

Installation & Maintenance Manual

PO Series Micro Modulating

Oil Burner

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IMPORTANT INFORMATION

SAFETY

It is essential that the following instructions and adjustments are carried out by qualified engineers that are experienced in forced draught pressure jet oil burner commissioning. 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 customers failing to follow these instructions, or as a result of misuse.

EMERGENCY INSTRUCTIONS

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

When used in accordance with the instructions provided, P Series Burners are unlikely to produce a hazardous condition. If, however, such a condition should arise in connection with the burner, the appliance or any instrument, machine or service in the vicinity of the burner, the **FUEL AND ELECTRICITY SUPPLIES SHALL BE ISOLATED IMMEDIATELY** and they shall remain isolated until the fault has been identified and rectified.

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

All burner and boiler bodies marketed separately within the European Union must comply with EN267 – Oil Burners, and EN303 – Heating Boilers. Burner adjustments must be made in accordance with the boiler manufacturers' instructions, and these must include flue gas temperatures, average water temperature and CO₂ or O₂ concentration.

GENERAL INFORMATION

INTRODUCTION

This handbook has been produced to enable users to install, commission and use P Series burners safely and efficiently. At each stage the conditions that should be met and the adjustments and other actions which should be carried out are detailed and the locations of the various components and adjustment mechanism are identified. where appropriate, this information is supported by tables and graphs.

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

FEATURES

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

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

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

Larger sizes of PO 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 8.

Fuel

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

An ultraviolet (UV) cell and automatic burner programming control unit provide continuous flame supervision.

Operating Mode

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

To ensure efficient operation of any boiler, two requirements are of paramount importance. The air to fuel ratio must be kept to a minimum whilst being sufficient for complete combustion and the settings for this condition, once arrived at, are accurately repeated. The temperature or pressure of the boiler must be monitored by the control system and the 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 mechanical modulating cam device. 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.

Modulation by Electronic Cam System

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

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

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

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

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

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

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

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

SITE CONDITIONS AND SERVICES

Flue and Chimney Requirements

It is 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 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.

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 9 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 10.

The inlet pressure of the oil will depend upon the type of oil. Oil must be handled and delivered at the appropriate temperatures and pressures.

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 supplied. 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 11 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 50Hz electrical supply is required. The power supply provided must comply with all relevant Codes and Standards.

BURNER PACKAGING, ASSEMBLY AND INSTALLATION

Packaging for Transit

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

- burner head, air plenum chamber and damper section with modulating air system
- modulating oil system as appropriate
- combustion air fan
- separate floor or wall-mounted 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 frontplate and appliance must be prepared; the details of the drilling arrangements are shown on page 9.

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

To assemble the burner:

1. Fit the burner head to the prepared appliance frontplate.
2. Ensure that the joint between the burner and the mounting flange is sealed effectively using the gasket provided. The flame tube should not generally extend beyond the inner face of the furnace brickwork or the frontplate protection, except where extensions have been expressly specified by the appliance manufacturer.
4. Position the combustion air fan and connect to the damper using the fasteners and gasket provided. Depending on the appliance layout it may be necessary for the customer to provide a connecting duct section between the damper and the fan scroll (not supplied by Nu-way).
5. For PO and PDF burners, place the oil pumping and heating unit (or pumping unit) in the desired position.
6. Connect the flexible oil pipes from the oil inlet and return to the pumping (and heating) unit, and the main oil supply pipework.
7. Locate the control panel in the desired position and make the necessary connections to the burner head, oil 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.

All screen cables as specified in the Autoflame manual.

Air Supply

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

Combustion Chamber Conditions

When the burner is fitted to an appliance designed to work under balanced or negative combustion chamber conditions, the over-fire draught must not exceed 0.05 kPA (0.2 inches water column, 0.5 mbar or 5mm w.c.)

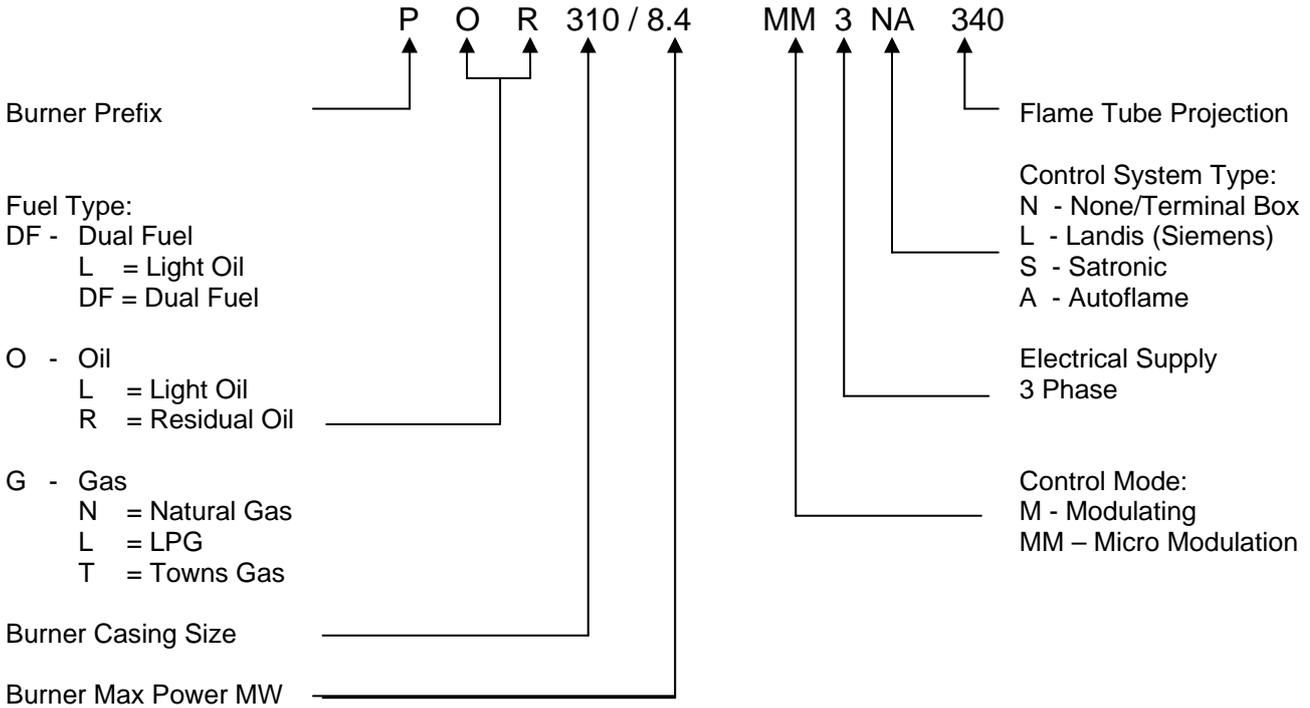
Should the over-fire draught exceed this value, then steps should be taken to reduce it to or below this level.

