



P SERIES GAS, OIL AND DUAL FUEL BURNERS



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'P' Series Gas, Oil and Dual Fuel Burners



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CHOOSING NU-WAY

To feel confident about buying combustion equipment you need to feel confident about the company supplying it.

Nu-way have been manufacturing combustion equipment since 1932 and have a proven record of combining technical innovation with unrivalled customer support.

Nu-way's products and services are backed by:

Our reputation. We are:

- ◆ *The UK's leading manufacturer of gas, oil and dual fuel burners.*
- ◆ *A major burner supplier world-wide.* Nu-way have links with more than 70 countries through joint venture partners, key distributors and major boiler manufacturers. These links ensure that the rapid and effective back-up you need to keep your plant operating is always available.
- ◆ *Committed to quality and customer satisfaction.* As part of this commitment, Nu-way are a BSI registered company, having successfully completed the rigorous design, manufacturing and testing procedures of BS EN ISO 9001, which are monitored by the British Standards Institution.
- ◆ A member of the Wolseley plc Group which is one of the top 100 companies quoted on the London Stock Exchange.
- ◆ Extensive facilities which include a fully equipped research and development department and a modern computer-aided design (CAD) system.
- ◆ A world-wide network of trained engineers supported by our own training school so that our engineers can develop their expertise under the optimum conditions.

Finally, what could give you more confidence in choosing a supplier than the knowledge that many prominent companies have made the same choice. Nu-way are proud to be associated with companies such as Rolls-Royce, Marks and Spencer, Jaguar, Ford, Nissan, Toyota, Honda, General Motors, Kelloggs, British Gas, Barclays, Stuart Crystal, Spillers, Lloyds Bank, ICI, Waterford Crystal and British Aerospace.

THE NU-WAY SERVICE

Selecting a suitable burner for a particular application is in itself not an easy process, as few companies have a simple requirement for a burner. Instead, they have a combustion need which must be met; a problem which must be solved, cost effectively, in accordance with a demanding performance specification and within a framework of increasingly complex and exacting legislation.

Unlike many other suppliers of combustion equipment, Nu-way recognises and understands this, and rather than simply providing burners, we offer a comprehensive service which will meet your needs and solve your problems, thus allowing you to concentrate fully on your core business objectives. Nu-way will work with you from the earliest stages of your project and provide the support you need for as long as you need it.

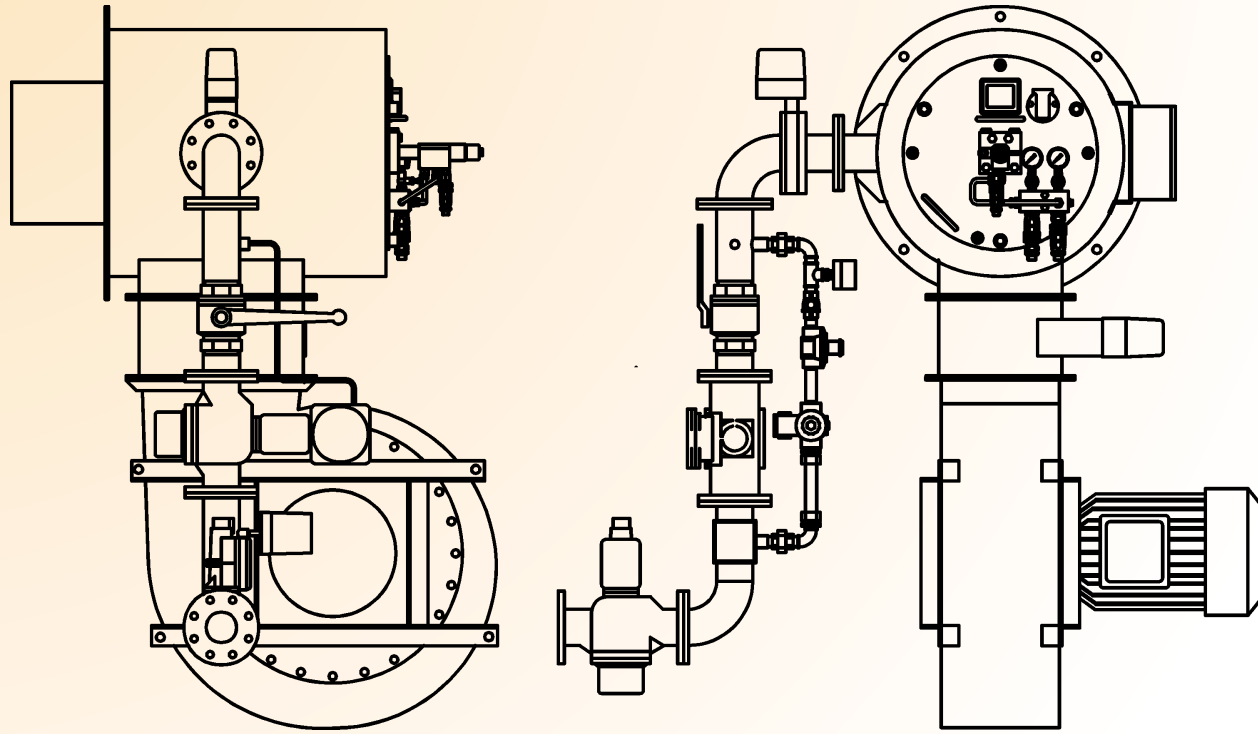
In addition to providing well proven, durable plant which will operate safely, reliably and efficiently we will:

- ◆ *Conduct a comprehensive survey of your site in order to identify potential installation difficulties or the need to upgrade services.*
- ◆ *Discuss your heating or process needs and work with you to prepare a detailed specification for the combustion plant required to meet them.*
- ◆ *Manufacture an appropriate burner and control system.* With Nu-way, the system you buy is one tailored specifically and precisely to your requirements, not, as with other manufacturers, the one in a range of standard systems which most closely approximates to your needs. To take only one example, we can readily provide proven systems suitable for operation on non-standard fuels.
- ◆ *Install and commission the equipment carrying out as required an agreed programme of tests to establish that the system meets its design specification.*
- ◆ *Service and maintain the plant, monitoring its performance to ensure that it continues to meet all requirements and to comply with relevant legislation.*

The Nu-way service: *comprehensive, matched precisely to your needs and provided within a context of complete commitment to quality and customer satisfaction.*



A PROFILE OF THE 'P' SERIES



Nu-way's 'P' series is a comprehensive range of packaged burners suitable for a wide variety of applications including industrial boilers, air heaters and process heating.

The range covers oil, gas and dual fuel versions from 3.7 - 20 MW (12.5-68.2 MBtu/h) based upon gross cv of fuel

- 1. PO Oil Burners.** These are available in two standard forms for distillate or residual fuel oils but can be configured for other liquid fuels provided that a full specification (viscosity, specific gravity, composition and calorific value) is made available.
- 2. PG Gas Burners.** In standard form the 'PG' series is configured for UK specification natural gas but versions are available for other types of natural gas, manufactured gas, liquefied petroleum gas (LPG) and other special gases e.g. biogas.
- 3. PDF Dual Fuel Burners.** These combine the important design characteristics and performance advantages of the 'PO' and 'PG' burners.

In accordance with Nu-way's uncompromising pursuit of optimum performance, each type of 'P' series burner has its own unique, purpose-designed burner head.

All burners are built to the highest standards of quality and reliability to meet current European Emission Standards, together with those of many other countries. All control systems and safety features comply with relevant burner standards and codes of practice.

Nu-way has a policy of always seeking to offer the best technology in all areas of system specification. As an example, although other types of fully modulating control system can be fitted by special request,

all 'P' series burners now incorporate Nu-way's 'Electronic Cam' Modulating (ECM) control system as standard. This microprocessor-based system extends the boundaries of modulating burner control by ensuring that the burner operates under optimum conditions at all times, thereby delivering substantial reductions in fuel consumption, operating costs and emissions of carbon dioxide, the principal green house gas. The ECM control system offers unprecedented accuracy in appliance control; when fitted to a boiler, for example, boiler temperature and pressure are not allowed to vary by more than 1°C or 1.5 psig respectively.

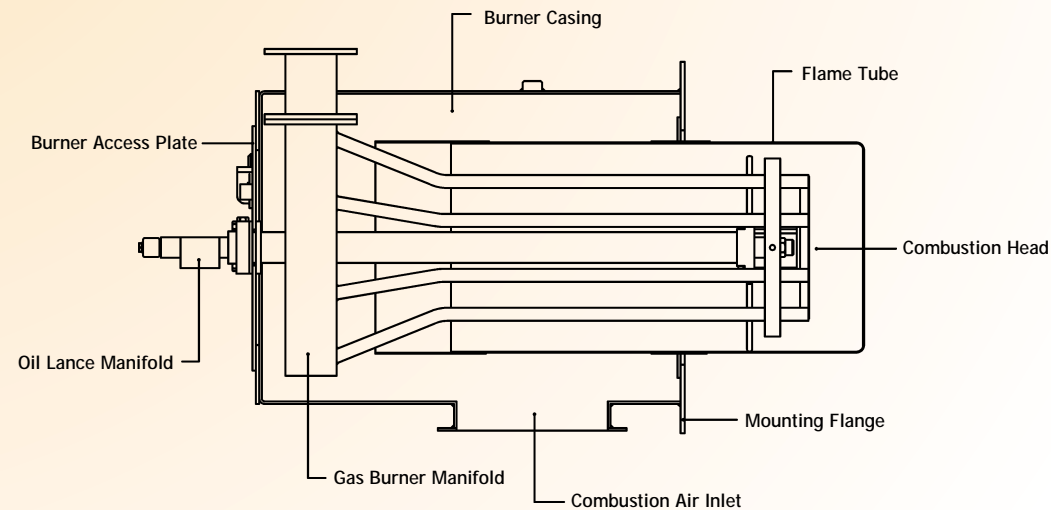
In the drive for even higher standards of performance, Nu-way have developed two additional control options which can be fitted to the 'P' series of burners on request:

- In addition to lower noise levels, the Nu-way fan speed control system offers a reduction in electrical power requirements and increased thermal efficiency, which in turn lead to lower operating costs and reduced emissions.
- Nu-way's ECM control system can be expanded through the incorporation of additional modules. These include an exhaust gas analysis and trim module which measures and displays exhaust gas oxygen level together with exhaust gas temperature and combustion efficiency. In this form the ECM control system offers valuable additional fuel savings and operates by varying the air damper position to ensure that optimum performance is maintained irrespective of variations in, for example, appliance back pressure. Further modules enable the ECM control system to measure and display flue gas nitric oxide and sulphur dioxide levels and allow local or remote (via an RS485 interface, modem and telephone line) display of a range of information including system firing rate, combustion efficiency, the status of alarm circuits and boiler temperature or pressure.

