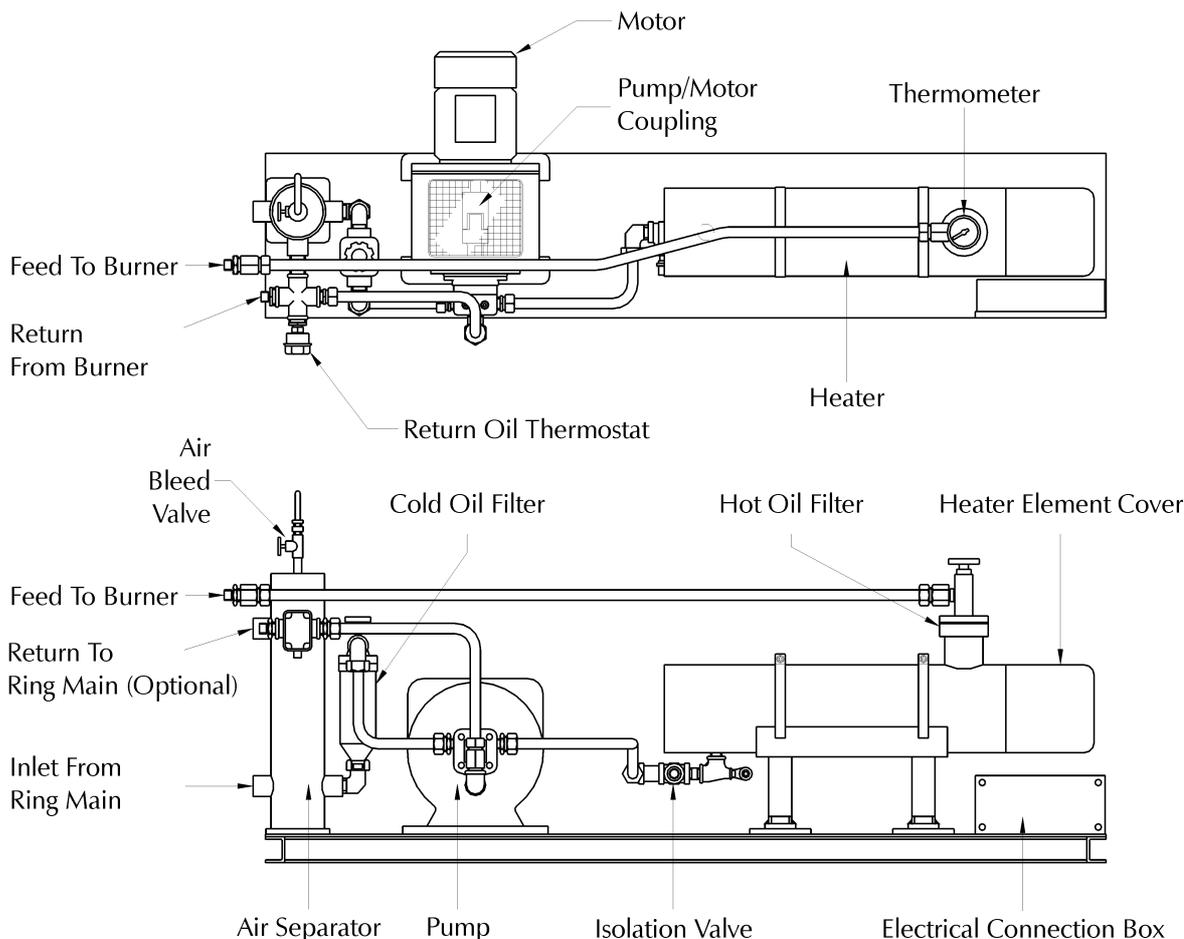
DISTILLATE OIL PUMPING SET



Schematic :



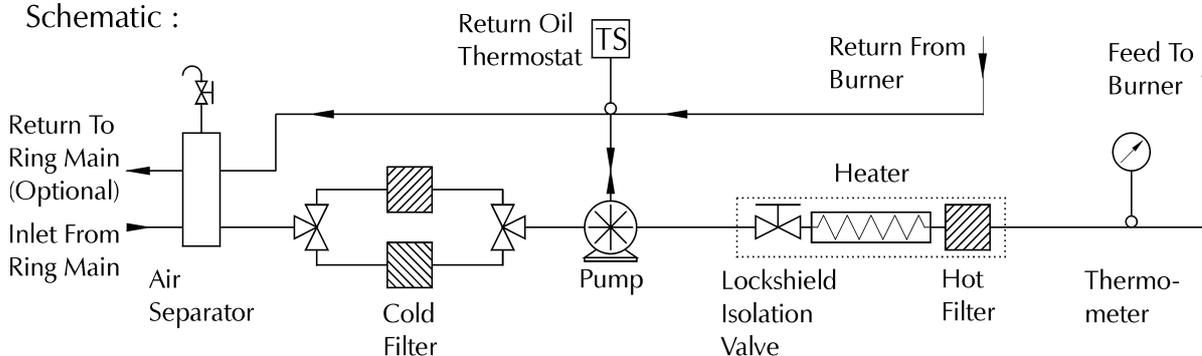
RESIDUAL OIL PUMPING/HEATING SET



Notes:

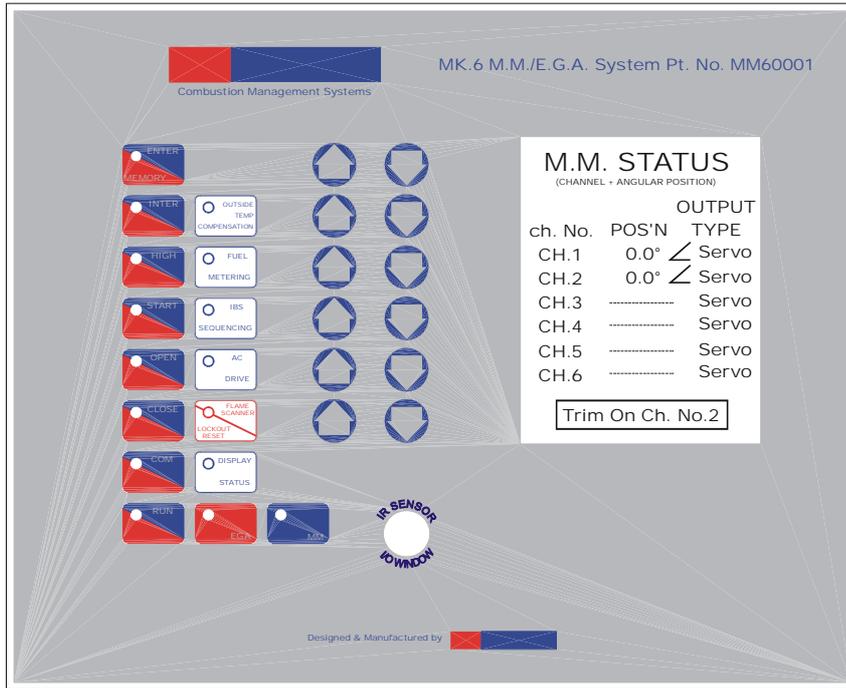
- 1) A single cold oil filter is shown above. In some instances duplex filters may be fitted (as in the schematic below).
- 2) The high limit, control and low limit thermostats are located beneath the heater element cover.