Electrical Power Supply

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

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

BURNER DESIGNATION CODE

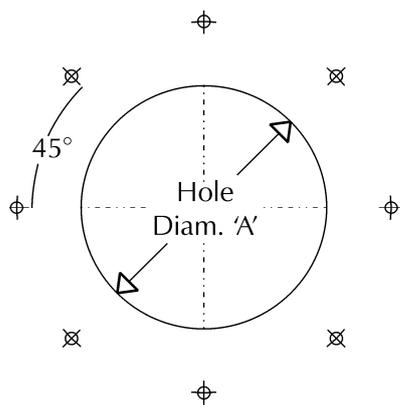


	Comment	Option
BURNER PREFIX	All burners in this series are prefixed 'P'	P
FUEL TYPE	The fuel on which the burner is designed to operate is identified as:	'O' : Oil 'G' : Gas 'DF' : Dual Fuel
FUEL SUB TYPE	The standard fuel sub types which can be specified are:	'L' : Light oil 'R' : Residual oil 'N'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

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 7.0	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		

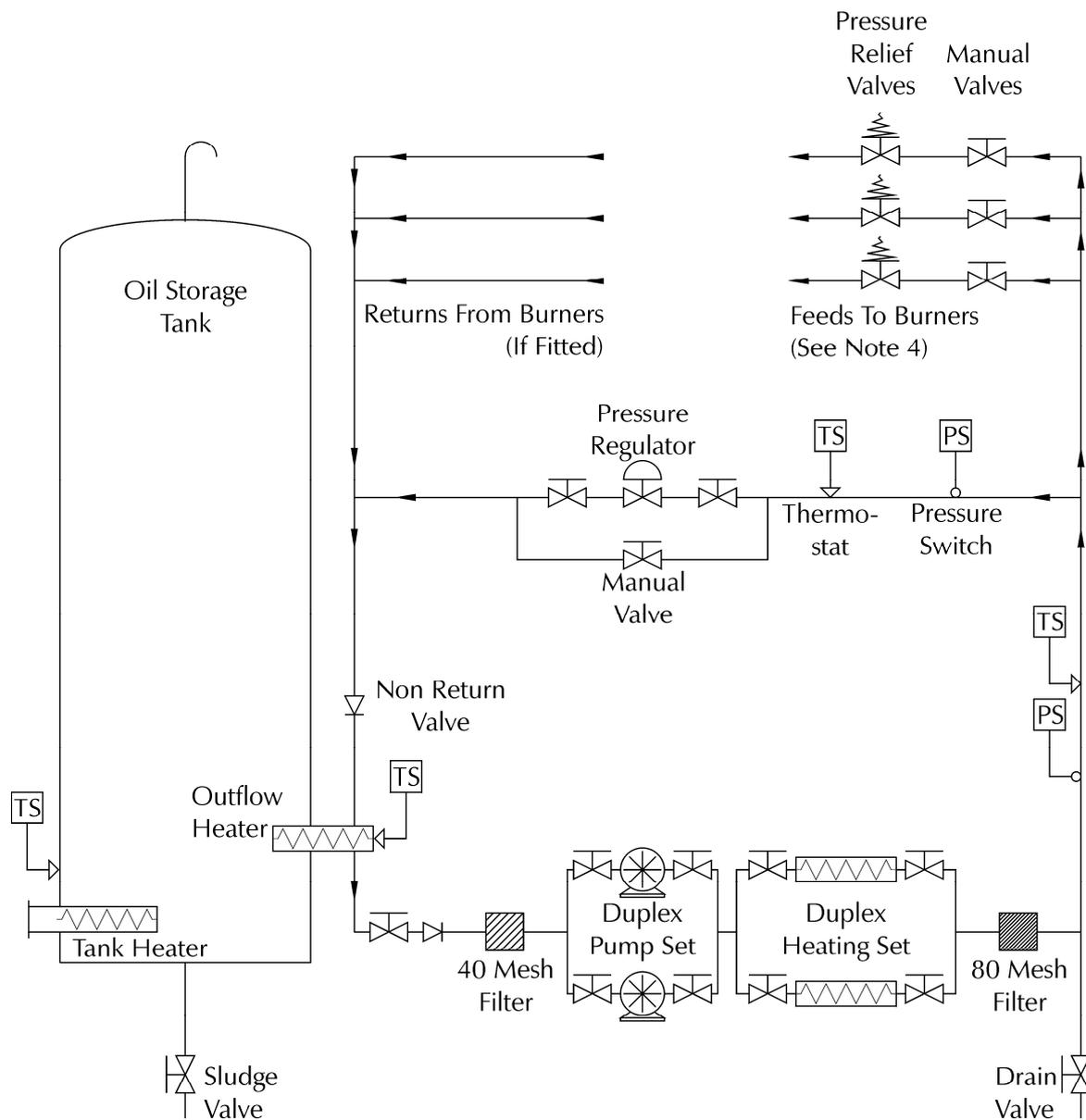
BURNER MOUNTING DETAIL



8 Holes tapped M12
equispaced on 'B' mm PCD

Burner Model	'A' (mm)	'B' (mm)
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

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 and COMPONENT IDENTIFICATION

The general arrangement of a PO burner employing Microprocessor modulating control is shown in the diagram Burner and Component Identification on page 14. An enlarged view of the burner head casing is shown in the diagram on page 15.

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 PO burners have an adjustable multi-blade damper located in a rectangular section attached directly to the burner casing (diagrams on pages 14 and 15). 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 21) is fitted to the front end of the inner assembly and is located within the flame tube. It directs the combustion air flow and creates a pressure drop across the burner head, promoting good air/fuel mixing and flame stability.

Air Pressure Switch

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

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

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. The oil must be supplied and maintained at the temperature and pressure given in the Table on page 9.

Burners with the Microprocessor modulating system are supplied with an oil system (see diagram on page 17 Distillate Oil Control Train Schematic, and on page 18 Residual Oil Control Train Schematic) consisting of:

- pumping/heating set
- oil manifold block
- oil valve (normally-closed; for distillate fuel oil) when required.
- inner gun assembly housing the oil nozzle
- oil solenoid (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 19 and Oil Pumps on page 16). 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)
- circulation 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 circulation 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 20.

The unit is pre-assembled on a base plate for floor-mounting (see diagrams Residual Oil Pumping Set on page 20 and Oil Pumps on page 16). 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 as this can lead to damage to the pump and couplings. The oil must be supplied and maintained at the temperature and pressure given on the Table on page 9.

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.

Inner Assembly Cam

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 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

PO Series pressure jet burners use a Fluidics atomising nozzle as shown in diagram Fluidics Oil Nozzle on page 13.