THE 'P' SERIES IN DETAIL

Each Nu-way 'P' series burner system is constructed in accordance with a detailed specification tailored to individual customer requirements. 'P' series systems consist of a number of well proven components and sub-systems which are carefully matched to produce combustion plant which operates safely, reliably, efficiently and in compliance with all relevant legislation.

BURNER COMBUSTION HEAD CONFIGURATION



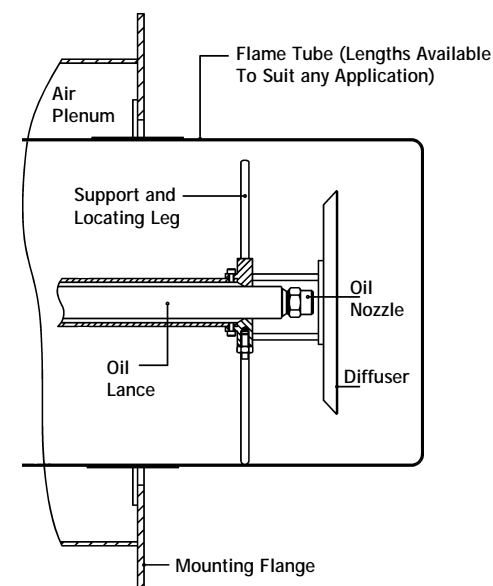
The heart of any combustion system is the burner head assembly, which must be robust, of high quality and capable of delivering:

1. Good combustion performance which is maintained over extended periods of operation, leading to optimum appliance thermal efficiency and hence to reduced running costs. This performance must be maintained over a high turndown range.
2. Low emissions of gaseous pollutants such as oxides of nitrogen (NO_x).
3. Excellent flame stability.

The well proven 'P' series burner head has been developed and refined in Nu-way's own laboratories over the last twenty years to meet the most exacting criteria. Each of the three types of 'P' series burner has its own unique burner head, for it is only in this way that each type can deliver optimum performance and Nu-way's commitment to the highest standards in combustion plant design can be maintained.

'PO' Series Oil Burners

The 'PO' series of burners utilise the latest developments in spill-type pressure jet technology to produce intense, compact flames ideally suited to boiler and process air heating applications. To enhance performance further twin fluid atomisation is available as an option to satisfy customers' individual plant requirements.



Traditionally, pressure jet systems have been considered the most economic and efficient means of atomising distillate and heavy fuel oils in burners rated at less than 4500 kW, whilst higher throughputs were the province of rotary cup atomisation, largely because the combination of a mechanically rotated cup and a low pressure air blast was the only reliable means of atomising highly viscous fuel oils. More recently, however, improvements in spill-type pressure jet technology have facilitated the development of large burners which offer excellent atomisation of heavy oils together with a number of important advantages over their rotary cup counterparts. Twin fluid atomisation using steam or compressed air can be added to such burners to enhance performance still further where individual site conditions require it.

Combustion

Nu-way have embraced and refined the latest developments in pressure jet technology to produce the 'PO' series of burners. The 'PO' atomising nozzle produces a finely divided oil spray consistent in both particle size and spray pattern, leading to intense, compact flames which are ideally suited to, modern shell boilers. High combustion intensities can be achieved if necessary and flame shape is variable.

Standard Turndown

On basic 'PO' series burners, changes in firing rate are achieved by linear movement of the oil spill valve, which varies the atomising oil pressure between maximum and minimum values chosen in accordance with the turndown required for a particular application. Typically, a 4:1 turndown corresponds to maximum and minimum oil pressures of 30 bar and 10 bar respectively. Higher turndowns can be achieved if required by varying the burner head design.

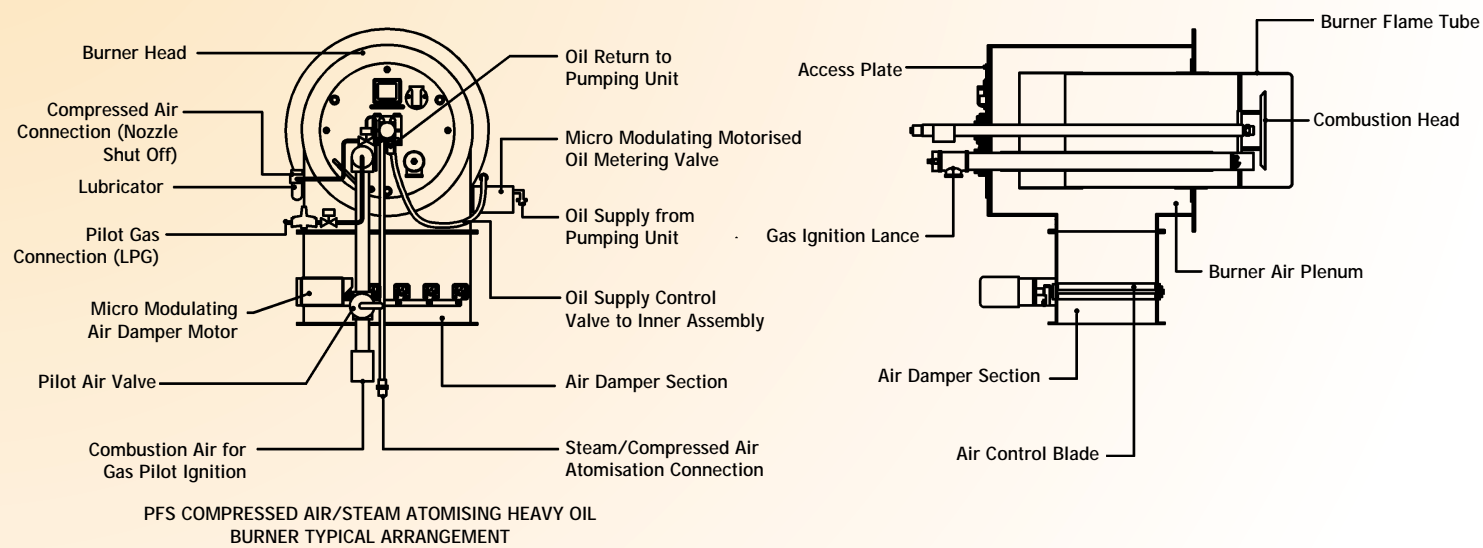
The Nu-way 'PO' series provides excellent combustion over these high turndowns through a range of design measures, including the incorporation of a specially designed air diffuser plate. This diffuser ensures that combustion air velocities and distribution patterns remain virtually constant throughout the firing range.

Key Features

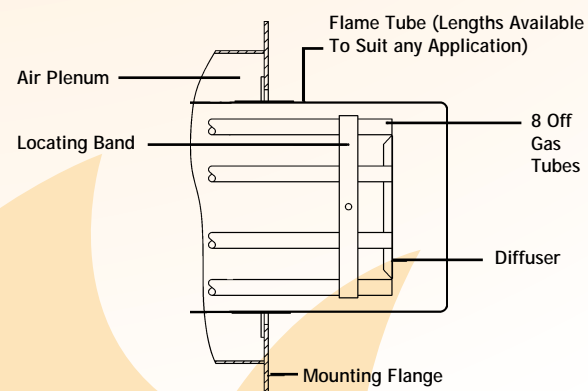
Other characteristics and advantages of the 'PO' series include:

- ◆ The burner head stays clean over long periods and therefore needs little routine maintenance. This is in sharp contrast to rotary cup burners, where daily cleaning of the oil cup and other components is required.
- ◆ When maintenance is needed, typically at three-monthly intervals, the procedure is rapid and simple as the oil gun and atomising nozzle can be withdrawn in minutes without disturbing other components or the burner settings.
- ◆ The burner has fewer moving parts than rotary cup burners. This makes an additional contribution to reducing the system's maintenance needs and extending the burner's working life. Regular cleaning of the oil filter also contributes to these objectives. The filter cleaning schedule is related to oil purity and burner operating hours.
- ◆ Elimination of the rotary cup reduces electricity consumption and running costs.
- ◆ The addition of steam/air atomisation reduces oil pump outlet pressures, thereby prolonging pump life, reduces emissions and increases turndown.
- ◆ Unlike rotary cup burners, the Nu-way 'PO' burner uses no refractories. The extended shutdown required to repair or replace the refractory on a two or three year cycle is therefore eliminated.
- ◆ Fewer moving parts and a lower fan pressure requirement combine to reduce burner noise levels and improve the working environment around the plant.
- ◆ On spill-type pressure jet systems a simple electric ignition system can be used, except for POG 490 Heavy Oil Burners and above where a gas/electric pilot system is used. Where steam/air atomisation is used, Nu-way supply a withdrawable Multiplex gas fired pilot burner which ensures reliable ignition. In standard form the Nu-way 'PO' series is suitable for oils as heavy as Class 'G' but versions suitable for heavier oils can be supplied if required, provided that a full specification (viscosity, specific gravity, composition and calorific value) can be made available.

Steam/Air Atomised Oil Burners



'PG' Series Gas Burners



As with the 'PO' series, the burner head used in Nu-way's 'PG' series burner was designed and developed specifically for boiler and process air heating applications. The head is of the diffuser type, which provides excellent combustion performance and flame stability over a high turndown range.

Standard Turndown

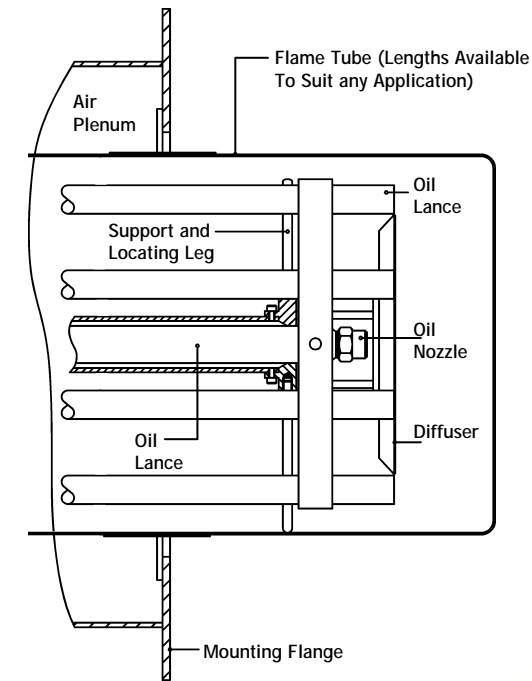
The 'PG' series offers a standard turndown of 5:1. For higher turndown ratios please see the section on the air plenum.