Schematic :

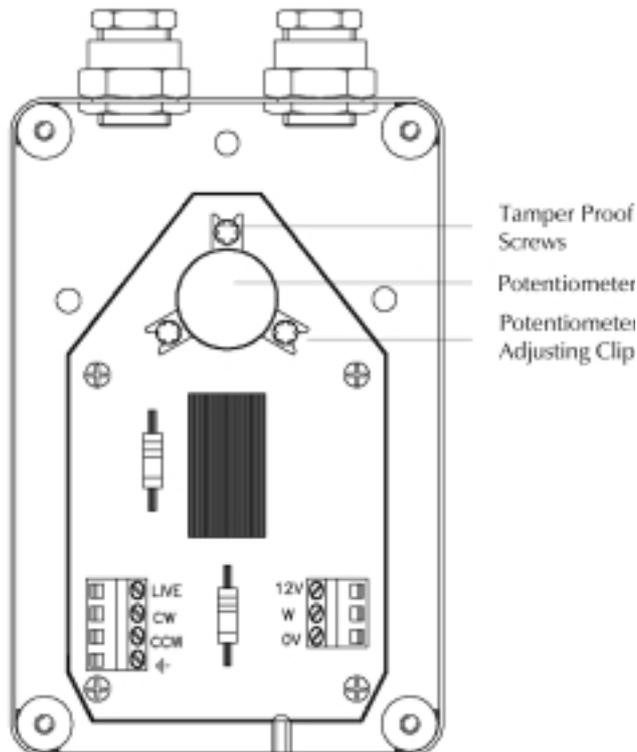


Thermostat Settings				
Fuel Class	High Limit	Control	Low Limit	Return Oil
E	110°C	85°C	65°C	40°C
F	130°C	100°C	80°C	50°C
G	150°C	140°C	100°C	70°C