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.

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

Non-Return Valve

This valve allow 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 and complies with applicable Codes & Standards, all screen cables as specified in the Autoflame manual.

Flame Detector

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

Modulating Control and Operation

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

BURNER OPERATING SEQUENCE

Burner Sequence Controller (Programmer)

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

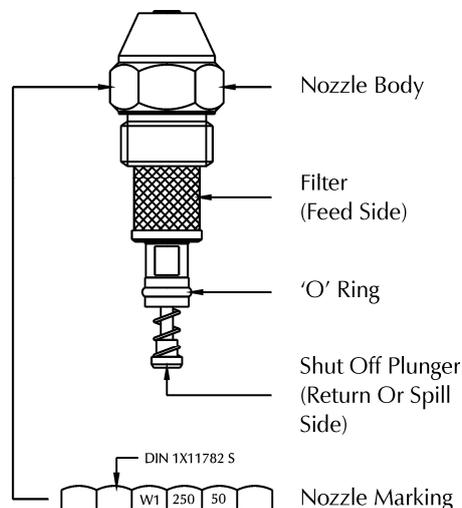
The typical operating sequence is as follows:

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

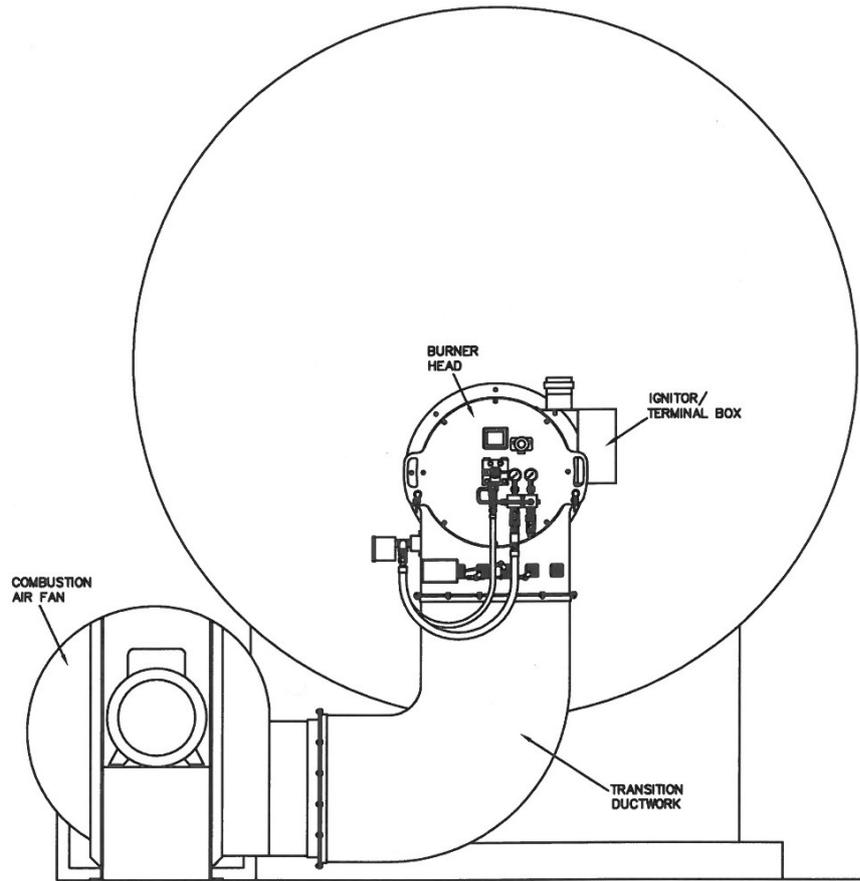
COMBUSTION HEAD DETAILS

The combustion head and inner assembly are shown in the diagram Burner Head on page 21.

FLUIDICS OIL NOZZLE

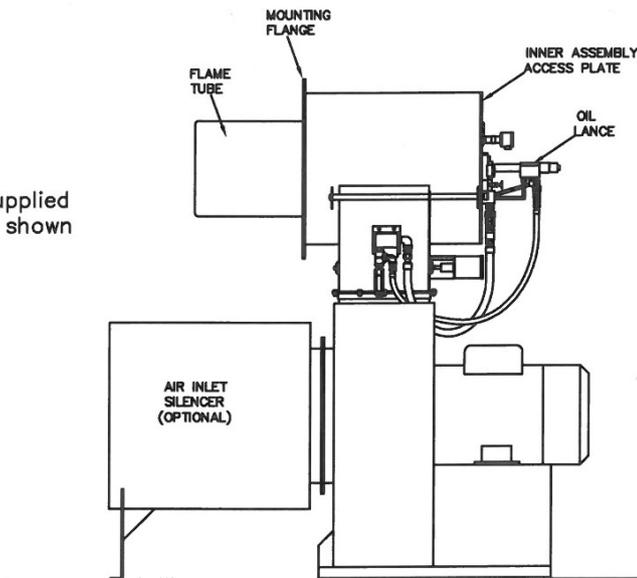


BURNER and COMPONENT IDENTIFICATION



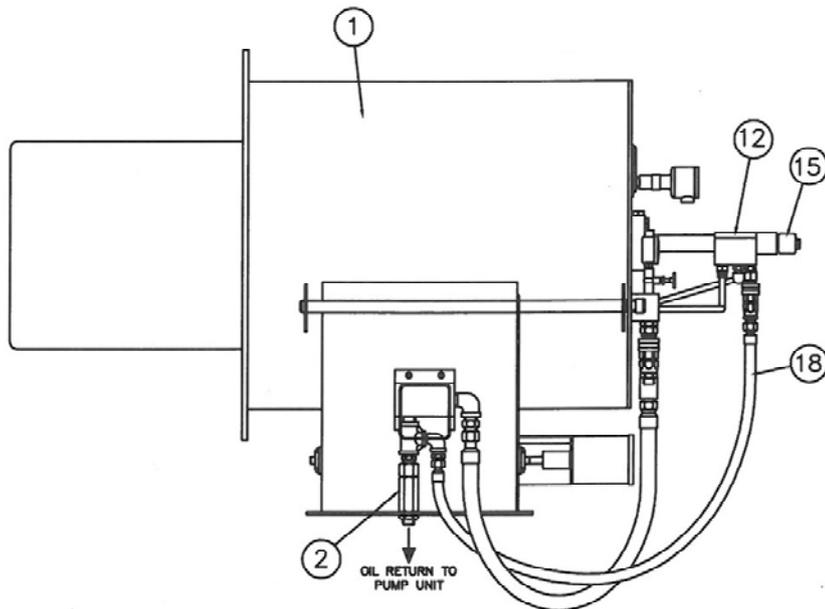
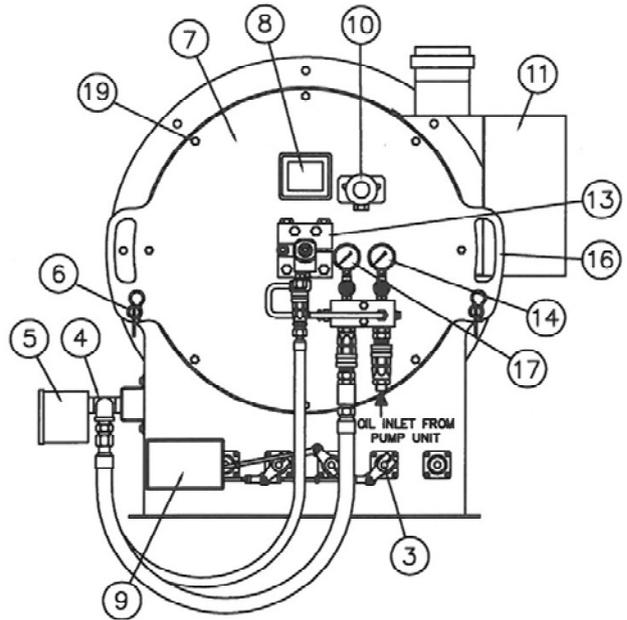
This diagram is for illustrative purposes only