Key Features

The 'PG' series of burners:

- ◆ Utilise the same air plenum chambers as the oil burner.
- ◆ Are robustly constructed and require little or no maintenance beyond a three-monthly check of the ignition probe and associated components.
- ◆ Are easy to service. When attention is needed, the burner head can be inspected and if necessary withdrawn easily without disturbing other components or the burner settings.
- ◆ In standard form are configured for UK specification natural gas. Such is the versatility of the 'PG' series design, versions of the 'PG' can readily be supplied configured for other types of natural gas, manufactured gas, liquefied petroleum gas (LPG) and low calorific value gaseous fuels such as biogas and refinery gas.

'PDF' Series Dual Fuel Burners



Nu-way believe that achieving optimum performance in the dual fuel configuration requires more than a combination of standard burner components. The 'PDF' burner has been designed accordingly.

Standard Turndown

The 'PDF' series offers a standard turndown of 4:1 on oil and 5:1 on gas. For higher turndown ratios please see the section on the air plenum.

Key Features

The 'PDF' burner :

- ◆ Utilises the same air plenum chambers as the 'PO' and 'PG' series oil and gas burners.
- ◆ Combines Nu-way's latest pressure jet oil burner technology, as used in the 'PO' series burner with the purpose-designed gas head unique to the 'PG' series.
- ◆ Uses elements from the design of Nu-way's successful 'NDF' series burners to enable different types of gaseous fuels to be burned. This rigorous approach ensures that the 'PDF' burner shares the characteristics and advantages of the 'PO' and 'PG' burners, which are detailed earlier.

AIR PLENUM

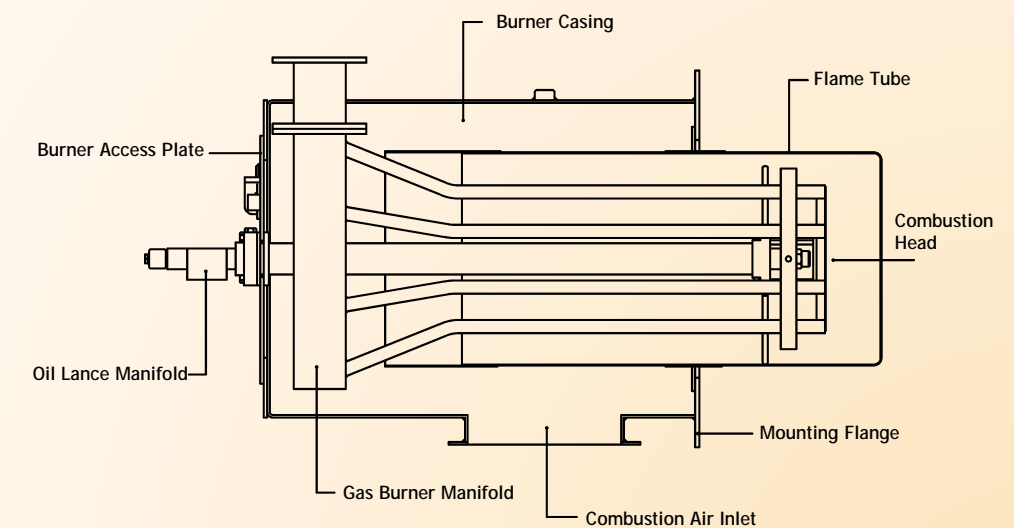
If good combustion performance is to be maintained over a wide range of operating conditions, careful attention must be paid to all aspects of burner design. The means by which air is distributed to the burner is an issue of vital importance and Nu-way have developed an innovative air plenum which incorporates an adjustable flow control system.

The Standard Air Plenum

This produces more uniform air flow distribution patterns around the burner head and improves combustion efficiency.

The 'Split Air' Plenum

The Nu-way 'P' series can now also use an unique patented split air plenum design, which enables the burner's excellent combustion performance to be maintained on ratio under high efficiency turndown of up to 10:1.



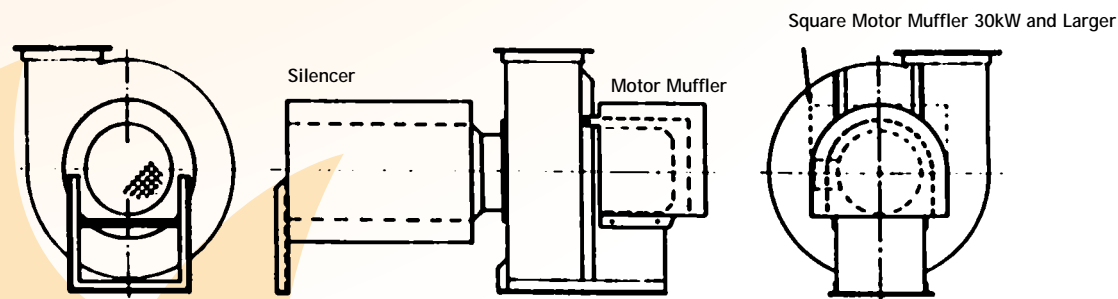
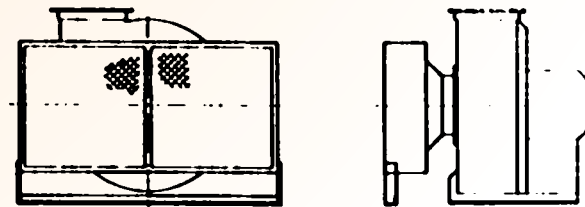
AIR SUPPLY

In order to minimise power consumption and running costs, all Nu-way burner systems use high efficiency fans. These well proven units incorporate integral motor pedestals and have welded, heavy-gauge steel casings stiffened with angle sections where appropriate. All fans can be used for clean, non-toxic and non-explosive gases at temperatures between -10 and +40°C. For safety, an inlet guard is fitted as standard. An inlet which incorporates an air filter can be supplied on request.

Fan noise is an important contributor to the overall noise output of combustion systems, which is an issue of growing importance to users for two reasons:

1. Environmental noise is the source of a growing number of complaints from the public and this concern is being reflected in new legislation.
2. Where workplace noise levels exceed 85 dB(A) (please see the section on Burner Performance for details of this scale of noise measurement), the Noise At Work Regulations require that a noise survey be undertaken by a competent person in order to assess the risk of hearing damage, and that appropriate steps be taken to protect the hearing of employees.

To help reduce overall noise levels Nu-way can supply fan silencers and acoustic enclosures.

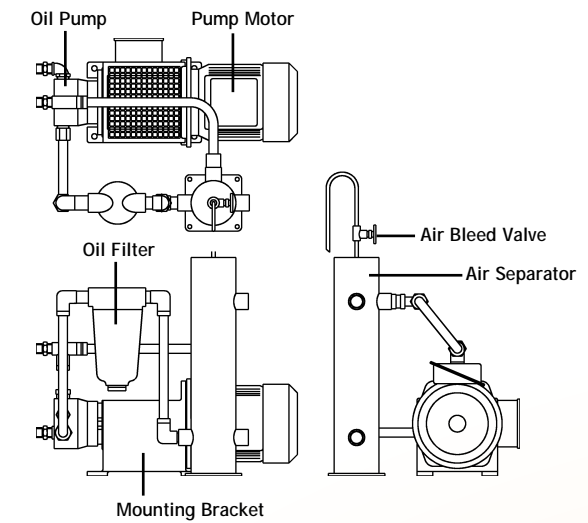


OIL SERVICES UNIT ('PO' AND 'PDF' SERIES BURNERS ONLY)

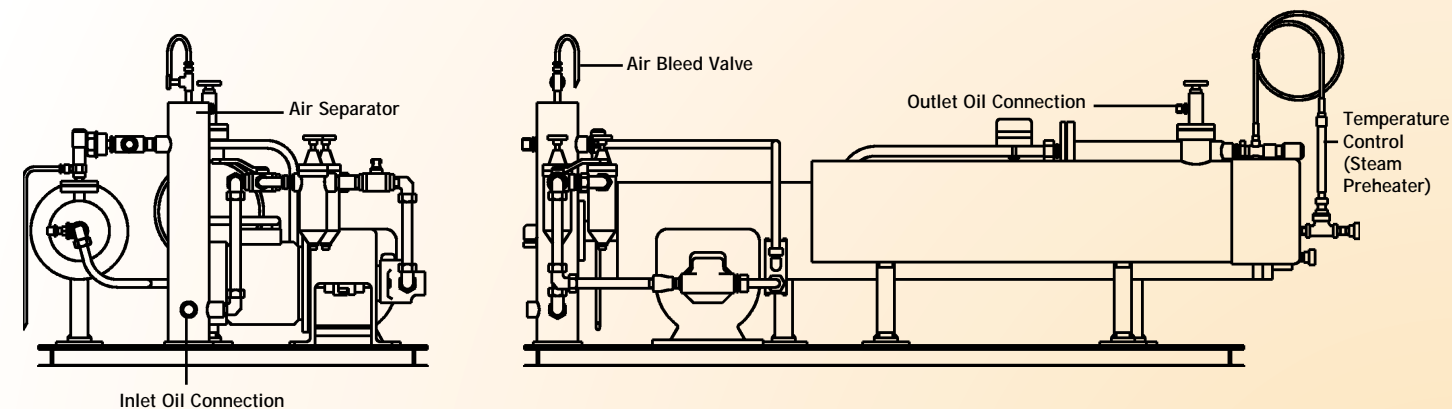
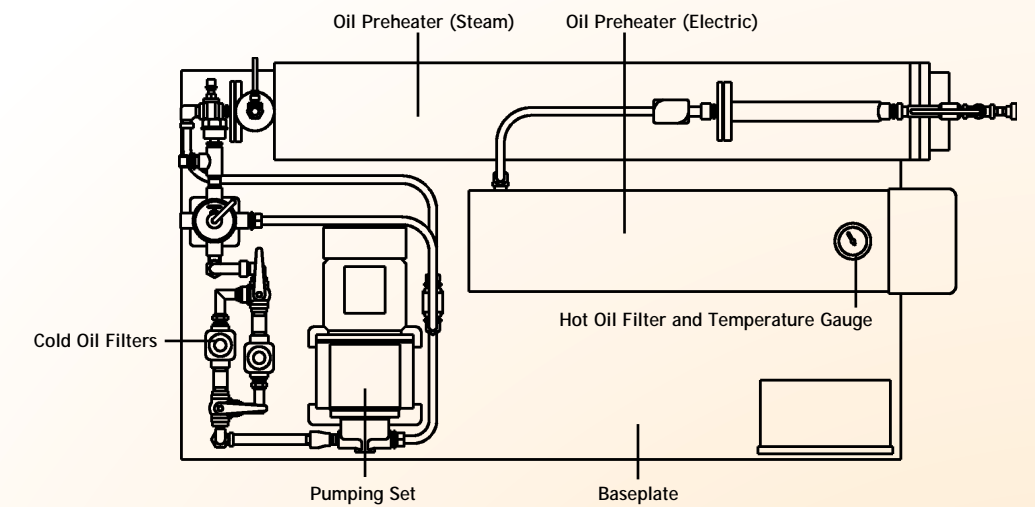
A number of oil services units are used on 'P' series burners depending on individual requirements.