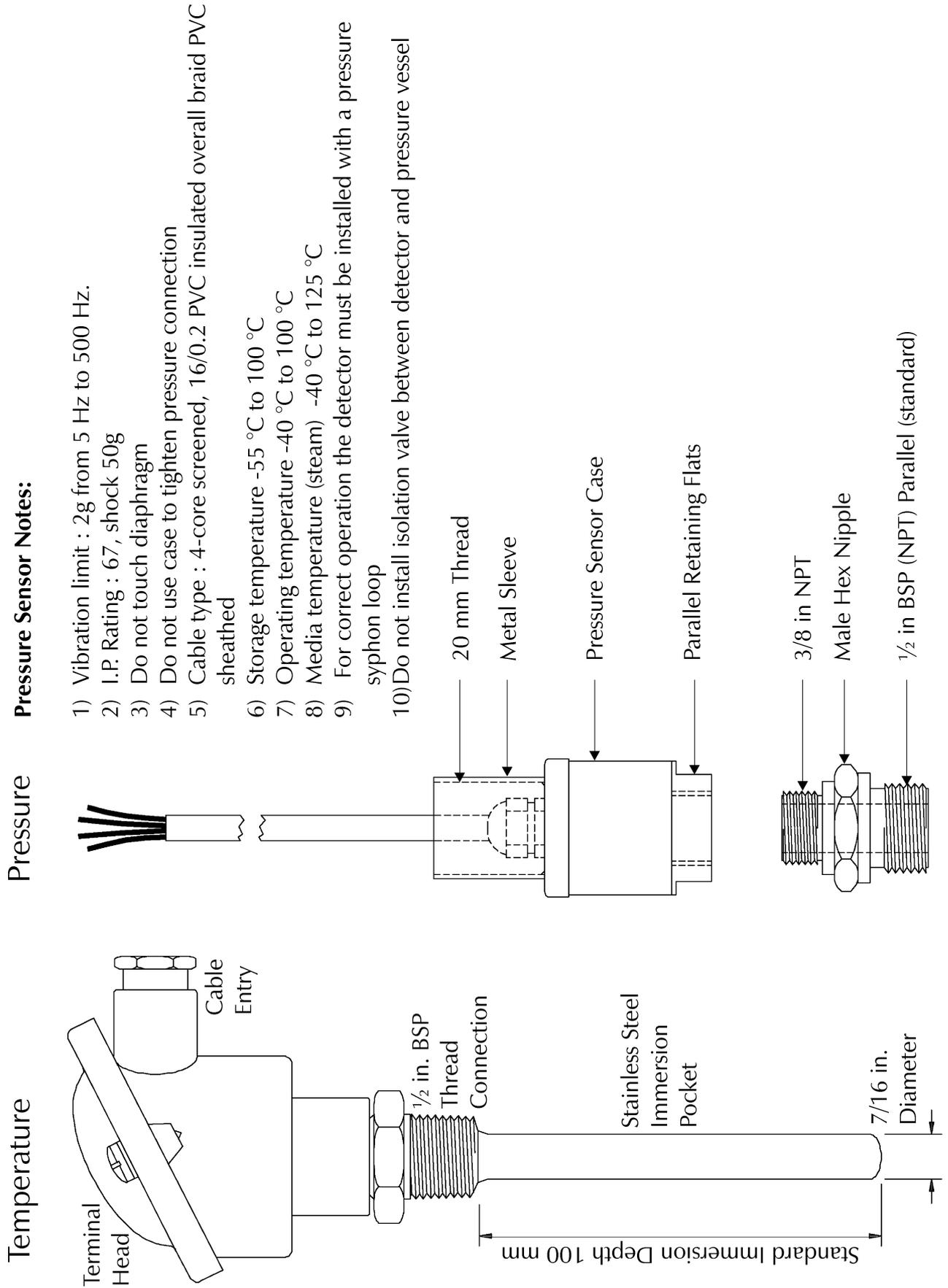
BURNER CONTROLLER : MM Mk. 6



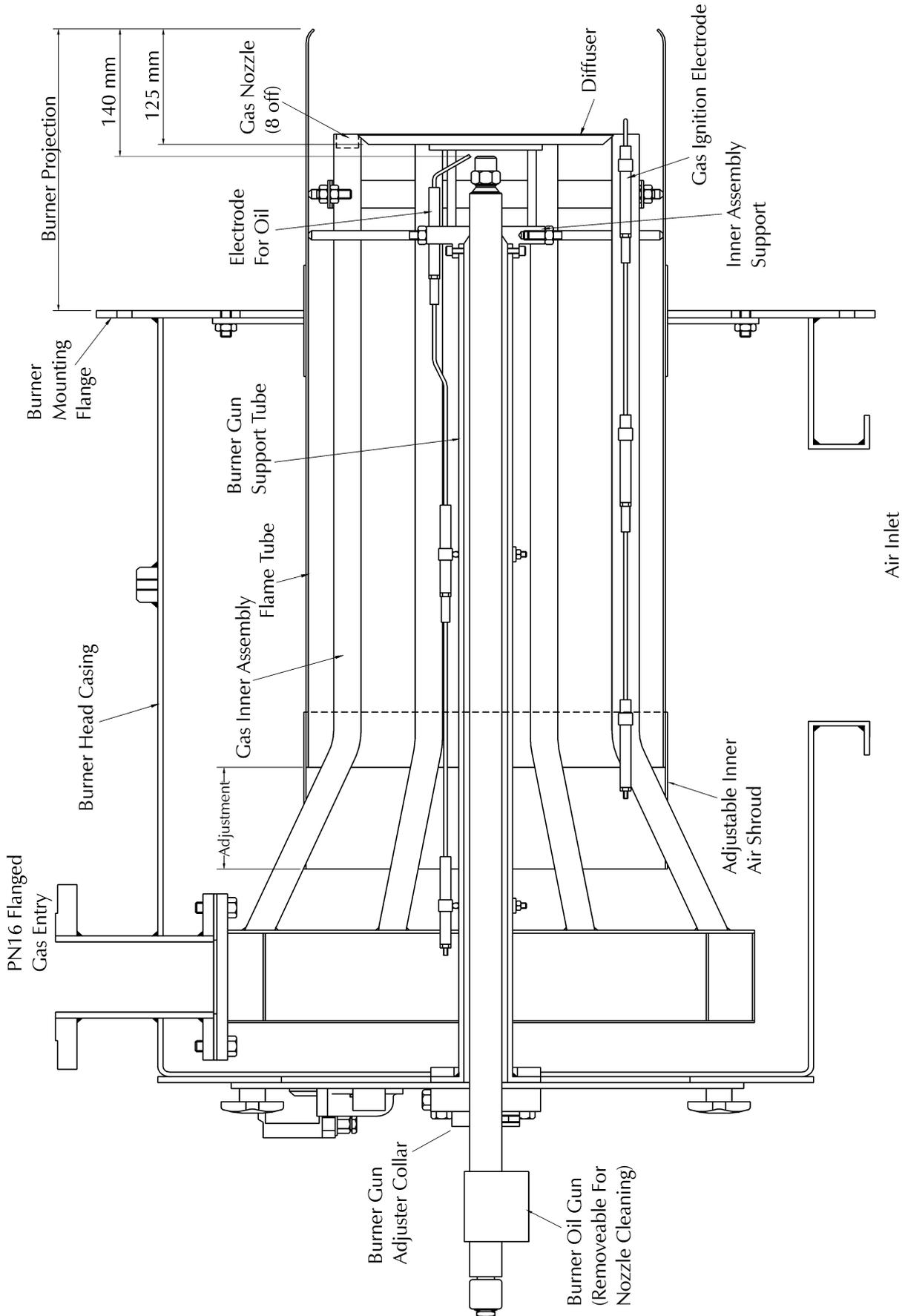
POSITIONING MOTOR



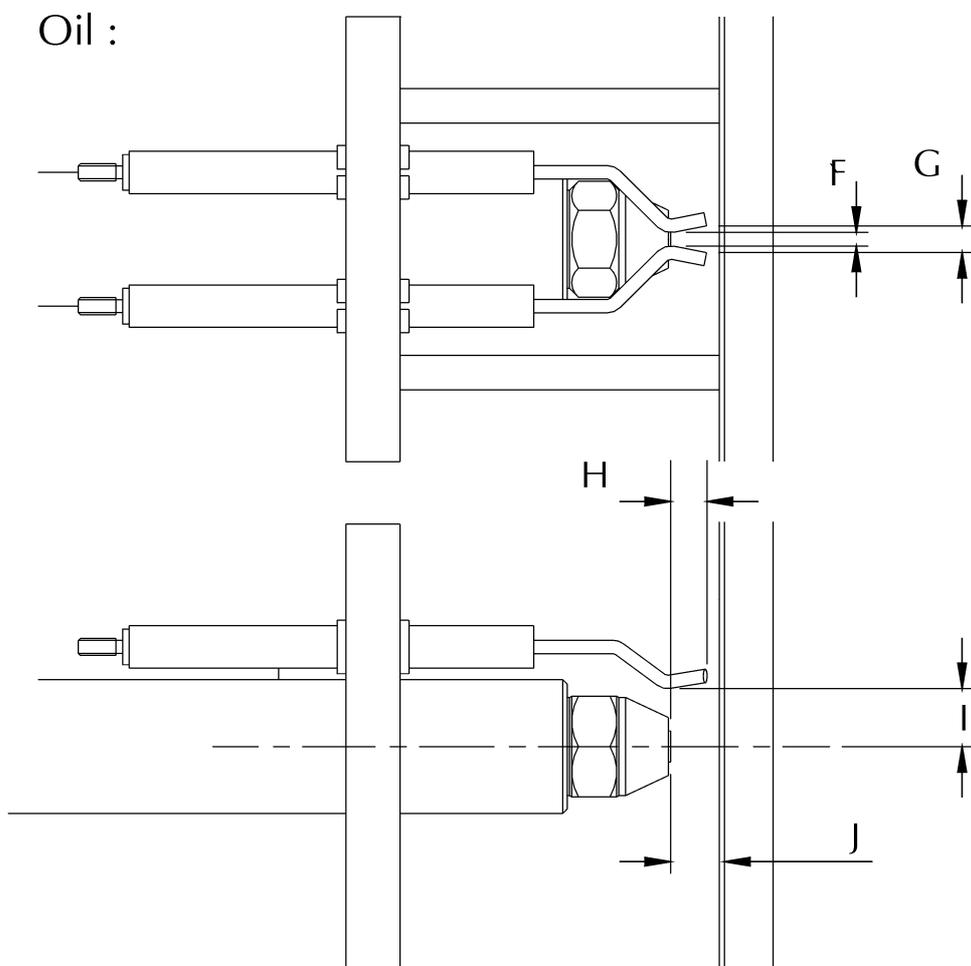
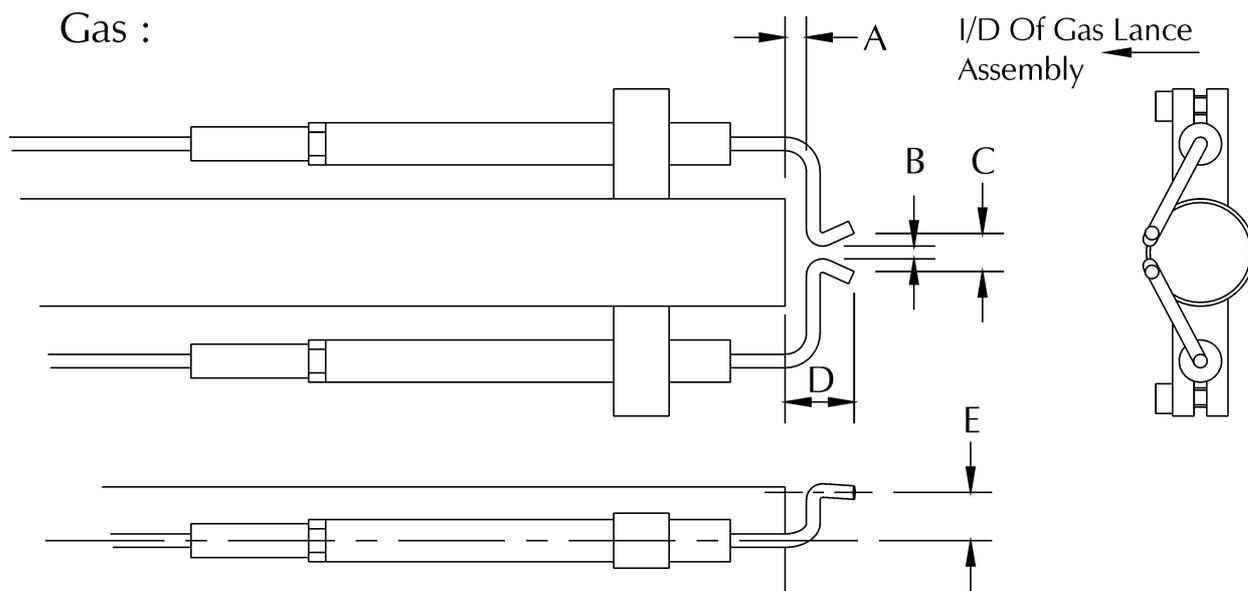
TEMPERATURE AND PRESSURE DETECTOR



BURNER HEAD



ELECTRODE SETTING DETAIL



Electrode Settings			
A	5 mm	F	3 mm
B	3.0 - 3.5 mm	G	10 mm
C	6.0 - 6.5 mm	H	10 mm
D	16 mm	I	13 mm
E	Mean Radius Of Gas Tube Wall	J	15 mm

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Burners\PFinal\C_Tech\PDF\MM Mk6\EGA\C_Tech.P65*

Revision 100401A



COMMISSIONING

INDIVIDUAL SETTING RECORD

This manual contains commissioning sheets (Pages D.14 and D.15) 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 P 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 CORGI 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

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.