Actual components supplied may vary from those shown



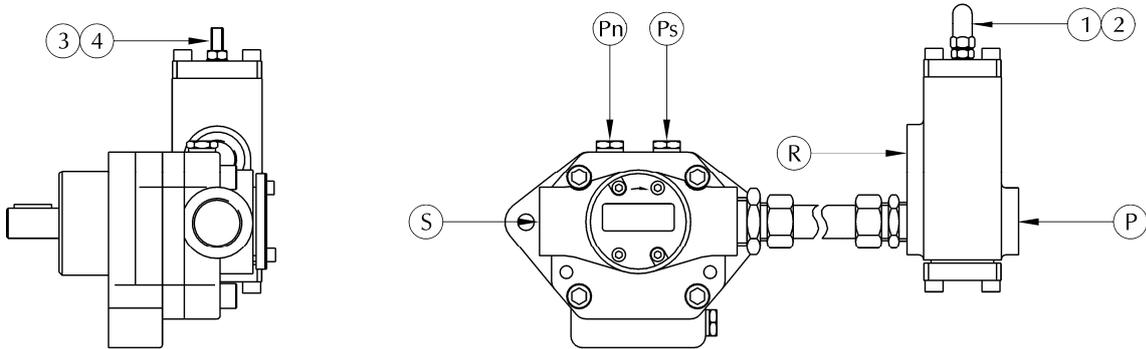
BURNER and COMPONENT IDENTIFICATION

Item	Component
1	Burner Head Casing
2	Oil Non-Return Valve
3	Air Control Vane
4	Oil Spill Return Valve
5	Fuel Control Servomotor
6	Guide Bar
7	Inner Assembly Backplate
8	Sight Glass
9	Air Damper Servomotor
10	U.V. Cell
11	Ignitor And Terminal Box Assembly
12	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 (8 off)

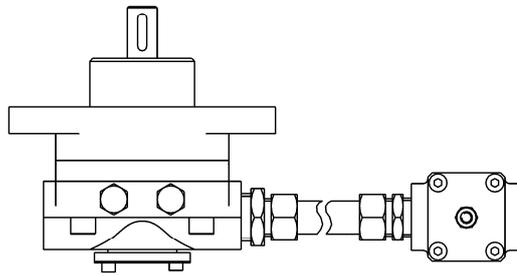


OIL PUMPS

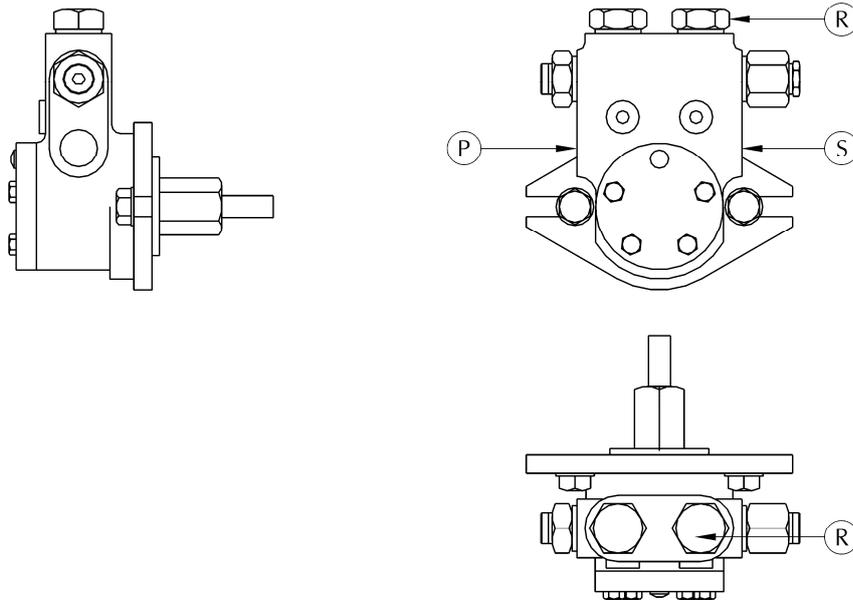
Suntec T Series Oil Pump With TV Pressure Regulator



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



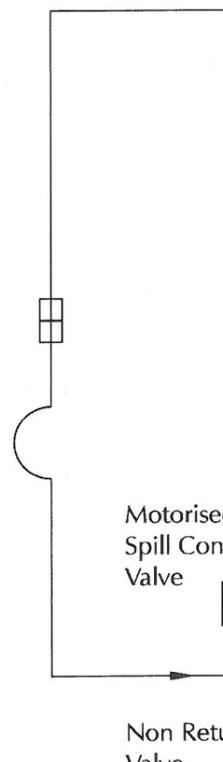
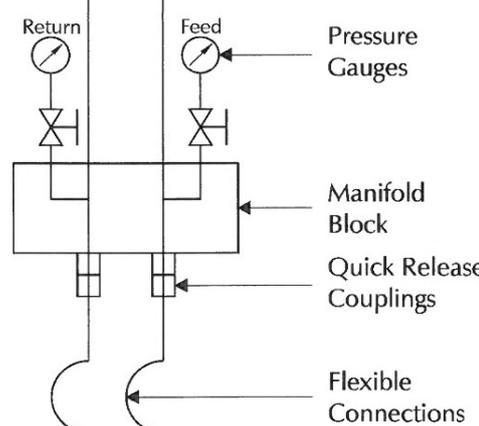
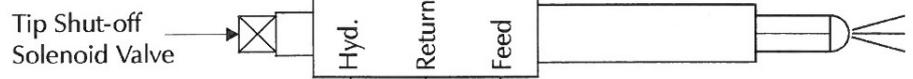
Safag Oil Pump