1. As an integral part of all 'PO' and 'PDF' series burners required to operate on distillate (Class D) oil, Nu-way supply an oil services unit based around a well proven pump/motor combination which is mounted on a rigid, cast aluminium floor-standing cradle. An inlet oil filter and an air separator bottle/vent valve are standard equipment.
2. Essentially the same arrangement of oil services unit is used on 'P' series burners intended for operation on residual fuel oils (Classes E, F and G), although here oil line heaters are added, together with duplex cold oil filters, a hot oil filter, an oil temperature indicator and appropriate heater controls.
3. Where residual oil is to be used, Nu-way can match individual needs precisely with a range of oil services units using electric, steam or combined electric/steam heating.

Light Oil Pumping Set



Heavy Oil Pumping and Conditioning Set



CONTROL SYSTEMS

Although the importance of good burner control is often underestimated, the control system plays a vital role in ensuring that combustion systems:

- Operate safely and reliably.
- Deliver optimum thermal efficiency and therefore the lowest possible running costs.
- Comply with emissions legislation and have the lowest practicable levels of pollutant emissions.

Nu-way are a major authority on the relationship between the control function and combustion system performance and are leading the way in the implementation of more accurate and comprehensive control systems. Foremost among these systems is Nu-way's modulating burner technology.

The Nu-way 'Electronic Cam Modulation' (ECM)

Combustion systems must, of course, be selected on the basis of the maximum load envisaged. In most cases, this leads inevitably to the system spending much of its working life operating at part load. In the past, it was accepted that part load operation led to reduced system performance in the areas of efficiency and emissions, but more recently, the drive to reduce both operating costs and the environmental impact of fossil fuel use has led to this link coming under scrutiny.

The evolution of typical burner control from the basic on/off through two-stage high/low operation to fully modulating systems incorporating electromechanical linkages has improved overall combustion system performance but it has now been recognised that optimum performance can only be achieved through the use of a control system which ensures that the burner operates at peak performance at all times.

The **Nu-way Electronic Cam Modulation system (ECM)** meets this need and delivers substantial benefits: typical fuel savings ranging from 5 to 10% mean that the additional cost of the system over its more conventional counterparts is often recovered through reduced fuel consumption in a few months or even a few weeks. In recognition of the value of these benefits, Nu-way have chosen to fit the **ECM system** as standard on all 'P' series burners.

The 'Electronic Cam' Modulation System is a flexible and easily programmable means of optimising combustion quality throughout the operating range of a boiler whilst ensuring that boiler temperature and pressure do not vary by more than 1°C or 1.5 psig. At the heart of the system is the control module, which houses the microprocessor and contains, beneath a tamper-proof cover, a panel which carries a key pad for data entry and LED readouts and status indicators. Sensors relay information on boiler temperature and pressure and the ECM compares these "Actual" values with the "Required" values which have been programmed into it. This programmed information is contained within the system in an EPROM, where it is protected against loss or corruption caused by power failures.

Interfaced with the microprocessor through high speed solid state switching mechanisms are up to five **servo motors**, although usually only two are required, both of which are normally connected to the burner's air damper and fuel flow control valve. The relative positions of the air and fuel motors are checked by the ECM control system fifty times per second, whilst a boiler load detector is interrogated every ten seconds. If the boiler temperature or pressure are found to be outside the specified range, the air and fuel flows are varied to both regain the "Required" values of these parameters and maintain the correct air/fuel ratio.

In standard form the Nu-way ECM offers unrivalled precision in burner control and substantial reductions in fuel consumption. The ECM does, however, incorporate several additional capabilities, the use of which can deliver valuable additional benefits:

1. The Nu-way flue gas monitoring and trim system expands the functions of the 'ECM' system to include measurement and display of flue gas temperature and oxygen (O₂). From this data the system calculates and displays a value for combustion efficiency. Under any firing conditions, the system continuously compares the measured values with the corresponding setpoints which were installed during commissioning and trims the air/fuel ratio to

combustion conditions are maintained at all times, irrespective of variations in boiler back pressure. All ECM/EGA modules incorporate error checking software which interrogates the system for component or data handling failure. This checking extends to items such as positioning motors and load detectors in addition to the main ECM/EGA system hardware.

2. The EGA can also be used as a stand alone analyser with six adjustable 4-20 mA outputs for interfacing with other controls.
3. To allow even more detailed monitoring of plant emissions, the EGA can, if required, monitor and display levels of nitric oxide (NO) and sulphur dioxide (SO₂).
4. All ECM units incorporate Nu-way's load sequencing software. Specially developed for the system, this software allows up to ten boilers fitted with **Electronic Cam Modulating Systems** to be connected together with one boiler nominated as the lead unit. This lead unit monitors the operation of all the boilers and ensures that no more are in operation than the minimum number required to satisfy the load on the system. This function can further increase overall system efficiency.
5. Also standard on all Nu-way 'Electronic Cam' Modulation systems is a remote monitoring and control capability. The system can be connected via an RS485 serial link to a local energy management computer and printer or, if required, through a modem and telephone line to a remote computer. In either case, the information which can be viewed and/or printed for analysis includes:

- Flue gas oxygen, carbon monoxide and carbon dioxide levels.
- Flue gas temperature.
- Boiler temperature and pressure.
- Combustion efficiency.
- System firing rate.
- Boiler sequencing data.
- The status of alarm circuits.

The monitoring computer can also be used to change individual boiler control set points or alter lead boiler requirements.

The Nu-way ECM control system offers unprecedented precision and versatility in combustion system control and its benefits are being demonstrated on more than 1000 installations operated by local authorities, property management groups, the Ministry of Defence and companies such as British Rail, British Airways and BOC.

Fan Speed Control

In a further innovative approach to enhancing the performance of our combustion systems, Nu-way have developed two options in fan speed control. On smaller systems (up to around 1 MW), two-speed step and modulating control is used, whereas larger burners such as the 'P' series are fitted with fully modulating speed control. With this system the maximum and minimum fan speeds are set at the time of commissioning to correspond to maximum and minimum load conditions. Thereafter, the fan speed is always precisely matched to the required heat input, ensuring that:

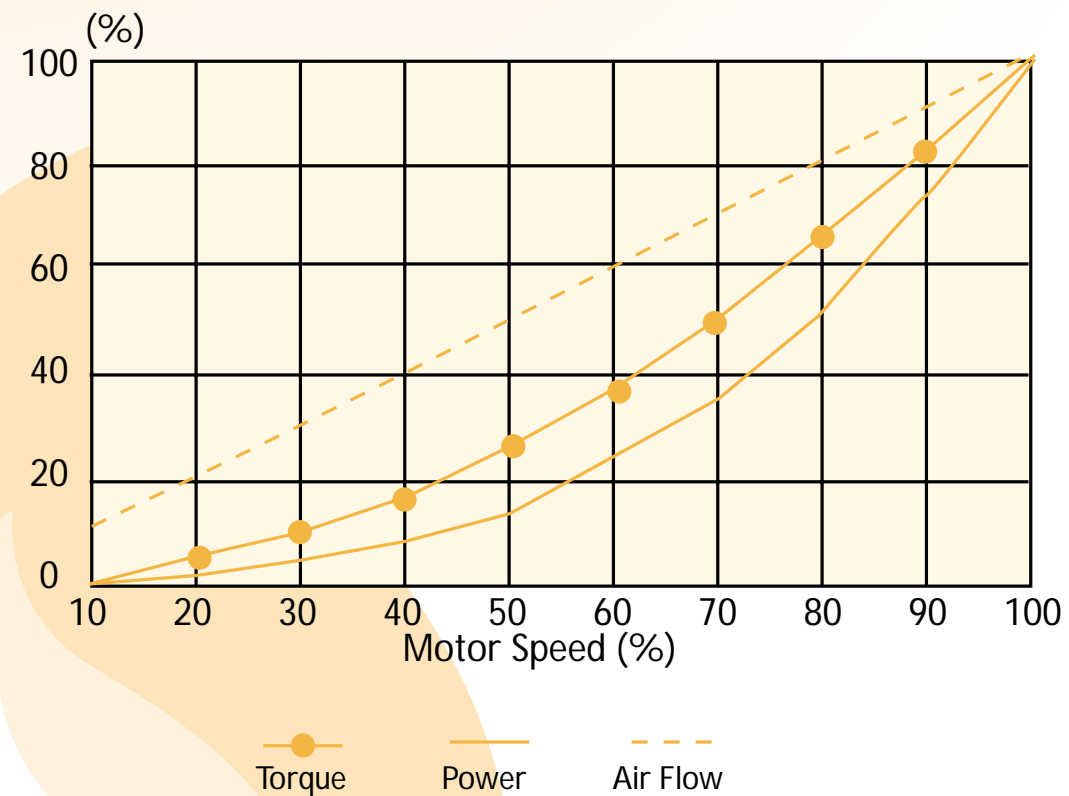
- * Air control dampers and the energy losses which occur across them are eliminated.
- * The absence of the turbulence caused by air control dampers improves air/fuel mixing.
- * Air flow distribution at the burner head is more uniform. This improves combustion and enhances turndown performance.

The benefits of the Nu-way fan speed control system therefore include:

- * Increased system efficiency, leading to reduced running costs.
- * Reduced emissions of greenhouse gases.
- * Lower noise levels.
- * Reduced electrical power consumption, which also reduces running costs.
- * Lower servicing and maintenance costs.

Fan Speed Control is offered as an optional extra, for more detailed information please contact our Technical Department.