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 (Technical Specification Page C.10) 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. (Technical Specification Pages C.19).
- 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 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. The burner control system EGA option enables the necessary flue product analyses to be made. The EGA probe must be installed and ready for use.
- 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.
- Press CLOSE. The CLOSE light will become steady and the ENTER light will begin to flash. If the CLOSE light remains flashing then the controlling instruments are not calling for heat and appropriate action must be taken. The LCD panel will display the default closed positions for the fuel valve (CH1) and the air valve (CH2).

Options and Parameters

The microprocessor controller is pre-configured before the burner leaves the factory. It may be necessary to change some values to suit particular application or site conditions. Data is stored as either 'Options' or 'Parameters'. For safety reasons certain critical data is entered both as a parameter and an option. A full list of Option and Parameter values is described on pages 2 to 19 of section 2.14.2.4 and pages 2 to 4 of section 2.14.2.5 of the MM/EGA Technical Manual that accompanies this handbook.

Enter Option Setting mode as follows :

- Press the UP and DOWN arrow buttons in the top row (CH1) simultaneously. 'Option' and 'Value' appear on the left hand side of the LCD display. On the right of the display is the option number and below it the numeric value assigned to that option. Initially the value for option 1 is displayed.

Using the second row of UP and DOWN arrow buttons scroll through the list of options.

Changing Option settings can determine whether the burner complies with relevant local standards and codes of practice. 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.

Use the third row of UP and DOWN arrow buttons to adjust the assigned values if necessary.

When all the Option values have been checked, leave Option Setting mode :

- Press ENTER, the CLOSE light is flashing and the COM light is on.
- Switch off the burner.
- Switch off the electrical power to the control panel.

Enter Parameter Setting mode as follows :

- Establish the electrical supply to the control panel and switch on the burner.
- Enter the Pass Code as described earlier.

COMMISSIONING THE BURNER

The Micro-Modulation Display, as shown on page C.16, is used to program the system and retrieve information from it.

The system has many functions; several of them need a pass code before the user can obtain access to them.

Entering the Pass Code

Enter the Pass Code as follows:

- Ensure that all the controlling instruments are calling for heat.
- Select the required fuel with the fuel selector switch on the control panel.
- Establish the electrical supply to the control panel.
- Switch on the burner.
- After a short interval the COM light on the controller panel begins to flash.
- Press COM. The CLOSE light flashes and 'Password' appears on the display together with the values for channels 1 & 2. (Note: if COM is not pressed within 5 seconds, the light goes off. To continue, re-start the procedure from "switch on the burner").
- Enter the access code 254 in the CH1 window by using the top row of UP and DOWN arrow buttons.
- Enter the access code 01 in the CH2 window by using the second row of UP and DOWN arrow buttons.

- Enter Parameter Mode by pressing the OPEN and CLOSE buttons simultaneously. The Set Parameters screen will appear on the LCD display. On the right of the display is the parameter number and below it the numeric value assigned to that parameter. Initially the value for parameter 1 is displayed.

Using the second row of UP and DOWN arrow buttons scroll through the list of parameters.

Changing Parameter settings can determine whether the burner complies with relevant local standards and codes of practice.

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.

Use the third row of UP and DOWN arrow buttons to adjust the assigned values if necessary.

When all the Parameter values have been checked, leave Parameter Setting mode :

- Press ENTER, the CLOSE light is flashing and the COM light is on.
- Switch off the burner.
- Switch off the electrical power to the control panel.

INITIAL SETTINGS : GAS

To prepare the burner for commissioning:

1. Check that the electrical power to the control panel and to the burner is off.
2. Ensure that the gas manual isolation valve is closed.
3. Check and if necessary re-set the ignition electrode gaps. The burner head arrangement is shown on Technical Specification Page C.20 and the electrode details are shown on Page C.21. The access instructions are provided in Operation and Maintenance on Page E.3.
4. Adjust the pressure governor of the SKP20 valve. Remove the brass plug from the center of the governor housing and using a flat blade screwdriver, set the adjuster 1/3rd in from the fully out position. (Note: there are 24 complete revolutions of the adjuster from fully in to fully out).
5. Set up the positioning motor potentiometers for the fuel and air valves as follows :
 - Ensure that all the controlling instruments are calling for heat.

- Select gas with the fuel selector switch on the control panel.
- Establish the electrical supply to the control panel and switch on the burner.
- Enter the Pass Code.
- Enter 0.0 in the CH1 window by using the top row of UP and DOWN arrow buttons.
- Enter 0.0 in the CH2 window by using the second row of UP and DOWN arrow buttons.
- For the air positioning motor : visually check that the air damper is fully closed. If not, drive the motor using the Up and Down buttons on CH2 to visually close the damper. Slacken the tamper-proof screws securing the air motor potentiometer (see Technical Specification Page C.18) and slowly turn the potentiometer to give a value of 0.0. In the CH2 window. Tighten the tamper-proof screws and re-check the air damper is fully closed when 0.0 is displayed in the CH2 window.
- For the fuel positioning motor : it is necessary to remove the positioning motor. Manually position the fuel valve slot to its closed position. Note the position of the drive pin on the positioning motor. Use the UP and DOWN arrow buttons to position the pin so that when the positioning motor is re-assembled to the valve it is in line with the slot. Re-assemble the positioning motor to the valve, loosen the three tamper proof screws and proceed to adjust the potentiometer position until 0.0 is displayed in the CH1 window.
- Press ENTER. The OPEN light will begin to flash.
- Switch off the burner.
- Switch off the electrical power to the control panel.

DRY RUN : GAS

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

1. Check that the electrical supply to the control panel and burner are turned off.
 2. Switch the burner On/Off switch to 'OFF' position.
 3. Set the Fuel Selector to 'Gas'.
 4. Ensure that the gas manual isolation valve is closed.
 5. Check that the gas pipework between the plant isolation valve and the safety-shut-off valve 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'.
 6. Set the Hand/Auto switch on the control panel to the 'Hand' position.
 7. If a gas booster is fitted, ensure that it is turned on.
 8. Establish the electrical supply to the control panel. Press the re-set button if necessary.
 10. Ensure that the flame detection system detects the presence of a simulated flame or, where permissible an independent flame source.
Remove the flame detector from the burner, expose the detector to a flame or simulated flame. This should cause a lockout indicated by illumination of the corresponding indicator light on the control panel.
 11. Replace the flame detector in its housing in the burner. Reset the sequence controller using the 'Reset' button on the control panel.
 12. Switch off the gas booster.
 13. Switch off the electrical power supply to the control panel and to the burner.
- 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, **FUEL AND ELECTRICITY SUPPLIES SHALL BE ISOLATED IMMEDIATELY** (electrical switches should not be thrown in areas where gas/air mixtures exist) 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.
 - The gas supply lines must be closed using the manual isolation valve (Technical Specification Page C.10).

Gas Supply Pressure

The supply pressure at the inlet to the burner shall not be less than that required for the maximum required continuous output from the burner and **NOT** more than 300 mbar (250mbar for DN125 valves). Fuel gas pressure requirements are presented in the Burner Specification Sheet (Technical Specification Page C.2).

Before proceeding with commissioning:

1. Fit a suitable pressure measuring device to the pressure test point on the upstream side of the SKP20 safety-shut-off valve, (Technical Specification Page C.10).
2. Switch on the gas booster (if fitted).
3. Slowly open the gas isolation valve at the inlet to the gas train.
5. Check that the fuel gas pressure is within the specified range for the particular installation.
6. Close the gas isolation valve at the inlet to the gas train.
7. Switch off the gas booster (if fitted).
8. Remove the pressure measuring device from the pressure test point.