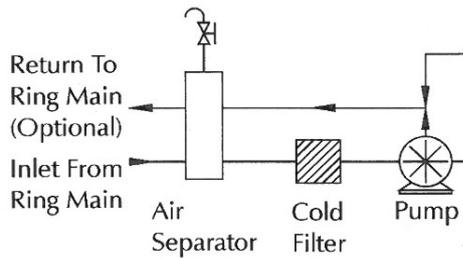
DISTILLATE OIL CONTROL TRAIN SCHEMATIC

Burner Mounted Components

Oil Lance With
Electro/hydraulic
Tip Shut-off



Pumping Set Components

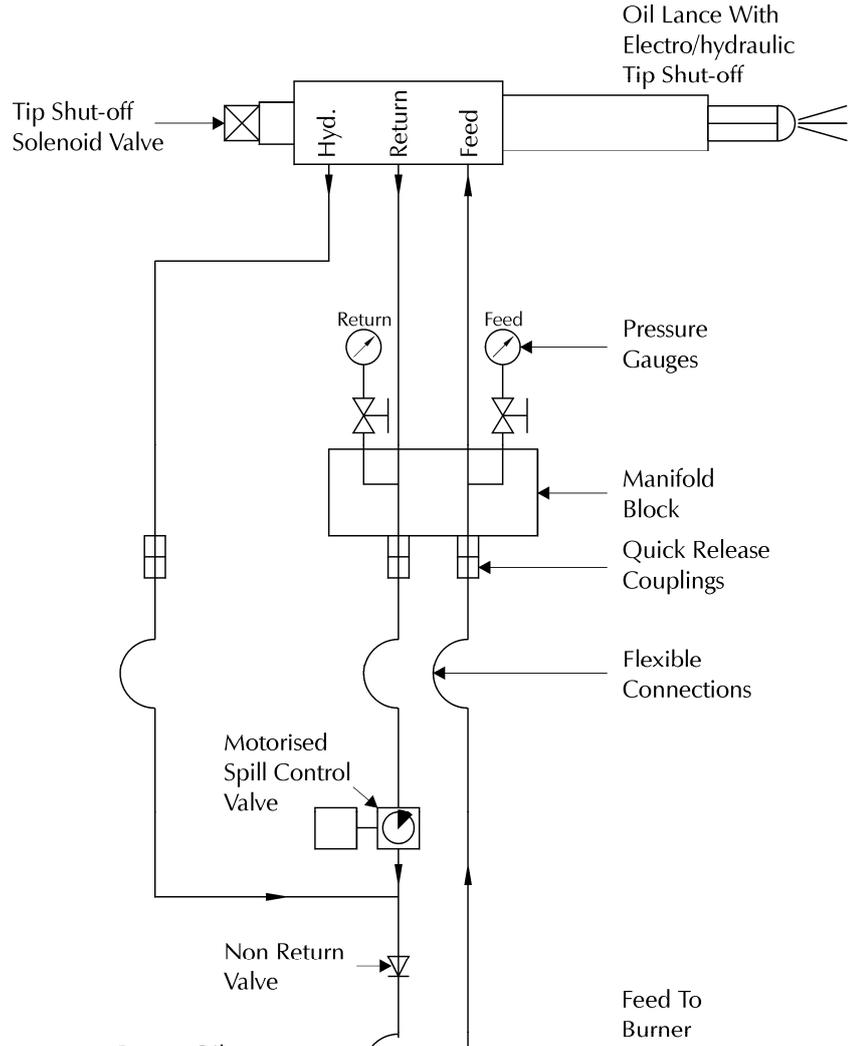


Notes:

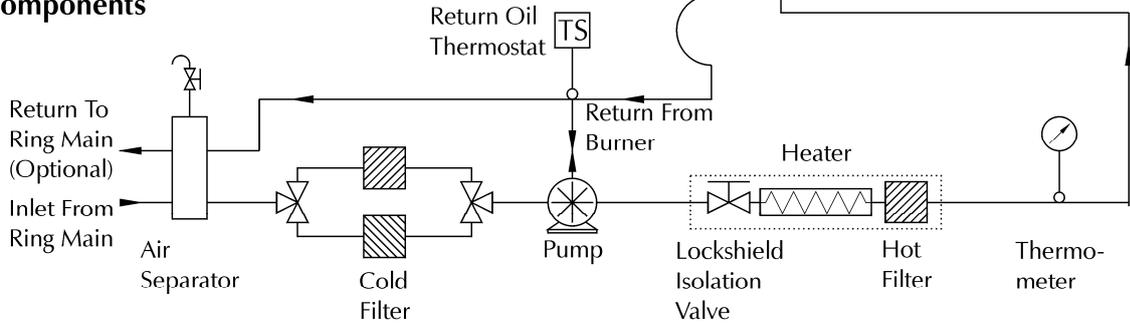
1. All interconnecting pipework must have a minimum bore of 19mm (3/4") and must be pressure rated for 42 kg/cm².
2. Pipework connections between the burner oil system and the separate pumping set are not supplied by Nu-way.
3. Connections to the ring main on the air separator bottle are 1" BSP.