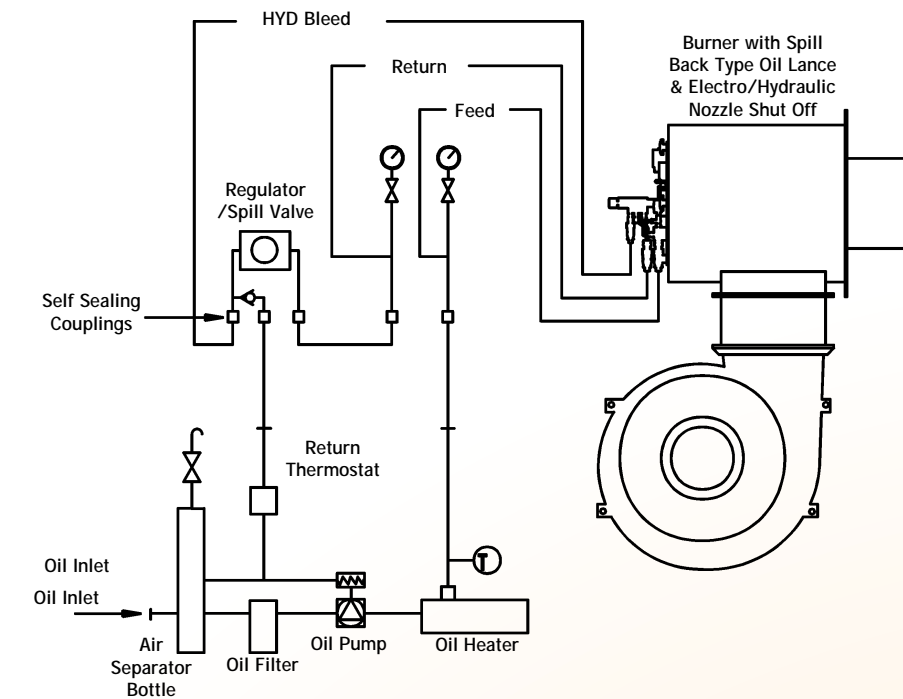
Torque and Power Requirements for Various Burner Air Flows



Oil and Gas Control Lines

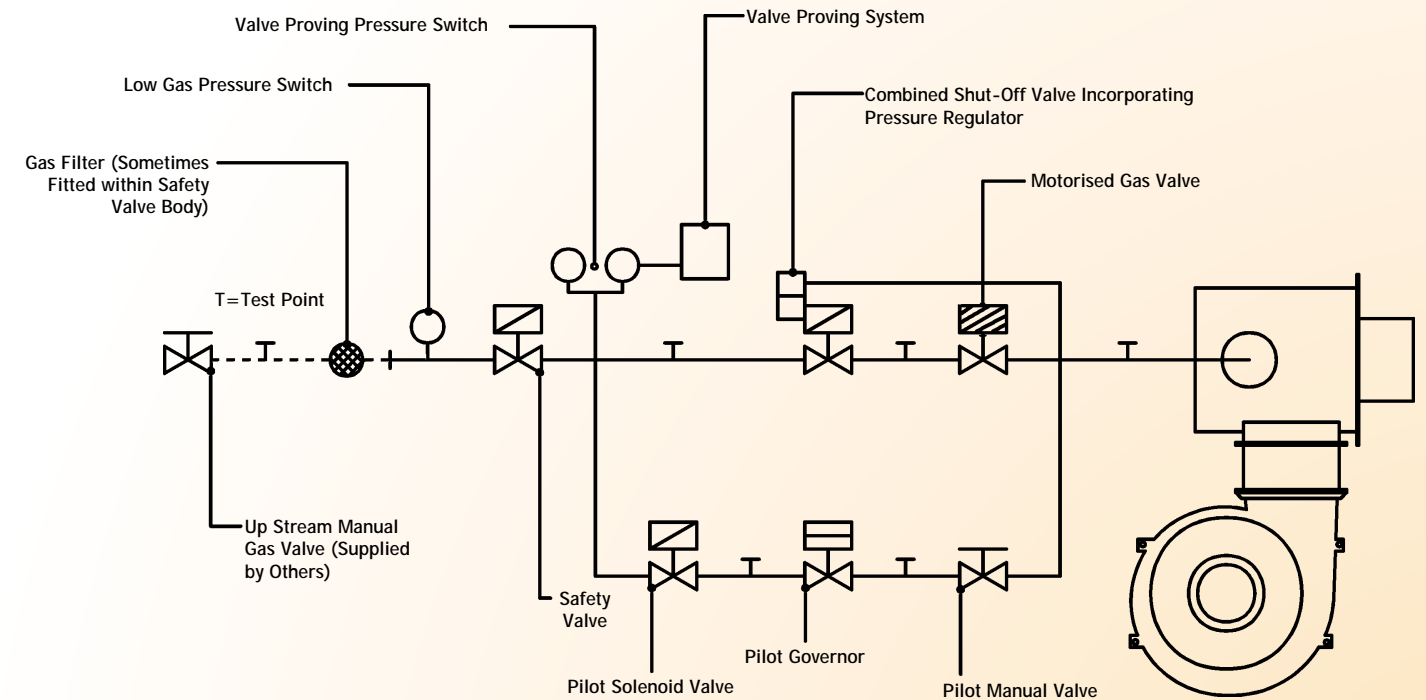
The oil and gas control lines used on 'P' series burners are shown schematically in the accompanying diagrams. They comply with relevant Standards and Codes of Practice and incorporate proprietary items of proven quality and reliability.

A Typical Oil Control Train:



Note : for light oil the preheater, thermostat and thermometer are omitted.

A Typical Gas Control Train :

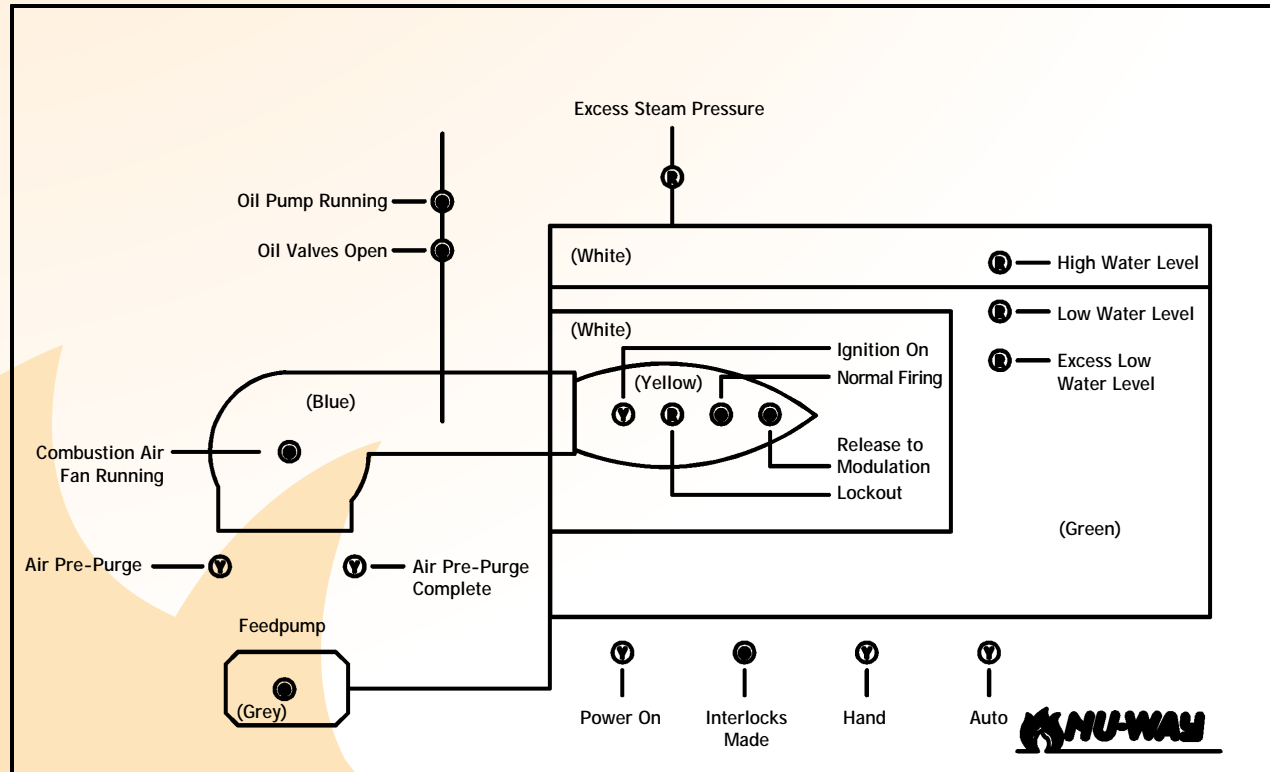
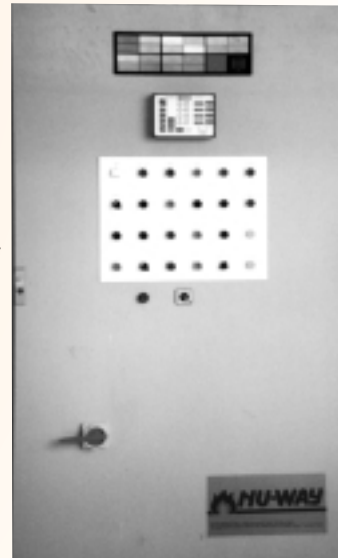


Control trains can be varied to suit individual customer's requirements. Please consult Nu-way's Technical Department for specific details.

Control Panel

The control panel used on Nu-way 'P' series burners is a purpose-designed and robustly constructed unit which complies with relevant Standards and Codes of Practice and can be tailored to individual requirements. Depending on burner specification, the panel incorporates such components as a burner management sequence controller, a fuel selector switch (for dual fuel burners), modulating control gear, starters for the combustion air fan, fuel pumps and boiler feed water pump and safety devices such as the low and high water cut-out relays (please see the next section for further information on Nu-way's commitment to safety).

Fitted into the fascia of the cabinet, often within a mimic diagram, are test switches, reset buttons and lights which provide a visual indication of burner operating condition and, in oil fired and dual fuel systems, the status of the preheater tank. The main electrical isolation switch is interlocked with the door catch.

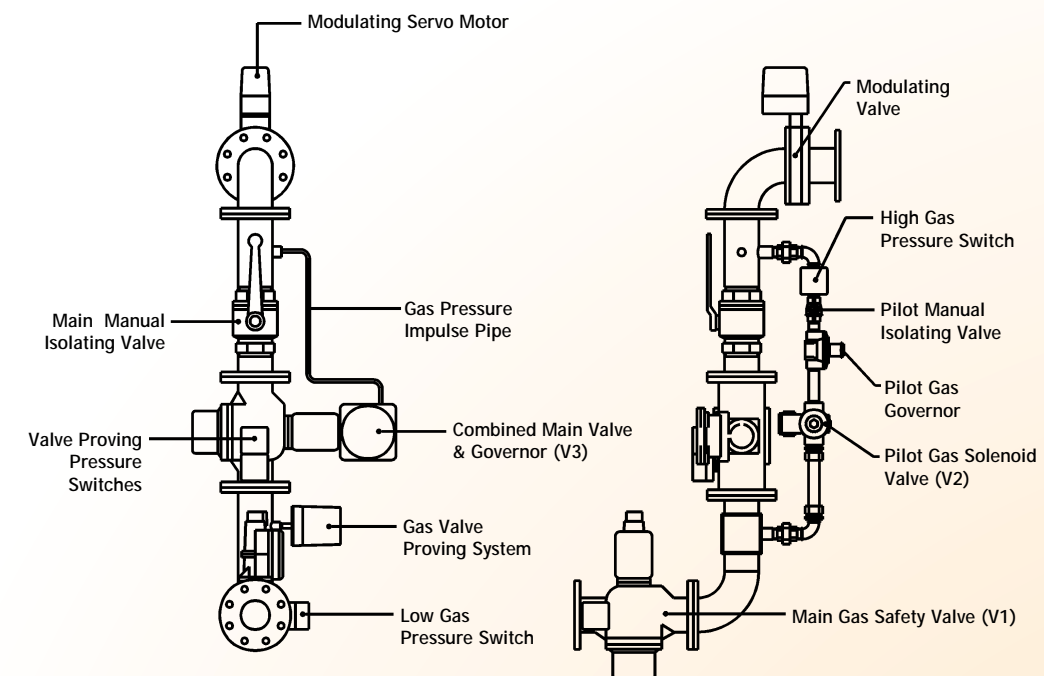


All Nu-way control panels are supplied pre-wired and fully tested in the interests of reliability and have their input and output connections grouped for ease of connection to the power supply and the burner components respectively. Flying leads between the burner and control panel can be supplied if required.