Initial Checks

1. Slowly open the gas isolation valve at the inlet to the gas train.
2. Establish electrical supply to the control panel and switch the burner on. If the burner sequence controller is at lockout press the re-set button.

LIVE RUN : GAS

General

The instructions in this section are presented as a 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 must precede such actions. At all stages, the operation of the burner should be checked against the programming sequence controller diagram (Technical Specification Page C.17).

Before proceeding check again that :



3. Wait for the valve proving cycle to complete.
Warning - During this period fuel gas will be admitted to the region between the two shut-off valves, so the system is pressurised.
4. The fan will start.
5. **IMMEDIATELY CLOSE** the gas isolation valve.
6. Observe that the rotation of the combustion air fan is in the direction of the arrow on the fan casing. If the fan rotation is incorrect, switch off the electricity supply and take action to remedy this.
7. The burner will proceed through its ignition sequence. Check that an ignition spark is present..
8. The ignition spark will cease and the system will go to lockout.
9. Switch off the burner and the electrical power supply to the control panel.
8. Set up the positioning motors to the fully open positions as follows:
 - Press OPEN. The OPEN light will become steady and the ENTER light will begin to flash.
 - Enter 90.0 in the CH1 and CH2 windows by using the UP and DOWN arrow buttons.
 - Press ENTER. The START light will begin to flash.
9. Set up the positioning motors to the initial ignition positions as follows:
 - Press START. The START light will become steady and the ENTER light will begin to flash.
 - Enter a start position in the CH1 and CH2 windows by using the UP and DOWN arrow buttons. This start position is only to ignite the burner initially and does not have to be clean combustion. A good starting point might be 20.0 for the fuel position (CH1) and 10.0 for the air valve position (CH2). These values may have to be adjusted to achieve ignition.

Establishing The Gas Flame

1. Ensure that all the controlling instruments are calling for heat.
2. Check that the gas manual isolation valve is closed.
3. Select gas with the fuel selector switch on the control panel.
4. Establish the electrical supply to the control panel.
5. Switch on the burner.
6. Enter the Pass Code.
7. Set up the positioning motors to the fully closed positions as follows:
 - Press CLOSE. The CLOSE light will become steady and the ENTER light will begin to flash. If the CLOSE light remains flashing then the controlling instruments are not calling for heat and appropriate action must be taken. The LCD panel will display the default closed positions for the fuel valve (CH1) and the air valve (CH2).
 - Enter 0.0 in the CH1 window by using the top row of UP and DOWN arrow buttons.
 - Enter 0.0 in the CH2 window by using the second row of UP and DOWN arrow buttons.
 - Press ENTER. The OPEN light will begin to flash.
10. Slowly open the gas manual isolation valve
Warning - From this point onwards the ignition sequence will be initiated and fuel will be admitted to the burner. Care must be exercised.
11. Begin the ignition sequence by pressing ENTER. The START light will begin to flash again.
The burner should proceed through the start-up sequence and ignite at the valve positions set in Step 9 above. If the burner fails to ignite or ignition is unstable then switch off the burner and repeat the procedure from step 1, using modified CH1 and/or CH2 START values as set in step 9.
12. The burner is firing with the initial arbitrary start valve positions which are not memorised. To set the memorised positions for subsequent ignitions under normal operation, adjust the 'golden start' valve positions as follows :
 - Press START
 - Adjust the fuel (CH1) and air (CH2) valve positions using the corresponding UP and DOWN arrow buttons to give the optimum start flame.

- Press ENTER - the start flame settings are now memorised and the HIGH light will begin to flash.

NOTE : The maximum value of the start gas flow rate will be found in the appropriate standard

13. With the burner running at start rate, prepare the controller for transition to high flame by pressing HIGH. The HIGH light will become steady, and the EGA light will begin to flash. No changes to the valve positions will occur at this time.
14. Press EGA. The display will show the exhaust gas analysis and temperature. The EGA and MM buttons toggle the display between the exhaust analysis and the valve positions. Press MM to return to the valve position display.
15. Slowly modulate the burner to high flame by small adjustments to the valve positions. Lead with the air (CH2) followed by the fuel (CH1) using the corresponding UP and DOWN arrow buttons.

Warning - the transition to high flame should be at a rate consistent with the requirements of the boiler, taking into account the starting temperature and pressure. If in doubt refer to the boiler manufacturer.

During the transition to high flame :

- Monitor the firing rate.
- Monitor the exhaust gas analysis by toggling between EGA and MM buttons.

If the fuel valve position (CH1) reaches 90.0 before the desired firing rate is achieved, then adjust the SKP20 gas governor to increase the gas rate. If the desired firing rate is achieved before the fuel valve position (CH1) reaches 90.0 then adjust the gas governor to decrease the gas rate. The aim is to have the desired firing rate at a gas valve position of 90.0.

16. Check that the combustion is clean. If the CO₂ is too low, press MM and slowly decrease the air valve position by using the CH2 DOWN arrow button to give the correct CO₂. If the CO₂ is too high, press MM and slowly increase air valve position by adjusting the CH2 UP arrow button to give the correct CO₂. Check that the gas rate is correct for high flame and adjust the governor setting if necessary.

17. Toggle to EGA mode if necessary by pressing EGA. The ENTER light will begin to flash.
18. Press ENTER. Wait until the INTER light flashes. This will take a few minutes as the system carries out the 'Auto Commission' routine.
19. Press INTER. The INTER light will become steady and the EGA light will begin to flash.
20. Reduce the air and fuel valve positions using the corresponding DOWN arrow buttons.
21. Press EGA.
22. Check that the combustion is clean. If the CO₂ is too low, press MM and slowly increase the fuel valve position by using the CH1 UP button to give the correct CO₂. If the CO₂ is too high, press MM and slowly increase the air valve position by adjusting the CH2 UP button to give the correct CO₂.
23. Toggle to EGA mode if necessary by pressing EGA. The ENTER light will begin to flash.
24. Store this intermediate position by pressing ENTER. Wait until the INTER light flashes. This will take a few minutes as the system carries out the 'Auto Commission' routine.
25. Repeat from step 19 until you consider enough INTER positions have been entered and the START light is flashing.
26. Press START. The START light will become steady and the EGA light will begin to flash.
27. Reduce the air and fuel valve positions to the low flame settings using the DOWN buttons.
28. Press EGA.
29. Check that the combustion is clean. If the CO₂ is too low, press MM and slowly increase the fuel valve position by using the CH1 UP button to give the correct CO₂. If the CO₂ is too high, press MM and slowly increase the air valve position by adjusting the CH2 UP button to give the correct CO₂.
30. Check that the gas rate is correct for low flame. If the gas rate is too low, toggle to MM mode and slowly increase the air and gas valve positions by using the UP buttons. If the gas rate is too high, toggle to MM mode and slowly decrease the air and gas valve positions by using the DOWN arrow buttons. Repeat from step 28 until the gas rate is correct for low flame.

31. Press ENTER. Wait until the RUN light flashes. This will take a few minutes as the system carries out the 'Auto Commission' routine.
32. Press RUN.
33. Switch off the burner and the electrical power supply to the control panel.

Setting The Gas Pressure Sensor Low Limit

Carry out this procedure when the appliance controls are calling for heat and the burner will be required to operate at high flame.

