Enertech Group

Installation & Maintenance Manual

NDF 35 - 100

Dual Fuel Burner

11/12

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Contents

IMPORTANT - SAFETY

IT IS ESSENTIAL THAT THE FOLLOWING INSTRUCTIONS AND ADJUSTMENTS ARE CARRIED OUT BY QUALIFIED ENGINEERS THAT ARE EXPERIENCED IN FORCED DRAUGHT GAS BURNER COMMISSIONING. IN THE U.K. IT IS A LEGAL REQUIREMENT THAT ANYONE WORKING ON GAS INSTALLATION, AS DEFINED IN THE "GAS SAFETY (INSTALLATION & USE) REGULATIONS 1994" IS GAS SAFE REGISTERED (OR WHATEVER REPLACEMENT SCHEME IS IN PLACE AT THE TIME). THE COMPOSITION OF THE FUEL IS CRITICAL TO THE CORRECT OPERATION AND SAFETY OF THE EQUIPMENT. OPERATION WITH FUELS CONTAINING EVEN TRACE ELEMENTS OF CERTAIN SUBSTANCES CAN GIVE RISE TO HAZARDOUS CONDITIONS IF YOU HAVE ANY DOUBTS ABOUT THE SPECIFICATION OF THE FUEL MEETING OUR REQUIREMENTS YOU SHOULD CONSULT YOUR SUPPLIER BEFORE OPERATION. THE MANUFACTURER CANNOT BE HELD RESPONSIBLE FOR ANY CONSEQUENTIAL DAMAGE, LOSS OR PERSONAL INJURY AS A RESULT OF FAILURE TO FOLLOW THESE INSTRUCTIONS, OR AS A RESULT OF MISUSE.

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

ALL BURNERS AND BOILER BODIES MARKETED SEPARATELY SHOULD COMPLY WITH EN676 (GAS BURNERS) AND EN303 (HEATING BOILERS). BURNER ADJUSTMENTS MUST BE MADE IN ACCORDANCE WITH BOILER MANUFACTURERS' INSTRUCTIONS, AND THESE MUST INCLUDE FLUE GAS TEMPERATURES, AVERAGE WATER TEMPERATURE, AND CO_2 OR O_2 CONCENTRATION.

INTRODUCTION

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

FEATURES

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

Burner Capacity

The figures quoted are nominal burner outputs based on net calorific value (NCV).

Burner Model	Capacity (kW)
NDF 35	253 – 1026
NDF 50	406 - 1353
NDF 60	496 - 1669
NDF 85	722 – 2210
NDF 100	766 – 2706
NDF 125	1786 – 3247
NDF 150	1380 – 4059
NDF 180	1125 – 4450

Please refer to the Appendix of this handbook for detailed burner performance data.

Fuel

Burners designated NDFL are suitable for light distillate oil (Class D) and those designated NDFR are suitable for residual oil (Classes E, F and G). All NDF burners are normally configured for natural gas but versions suitable for liquefied petroleum gas (LPG) or manufactured gas (towns gas) can be supplied on request. Operation with fuels containing even trace elements of certain substances can give rise to hazardous conditions if you have any doubts about the specification of the fuel meeting our requirements you should consult your supplier before operation.

Air Fan Size

To match NDF burners with the appliance, with respect to both burner output and appliance, resistance, a number of combustion air fan sizes are available for each model, as detailed in the table below.

The fan size quoted is the diameter of the fan impellor (measured in cm) and appears as a suffix to the model number. For example, a burner designated NDFR 60-34 is a model 60 for residual fuel oil firing with a 34cm diameter combustion air fan impellor.

Burner Model	Available Fan Sizes
NDF 35	25, 34, 38
NDF 50	28, 34, 38
NDF 60	28, 34, 38
NDF 85	38
NDF 100	38, 41, 44
NDF 125	36, 41, 44
NDF 150	36, 41, 44
NDF 180	44

Controls and Safety Systems

NDF burners are fitted with a combustion airflow control and an air/fuel ratio control system which together ensures smooth starting and optimum operating efficiency.

An air pressure switch provides safe burner shutdown if the combustion air supply becomes insufficient for complete combustion. The burner's additional safety systems include for gas pressure monitoring (low and high) whilst gas firing and low oil temperature monitoring (NDFR) whilst firing on fuel oil. Continuous flame supervision is provided by an ultraviolet (UV) cell and automatic programming control unit.

Operating Mode

Standard NDF burners are manufactured for either fully modulating or two-stage (high/low) operation on both fuels. A special variation of the NDFL 35 to NDFL 100-38 burner is available on request, designated Modulating-High/Low. In this version, the burner operates in fully modulating mode when firing on gas, and 2 stage (high/low) mode when firing on oil.

Oil Firing

Two Stage Operation: NDFL burners up to and including the NDFL 100-38 use twin simplex oil nozzles, one for low fire and both for high fire. The oil nozzles are sized to give a turndown ratio of between 1.8 and 2.0:1.

NDFL burners NDFL 100-41 and larger, together with all NDFR burners are supplied with a system designated 'Sliding High/Low' which uses a single spill-back oil nozzle (similar to that employed in the fully modulating mode) which is constrained to operate at either of two fixed oil flows corresponding to the high and low fire rates. If the burner has been correctly matched to the appliance, a turndown ratio of up to 3.0:1 may be achieved.

Fully Modulating Operation: All NDF burners manufactured for fully modulating operation use a single spill-back oil nozzle. If the burner has been correctly matched to the appliance, a turndown ratio of up to 3.0:1 may be achieved.

Gas Firing – All Modes

When gas firing, the fuel gas flow is controlled by an automatic valve which, following commissioning, precisely matches the fuel flow to the air flow to achieve the required fuel/air ratio at any point in the full turndown range. If the burner has been correctly matched to the appliance, a turndown ratio between 2.0 and 2.5:1 may be achieved.

Burner Type Nomenclature

NDF burners are divided into two groups, depending on the oil nozzle employed:

Twin Nozzle Pressure Jet Burners
Comprising two stage NDFL burners up to and including the NDFL 100-38.

Single Nozzle Spill-back Burners
Comprising two stage NDFL burners NDFL 100-41 and larger
All fully modulating NDFL burners
All two stage NDFR burners
All fully modulating NDFR burners

Throughout this handbook the burners are referred to by this grouping.

FIG 1: BURNER AND COMPONENT IDENTIFICATION FOR NDF MODULATING BURNER

(MODEL SHOWN NDF 125 SHOWN)

Item	Description	Item	Description
1	Burner Casing	13	Valve Proving Pressure Switch
2	Hinged Extension	14	Modulating Cam Box
3	Flame Tube	15	Valve Proving System
4	Fan Motor	16	Pilot Solenoid Valve
5	Air Inlet	17	Pilot Governor
6	Damper Motor	18	Low Gas Pressure Switch
7	Burner Terminal Panel	19	Flexible Oil Pipe
8	Casing Access Lid	20	Quick Release Oil Couplings
9	High Gas Pressure Switch	21	Pressure Gauges
10	Valve Body	22	Oil Manifold
11	Control Valve	23	Manual Gas Interlock Valve
12	Main Valve		

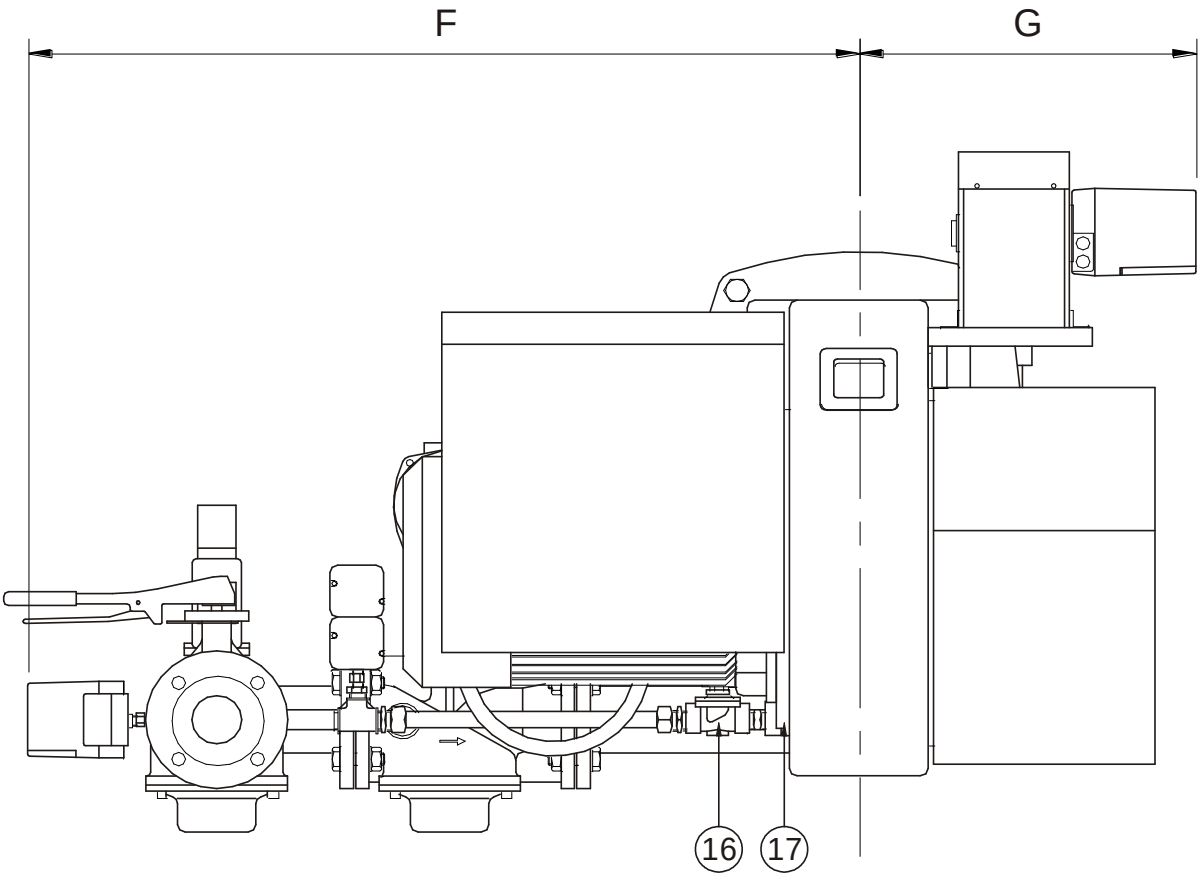

FIG 2

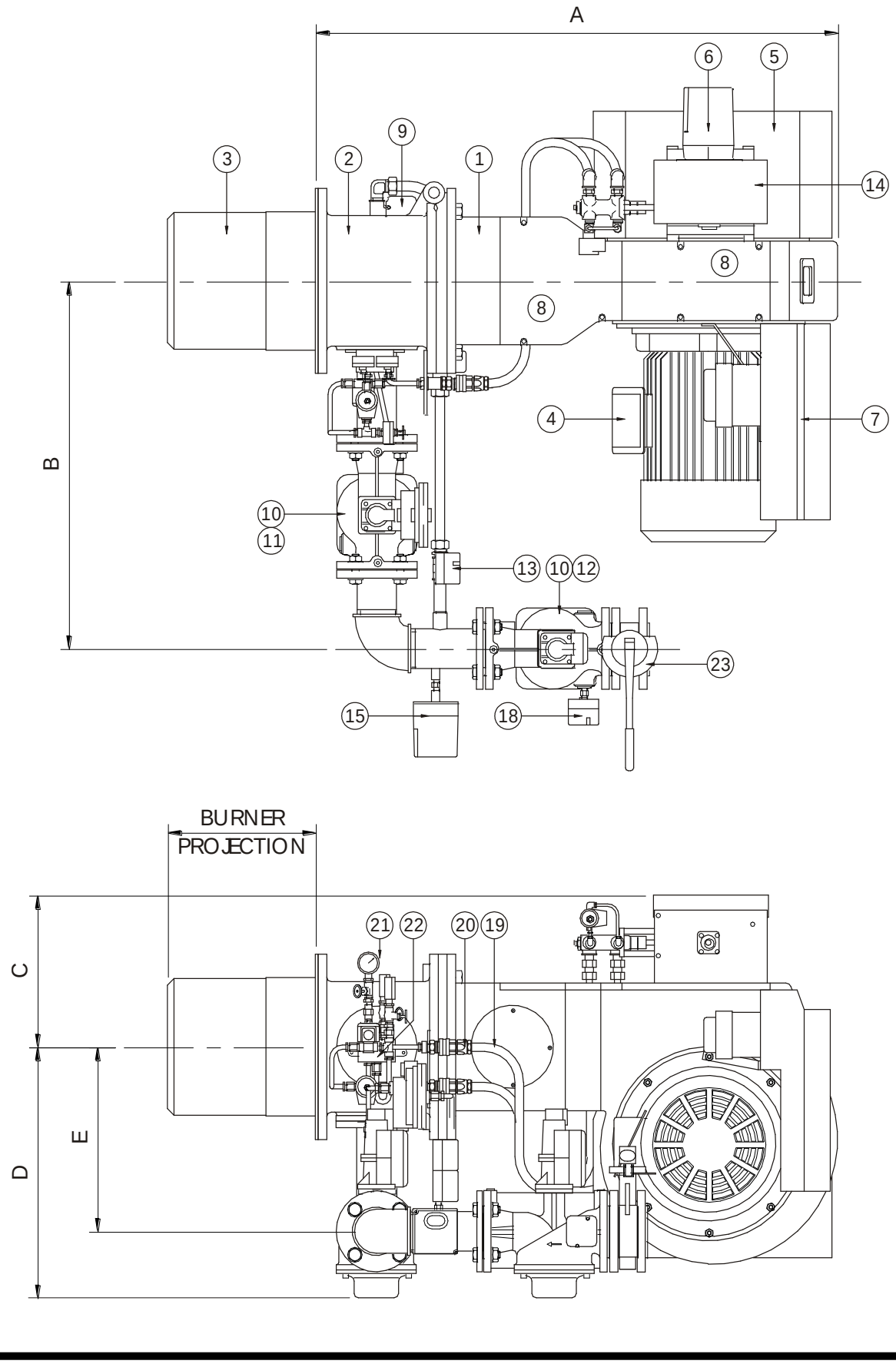
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FIG 3: BURNER AND COMPONENT IDENTIFICATION FOR NDF TWO STAGE (H/L) BURNER