Safety Systems

Nu-way believe that no aspect of the design, manufacture, installation or operation of combustion systems is more important than safety. Our uncompromising position on safety is reflected in:

- Our commitment to research and development (R&D). This is backed by an equally powerful commitment to rapid implementation of the improvements and refinements in all aspects of burner performance which this R&D programme yields.
- Our use of the most modern design and manufacturing techniques, supported by rigorous quality control procedures.
- The comprehensive service we offer (please see the section 'The Nu-way Service') in order to ensure that the standards applied to installing, commissioning and servicing our burner systems match those used in their design and manufacture.
- The resources we devote to training our engineers.
- The specifications of our burners.
- Comply with relevant Standards and Codes of Practice.
- Incorporate only proven, high quality proprietary components (for example pressure switches and safety shut-off valves).



- Often include additional safeguards such as the Nu-way LDU 11 Valve Proving System. This system uses two pressure switches to check the sealing of the fuel control valves on gas fired burners before the start of each firing cycle. Referring to the accompanying diagram, the sequence of checks is as follows.

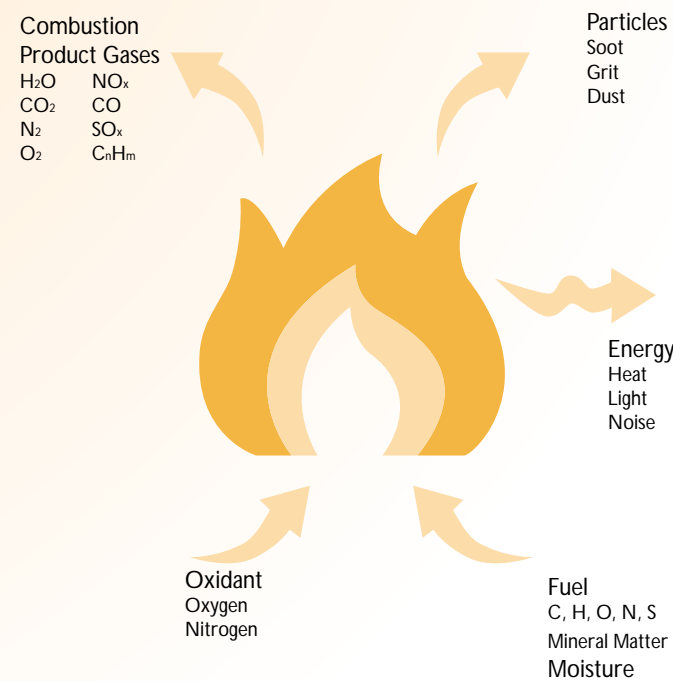
1. Valve 2 opens, venting any gas built up between the valves. Valve 2 closes after 5 seconds a pressure switch then checks for a rise in pressure. The absence of such a rise proves that valve 1 is closed tightly.
2. Valve 1 opens, pressurising the pipework between valves 1, 2 and 3. Valve 1 closes after 5 seconds and the pressure switch checks for a drop in pressure. The absence of such a drop proves that valves 2 and 3 are closed.
3. Only when these checks have been completed satisfactorily will the burner controller continue through its cycle.

BURNER PERFORMANCE

In recent years, research and development on combustion systems has largely been driven by user demands to increase efficiency, in pursuit of lower running costs, and to reduce emissions, in response to growing public concern over the environmental impact of fossil fuel use and the expanding body of legislation. Nu-way are committed to meeting European and worldwide environmental requirements.

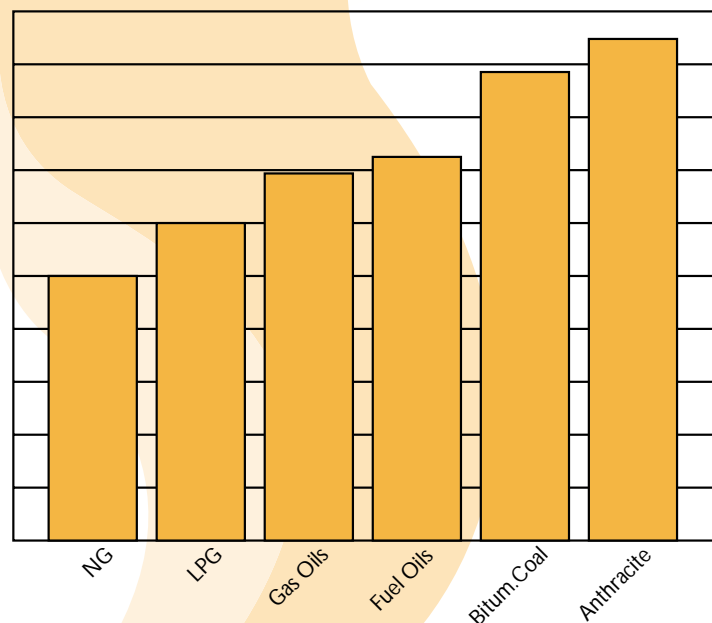
Combustion and Atmospheric Emissions

Fossil fuels consist largely of carbon and hydrogen, and in an ideal system the combustion of such fuels would produce nothing but heat, water and carbon dioxide. Even here, the combustion process would not be environmentally neutral as carbon dioxide (CO₂) is the main greenhouse gas, but real combustion systems also produce, depending on the composition of the fuel and the efficiency of the combustor, a variety of other pollutants including carbon monoxide (CO), which is poisonous and contributes to atmospheric smog; oxides of nitrogen (NO_x), which contribute to acid rain and react with hydrocarbons in sunlight to produce ozone, one of the principal irritants in smog; unburnt hydrocarbons, which are also greenhouse gases; and particulates, some of which have been linked to cancer.



Fossil fuel use is, and for the foreseeable future will remain, an essential part of all our lives, but there is a growing realisation that one of the key challenges confronting industrialised societies is how they can continue to enjoy the benefits of energy use without causing further damage to the environment. Users and manufacturers of combustion equipment must both play a part in meeting this challenge, and in designing and developing the 'P' series of burners, Nu-way have, in addition to

CO₂ Produced for Various Fuels



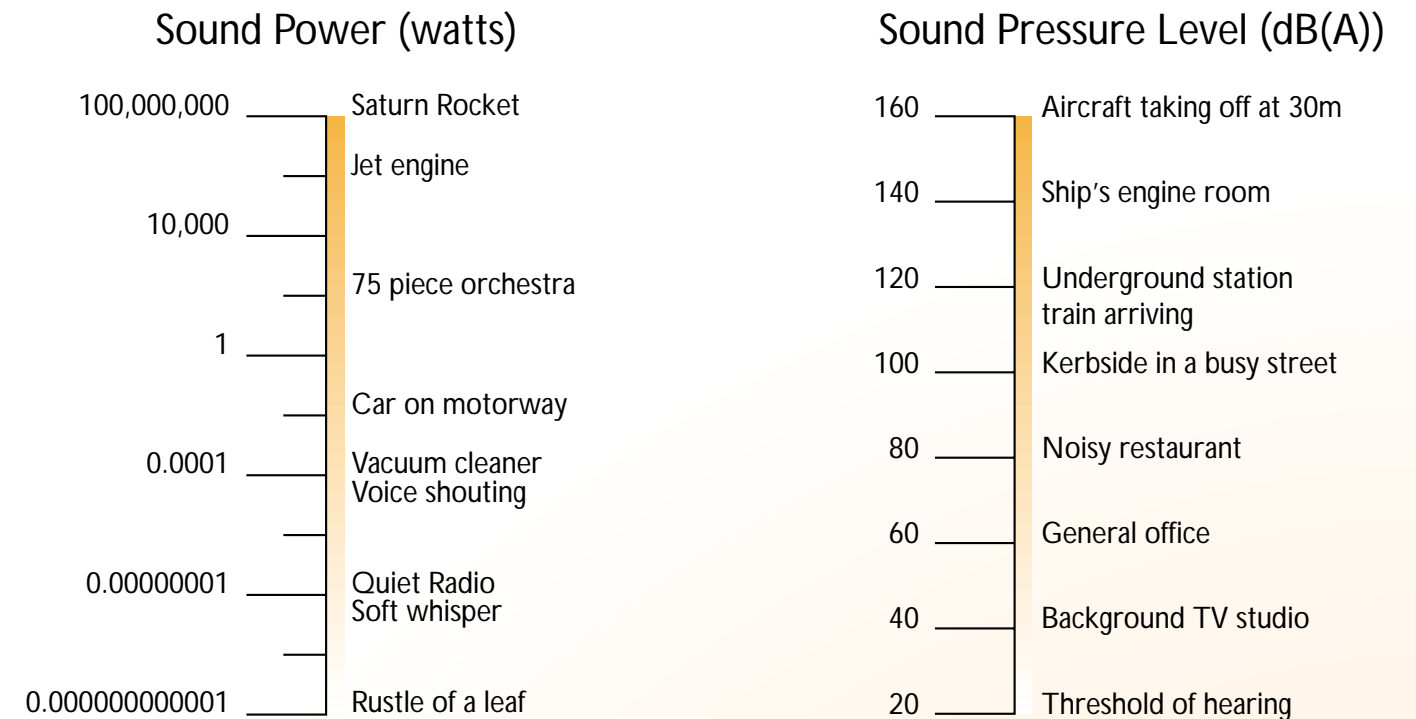
incorporating the advanced control systems described above, paid particular attention to measures which promote good fuel/air mixing and complete combustion. Such measures lead to improved efficiency, which in turn leads not only to reduced running costs but also to reduced carbon dioxide emissions.

For more information on combustion and emissions, please ask for the Nu-way publication "An Introduction to Combustion and the Environment".

Noise

The sound power emitted by a noise source is perceived as a consequence of the sound pressure levels it creates near the ear.

As the ear is sensitive to a very wide range of sound pressures (there is a factor of 1,000,000 between the lower and upper thresholds of hearing), both sound power and sound pressure are normally expressed as a ratio on a logarithmic scale, the common unit being the decibel or dB.