1. Switch off the burner and the electrical power supply to the control panel.
 2. Fit a suitable pressure measuring device to the pressure test point on the downstream side of the SKP20 safety-shut-off valve, (Technical Specification Page C.10) so that the pressure in the test space can be monitored.
 3. Select 'Gas' with the fuel selector switch.
 4. Set the Hand/Auto switch to Auto.
 5. Establish the electrical supply to the control panel and switch on the burner. Allow the burner to proceed through its operating sequence and modulate to high fire.
 6. Observe the pressure in the test space when the burner is operating at high flame. Calculate the value for the lower limit by taking XX% of the observed value.
 7. Switch off the burner and the electrical power supply to the control panel.
 8. Using the the procedures for entering Option Mode and Parameter Mode and changing assigned values described on pages D.3 & D.4 set the low gas pressure limit (Option 136 and Parameter 136) to the low limit value calculated above.
- Note : ensure that the pressure calculated and input as the low limit is expressed in the same units that the controller is set to display.**
9. Establish the electrical supply to the control panel and switch on the burner. Allow the burner to proceed through its operating sequence and modulate to high fire.
 10. Whilst monitoring the pressure in the test space, slowly close the manual isolation valve. Verify that the burner shuts-down at the appropriate pressure.

11. Open the manual isolation valve
12. Switch off the burner and the electrical power supply to the control panel.

INITIAL SETTINGS : OIL

If not already completed (ie: Gas has not been commissioned) carry out procedures 1,2,3 & 5 under the heading "Initial Settings : Gas" on page D4.

In addition check the setting of the four residual oil thermostats (where relevant). The required values are shown in the Technical Specification page C.15.

DRY RUN : OIL

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

1. Check that the electrical supply to the control panel and burner are turned off.
 2. Switch the burner On/Off switch to 'OFF' position.
 3. Set the Fuel Selector to 'Oil'.
 4. Ensure that the gas manual isolation valve is closed.
 5. Check that the oil pipework and ringmain are ready for operation.
 6. Set the Hand/Auto switch on the control panel to the 'Hand' position.
 7. Establish the electrical supply to the control panel. Press the re-set button if necessary.
 8. Ensure that the flame detection system detects the presence of a simulated flame or, where permissible an independent flame source.
- Remove the flame detector from the burner, expose the detector to a flame or simulated flame. This should cause a lockout indicated by illumination of the corresponding indicator light on the control panel.
9. Replace the flame detector in its housing in the burner. Reset the sequence controller using the 'Reset' button on the control panel.
 10. Switch off the electrical power supply to the control panel and to the burner.

LIVE RUN : OIL

General

The instructions in this section are presented as a 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 must precede such actions. At all stages, the operation of the burner should be checked against the programming sequence controller diagram (Technical Specification Page C.17).

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 oil supply pipework is correctly installed and has been leak tested. If, at any time during commissioning, there is a fuel leak, **FUEL AND ELECTRICITY SUPPLIES SHALL BE ISOLATED IMMEDIATELY** 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.
- The gas supply lines must be closed using the manual isolation valve (Technical Specification Page C.10).

Oil Supply Temperature And Pressure

Check that the temperature and pressure of the oil delivered to the burner are as stated in General information Page B.8.

Initial Checks

1. Establish electrical supply to the control panel and switch the burner on. If the burner sequence controller is at lockout press the re-set button.
2. The fan will start.
3. If not previously checked, observe that the rotation of the combustion air fan is in the direction of the arrow on the fan casing. If the fan rotation is incorrect, switch off the electricity supply and take action to remedy this.

4. 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 Operation and Maintenance Page E.3).
5. The ignition spark will cease and the system will go to lockout.
6. Switch off the burner and the electrical power supply to the control panel.

Establishing The Oil Flame

1. Ensure that all the controlling instruments are calling for heat.
2. Check that the gas manual isolation valve is closed.
3. Select 'Oil' with the fuel selector switch on the control panel.
4. Establish the electrical supply to the control panel.
5. Switch on the burner.
6. Enter the Pass Code.
7. Set up the positioning motors to the fully closed positions as follows:
 - Press CLOSE. The CLOSE light will become steady and the ENTER light will begin to flash. If the CLOSE light remains flashing then the controlling instruments are not calling for heat and appropriate action must be taken. The LCD panel will display the default closed positions for the fuel valve (CH1) and the air valve (CH2).
 - Enter 0.0 in the CH1 window by using the top row of UP and DOWN arrow buttons.
 - Enter 0.0 in the CH2 window by using the second row of UP and DOWN arrow buttons.
 - Press ENTER. The OPEN light will begin to flash.
8. Set up the positioning motors to the fully open positions as follows:
 - Press OPEN. The OPEN light will become steady and the ENTER light will begin to flash.
 - Enter 90.0 in the CH1 and CH2 windows by using the UP and DOWN arrow buttons.

- Press ENTER. The START light will begin to flash.
9. Set up the positioning motors to the initial ignition positions as follows:
 - Press START. The START light will become steady and the ENTER light will begin to flash.
 - Enter a start position in the CH1 and CH2 windows by using the UP and DOWN arrow buttons. This start position is only to ignite the burner initially and does not have to be clean combustion. A good starting point might be 20.0 for the fuel position (CH1) and 10.0 for the air valve position (CH2). These values may have to be adjusted to achieve ignition.
 10. **Warning - From this point onwards the ignition sequence will be initiated and fuel will be admitted to the burner. Care must be exercised.**
 11. Begin the ignition sequence by pressing ENTER. The START light will begin to flash again.
The burner should proceed through the start-up sequence and ignite at the valve positions set in Step 9 above. If the burner fails to ignite or ignition is unstable then switch off the burner and repeat the procedure from step 1, using modified CH1 and/or CH2 START values as set in step 9.
 12. The burner is firing with the initial arbitrary start valve positions which are not memorised. To set the memorised positions for subsequent ignitions under normal operation, adjust the 'golden start' valve positions as follows :
 - Press START
 - Adjust the fuel (CH1) and air (CH2) valve positions using the corresponding UP and DOWN arrow buttons to give the optimum start flame.
 - Press ENTER - the start flame settings are now memorised and the HIGH light will begin to flash.
 13. With the burner running at start rate, prepare the controller for transition to high flame by pressing HIGH. The HIGH light will become steady, and the EGA light will begin to flash. No changes to the valve positions will occur at this time.
 14. Press EGA. The display will show the exhaust gas analysis and temperature. The EGA and MM buttons toggle the display between the exhaust analysis and the valve positions. Press MM to return to the valve position display.
 15. Slowly modulate the burner to high flame by small adjustments to the valve positions (CH1 for fuel and CH2 for air) using the corresponding UP and DOWN arrow buttons.
Warning - the transition to high flame should be at a rate consistent with the requirements of the boiler, taking into account the starting temperature and pressure. If in doubt refer to the boiler manufacturer.
During the transition to high flame :
 - Monitor the firing rate by observing the oil spill pressure . The spill pressure equivalent to the maximum burner rate can be found on the burner data plate located on the burner casing.
 - Monitor the exhaust gas analysis by toggling between EGA and MM buttons.
 Continue increasing the firing rate until the appropriate spill pressure is achieved.
 16. Check that the combustion is clean. If the CO₂ is too low, press MM and slowly decrease the air valve position by using the CH2 DOWN arrow button to give the correct CO₂. If the CO₂ is too high, press MM and slowly increase air valve position by adjusting the CH2 UP arrow button to give the correct CO₂. Check that the spill pressure is still correct for high flame and adjust the fuel valve position (CH1) if necessary.
 17. Toggle to EGA mode if necessary by pressing EGA. The ENTER light will begin to flash.
 18. Press ENTER. Wait until the INTER light flashes. This will take a few minutes as the system carries out the 'Auto Commission' routine.
 19. Press INTER. The INTER light will become steady and the EGA light will begin to flash.
 20. Reduce the air and fuel valve positions using the corresponding DOWN arrow buttons.
 21. Press EGA.