RESIDUAL OIL CONTROL TRAIN SCHEMATIC

Burner Mounted Components



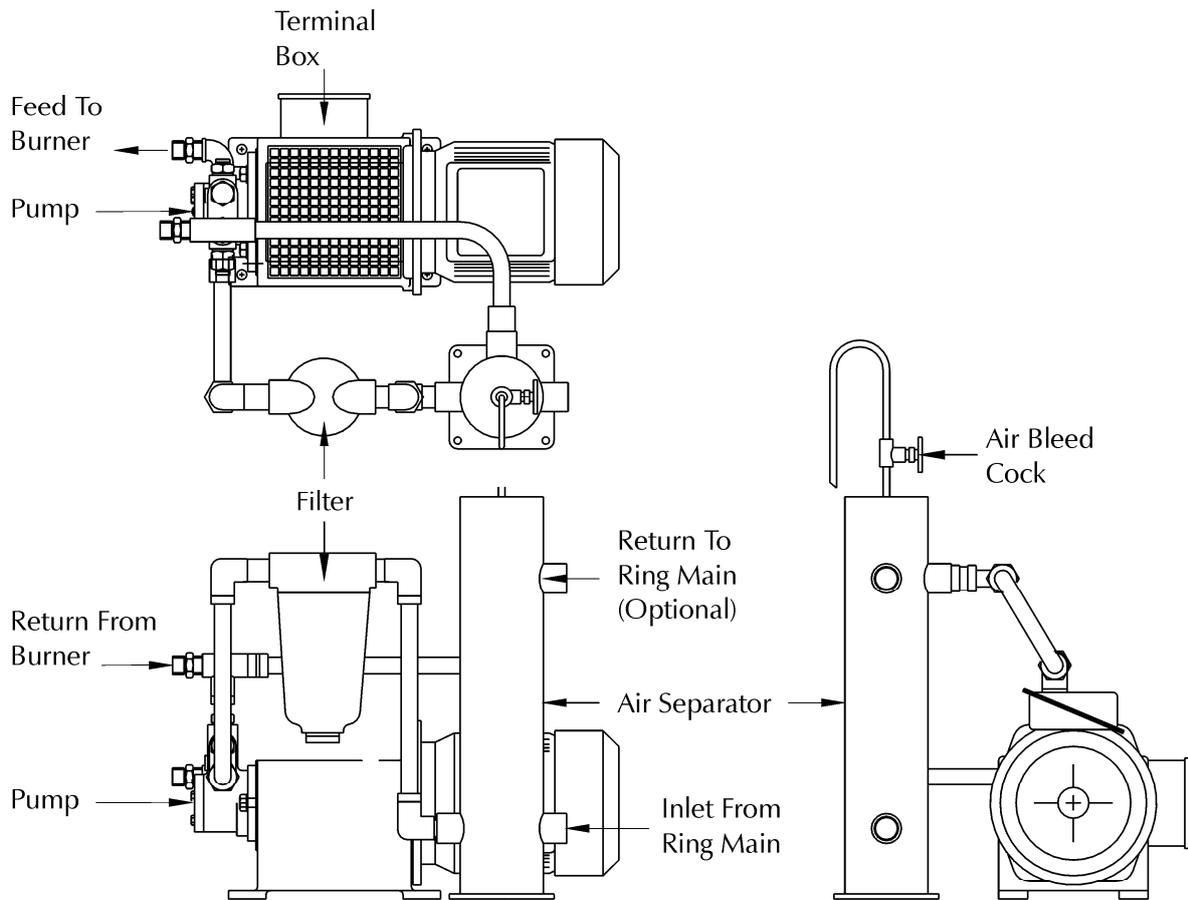
Pumping/Heating Set Components



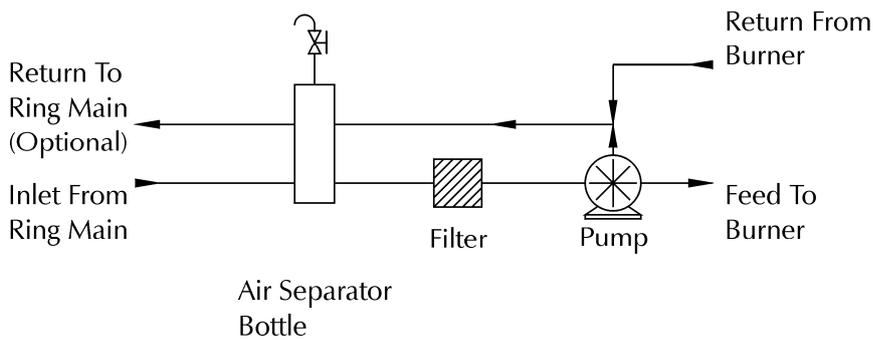
Notes:

1. All interconnecting pipework must have a minimum bore of 19mm (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 set are not supplied by Nu-way.
4. Connections to the ring main on the air separator bottle are 1" BSP.

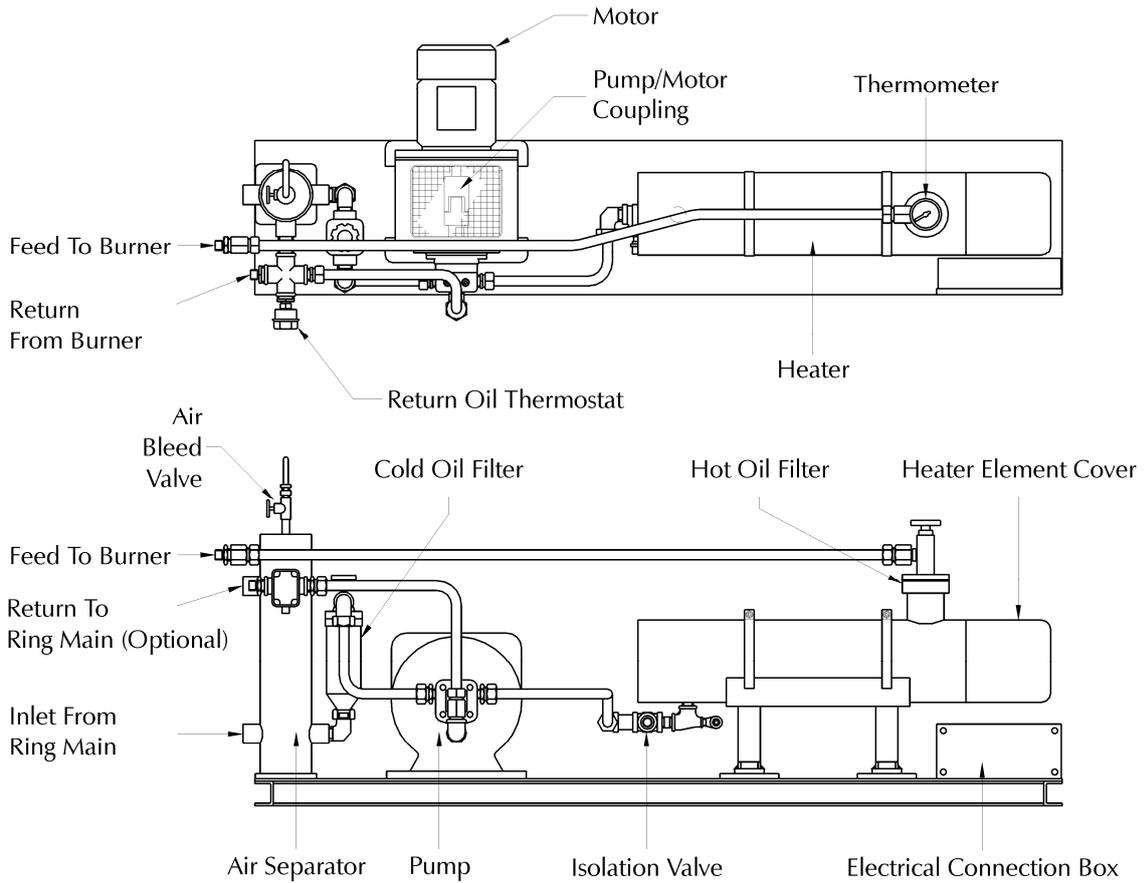
DISTILLATE OIL PUMPING SET



Schematic :