Typical Sound Power and Sound Pressure Levels

Sound powers are expressed in terms of their ratio to 10⁻¹² watts (120 dB sound power is therefore equal to 1 watt), whilst sound pressure levels are related to a standard pressure of 2 x 10⁻⁵ Pascals. Because of the way in which the human ear responds to noise of different frequencies, it is common practice to weight the contribution of sound pressures over the audible spectrum so as to approximate to the ear's response. The most commonly used method is known as "A-weighting" and sound pressure levels measured in this way are designated "dB(A)".

Overall noise levels for the Nu-way 'P' series of burners are shown in the Table overleaf.

Noise Ratings : P Series Burners		
Fuel	Burner Model	Noise Level (dBA)
Natural Gas	PG160/4.8	92
	PG250/7.3	93
	PG310/98.2	93
Oil Class 'D'	POL250/5.5	93
	POL250/6.2	93
	POL250/6.6	96
	POL250/7.0	96
	POL250/7.3	96
Oil Class 'E', 'F' and 'G'	POR250/5.5	93
	POR250/6.2	93
	POR250/6.6	96
	POR250/7.0	96
	POR250/7.3	96
Dual Fuel (NG/Class D)	PDF160/4.4	92
	PDF160/4.8	93
	PDF250/5.1	93
	PDF250/5.5	93
	PDF250/6.0	93

For Burners above these sizes please refer to Nu-way

As with all combustion systems, this noise is generated in two ways:

- Combustion generates broadband noise with significant peaks in the 300 to 1200 Hz band.
- The burner's ancillary equipment, including fans and pumps, can contribute significantly to the overall noise level around the plant.

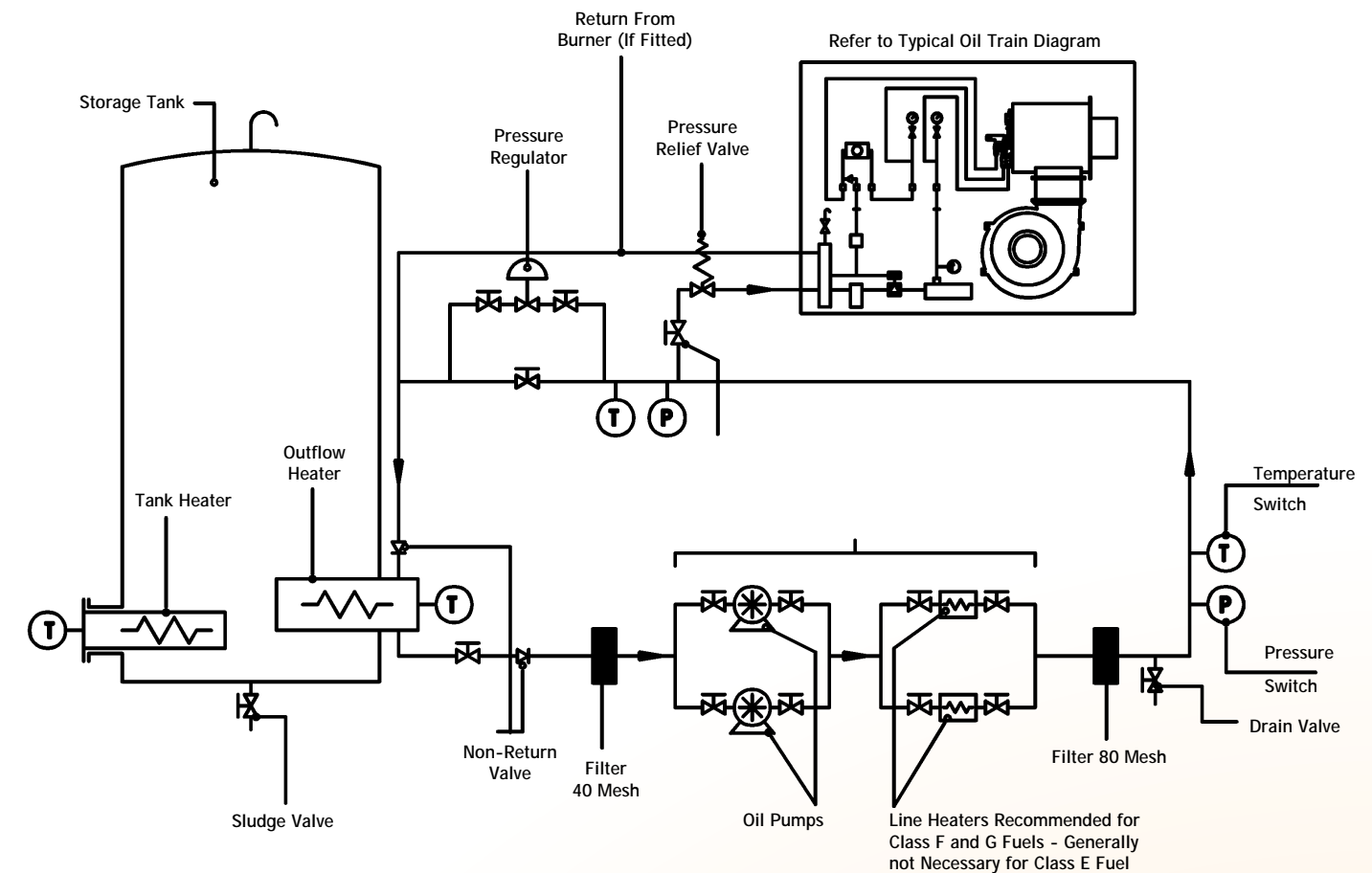
Nu-way have paid careful attention to both of these forms of noise generation in designing and developing the 'P' series, and as additions to the standard specification designed to reduce noise output still further, we can provide fully modulating fan speed control, fan inlet silencers and acoustic enclosures. As a guide to the reductions which can be expected, silencers normally reduce overall noise levels by between 6 and 8 dB(A) and acoustic enclosures produce reductions of up to 15 dB(A).

SERVICES

Oil Supply

The ring main oil supply system required by Nu-way 'PO' and 'PDF' burners is outlined in the accompanying diagram. Where heavy oil is to be used, the oil filtration section of the ring main is of particular importance and should be tailored to the particular requirements of each burner installation. The ring main must be constructed and installed in such a way as to ensure that it complies with relevant Standards and Codes of Practice and is appropriate to local conditions.

Heating arrangements (including trace heating of the pipework and components) will vary according to the class of oil in use.



Nu-way have a good deal of practical experience in this area and we can provide any degree of support which may be required, including:

- Providing general guidelines on the layout of oil supply systems, the components which should be incorporated and the size of pipework required.
- Designing an appropriate system and providing a detailed specification for the components to be used.
- Providing such a system, fully assembled and tested, as part of the burner package.

Gas Supply

The gas supply pipework provided must be constructed and installed in such a way as to ensure that it complies with relevant Standards and Codes of Practice and is appropriate to local conditions. It should be of sufficient size to provide the pressure and flow required by the burner(s). Nu-way's Technical Department can provide advice on these matters.

The gas supply pipework to each burner should terminate in a 90° manual shut-off valve to allow the burner to be isolated for maintenance. The size of the valve should not be less than that of the burner control train. The gas meter on the supply line to the burner(s) should be checked to ensure that it is capable of handling the required flow rate.

Electrical Power Supply

Nu-way 'P' series burners require a 3 phase supply. The burner's overall electrical power requirement is related closely to the rating of the combustion air fan, which, depends upon the burner heat input and appliance back pressure. Nu-way's Technical Department will provide more detailed information on request.

BURNER SELECTION

Although Nu-way prefer to support customers in the selection, installation and use of Nu-way burners through their comprehensive service detailed in 'The Nu-way Service' section of this brochure, some customers may wish to carry out the burner selection process themselves. Here information is presented which is designed to assist with this process.

Nu-way 'P' series burners are designated by a series of letters and numbers which collectively form the burner code.

Burner Code

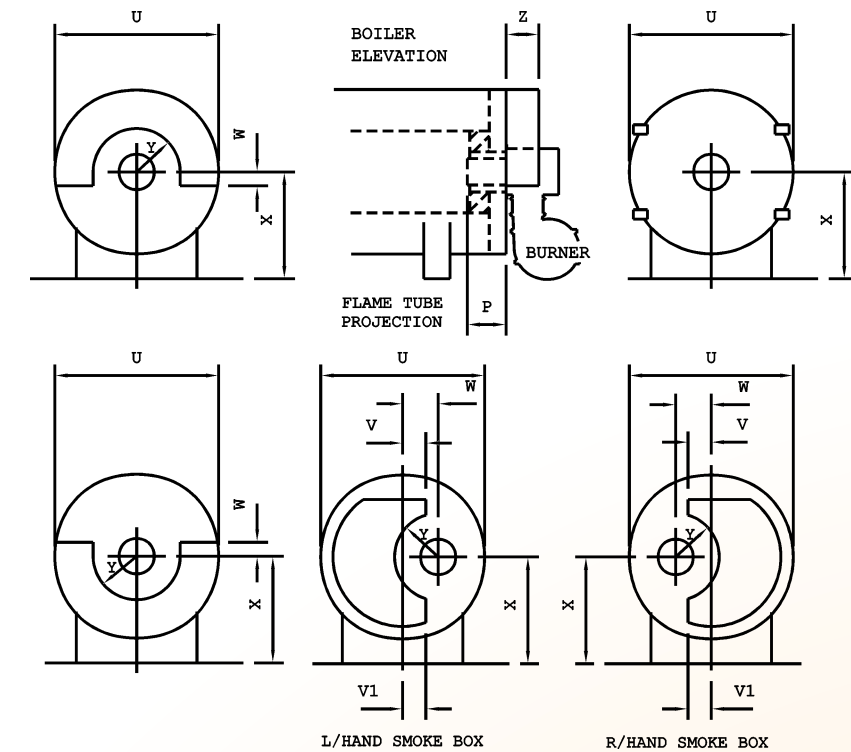
The first step in formulating the burner code is to specify the plant rating. The accompanying Table can then be used to derive the appropriate model of 'P' series burner, which is defined in terms of a casing size and a maximum power output, for example 310/8.4. Nu-way use the Gross Calorific Value when specifying ratings.