(MODEL SHOWN NDF 35 SHOWN)

Item	Description	Item	Description
1	Burner Casing	14	Connection Box
2	Hinged Extension	15	Valve proving system
3	Flame Tube	16	Pilot Solenoid Valve
4	Fan Motor	17	Pilot Governor
5	Damper Motor	18	Low Gas Pressure Switch
6	Burner Control Panel	19	Flexible Oil Pipe
7	Air Inlet	20	Oil Pump
8	Casing Access Lid	21	Pressure Gauge
9	High Gas Pressure Switch	22	Isolation Valve
10	Valve Body	23	Microswitch
11	Control Valve	24	Twin Solenoid Valve
12	Main Valve	25	Oil Manifold
13	Valve Proving Pressure Switch	26	Manual Gas Interlock Valve

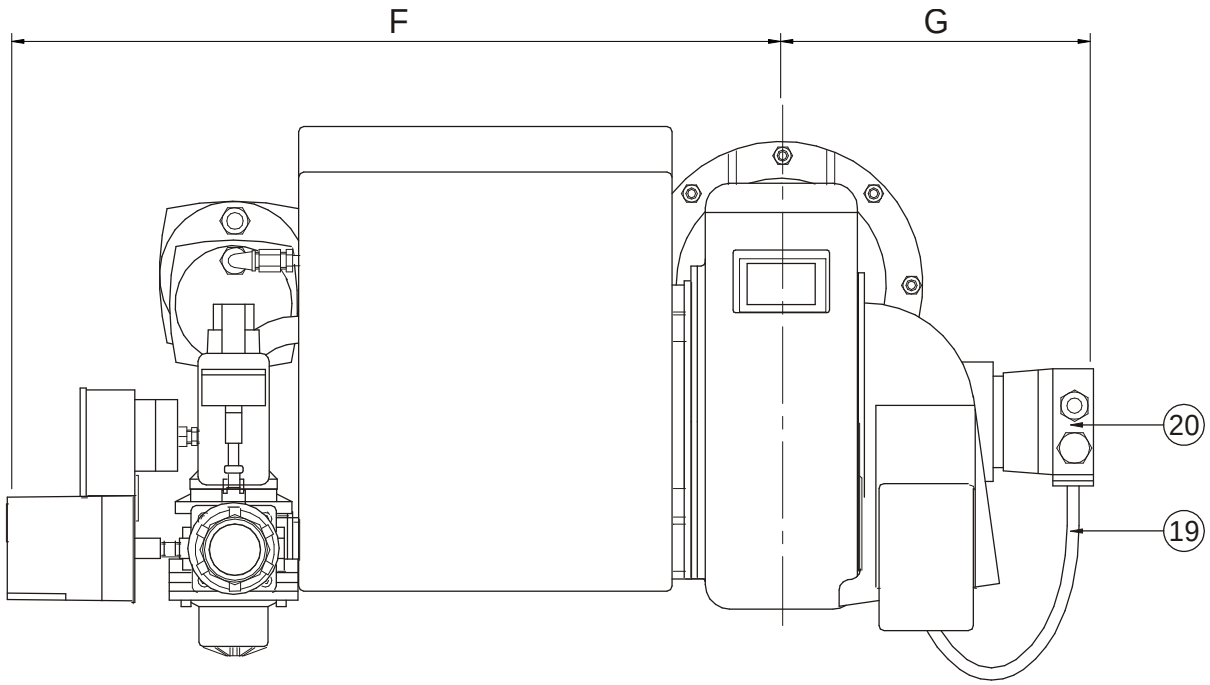
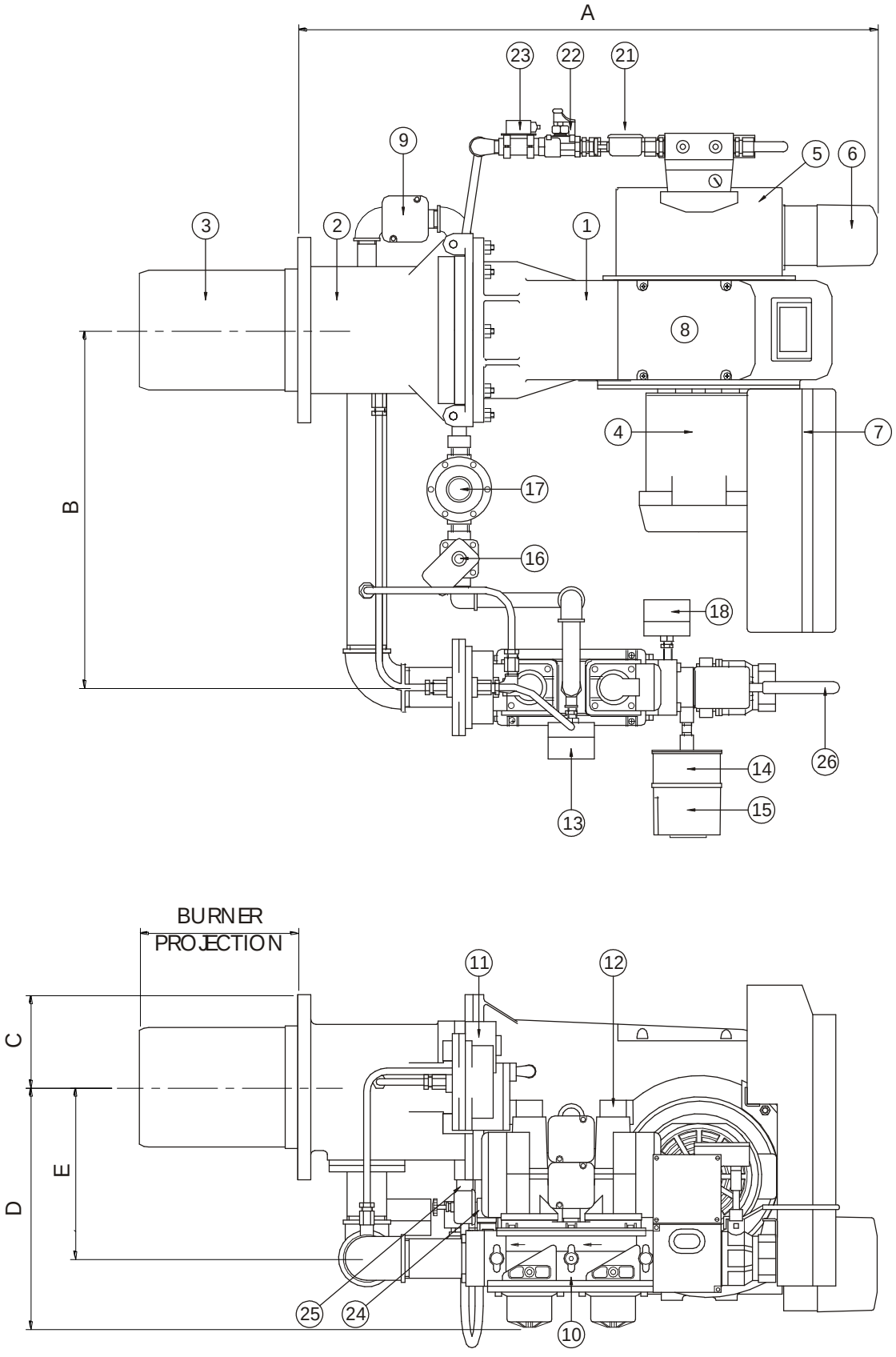


FIG 4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BURNER
PROJECTION
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C
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D
25
24
10

FIG 5: BURNER DIMENSIONS

Twin Pressure Jet Oil Nozzle Burners

NDFL 35-25 to NDFL 100-38 Two Stage (High/Low)

Model	Dimensions (all mm)						
	A	B	C	D	E	F	G
NDFL 35-25	885	540	165	410	305	686	280
NDFL 35-34	1069	540	165	410	305	686	330
NDFL 35-38	1081	540	165	410	305	686	330
NDFL 50-28	1069	540	165	410	305	800	370
NDFL 50-34	1069	540	165	410	305	800	370
NDFL 50-38	1081	540	165	410	305	800	370
NDFL 60-28	1069	540	165	410	305	800	360
NDFL 60-34	1069	540	165	410	305	800	360
NDFL 60-38	1081	540	165	410	305	800	360
NDFL 80-28	1069	920	165	550	385	1196	360
NDFL 80-34	1069	920	165	550	385	1196	360
NDFL 85-38	1081	920	165	550	385	1196	360
NDFL 100-38	1081	920	165	550	385	1196	372

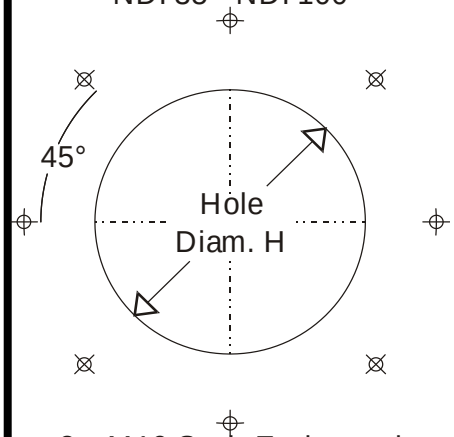
Single Spill-back Oil Nozzle Burners

NDFR 35 to NDFR 180 Two Stage (Sliding High/Low) & Modulating
NDFL 100-41 to NDFL 180-44 Two Stage (Sliding High/Low)

Model	Dimensions (all mm)						
	A	B	C	D	E	F	G
NDF 35-25	810	540	280	410	305	686	210
NDF 35-34	967	540	300	410	305	686	260
NDF 35-38	1014	540	300	410	305	686	260
NDF 50-28	967	540	300	410	305	800	260
NDF 50-34	967	540	300	410	305	800	260
NDF 50-38	1014	540	300	410	305	800	260
NDF 60-28	967	540	300	410	305	800	260
NDF 60-34	967	540	300	410	305	800	260
NDF 60-38	1014	540	300	410	305	800	260
NDF 80-28	967	920	300	550	385	1196	260
NDF 80-34	967	920	300	550	385	1196	260
NDF 85-38	1014	920	300	550	385	1196	260
NDF 100-38	1014	920	300	550	385	1196	260
NDF 100-41	1240	920	345	580	416	1196	440
NDF 100-44	1240	920	345	580	416	1196	440
NDF 125-36	1240	920	345	580	416	1196	440
NDF 125-41	1240	920	345	580	416	1196	440
NDF 125-44	1240	920	345	580	416	1196	440
NDF 150-36	1240	920	345	580	416	1210	440
NDF 150-41	1240	920	345	580	416	1210	440
NDF 150-44	1240	920	345	580	416	1210	440
NDF 180-44	1240	920	345	580	416	1210	440

FIG 6: BURNER MOUNTING ARRANGEMENT

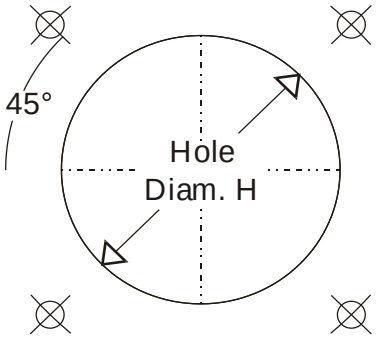
NDF35 - NDF100



8 x M10 Studs Equispaced
on 305 mm PCD

Burner	Diam. H mm
NDF35	230
NDF50	230
NDF60	230
NDF80	280
NDF85	280
NDF100	280
NDF125	350
NDF150	350
NDF180	350

NDF125 - NDF180



4 x M20 Studs Equispaced
on 454 mm PCD

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

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

Existing Appliances
The appliance should be prepared for the installation of the NDF burner by thorough cleaning, including the removal of all adhering tar, scale and dirt. An inspection should also be carried out to ensure that the appliance is in good condition. Any doubt about the suitability of the appliance for dual fuel firing should be referred to the appliance manufacturer.
Combustion Chamber Conditions