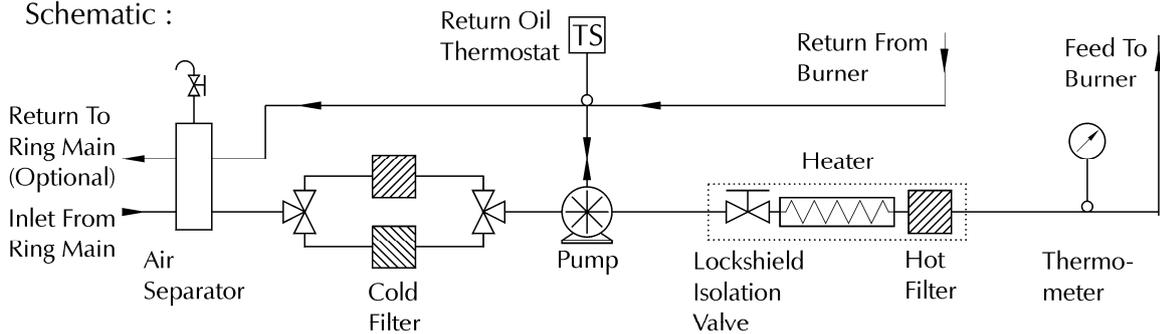
RESIDUAL OIL PUMPING/HEATING SET



Notes:

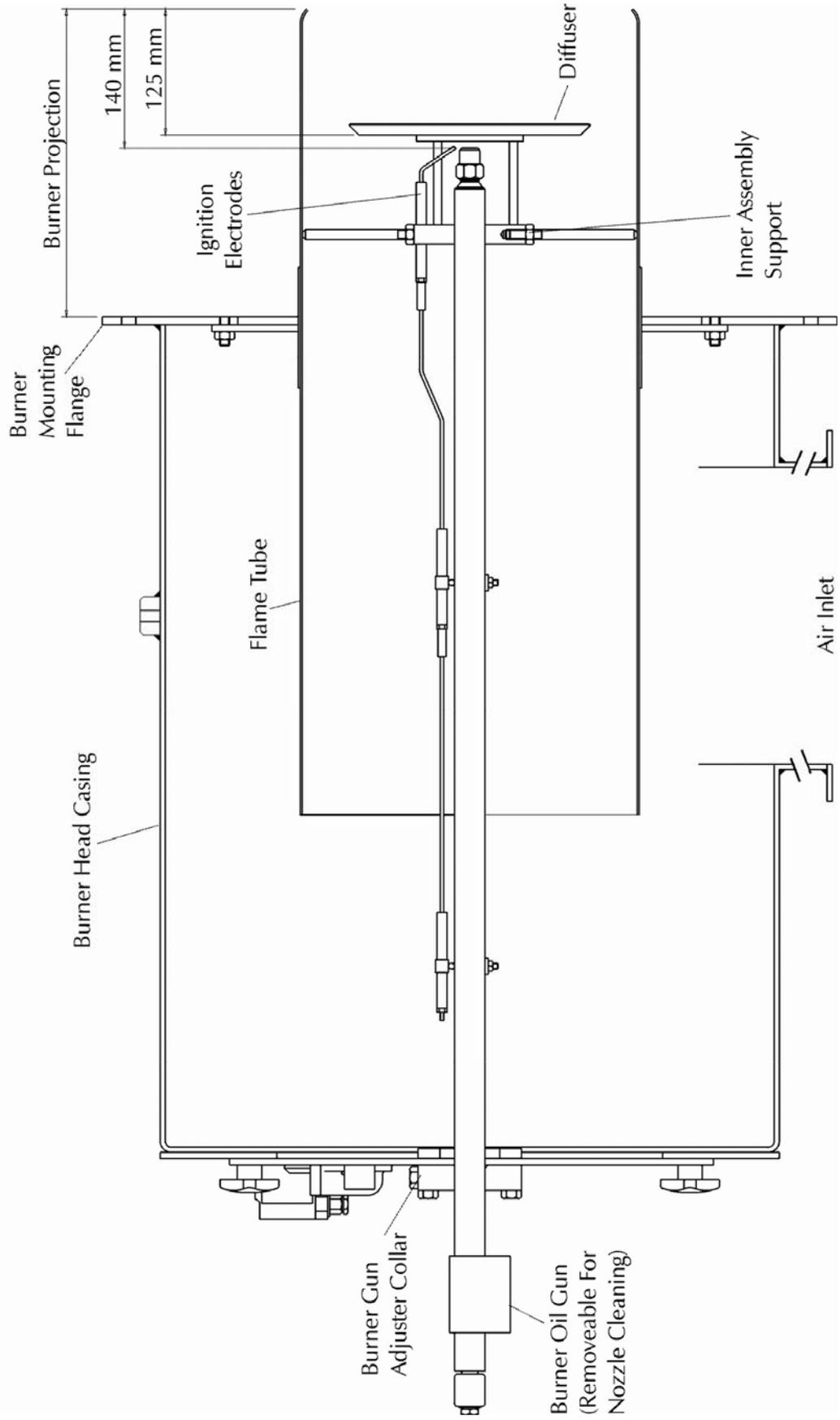
- 1) A single cold oil filter is shown above. In some instances duplex filters may be fitted (as in the schematic below).
- 2) The high limit, control and low limit thermostats are located beneath the heater element cover.

Schematic :



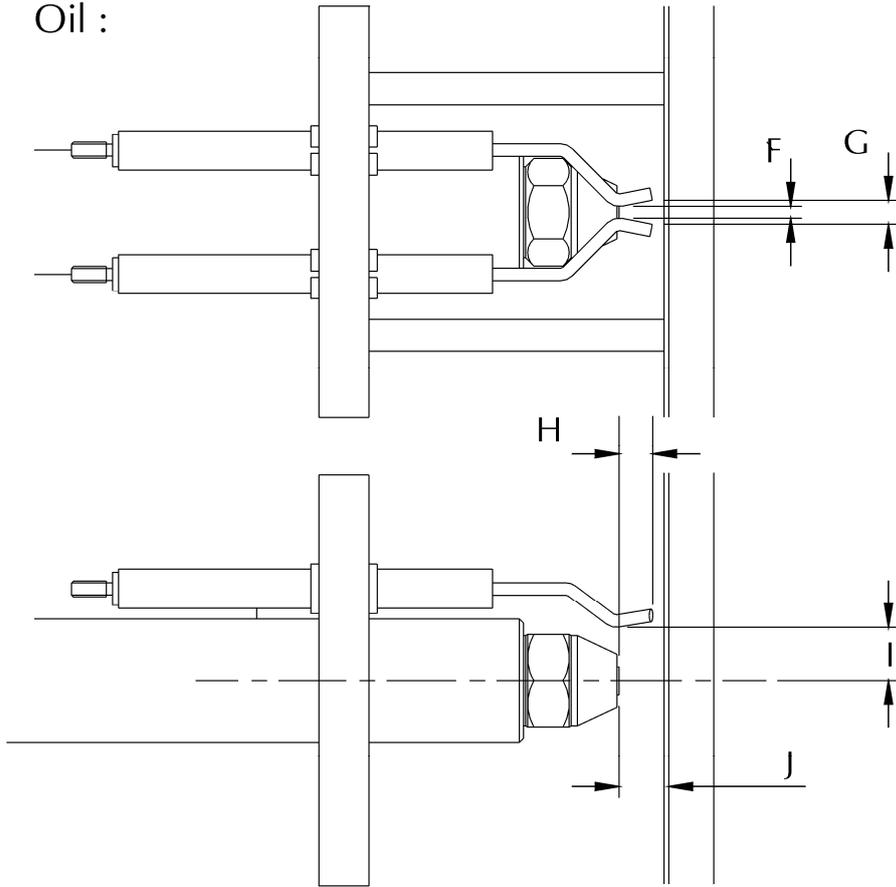
Thermostat Settings				
Fuel Class	High Limit	Control	Low Limit	Return Oil
E	110°C	85°C	65°C	40°C
F	130°C	100°C	80°C	50°C
G	150°C	140°C	100°C	70°C