22. Check that the combustion is clean. If the CO₂ is too low, press MM and slowly increase the fuel valve position by using the CH1 UP button to give the correct CO₂. If the CO₂ is too high, press MM and slowly increase the air valve position by adjusting the CH2 UP button to give the correct CO₂.
23. Toggle to EGA mode if necessary by pressing EGA. The ENTER light will begin to flash.
24. Store this intermediate position by pressing ENTER. Wait until the INTER light flashes. This will take a few minutes as the system carries out the 'Auto Commission' routine.
25. Repeat from step 19 until you consider enough INTER positions have been entered and the START light is flashing.
26. Press START. The START light will become steady and the EGA light will begin to flash.
27. Reduce the air and fuel valve positions to the low flame settings using the DOWN buttons. Monitor the firing rate by observing the oil spill pressure. The spill pressure equivalent to the minimum burner rate can be found on the burner data plate located on the burner head casing.
28. Press EGA.
29. Check that the combustion is clean. If the CO₂ is too low, press MM and slowly decrease the air valve position by using the CH2 Down button to give the correct CO₂. If the CO₂ is too high, press MM and slowly increase the air valve position by adjusting the CH2 UP button to give the correct CO₂.
30. Re-check that the oil spill pressure is correct for low flame. If the pressure is too high, toggle to MM mode and slowly increase the air and fuel valve positions by using the UP buttons. If the pressure is too low, toggle to MM mode and slowly decrease the air and fuel valve positions by using the DOWN arrow buttons. Repeat from step 28 until the oil spill pressure is correct for low flame.
31. Press ENTER. Wait until the RUN light flashes. This will take a few minutes as the system carries out the 'Auto Commission' routine.
32. Press RUN.
33. Switch off the burner and the electrical power supply to the control panel.

FINAL COMMISSIONING STAGES - OIL AND GAS

Checking The Flame Signal

The flame signal can be checked from the 'Flame Scanner Status' screen menu.

With the burner running on main flame, press the button marked 'Flame Scanner' on the microprocessor control panel to change the display to the 'Flame Scanner Status' screen. The flame signal will be represented by a number in the top centre of the screen.

For reliable operation, a flame signal in excess of the value 10 is required under all load conditions on both gas and oil firing.

Setting The Air Pressure Sensor

1. Check that the electrical supply to the control panel off and that the burner is off.
2. Fit a manometer or other approved pressure measuring instrument so that the actual measured air pressure can be compared to the pressure switch dial setting.
3. Check that the Hand/Auto switch is set to Hand operation.
4. 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.
5. Observe the actual air pressure when the burner is operating at low flame. Calculate the value for the lower limit by taking XX% of the observed value.
6. Switch off the burner and the electrical power supply to the control panel.
7. Using the the procedures for entering Option Mode and Parameter Mode and changing assigned values described in the Initial Settings section on pages D.3 & D.4 set the low gas pressure limit (Option 149 and Parameter 149) to the low limit value calculated above.
Note : ensure that the pressure calculated and input as the low limit is expressed in the same units that the controller is set to display.
8. Establish the electrical supply to the control panel and switch on the burner. Allow the burner to proceed through its operating sequence.

9. Remove the pressure measuring equipment.

Set-Point Adjustment

To enter or edit the controller set-point, which is also known as the 'Required Value' (Re), follow the procedure below :

1. Establish the electrical power supply to the control panel.
2. Select the either fuel with the fuel selector switch on the control panel.
3. If oil is the selected fuel :
 - Close the manual gas isolation valve
 - Ensure that the oil supply is operational at the correct temperature and pressure
4. Set the Hand/Auto switch to Auto
5. Switch on the burner. The burner will go through the ignition sequence and be released to modulation under the control of the burner controller.
6. Press the STATUS button on the microprocessor control panel and use the bottom row of UP and DOWN arrow buttons to adjust the Re value in the display.

The range of adjustment of the required value is limited by the type of sensor being used.

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.

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 CONCISE EMERGENCY SHUTDOWN PROCEDURES ARE DISPLAYED.**

COMMISSIONING SHEET : GAS

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.

Installer's Name :

Address :

Site Address :

Appliance	Type :	Size :	Serial No. :
Burner	Type :	Size :	Serial No. :

Commissioning Date :

Guarantee Expiry Date :

Fuel Gas Type :

Gas pressure at the upstream tapping on the first shut-off valve :

Standing mbar or ins w.g. Running mbar or ins w.g.

Firing Rate		High Fire	Intermediate Positions					Low Fire	Units ¹
Pressure at burner head	Gas							mbar or ins w.g.	
	Air							mbar or ins w.g.	
Gas rate								m ³ /h or ft ³ /h	
Heat input								MW or MJ/h or Btu/h	
O ₂								% Dry Basis	
CO ₂								% Dry Basis	
CO								ppm Dry Basis	
Flue Temp.								°C or °F	
Ambient Temp.								°C or °F	
Temp. Difference								°C or °F	
Efficiency								%	

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

COMMISSIONING SHEET : OIL

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.

Installer's Name :

Address :

Site Address :

Appliance	Type :	Size :	Serial No. :
Burner	Type :	Size :	Serial No. :

Commissioning Date :

Guarantee Expiry Date :

Fuel Oil Type :

Oil pressure upstream of pump :

Standing bar or psi Running bar or psi

Firing Rate		High Fire	Intermediate Positions				Low Fire	Units ¹
Pressure at burner	Oil						bar or psi	
	Air						mbar or ins w.g.	
Oil rate							kg/h or lb/h	
Heat input							MW or MJ/h or Btu/h	
O ₂							% Dry Basis	
CO ₂							% Dry Basis	
CO							ppm Dry Basis	
Flue Temp.							°C or °F	
Ambient Temp.							°C or °F	
Temp. Difference							°C or °F	
Efficiency							%	

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



OPERATION AND MAINTENANCE

NORMAL OPERATION

End User Operation

1. Establish the electrical power supply to the control panel.
2. Select the required fuel with the fuel selector switch on the control panel.
3. If oil is the selected fuel :
 - Close the manual gas isolation valve
 - Ensure that the oil supply is operational at the correct temperature and pressure
4. Set the Hand/Auto switch to Auto
5. Switch on the burner. Upon initial selection of a commissioned fuel, a logo screen flashes up followed by the 'MM STATUS' display. The COM light flashes for five seconds. If the burner control circuit is closed the burner system will sequence through the burner start up procedure. The system purges and ignites, and twenty seconds (nominal) after ignition the system modulates.

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.

Controller Displays

Several different displays are available to provide the operator with information through start-up and normal operation. Values are displayed according to the selected screen and these are shown in detail on page 2 of section 2.14.1.5 of the M.M./E.G.A. Technical Manual that accompanies this handbook.

To select one of the display modes just press the corresponding button. The respective light will remain illuminated to indicate which mode is selected.

Software Version

The software version number can be displayed by pressing the Top CH1 UP and DOWN buttons simultaneously, when in the MM display mode.

Exhaust Gas Analyser

The E.G.A. will calibrate every time the burner starts and stops. When COM or EGA display modes are selected CAL is displayed when the EGA is calibrating. If the E.G.A. is cooling, COOL is displayed. If the burner is not firing, EGA is displayed. When the burner is firing both modes show EGA. If the Actual value has not reached the value at which trimming is permitted. If an E.G.A. error has occurred the error code number is displayed if either of EGA or COM modes are selected.

FUEL CHANGEOVER PROCEDURE

The procedure to be followed when switching fuels during normal operation is as follows:

Switching From Gas To Light Oil

- 1 Switch off the burner and the electrical power supply to the burner.
- 2 Close the manual gas isolation valve.
- 3 Turn the fuel selector switch on the control panel to the oil position.
- 4 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.