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

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

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

Gas Boosters

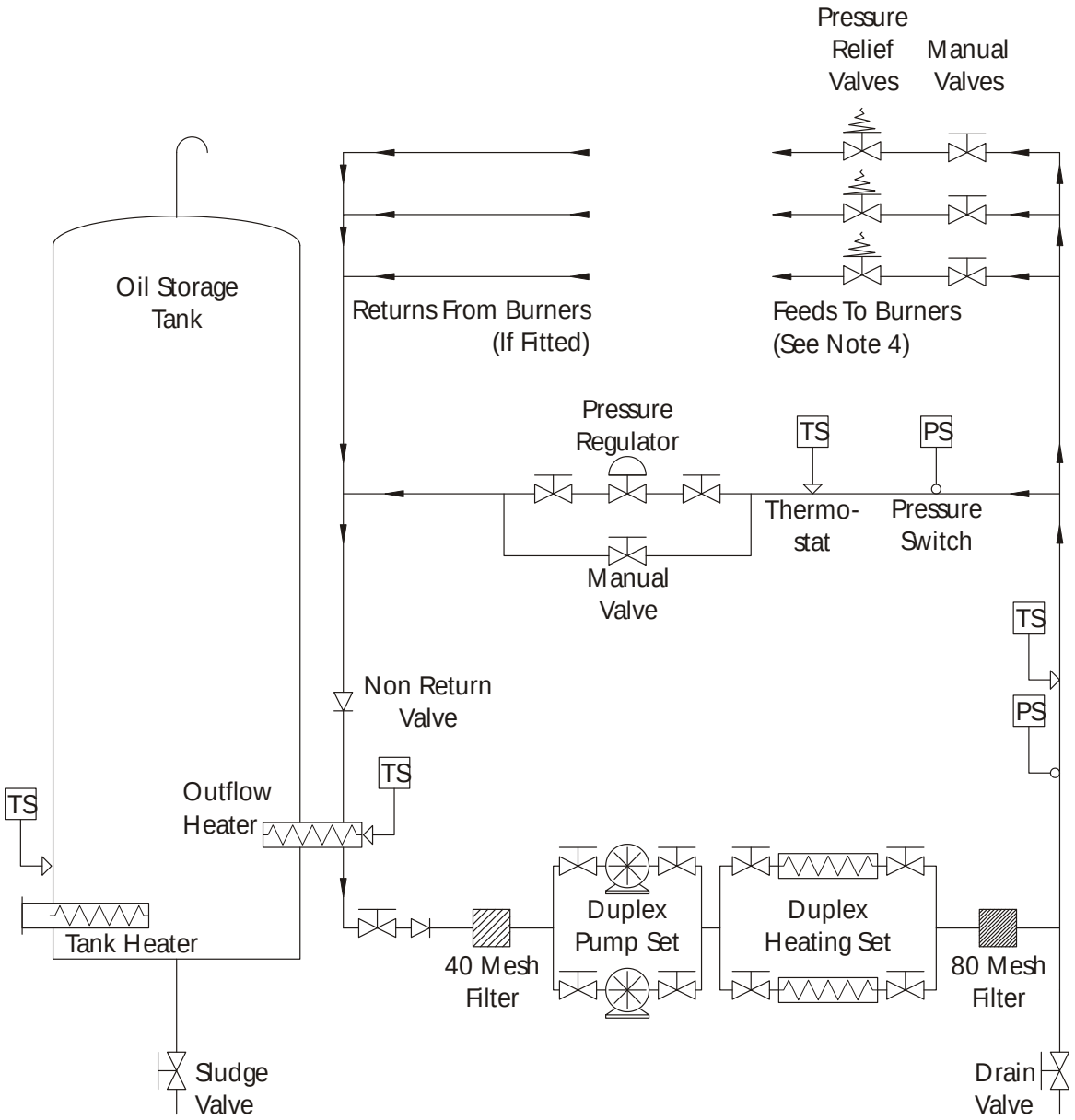
When a gas booster is used, the gas pressure at the booster inlet must not fall below 10 mbar under any conditions. A low gas pressure switch must be fitted on the upstream side of the booster to prevent it starting if the supply pressure is insufficient.

An additional pressure switch should be used to monitor the pressure downstream of the booster and prevent the burner going to high fire if the pressure is insufficient.

It should be noted that CE marked burners fitted with a low gas pressure switch will not run if the gas pressure from the booster is insufficient. This is due to the low gas pressure switch being set to safeguard combustion quality at the high fire setting. In this situation the booster outlet pressure switch will have no bearing on the burner control, but can be used to indicate booster failure.

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

FIG 7: A 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 & G fuels, but are not normally necessary for Class E fuel.
3. Pre-heating Class D fuel is not normally required, but a minimum temperatyre 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/cm^2 (10 psi) above the normal supply pressure.

Oil Supply

The oil supply pipework to the burner must be appropriate to local conditions and must be constructed and installed in compliance with appropriate Codes and Standards. It shall be of sufficient size to satisfy the pressure and volume flow requirements of the burner under all firing conditions. Checks should be made to ensure that all meters and other components are appropriately rated for the maximum oil flow rate anticipated. Galvanised steel pipe should not be used. The supply pipework should include an appropriate filter. The final connection to the oil pump inlet port should be made using the flexible pipes supplied with the burner.

NDFL burners may employ a pumped ring main (see Fig 6) or gravity feed oil supply system. Where a gravity feed system is used it should be designed and sized such that the oil pressure at the pump inlet is not less than 350 mbar and not more than 689 mbar. A two-pipe system must be used. It is important to ensure that the return pipe is not obstructed as this may result in damage to the pump.
Where it is thought desirable, a pumped ring main (see Fig 6) of appropriate capacity may be used for NDFL burners and such a system is essential where the burner is to operate on residual oil (NDFR burners). The capacity of the ring main pump should be at least 1.25 times that of the burner pump(s) that it is required to supply. In the case of NDFR burners the pipework and oil storage tank should be insulated, trace heated and thermostatically controlled in accordance with the data shown in table 2.

FIG 8: Oil Handling Temperatures and Pressures

Fuel Handling Temperatures (^{o} C)					Fuel Delivery Pressures (At inlet to burner oil pump)	
Fuel Class	Viscosity (seconds)	Min from tank	Burner Inlet	Atomising	Kg/cm2	Psi
D	35	Minimum 5 recommended			0.35 to 0.7	72.5 max
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		

Electrical Power Supply

A three-phase 50 Hz supply is required. Power requirements are listed in Table 3 and Table 4. The power supply provided must comply with all relevant Codes and Standards.

Unpacking & Assembly

To safeguard against damage in transit, NDF burners are supplied in partly assembled form.

Twin Nozzle Pressure Jet Burners (NDFL35-25 to 100-38 2 Stage (High/Low))

NDFL burner systems comprise two units:

1. The burner body, complete with control package, hinged extension and flame tube assembly.
2. The gas control train.

To assemble the burner:

1. Fit the gas control train to the burner body using the gasket supplied, ensuring that the gasket is fitted correctly with all holes corresponding with those on the burner flange.
2. Connect the combustion air impulse pipe from the SKP75 air/gas ratio controller to the left side of the hinged extension.
3. Connect the multi-pin plug on the gas valve train to the socket on the rear of the control package.

Note: In some circumstances it may be advisable to fit the burner casing to the appliance before attaching the gas control train. It is recommended that lifting gear should be employed if necessary.

FIG 9: ELECTRICAL POWER REQUIREMENTS: TWIN PRESSURE JET OIL BURNERS

(NDFL 35-25 to NDFL 100-38 Two Stage Operation)

Burner	Fan Motor kW/hp	Start Current A/Phase	FLC A/Phase	Cable Size (mm^2)	HRC Fuse (A)
NDF 35-25	1.1/1.5	15.8	2.7	1.0	10
NDF 35-34	2.2/3.0	29.3	5.0	1.5	16
NDF 35-38	3.0/4.0	38.6	6.6	2.5	20
NDF 50-28	2.2/3.0	29.3	5.0	1.5	16
NDF 50-34	3.0/4.0	38.6	6.6	2.5	20
NDF 50-38	4.0/5.5	49.7	8.5	2.5	25
NDF 60-28	2.2/3.0	29.3	5.0	1.5	16
NDF 60-34	4.0/5.5	49.7	8.5	2.5	25
NDF 60-38	4.0/5.5	49.7	8.5	2.5	25
NDF 80-28	3.0/4.0	38.6	6.6	2.5	20
NDF 80-34	4.0/5.5	49.7	8.5	2.5	25
NDF 85-38	5.5/7.5	66.1	11.3	2.5	32
NDFL 100-38	7.5/10.0	88.9	15.2	4.0	32

Single Spill-back Burners

(NDFL Modulating Burners, NDFR Burners)

NDFR burner systems comprise four units:

1. The burner body, complete with hinged extension and flame tube assembly.
2. The gas control train.
3. The oil pump
    - The oil pump unit (NDFL)
    - The oil pumping and heating unit (NDFR).
4. A free-standing or wall-mounted control panel).

To assemble the burner:

1. Fit the gas control train to the burner body using the gasket supplied, ensuring that the gasket is fitted correctly with all holes corresponding with those on the burner flange.
2. Connect the combustion air impulse pipe from the SKP75 air/gas ratio controller to the left side of the hinged extension.
3. Connect the multi-pin plug on the gas valve train to the socket on the rear of the burner mounted terminal panel.
4. Place and secure the oil pump/pumping and heating unit in the desired position. The floor mounting arrangements are shown in Figure 24 (residual fuels) and Figure 25 (distillate fuels). Connect the unit to the burner pipework using the flexible connectors provided.
5. Fix the control panel in an appropriate position and make the electrical connections to the burner package and oil pump unit, as shown in the wiring diagram contained in the instruction pack attached to the burner.

Note: In some circumstances it may be advisable to fit the burner casing to the appliance before attaching the gas control train. It is recommended that lifting gear should be employed if necessary.

FIG 10: ELECTRICAL POWER REQUIREMENTS: SINGLE SPILL-BACK NOZZLE DISTILLATE OIL BURNERS

(NDFL 35-25 to NDFL 180-44 Modulating and Two Stage Operation)

Burner	Fan Motor kW/hp	Pump Motor kW/hp	Start Current A/Phase	FLC A/Phase	Cable Size (mm^2)	HRC Fuse (A)
NDF 35-25	1.1/1.5	0.55/0.75	25.2	4.3	1.5	16
NDF 35-34	2.2/3.0	0.55/0.75	38.6	6.6	2.5	20
NDF 35-38	3.0/4.0	0.55/0.75	48.0	8.2	2.5	25
NDF 50-28	2.2/3.0	1.1/1.5	45.0	7.7	2.5	25
NDF 50-34	3.0/4.0	1.1/1.5	54.4	9.3	4.0	32
NDF 50-38	4.0/5.5	1.1/1.5	65.5	11.2	4.0	32
NDF 60-28	2.2/3.0	0.75/1.0	41.0	7.0	2.5	25
NDF 60-34	4.0/5.5	0.75/1.0	61.5	10.5	4.0	32
NDF 60-38	4.0/5.5	0.75/1.0	61.5	10.5	4.0	32
NDF 80-28	3.0/4.0	0.75/1.0	50.4	8.6	2.5	25
NDF 80-34	4.0/5.5	0.75/1.0	61.5	10.5	4.0	32
NDF 85-38	5.5/7.5	0.75/1.0	77.9	13.3	4.0	32
NDF 100-38	7.5/10.0	1.5/2.0	101.3	17.3	4.0	40
NDF 100-41	11.0/15.0	1.5/2.0	97.0	25.3	6.0	40
NDF 100-44	11.0/15.0	1.5/2.0	97.0	25.3	6.0	40
NDF 125-36	7.5/10.0	1.5/2.0	101.3	17.3	4.0	40
NDF 125-41	11.0/15.0	1.5/2.0	97.0	25.3	6.0	40
NDF 125-44	11.0/15.0	1.5/2.0	97.0	25.3	6.0	40
NDF 150-36	11.0/15.0	1.5/2.0	97.0	25.3	6.0	40
NDF 150-41	11.0/15.0	1.5/2.0	97.0	25.3	6.0	40
NDF 150-44	15.0/20.0	1.5/2.0	123.6	32.9	10.0	50
NDF 170-44	15.0/20.0	1.5/2.0	123.6	32.9	10.0	50
NDF 180-44	15.0/20.0	1.5/2.0	123.6	32.9	10.0	50

Special Compact Burner Arrangement

Depending on the burner model and application, a special compact version of NDFL Modulating and NDFR burners can be supplied. These burner models are supplied to special order only and are delivered with the oil pumping (pumping and heating) equipment mounted under the burner throat.

If additional appliance control requirements are not specified, then the burner control panel can also be burner mounted. The equipment is thus delivered as a packaged arrangement with all of the interconnecting oil pipework and electrical control connections pre-made. The gas control will be supplied loose.

IMPORTANT:
The NDF compact burner, in particular the NDFR series, will be heavier than its standard counterpart.
This must be taken into consideration when fitting the burner to the appliance.
It is strongly recommended that lifting gear should be employed when carrying out this task.

FIG 11: ELECTRICAL POWER REQUIREMENTS: SINGLE SPILL-BACK NOZZLE RESIDUAL OIL BURNERS WITH OIL PRE-HEATER

(NDFL 35-25 to NDFL 180-44 Modulating and Two Stage Operation)

Burner	Pump Motor kW/hp	Start Current A/Phase	FLC A/Phase	Cable Size (mm^2)	HRC Fuse (A)	Pre-heater kW	Cable Size (mm^2)
NDF 35-25	1.1/1.5	31.6	14.0	4.0	32.0	6.0	1.5
NDF 35-34	1.1/1.5	45.0	16.4	4.0	32.0	6.0	1.5
NDF 35-38	1.1/1.5	54.4	18.0	4.0	40.0	6.0	1.5
NDF 50-28	1.1/1.5	45.0	18.5	4.0	40.0	7.5	1.5
NDF 50-34	1.1/1.5	54.4	20.1	4.0	40.0	7.5	1.5
NDF 50-38	1.1/1.5	65.5	22.0	4.0	40.0	7.5	1.5
NDF 60-28	1.1/1.5	45.0	18.5	4.0	40.0	7.5	1.5
NDF 60-34	1.1/1.5	65.5	22.0	4.0	40.0	7.5	1.5
NDF 60-38	1.1/1.5	65.5	22.0	4.0	40.0	7.5	1.5
NDF 80-28	1.5/2.0	59.7	21.0	4.0	40.0	7.5	1.5
NDF 80-34	1.5/2.0	70.8	22.9	4.0	40.0	7.5	1.5
NDF 85-38	1.5/2.0	87.2	25.7	6.0	40.0	7.5	1.5
NDF 100-38	1.5/2.0	101.2	28.1	6.0	40.0	7.5	1.5
NDF 100-41	1.5/2.0	97.0	36.1	10.0	50.0	7.5	1.5
NDF 100-44	1.5/2.0	97.0	36.1	10.0	50.0	7.5	1.5
NDF 125-36	1.5/2.0	101.2	30.3	6.0	40.0	9.0	2.5
NDF 125-41	1.5/2.0	97.0	38.3	10.0	50.0	9.0	2.5
NDF 125-44	1.5/2.0	97.0	38.1	10.0	50.0	9.0	2.5
NDF 150-36	1.5/2.0	97.0	42.7	10.0	63.0	12.0	4.0
NDF 150-41	1.5/2.0	97.0	42.7	10.0	63.0	12.0	4.0
NDF 150-44	1.5/2.0	123.7	50.3	16.0	80.0	12.0	4.0
NDF 170-44	1.5/2.0	123.7	50.3	16.0	80.0	12.0	4.0
NDF 180-44	1.5/2.0	123.7	50.3	16.0	80.0	12.0	4.0

NOTE: Burner fan motors up to and including 7.5 kW are started D.O.L.
Above 7.5 kW Star/Delta starters are fitted.