Burner Output Based upon Gross CV of Fuel		Air Plenum Size	Burner Designation	Air Plenum Size	Burner Output Based upon Gross CV of Fuel		Burner Designation
Btu/h*10 ⁶	MW				Btu/h*10 ⁶	MW	
12.50	3.7	P4	160/3.7	P8	41.25	12.1	490/12.1
13.75	4.0		160/4.0		42.50	12.5	490/12.5
15.00	4.4		160/4.4		43.75	12.8	490/12.8
16.25	4.8		160/4.8		45.00	13.2	490/13.2
17.50	5.1	P5	250/5.1	P9	46.25	13.6	490/13.6
18.75	5.5		250/5.5		47.50	13.9	490/13.9
20.00	6.0		250/6.0		48.75	14.3	490/14.3
21.25	6.2		250/6.2		50.00	14.7	575/14.7
22.50	6.6	P6	250/6.6	P10	51.25	15.0	575/15.0
23.75	7.0		250/7.0		52.50	15.4	575/15.4
25.00	7.3		250/7.3		52.75	15.8	575/15.8
26.25	7.7		310/7.7		55.00	16.1	575/16.1
27.50	8.0	P7	310/8.0	P10	56.25	16.5	575/16.5
28.75	8.4		310/8.4		57.50	16.9	575/16.9
30.00	8.8		310/8.8		58.75	17.2	660/17.2
31.25	9.2		310/9.2		60.00	17.6	660/17.6
32.50	9.5	P7	400/9.5	P10	61.25	18.0	660/17.0
33.75	9.9		400/9.9		62.50	18.3	660/18.3
35.00	10.3		400/10.3		63.75	18.7	660/18.7
36.25	10.6		400/10.6		65.00	19.0	660/18.0
37.50	11.0	P7	400/11.0	P10	66.25	19.4	660/19.4
38.75	11.4		400/11.4		68.25	20.0	660/20.0
40.00	11.7		400/11.7				

Additional information

In addition to the burner code, the combustion air fan orientation/burner mounting position and the details of the burner mounting plate must be specified.

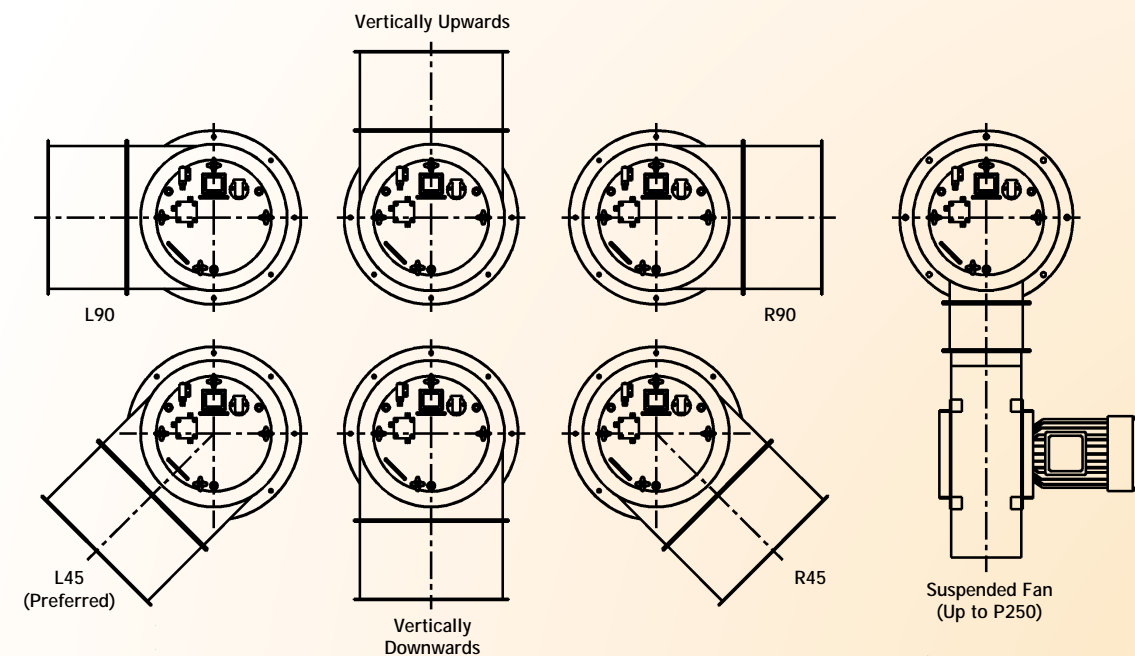
Burner Mounting plate



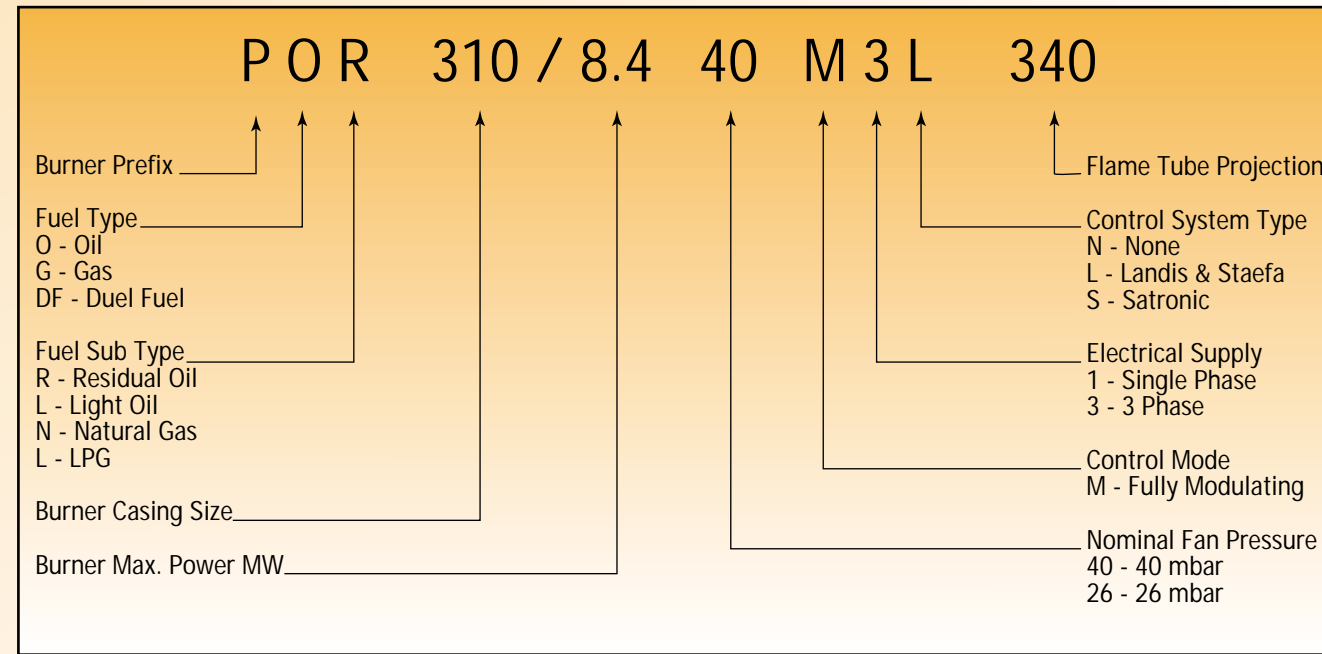
Fan/Burner Orientation

All 'P' Series Burners can be specified for mounting in an orientation to suit your application

Burner Mounting Positions



This casing/maximum power output designation is at the heart of the burner code, a typical example of which is shown below.



This comprehensive code 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 of:

	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 accompanying Table.	
MAXIMUM POWER	Obtained from accompanying Table.	
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 (PLCs). Individual requirements should be discussed with Nu-way's Technical Department.	'N': None 'L': Landis & Staefa 'S': Satronic
FLAME TUBE PROJECTION	The flame tube projection on Nu-way 'P' series burners is matched to the individual application.	State required length

Previous Designation Comparisons

Burner Designation	Burner Output Based upon Gross CV of Fuel		Previous Burner Designation		
	Btu/h10 ⁶	MW	PF	PG	PDF
160/3.7	12.50	3.7	PF4A	PG160	PDF160
160/4.0	13.75	4.0	PF4B	PG 160	PDF160
160/4.4	15.00	4.4	PF4C	PG160	PDF160
160/4.8	16.25	4.8	PF4D	PG 160/200	PDF160/200
250/5.1	17.50	5.1	PF5A	PG200	PDF250
250/5.5	18.75	5.5	PF5B	PG 200	PDF250
250/6.0	20.00	6.0	PF5C	PG200	PDF250
250/6.2	21.25	6.2	PF5D	PG250	PDF250
250/6.6	22.50	6.6	PF5E	PG250	PDF250
250/7.0	23.75	7.0	PF5F	PG250	PDF250
250/7.3	25.00	7.3	PF5G	PG250	PDF250
310/7.7	26.25	7.7	PF6A	PG310	PDF3 10
310/8.0	27.50	8.0	PF6B	PG310	PDF310
310/8.4	28.75	8.4	PF6C	PG310	PDF3 10
310/8.8	30.00	8.8	PF6D	PG310	PDF310
310/9.2	31.25	9.2	PF6E	PG310/375	PDF310/400
400/9.5	32.50	9.5	PF7A	PG375	PDF400
400/9.9	33.75	9.9	PF7B	PG375	PDF400
400/10.3	35.00	10.3	PF7C	PG375	PDF400
400/10.6	36.25	10.6	PF7D	PG375	PDF400
400/11.0	37.50	11.0	PF7E	PG375	PDF400
400/11.4	38.75	11.4	PF7F	PG440	PDF400
400/11.7	40.00	11.7	PF7G	PG440	PDF400
490/12.1	41.25	12.1	PF8A	PG440	PDF440
490/12.5	42.50	12.5	PF8B	PG440	PDF440
490/12.8	43.75	12.8	PF8C	PG440	PDF440
490/13.2	45.00	13.2	PF8D	PG500	PDF500
490/1 3.6	46.25	13.6	PF8E	PG500	PDF500
490/1 3.9	47.50	13.9	PF8F	PG500	PDF500
490/14.3	48.75	14.3	PF8G	PG500	PDF500
575/14.7	50.00	14.7	PF9A	PG500	PDF500
575/1 5.0	51.25	15.0	PF9B	PG590	PDF590
575/1 5.4	52.50	15.4	PF9C	PG590	PDF590
575/1 5.8	52.75	15.8	PF9D	PG590	PDF590
575/16.1	55.00	16.1	PF9E	PG590	PDF590
575/16.5	56.25	16.5	PF9F	PG590	PDF590
575/16.9	57.50	16.9	PF9G	PG590	PDF590
660/17.2	58.75	17.2	PF10A	PG590	PDF590
660/17.6	60.00	17.6	PF10B	PG675	PDF675
660/18.0	61.25	18.0	PF10C	PG675	PDF675
660/18.3	62.50	18.3	PF10D	PG675	PDF675
660/18.7	63.75	18.7	PF10E	PG675	PDF675
660/19.0	65.00	19.0	PF10F	PG675	PDF675
660/19.4	66.25	19.4	PF10G	PG675	PDF675
660/20.0	68.25	20.0	PF10H	PG675	PDF675