Switching From Gas To Heavy Oil

- 1 Switch off the burner and the electrical power supply to the burner.
- 2 Close the manual gas isolation valve.
- 3 Ensure that oil is available at the required temperature (refer to the table on Page 13) and pressure.
- 4 Turn the fuel selector switch on the control panel to the oil position.
- 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.

Switching From Oil To Gas

- 1 Switch off the burner and the electrical power supply to the burner.
- 2 Open the manual gas isolation valve.
- 4 Turn the fuel selector switch on the control panel to the gas position.

- 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. If the burner has been operating on oil for a prolonged period it may be necessary to purge the gas line of air.

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 light. 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.

Gas Pressure Sensor Low Limit

Carry out this procedure when the appliance controls are calling for heat and the burner will be required to operate at high flame.

1. Switch off the burner and the electrical power supply to the control panel.
2. Fit a suitable pressure measuring device to the pressure test point on the downstream side of the SKP20 safety-shut-off valve, (Technical Specification Page C.10) so that the pressure in the test space can be monitored.
3. Select 'Gas' with the fuel selector switch.
4. Set the Hand/Auto switch to Auto.
5. Establish the electrical supply to the control panel and switch on the burner. Allow the burner to proceed through its operating sequence and modulate to high fire.
6. Observe the pressure in the test space when the burner is operating at high flame.
7. Whilst monitoring the pressure in the test space, slowly close the manual isolation valve. Verify that the burner shuts-down at the appropriate pressure.
8. Open the manual isolation valve
9. Switch off the burner and the electrical power supply to the control panel.

Combustion Air Pressure Switch

1. Check that the electrical supply to the control panel and the burner are off.
2. Fit a manometer or other approved pressure measuring instrument so that the actual measured air pressure can be compared to the pressure switch dial setting.
3. Check that the Hand/Auto switch is in Hand operation.
4. 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.
5. Whilst monitoring the actual air pressure, restrict the combustion air supply by
6. Verify that the burner goes to lock-out at the appropriate pressure.
7. Remove the air supply restrictor
8. Switch off electrical supply to the control panel and to the burner
9. 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.

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.

Replace the plate and retaining nuts.

Burner Inner Assembly

Oil Nozzle

The oil lance can be removed separately from the burner for inspection and cleaning of the oil nozzle.

- 1 Disconnect the steel pipework between the oil lance and the main manifold block at the compression fittings.
- 2 Disconnect the hydraulic bleed hose at the quick release coupling on the oil lance.
- 3 Loosen the 2 vertical bolts clamping the oil lance at the backplate. **DO NOT loosen the collar fitted to the oil lance. This is the position stop.**
- 4 Pull the lance rearwards from the backplate until the nozzle is clear of the burner.

The Burner lance is designed to operate spill-back atomisers having a spring loaded orifice shut-off needle and a 7/8" x 20 UNEF fixing thread. The Fluidics W series atomiser is the preferred type.

Remove the nozzle from the oil lance. Unscrew and wash the filter in paraffin or similar medium. Further dismantling of the nozzle IS NOT recommended due to the close tolerances and finishes employed in its manufacture. Re-assemble the filter and refit the nozzle to the oil lance.

When the nozzle has completed 5000 hours of operation, it should be replaced with the same Make, Type and Size as fitted. Failure to do so will alter the characteristics of the burner and may impair the performance and efficiency of the plant. The nozzle identification code is stamped onto the face of the hexagonal nut section of the nozzle body as shown on Page C.7

Oil Inner Assembly

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

- 1 Disconnect the oil feed and spillback hoses at the quick release couplings on the main manifold block.
- 2 If the oil lance is fitted, disconnect the hydraulic bleed hose at the quick release coupling at the oil lance.
- 3 Remove the UV cell from its holder and secure to a safe place.
- 4 Insert the 3 off 1" BSP rods, supplied with the burner, into their corresponding sockets on the back face of the burner casing.
- 5 Loosen and remove the 4 handwheels securing the backplate to the burner casing.
- 6 Pull the backplate and oil inner assembly rearwards, sliding the backplate along the rails for 500-600mm.
- 7 Disconnect the 2 High Tension leads for the oil ignition electrodes, and secure to a safe place.
- 8 Pull the backplate and oil inner assembly rearwards and clear of the rails, guiding the inner assembly until the diffuser is clear of the burner casing.

Oil 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 C.19.

Air Diffuser

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 above.
- 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 rearwards 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 C.19.

Gas Nozzles

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

Check nozzle inserts for tightness.

Re-assembly

Re-assemble all components 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.

Oil Filters - Light Oil

If the filter fitted in the oil supply line has a disposable element this should be replaced at least once a year, more frequently if this is dictated by the condition of the fuel or other local conditions. If the filter element is re-usable it should be cleaned at appropriate intervals.

After filter cleaning operations it will be necessary to remove air from the system by bleeding the pump.

Oil Filters - Residual Oil

The oil filter located on top of the preheater should be removed and cleaned in paraffin or another suitable solvent.

SAFETY WARNING : CLASS 'G' OIL BURNERS OPERATE WITH OIL AT 140°C FOR ATOMISATION. THE BURNER SYSTEM SHOULD BE TAKEN OFF LINE AND ALLOWED TO COOL BEFORE ATTEMPTING THESE TASKS.

In the case of the cold oil filter, remove the plug from the sump and drain off any sludge and/or water present at six-weekly intervals. The cleaning knob on this filter should be rotated daily. After filter cleaning operations it will be necessary to remove air from the system by bleeding the pump.

Oil Preheater - Residual Oil Only

Regular checks should be made to ensure that the oil temperature is maintained at the correct level (refer to the table on Page B.8).

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/EGA system hardware.

Any error identified by the system is indicated by "ERROR" being displayed with the relevant error No. In the case of EGA related faults, "ERROR EGA" is displayed with the corresponding error identification code.

A full list of 'error', 'lockout' and diagnostic codes is described in the following relevant sections of the MM/EGA Technical Manual that accompanies this handbook.

Key to Errors Detected in the Mk.6 M.M. System:

Refer to Section 2.14.4.1.1

Mk.6 Burner Control Lockouts:

Refer to sections 2.14.4.2.1&2

Gas Sensor Related:

Refer to section 2.14.4.3.1

EGA Related:

Refer to section 3.4.1

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 of rotation is incorrect, interchange any two phases.

Fan Motor Fails To Start

Check that :

- 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 burner 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 control train causing a failure of the valve proving check
- The appliance controls are calling for heat
- The fuel selector switch is correctly set
- 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
- The oil preheater thermostats and oil temperature

Fan Motor Starts And Burner Goes To Lockout

If there is no ignition spark check that:

- The combustion air pressure sensor setting is correct
- 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 controller is not faulty

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

- The fuel 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 U.V. Cell is clean and correctly orientated (it must face towards the flame)
- The UV Cell and wiring are not faulty
- The burner controller is not faulty

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

- The oil supply to the burner
- The oil pump
 - The pump
 - The pump coupling
 - The pump drive motor
- The oil pressure and temperature are in accordance with the values in the Table on Page B.8

- The oil valve(s) have opened at the appropriate time in the sequence
- The filters are clear
- The nozzle is clear
- There is no carbon on the diffuser

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 that:

- The glass envelope on the U.V. 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 controller is not faulty
- The nozzle is clear
- There is no carbon on the diffuser
- 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 controller is not faulty
- The manual isolation valves are open fully and there are no partial blockages in the control train
- The MM Mk.6 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

Date	Details Of Service	Signature

NOTES

NOTES



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