INSTALLATION

General

Ensure 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. Detailed burner performance data are presented in the Appendix of this handbook.

Fitting to the Appliance

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

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

The flame tube should be flush with the inner face of the appliance combustion chamber. Up to 10mm protrusion may be acceptable (refer to the appliance manufacturer) however, it is not generally permissible for the flame tube to sit within the appliance firing tunnel.

Special extensions may be specified by the appliance manufacturer, for example in the case of a reverse flame boiler.

Electrical Power Connection

Connect a three-phase, 50Hz electrical supply to the burner, observing all applicable Codes and Standards. The electrical connections required are shown in the wiring diagram contained in the instruction pack attached to the burner. These diagrams also show the external auxiliary control connections which must be made. If the burner is supplied as part of a packaged appliance/burner unit, refer to the appliance manufacturer's instructions.

BURNER CONTROL AND OPERATION

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

Air Controls:

Air Regulator:

NDF 35-25 to NDF 100-38

The flow of combustion air into the burner is controlled by a single adjustable air damper blade located within the air damper casting on the right-hand side (in all cases, such descriptions refer to the system as viewed from the rear) of the burner.

NDF 100-41 – NDF 180-44

The flow of combustion air into the burner is controlled by a multiple-aperture rotary type damper, fitted to the burner casing within the air inlet silencer on the right-hand side of the burner.

Air Damper Motor:

In all cases, the air damper is controlled by a servomotor containing adjustable limit switches for the low and high fire positions.

Twin Pressure Jet Burners

On twin pressure jet burners a **Berger Lahr STM6** 5 cam motor is used, as shown in Figure 12. A fully closed position is provided to prevent air flowing through the appliance when the burner is not in operation. On these burners, the servomotor is mounted on the rear face of the air inlet and directly coupled to the air damper blade.

Single Spill-back Burners

The single spill-back burners employ a **Siemens SQM10** motor as shown in Figure 13. This motor activates the damper through an adjustable cam and cable system, and is mounted above the air inlet on all models.

Air Diffuser

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

Air Pressure Switch

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

Air flow failure at any stage beyond the first few seconds of the pre-purge sequence will result in burner lockout.

Gas Controls:

A typical gas train fitted is shown in Figure 14.

Gas Nozzle

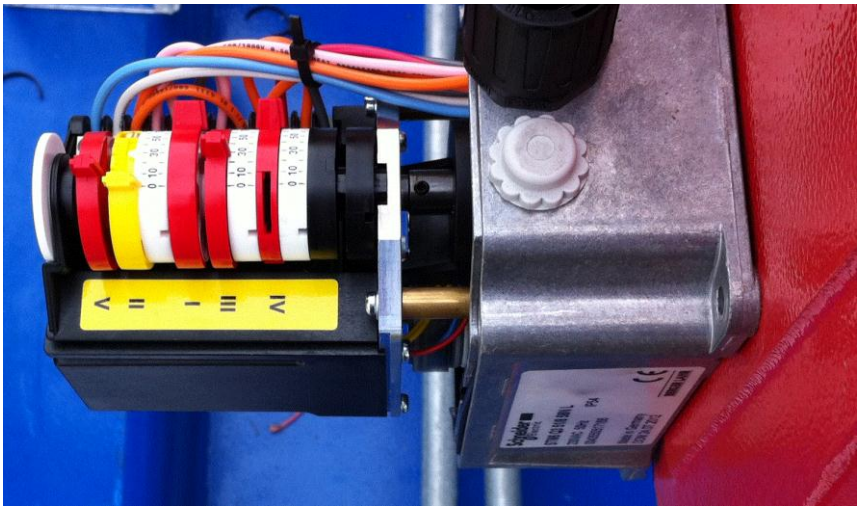
NDF burners utilise a spiked head design with multiple gas tubes fitted with appropriately sized gas restrictors. Referred to as the "gas nozzle" this is fitted to the front of the burner assembly, within the flame tube (refer to the Appendix). The number and diameter of the gas tubes in this nozzle are specified in accordance with the rating of the burner and the gas to be used (refer to the table on the appendix).

High Gas Pressure Switch

A high gas pressure switch is fitted at the outlet of the gas train to ensure that any increase in gas supply pressure above the level needed to maintain the set conditions results in a safe burner shutdown. In most cases, high gas pressure would indicate a fault with the air/gas ratio controller.

The pressure switch, which is fitted with an illuminated fault indicator and manual reset button, is factory set to the maximum value. Final adjustment of the setting of this switch is described in the Section on commissioning.

FIG 12: AIR DAMPER SERVOMOTOR: TWIN PRESSURE JET BURNERS
Model: Schneider (Berger Lahr) STM 6 Q3



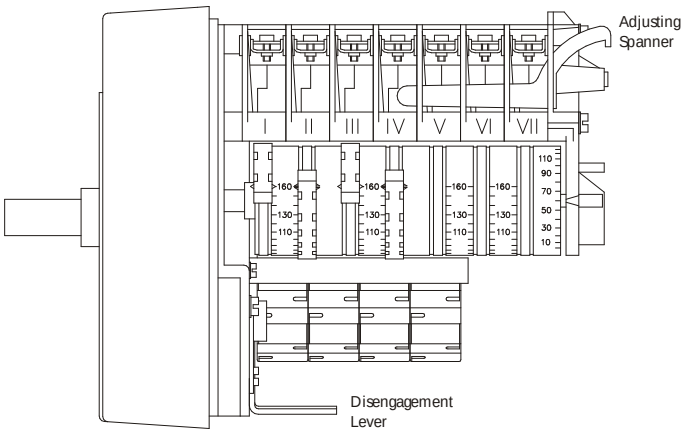
Factory Settings		
Cam	Function	Setting (°)
II	Full Air Shut-off	0
V	Low Fire Air	20
I	High Fire Air	60
III	High Flame Oil Valve Out	50
IV	High Flame Oil Valve In	40

Notes:

1. The burner air damper should be set to give optimal combustion whilst firing on oil. When firing gas, the SKP75 air/gas ratio control valve should be adjusted to give optimal combustion with the same air damper settings.
2. The fully closed cam (II) is factory set and under normal circumstances should not require further adjustment.
3. Operation of the low and high fire air switches (cams V and I) is made by manually adjustable cams. A setting scale is provided at the end of the cam stack for guidance. Adjustments are made using the screw adjusters situated within the cam disc body,
4. The position at which the main flame oil valve is activated is controlled by adjusting cams III and IV. A setting should be made to ensure a smooth changeover whilst maintaining good combustion quality.
5. The motor will traverse 90° within a maximum of 6 seconds.

FIG 13: AIR DAMPER SERVOMOTOR: SINGLE SPILL-BACK NOZZLE BURNERS

Model: Siemens (Landis & Staefa) SQM 10

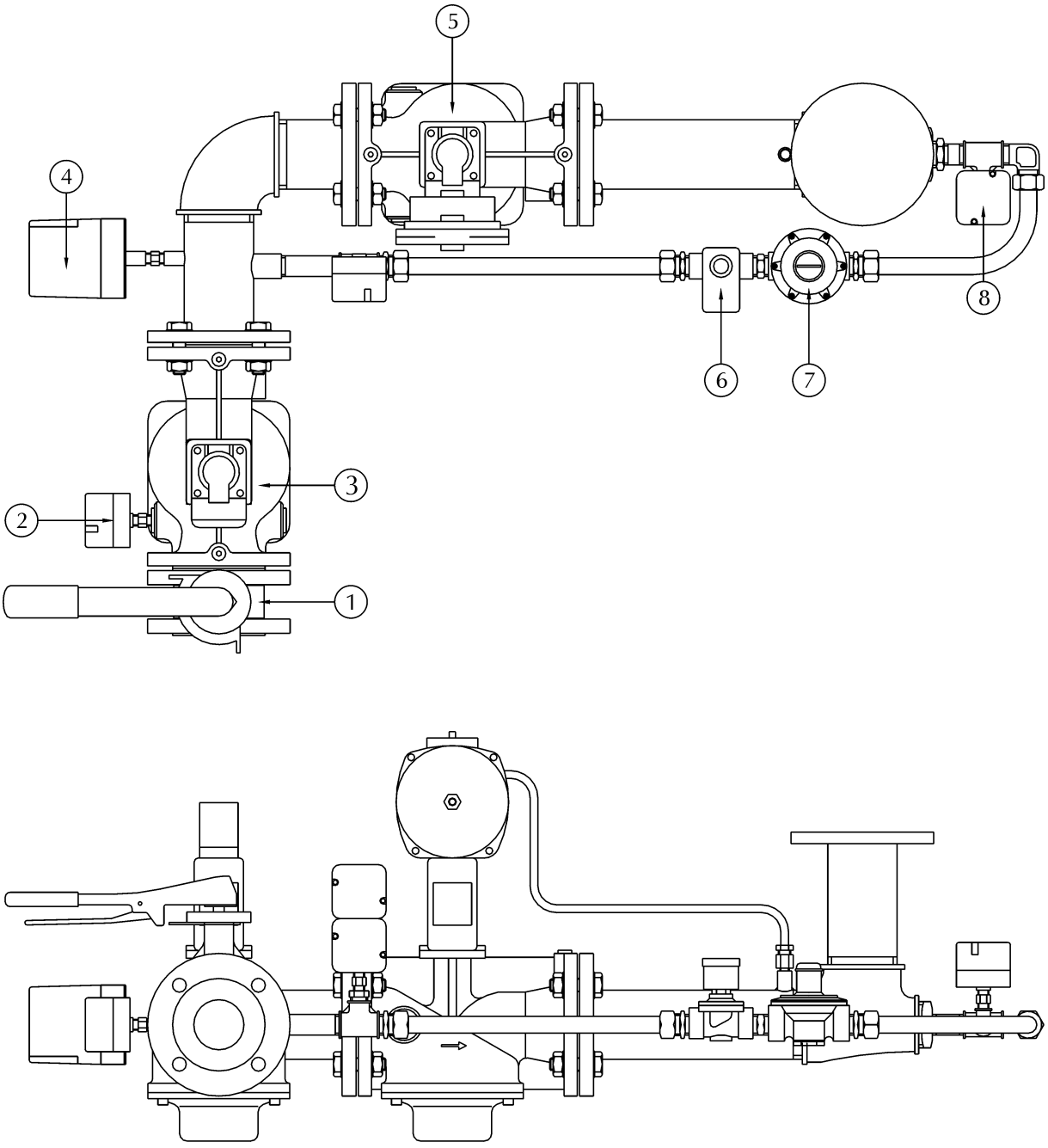


Factory Settings			
Cam	Function		Setting (°)
1	Gas Firing	High Fire Air	160
2		Low Fire Air	0
3	Oil Firing	High Fire Air	160
4		Low Fire Air	0
5	Not Used		
6			
7			

Notes:

1. The servomotor operates both the air damper mechanism and the oil spill adjusting valve via mechanical cam arrangements mounted on a common shaft within the 'Modulating Cam Box'.
2. The operation and adjustment of the 'Modulating Cam Box' arrangement should be fully understood before attempting to adjust the motor settings.
3. Cams 1 and 4 represent the low and high limits of the mechanism. These are factory set and should not require further adjustment.
4. Cams 2 and 3 may be adjusted to give the correct related burner firing rates on gas and oil.
5. The cam assembly can be rotated manually by disconnecting it from the drive motor using the disengagement lever. The cams are adjusted with the special 'C' spanner provided.