BURNER HEAD



ELECTRODE SETTING DETAIL

Oil :



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

COMMISSIONING

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

INDIVIDUAL SETTING RECORD

This manual contains a commissioning sheet (page 25-26) 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 oil burners.

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 oil pipework is correctly sized and that it has been checked for leakage.
- Check that the appropriate modulating detector which is supplied loose with each burner, is fitted correctly to the appliance.
- Make all personnel involved in the commissioning aware of the location of the emergency oil and electricity isolation points.
- Check that the appliance's ventilation and flueing arrangements are adequate.
- Ensure that any warning notices are appropriate to the commissioning procedure are in position.
- Ensure that all necessary tools and test equipment are available and ready for use. Essential items include a manometer or other approved pressure measuring instrument. The Autoflame 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.

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

Check that the Autoflame options and parameters have been set for the site installation:

- load detector
- fuel/air profile
- VSD (if applicable)
- gas valve proving (if applicable)
- golden start (i.e. no pilot)

FINAL COMMISSIONING STAGES

Setting the Air Pressure Switch

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

Final Checks

1. Check that all covers have been replaced and that all locking devices are secure.
2. Check the operation of the appliance control instruments and safety interlocks.
3. Ensure that the appliance safety controls and any other interlocks are set to safe limits.
4. **COMMISSIONING OF THE BURNER IS NOW COMPLETE.**

On Completing Commissioning

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

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

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

1. All personnel concerned with operating, supervising and maintaining the plant receive instruction covering:
 - The way in which the plant operates and the locations and functions of the plant's safety systems.
 - The correct light-up and shutdown procedures.
 - Adjustment of operating variables.
 - Checking of plant interlocks.
 - The plant's maintenance requirements.
 - The actions to be taken in the event of a fault condition.
2. Clear light-up and shutdown procedures are displayed on the plant and that the pipes, valves and switches involved are clearly marked.
3. **CLEAR AND PRECISE EMERGENCY SHUTDOWN PROCEDURES ARE DISPLAYED.**

COMMISSIONING SHEET : OIL (1)



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

Oil Commissioning Sheet - Page 1 : Plant Details

Installers Name:		Commissioning Date:	
Address:			
Site Address:			
Appliance:	Type:	Size:	Serial No:
Burner:	Type:	Spec No:	Serial No:
Fuel Oil Type:	Nozzle Details:		
Oil pressure upstream of pump:	Standing	Running	bar or psi
Boiler Room Ventilation (BS6644)	Satisfactory		Unsatisfactory
Flue Check (Visual) (BS5440)	Satisfactory		Unsatisfactory
Oil Leaks (Visual)	Satisfactory		Unsatisfactory
COMMENTS:			

COMMISSIONING SHEET : OIL (2)



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

Oil Commissioning Sheet - Page 2 : Performance Details

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

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

OPERATION AND MAINTENANCE

NORMAL OPERATION

1. Establish the electrical power supply to the control panel.
2. Ensure that the oil supply is operational at the correct temperature and pressure
3. Set Hand/Auto switch to Auto.
4. Switch on the burner. The burner will go through the ignition sequence and be released to modulation under the control of the Autoflame Micro Modulating Controller.

The burner will now operate normally until:

- It is switched off by the appliance controls
- It is switched off manually
- There is an electrical power failure. In this event the burner will restart and run normally when power is restored. No manual intervention is required.
- A failure in any of the safety functions monitored by the sequence controller.

ROUTINE SAFETY CHECKS

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

Combustion Air

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

Flame Detector

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

Combustion Air Pressure Switch

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

ROUTINE MAINTENANCE

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

Combustion Air Fan

Access the fan blades as follows:

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

Burner Inner Assembly

Oil Nozzle

Remove the oil nozzle, dismantle it and wash the internal filter and other components in a suitable solvent.

Remove any remaining deposits with a clean, lint-free cloth. The oil nozzle should be replaced after 2000 hours operation.

Re-assemble the inner assemblies in reverse order.

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

Air Diffuser

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

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

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 22.

Oil Filters

The oil filter located at the 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. 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 Pre-Heater

Regular checks should be made to ensure that the oil temperature is maintained at the correct level (refer to the table on Page 9).

FAULT FINDING

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

Error Checking, Fault Analysis & Identification Codes

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

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

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

Incorrect Rotation of the Fan Motor

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

Fan Motor Fails to Start

Check:

- the electricity supply is available
- the burner is correctly wired
- the fuses are correctly sized and not blown
- the motor overload is not tripped
- the appliance controls are calling for heat
- the fuel selector switch is correctly set
- the oil pre-heater thermostats and oil temperature
- air pressure switch set in start position

Fan Motor Starts and Burner goes to Lockout

If there is no ignition spark check:

- 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 sequence controller is not faulty

If there is an ignition spark but no start flame, check:

- 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 9.
- 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:

- the glass envelope on the UV cell is clean and correctly orientated (it must face towards the flame)
- the UV cell and wiring are not faulty
- the flame detector current is adequate and stable
- the burner sequence controller is not faulty
- 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

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

BURNER SERVICE RECORD

Sheet 2

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

Date	Details of Service	Signature

Enertech Limited,
P O Box 1,
Vines Lane
Droitwich,
Worcestershire,
WR9 8NA

Tel: +44 (0) 1905 794331
Email: info@nu-way.co.uk

Fax: +44 (0) 1905 794017
Web: www.nu-way.co.uk