FIG 14: TYPICAL GAS TRAIN



Item	Description	Item	Description
1	Manual Gas Interlock Valve	5	Control valve
2	Low Gas Pressure Switch	6	Pilot Solenoid Valve
3	Main Valve	7	Pilot Governor
4	Valve Proving System	8	High Gas Pressure Switch

Low Gas Pressure Switch

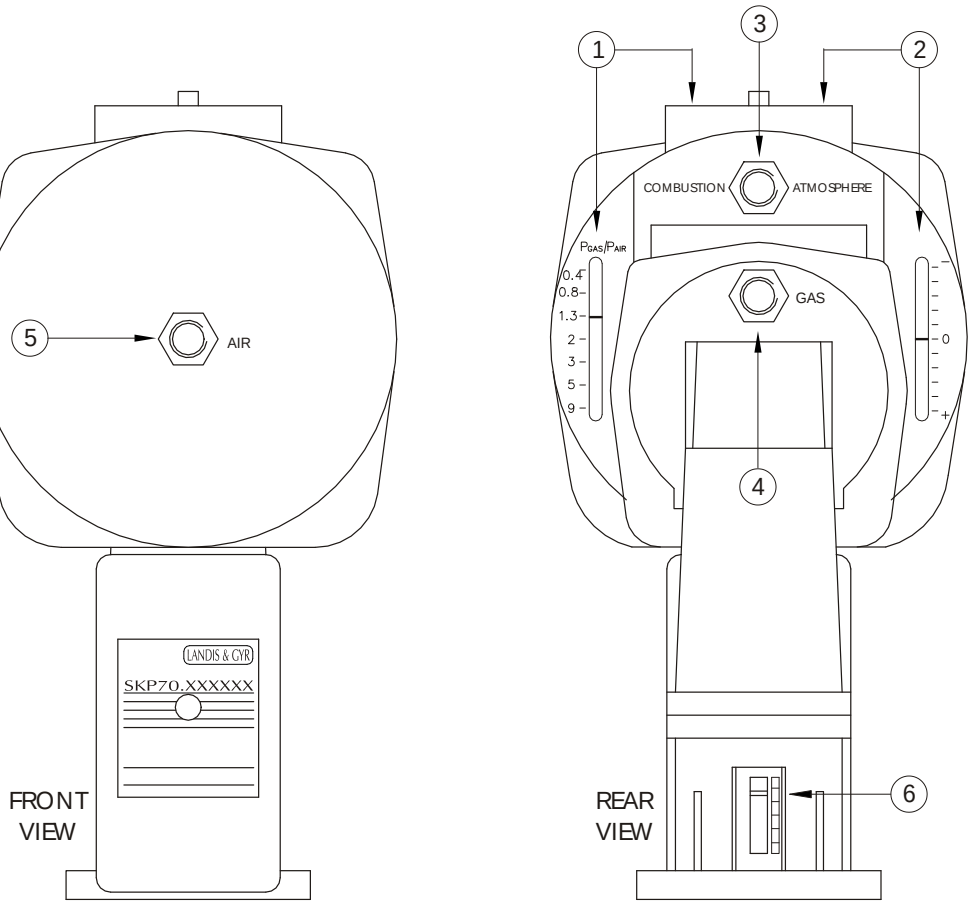
Provision of a low gas pressure switch is required by European Standard EN 676 – automatic forced draught burners for gaseous fuels. This pressure switch is fitted to all burners which carry the CE marking but it may not be fitted to non-CE marked burners.

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

Gas Valve Train

In addition to the pressure switches noted above, the gas control train includes an air/gas ratio controller, automatic safety shut-off valves and a governor in the start gas line. A manual isolation valve must be fitted during installation at the inlet to the gas train.

FIG 15: GAS CONTROL VALVE (SKP 70/75)



Item	Function
1	Adjustment and indication of the gas/air ratio (high fire setting)
2	Adjustment and indication of the parallel displacement of the characteristic (low fire setting)
3	Vented to atmosphere
4	Connection to the fuel gas line
5	Connection to the combustion air supply at the burner head
6	Indication of the valve stroke

SKP70/75 Air/Gas Ratio Controller

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

SKP70/75 combustion chamber impulse connection

The impulse connection to the combustion chamber is not required in the majority of applications and is therefore not supplied as part of the burner package. This is because the resistance of the combustion chamber / flue assembly is assumed to remain constant and that the pressure within this chamber will change in proportion to the burner gas and combustion air pressure (as the burner output changes). If however the pressure in the combustion chamber does not change in proportion to the burner gas or air pressure, i.e. the plant is fitted with a flue gas fan, continuously operating flue gas damper or the combustion chamber pressure changes from negative to positive whilst moving from Low to High flame, then a compensating circuit is required. This means that the pressure in the combustion chamber must be connected to the SKP70/75 so that the controller can automatically offset the pressure changes.

This compensating circuit should also be used if pressure shocks and vibrations, which adversely affect burner start up, develop in the combustion chamber during the start-up phase.

Naturally, it must always be taken into consideration that the burner output decreases as the pressure in the combustion chamber increases, and visa versa.

Installation of the combustion chamber impulse pipe

A minimum inside pipe diameter of 8mm is recommended.

The impulse pipe should be as short as possible to allow the controller to respond quickly to sudden burner output changes. It must be installed such that the gases will cool down in the area of the impulse pipe and condensing gases will not enter the controller but run back into the combustion chamber. If necessary, a water trap must be provided.

Valve Proving System (VPS)

A valve proving system, as shown schematically in Figure 16 is standard on all NDF burners with maximum firing rates which exceed 1200 kW. When the burner operating sequence is initiated, the burner control box energises the proving system, which then carries out the following checks.

Siemens (Landis & Staefa) LDU11

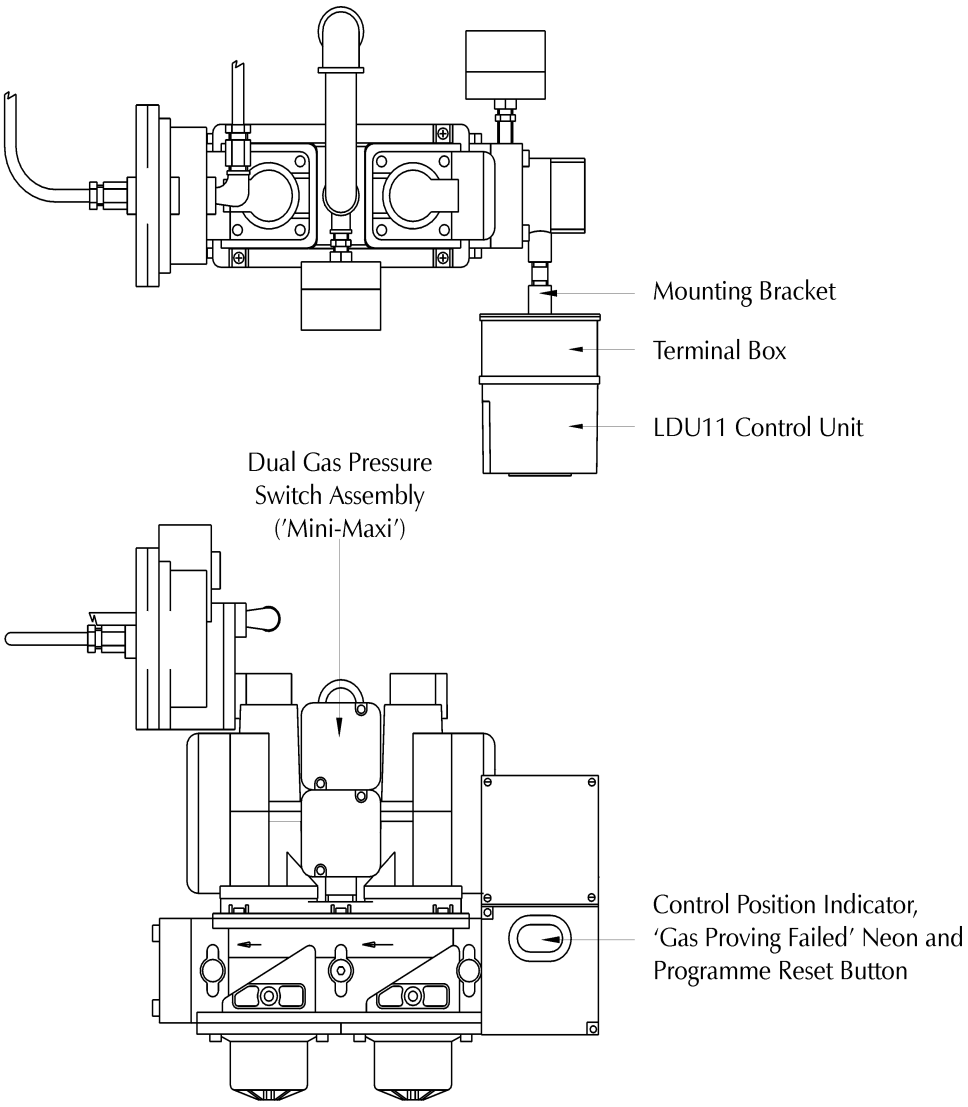
The LDU11 control unit is designed to provide automatic gas valve proving (leakage test) based on the pressure proving principal. The system comprises of the control unit, which is fixed to a bracket / terminal box assembly close to the main valve block, and a dual pressure switch which is connected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

Gas valve proving is initiated automatically upon completion of the burner control circuit prior to burner start up. The proving test is based on the 2-stage pressure proving principal. First, the main safety valve (V1) on the upstream side of the gas circuit is tested by evacuating the test space (via the pilot valve V3) and by monitoring the atmospheric pressure in it, then the valves (V2 & V3) on the burner side are tested by pressurising the test space and monitoring the gas pressure. If the pressure increases excessively during the first test phase (TEST 1) or decreases excessively during the second test phase (TEST 2), the control unit inhibits burner start-up and goes to lockout. The lockout reset button lights up and signals a fault.

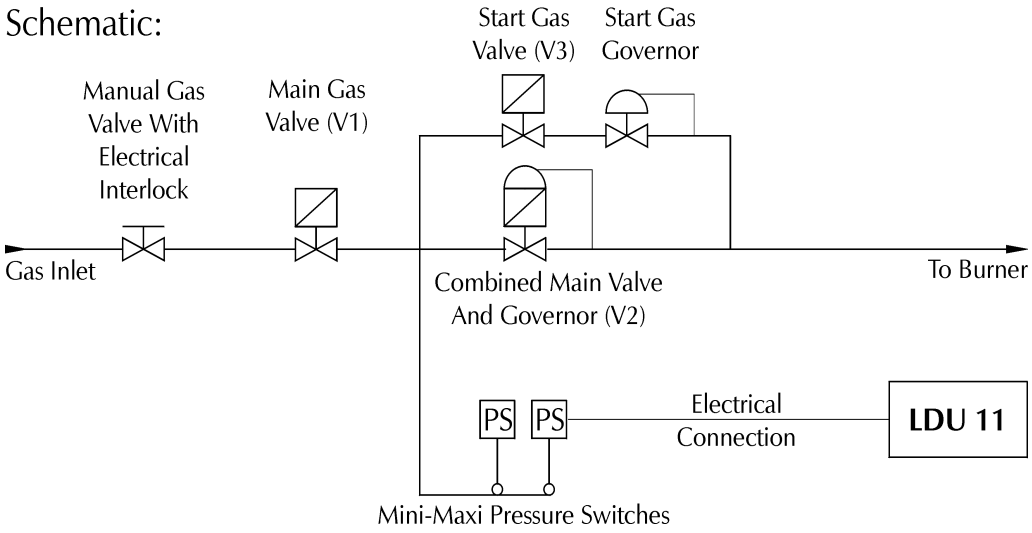
A program indicator, which stops whenever a fault is signalled, indicates which valve(s) set is leaking.

The control unit requires to be reset manually, either on the unit itself or by a remote resetting if this has been fitted.

FIG 16: VALVE PROVING SYSTEM: LDU 11



Schematic:



Oil Controls – Twin Pressure Jet Oil Burners

The oil control system used on NDFL burners with twin pressure jet oil nozzles is shown in Figure 17. In addition to the oil pump it includes high and low fire safety shut-off valves (normally closed type) and a manually operated ball valve.

Oil Supply:
Oil can be supplied from a two-pipe gravity feed system or from a two-pipe pumped ring main system. A two-pipe system is essential to enable oil circulation through the oil pump during periods of gas firing to ensure adequate lubrication. The oil must be supplied and maintained at the temperatures and pressures given in Figure 8.

Filter:
The filter is usually supplied loose and must be attached to the oil pump inlet prior to commissioning.

Oil Pump:
The oil pump is mounted on the air inlet casing on the right-hand side of the burner. it is driven by the burner motor through a flexible coupling.
When firing on gas for extended periods, it is recommended that this coupling is removed in order to protect the pump from unnecessary wear.
Information on the pumps fitted to the NDF burner range is given in Figure 18.
The pumps are shown in Figures 20 and 21.

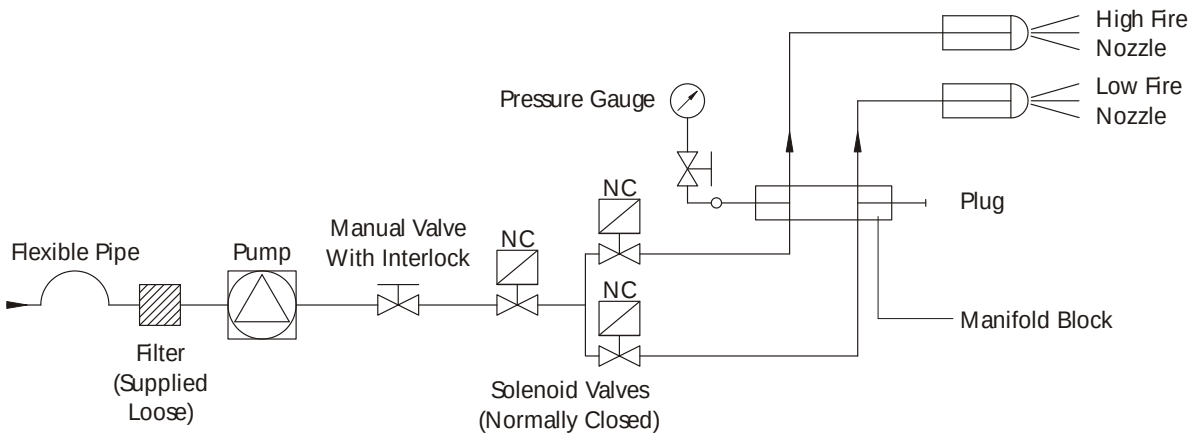
Manual Valve:
The manual valve is fitted with an electrical interlock to prove that the valve is in the closed position before the burner can be run on gas.

Oil Manifold Block:
The oil manifold block is located below the burner hinged extension. It connects the oil inner assembly to the external oil system.

Oil Nozzles:
The two oil nozzles (high and low fire) are held in a nozzle block located within the flame tube (refer to the Appendix). The nozzles are pre-sized by Nu-way in accordance with the heat inputs required and the available operating pressure.

The oil nozzles are usually supplied in the instruction pack attached to the burner and must be fitted to the burner nozzle block prior to commissioning.

FIG 17: OIL CONTROL SYSTEM: TWIN PRESSURE JET OIL BURNERS



Notes:

1. For operation on gas only, when there is no oil supply connected to the burner, the oil pump coupling should be removed to avoid running the pump dry.
2. To ensure the pump is adequately lubricated during periods of gas firing it is essential that the internal bypass plug is fitted to the pump and that the pump's 'return' port is piped back to the tank or as far as possible (depending on site conditions) to give an adequate volume of oil to re-circulate continuously through the pump.

FIG 18: OIL PUMPS FITTED

Burner	Twin Pressure Jet Burners	Single Spill Back Nozzle Burners	
		Distillate Oil	Residual Oil
NDF35-25	Suntec AJ6	Suntec AJ6	Danfoss KSA630
NDF50-28	Suntec AJ6	Danfoss KSA 1000	Danfoss KSA1000
NDF60-28	Suntec E7	Suntec TA5C	Danfoss KSA1000
NDF80-28	Suntec E7	Suntec TA5C	Danfoss KSA1000
NDF85-38	Suntec E7	Suntec TA5C	Danfoss KSA1000
NDF100-38	Suntec E7	Suntec T3C	Danfoss KSA1000
NDF125-36	N/A	Suntec TA5C	Suntec T3C
NDF150-36	N/A	Suntec T2C	Suntec T3C

Oil Controls – Single Spill Back Oil Burners

The oil control system comprises the burner mounted components and a separate pumping unit for distillate fuels or pumping/heating unit for residual fuels. The burner mounted components are similar for both light and residual oils. The separate oil pumping or pumping/heating set is connected to the burner utilising the braided high pressure hoses supplied. The burner lance incorporates hydraulic tip shut off for the oil nozzle whist the system controlling valves are closely mounted at the burner head.
Schematics of the oil controls are shown in Figure 22 for residual fuels and Figure 23 for distillate fuels.
Details of the pumping/heating set for residual fuels, including the mounting arrangement are shown in Figure 24.
The pumping set for distillate fuels is shown in Figure 25.

Oil Nozzle

NDFL Modulating /NDFR burners use a single oil nozzle (Figure 19) within the inner assembly (see Appendix).

This nozzle is factory-specified to deliver optimum performance under the specified operating conditions. Any queries regarding the size of the nozzle should be referred to Nu-way.

The nozzle is held in position by the inner assembly oil lance, through which the oil flows from the manifold block to the nozzle and is recirculated back through the spill regulating valve.

Oil Manifold Block

The oil manifold block is located below the burner hinged extension. It carries a pressure gauge which indicates high fire oil pressure.

FIG 19: FLUIDICS W1 NOZZLE

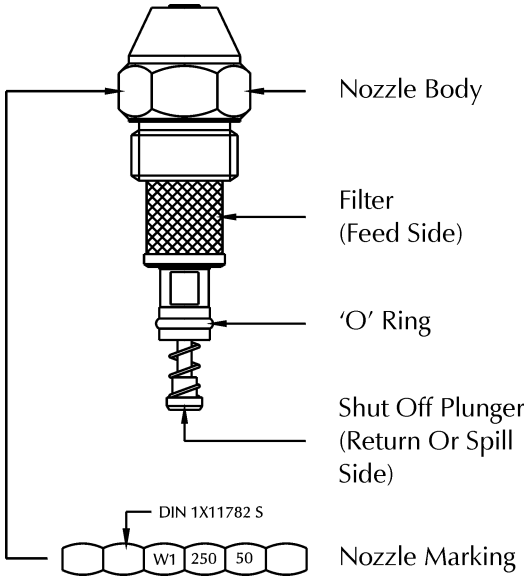
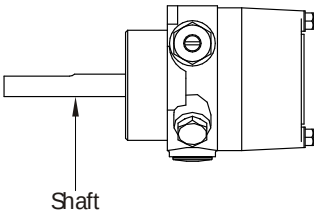
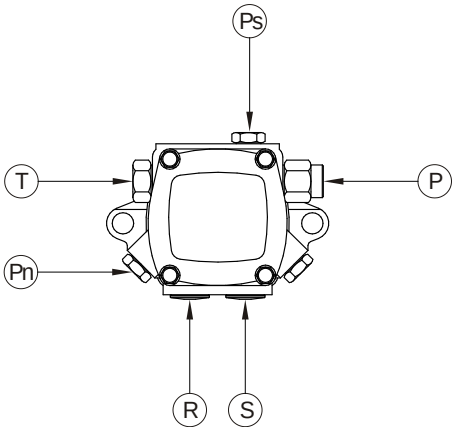


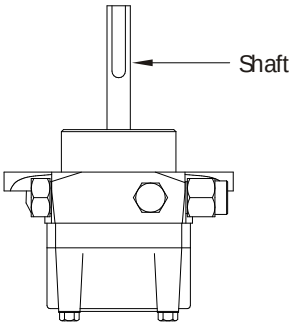
FIG 20: SUNTEC OIL PUMP IDENTIFICATION AND PORT SIZING

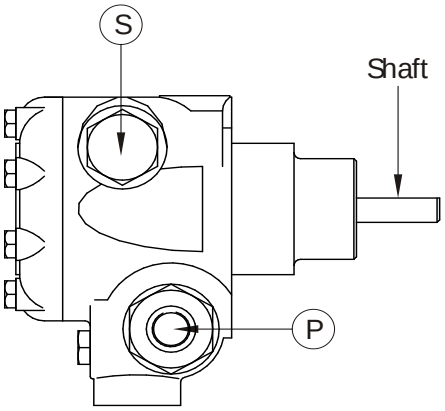
Suntec AJ Series Oil Pump

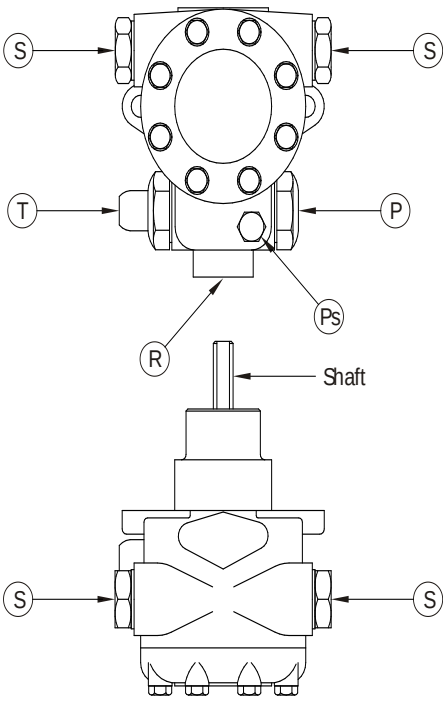




Connection Sizes		
Item	**Description**	**Size**
P	Pressure port	1/8"
R	Return port	¼ "
S	Suction port	¼ "
Pn	Vacuum gauge & internal bypass plug	1/8"
Ps	Pressure gauge	1/8"
T	Regulator	N/A



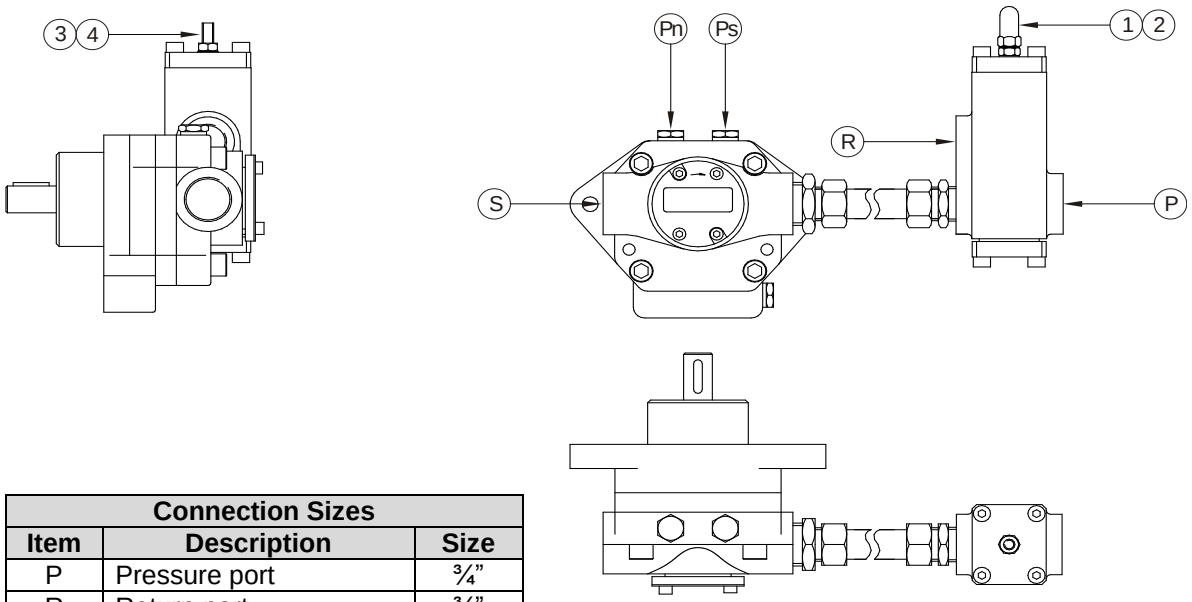




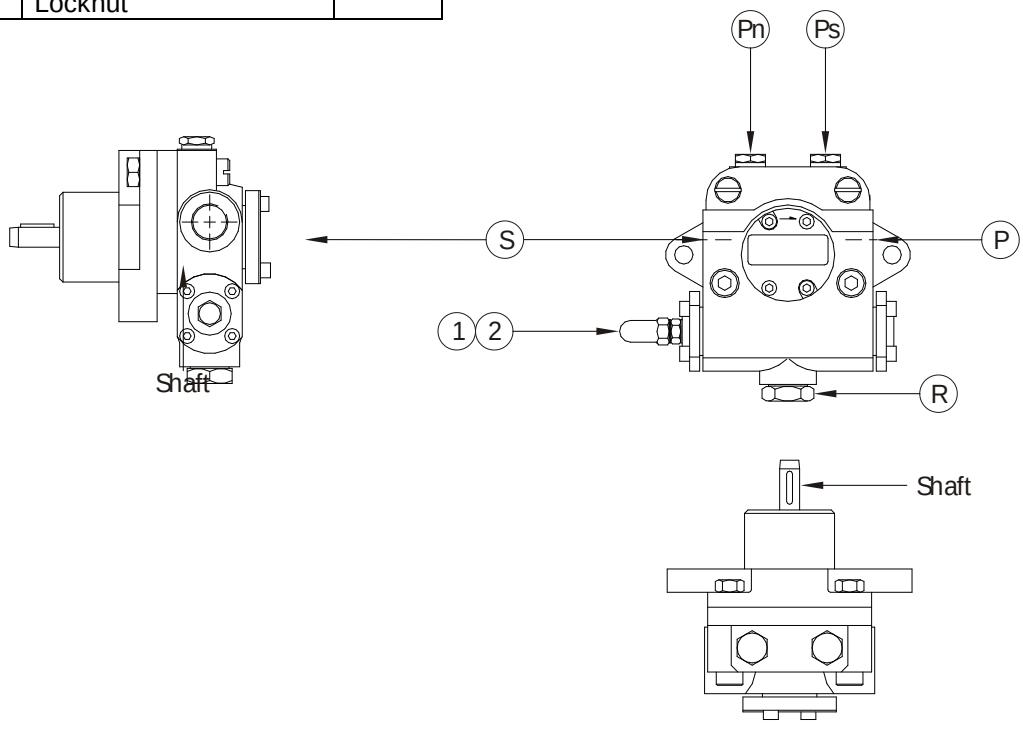
Connection Sizes		
Item	**Description**	**Size**
P	Pressure port	1/4"
R	Return port & internal bypass plug	½"
S	Suction port or vacuum gauge	½"
Ps	Pressure gauge	1/8"
T	Regulator	N/A

FIG 21: SUNTEC OIL PUMP IDENTIFICATION AND PORT SIZING

Suntec T Series Oil Pump with TV Pressure Regulator



Connection Sizes		
Item	**Description**	**Size**
P	Pressure port	¾"
R	Return port	¾"
S	Suction port	¾"
Pn	Vacuum gauge & internal bypass plug	¼"
Ps	Pressure gauge	¼"
1	Regulator cap nut	N/A
2	Washer	
3	Regulator screw	
4	Locknut	



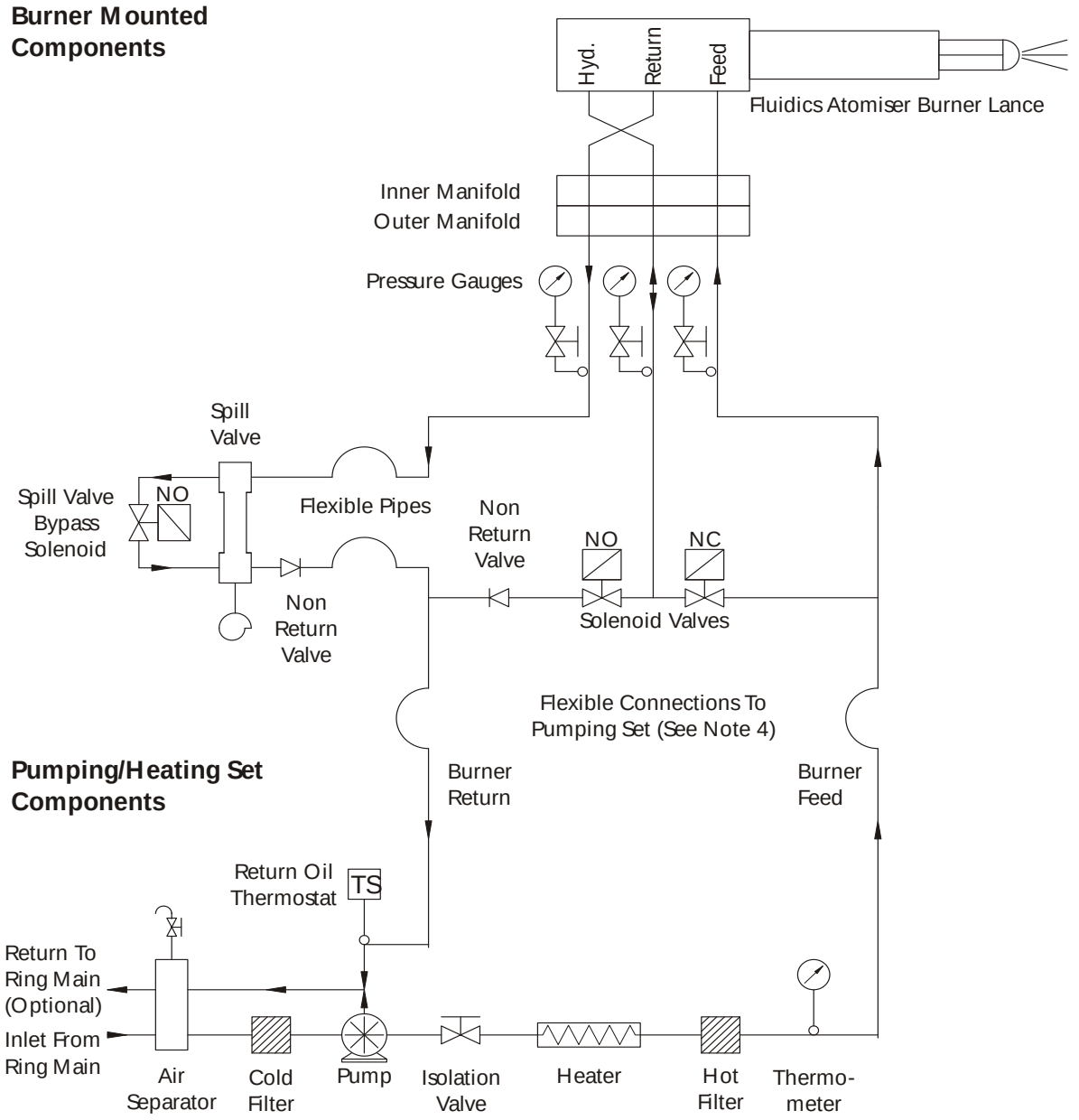
Oil Spill Regulating Valve

The oil spill regulating valve is driven by the motor which actuates the air damper. It varies the spill pressure in order to provide the required oil flow rate to the nozzles at each operating condition.

Oil Pump

The oil pump is incorporated into a free-standing packaged unit as shown schematically in Figures 24 and 25. This package includes the oil filters, an air separation bottle and in the case of NDFR burners the oil preheater tank (including a thermometer to indicate outlet oil temperature) and the return thermostat which ensures that the recirculating oil temperature is maintained at an appropriate level during shutdown periods. Information on the pumps fitted to the NDF burner range is given in Figure 18. The pumps are shown in Figures 20 and 21.

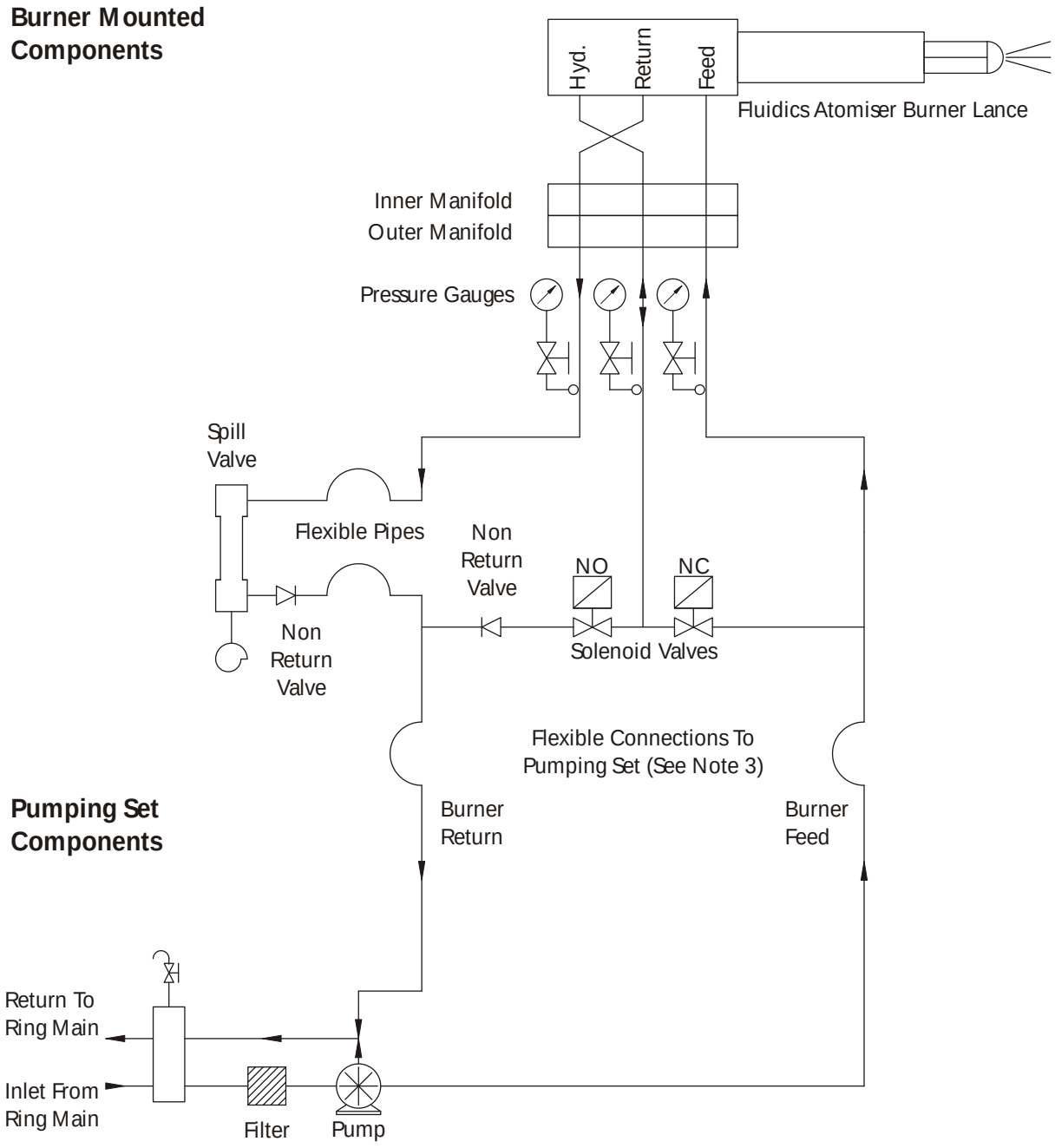
FIG 22: OIL CONTROLS: SINGLE SPILL-BACK NOZZLE RESIDUAL OIL BURNERS



Notes:

1. All interconnecting pipework must have a minimum bore of 19mm (¾") and must be pressure rated for 12 kg/cm^2.
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. Solenoid valves are shown as either NO (normally open) or NC (normally closed).
4. Pipework connections between the burner oil system and the separate pumping/heating set are not supplied by Nu-way. (N.B: This pipework is not required on the 'Compact' burner).

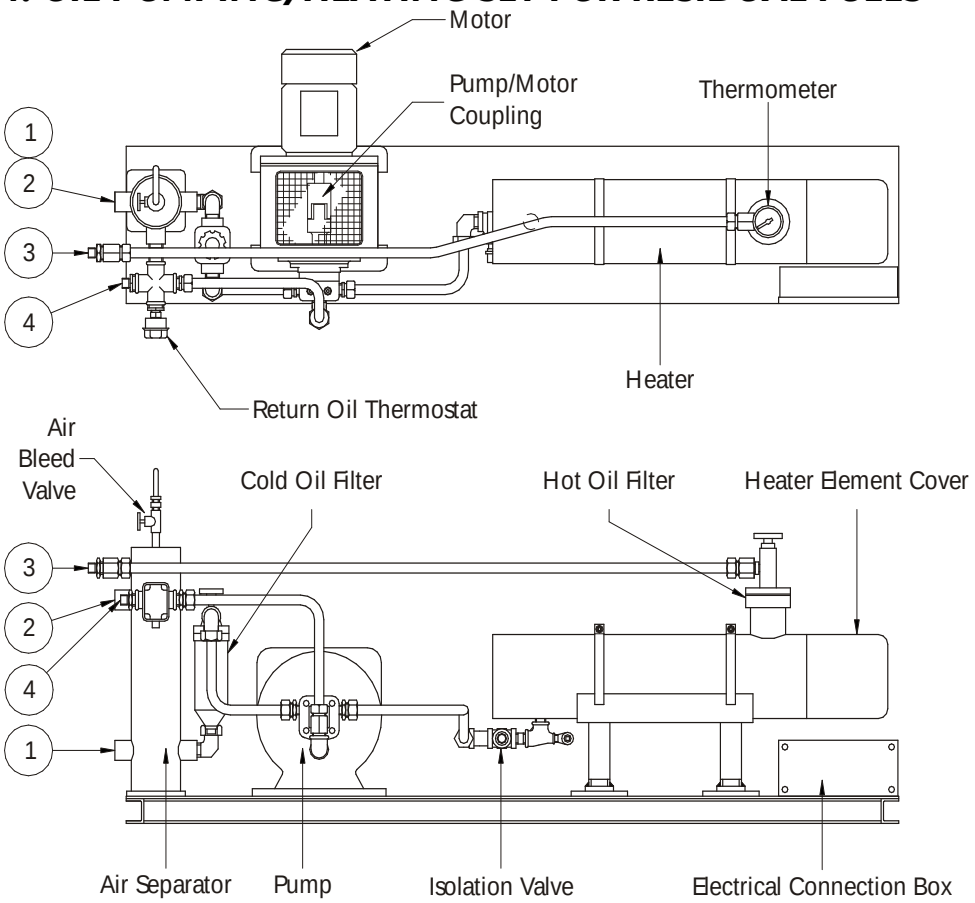
FIG 23: OIL CONTROLS : SINGLE SPILL-BACK NOZZLE DISTILLATE OIL BURNERS

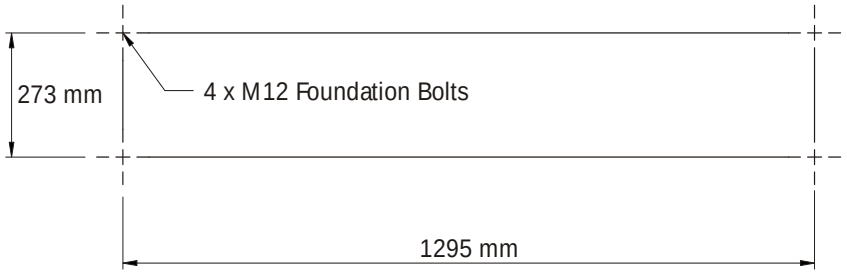


Notes:

1. All interconnecting pipework must have a minimum bore of 19mm (¾") and must be pressure rated for 12 kg/cm^2.
2. Solenoid valves are shown as either NO (normally open) or NC (normally closed).
3. Pipework connections between the burner oil system and the separate pumping/heating set are not supplied by Nu-way. (N.B: This pipework is not required on the 'Compact' burner).

FIG 24: OIL PUMPING/HEATING SET FOR RESIDUAL FUELS



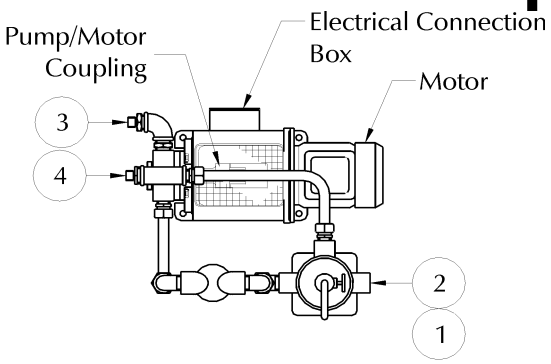


Connection		
Item	**Description**	**Size (inches)**
1	Main Inlet Connection	1
2	Main Return Connection (Optional)	1
3	Burner Feed	¾
1	Burner Return	¾

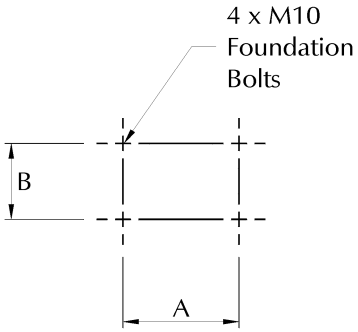
Thermostat Settings			
Fuel Class	Temperature ^{o}C	Control Thermostat ^{o}C	Low Oil Temperature ^{o}C
E	110	85	65
F	130	100	80
G	150	125	100

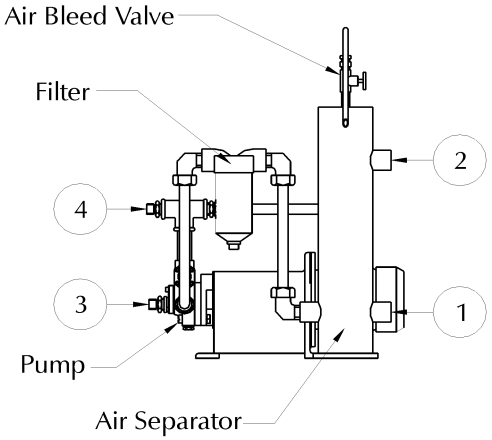
FIG 25: OIL PUMPING SET FOR DISTILLATE FUELS

Connection Sizes		
Item	Description	Size (Inches)
1	Main Inlet Connection	1
2	Main Return Connection (Optonal)	1
3	Burner Feed	¾
4	Burner Return	¾



Mounting Arrangement :





Mounting Dimensions		
Burner Model	A	B
Up to NDFL 50	223	152
NDFL 60 to NDFL 150	220	194

Control Panel

NDFL35-25 to 100-38 2 Stage (High/Low)

On NDFL 2 stage burners the programming burner controller, ignition transformer, contactors and other items are located in an enclosure mounted on the left side of the burner.

The front panel of this enclosure carries the burner On/Off switch and two neon indicator lights. The amber light indicates “BURNER ON” and the red light is illuminated when the burner stops as a result of “EXCESS TEMPERATURE/PRESSURE” in the appliance.

The fuel selector switch and two additional neon indicator lights are mounted on the side of the enclosure. The amber light is illuminated when “OIL” is the chosen fuel and the red light indicates that “GAS” has been selected.

Single Spill-back Nozzle Oil Burners

On NDF Modulating and Sliding High/Low burners, the enclosure mounted on the left side of the burner serves mainly as a housing for electrical connections, although it also contains the ignition transformers and carries the burner On/Off switch, the Hand/Auto switch and the Inching switch required by modulating burners.

A separate free-standing panel contains the programming burner controller, contactors and other items. This enclosure carries an amber light which indicates “BURNER ON” and a red light which is illuminated when the burner stops as a result of “EXCESS TEMPERATURE / PRESSURE” in the appliance.

Also located on this enclosure are the fuel selector switch and two additional neon indicator lights. The amber light is illuminated when “OIL” is the chosen fuel and the red light indicates that “GAS” has been selected.

Burner Controller

The burner controller, together with the flame monitor (see below), provide a safe light-up and shutdown sequence for the burner.

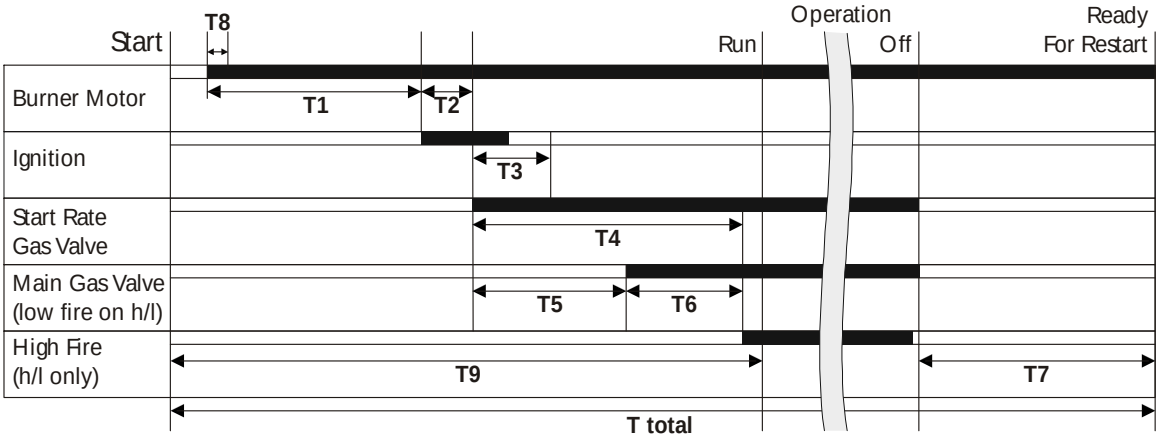
Twin Pressure Jet Burners:
Two options are available, the Siemens (Landis & Staefa) LFL 1.333 as standard (Figure 27), or the Satronic TMG 740-3 (Figure 28).

Single Spill-back Burners:
The Siemens (Landis & Staefa) LFL 1.333 is fitted as standard (Figure 27).

Flame Monitor

In standard configuration, NDF burners are fitted with a continuous flame supervision system which uses an ultraviolet (UV) cell and amplifier (incorporated within the burner controller) to detect the presence of the flame.

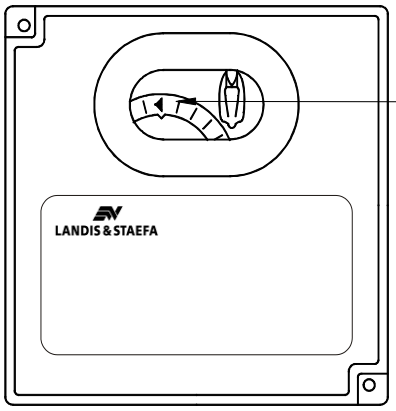
FIG 26: BURNER CONTROLLER SEQUENCE AND TIMING CHART

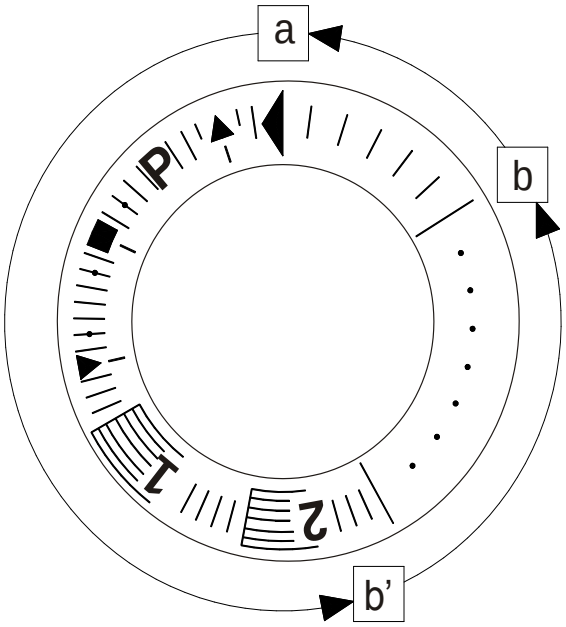


Time (seconds)	Controller Type		Description
	TMG 740-3 MOD 43-35	LFL 1.333	
T1	40	40	Pre-purge
T2	4	6	Pre-ignition
T3	3	3	Safety lockout time
T4	Not applicable to two stage or fully modulating operation		Delay start rate to main flame – single stage
T5	9	12	Delay start rate to main flame – multi stage
T6	6	12	Delay between main flame low & main flame high (two stage burners)
T7	10	18	Post-purge
T8	8	12	Air pressure switch interlock
T9	80	91	Total start time
T total	90	106	Total controller cycle time

Note: The pre-purge times shown refer to the control box only. the time taken for the air damper to move to the appropriate position will extend the total purge time up to a maximum of 157 seconds depending on the firing rate and air requirements of the appliance.

FIG 27: BURNER CONTROLLER: SIEMENS (LANDIS & STAEFA) LFL 1



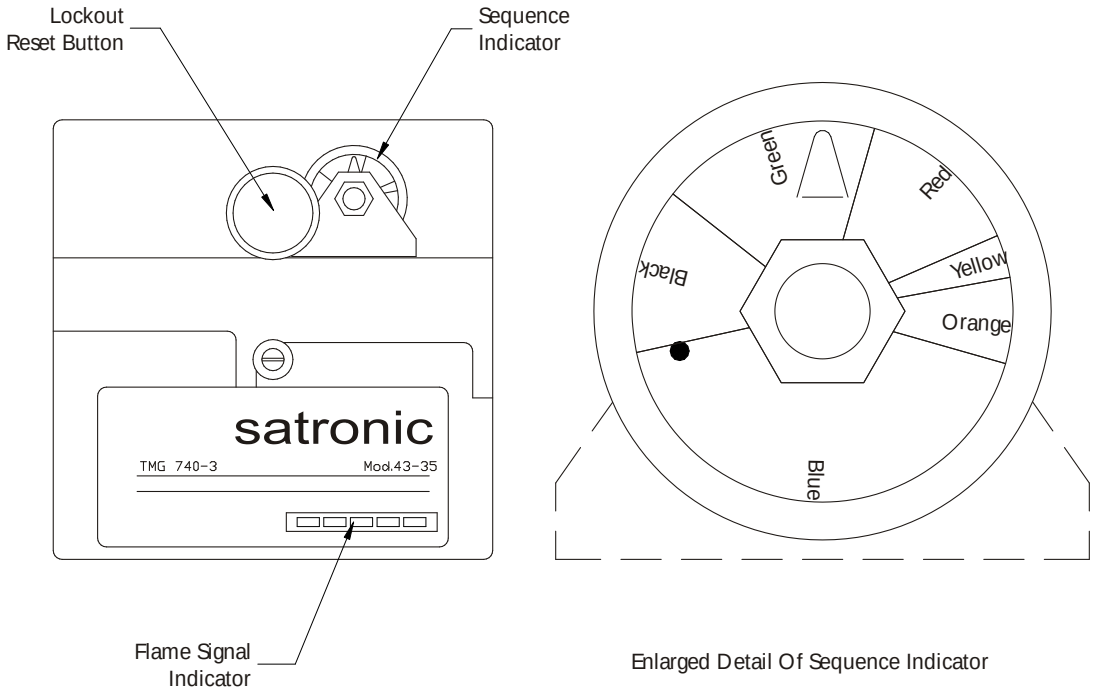


Enlarged Detail Of Sequence Indicator

In the event of a fault condition the sequence disc stops rotating, with the symbol appearing above the indicator mark indicating the nature of the fault.
If the fault leads to a lockout condition the orange lockout indicator will be illuminated.

Symbol	Lockout	Fault
◀	No	Failure of one or more of the pre-start checks. Before allowing the sequence to begin the unit carries out the following checks: Burner Controller not in lockout position Air Damper closed (proved by limit switch supplying voltage from terminal 11 to terminal 8) Fuel Valves closed (proved by limit switch supplying voltage to terminal 12) Air Pressure Switch indicating 'no air' (proved by voltage present on terminal 4) Fuel Gas Pressure Switch, Limit Thermostat or Limit Pressure Switch all closed (proved by continuity between terminals 4 and 5)
▲	No	Interruption to sequence whilst controller waits for the air damper to drive to open position (proved by servo motor limit switch).
P	Yes	Lockout caused by the failure of the air pressure switch to changeover from the 'no air' position shortly after the start of the pre-purge
■	Yes	Lockout caused by a fault in the flame supervision circuit.
▼	No	Interruption to sequence whilst controller waits for the air damper to drive to start position (proved by servo motor limit switch).
None	Yes	Lockout during the pre-ignition period not marked by a symbol is usually caused by premature flame signal.
1	Yes	Lockout caused by the absence of a flame signal at the end of the first safety period (time for start flame establishment).
2	Yes	Lockout caused by the absence of a flame signal at the end of the second safety period (time for main flame establishment).
I	Yes	Lockout caused by the loss of the flame signal during normal operation.
◀	Yes	Lockout caused by flame signal (either real or due to extraneous light) or flame supervision circuit fault after completion of shutdown.

FIG 28: BURNER CONTROLLER: SATRONIC TMG 740



Connection	
Colour Showing On Sequence Indicator	**Step**
End of Black / Start of Blue	Start position
Start of Blue sector	Pre-purge begins
Red line in Blue sector	Air supply proved
Blue sector	Pre-purge
End of Blue sector	Pre-purge ends
Orange sector	Pe-ignition
Start of Yellow sector	Initial fuel release (start gas)
End of Yellow / Start of Red	Lockout position due to ignition or flame detection failure
Red sector	Start gas flame proving period followed by opening of main fuel valves
End of Red / Start of Green	Main flame established at low fire
End of Green / Start of Black	Run position, released to high fire
Black sector	Post purge

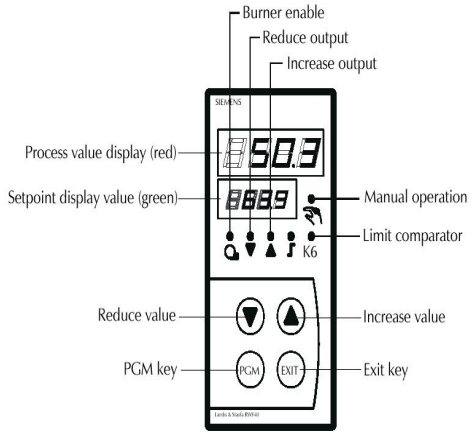
Modulating Controller

The Siemens RWF40 (Figure 29) is fitted as standard to all fully modulating burners. The following section describes the operation and recommended settings.

To enter Configuration Value

1. Press and hold down **PGM** button until the Green set point figure changes to **AL**.
2. Release **PGM** button then re-press and hold, **AL** will change to **C111**. The upper red figure will either show 9031 for hot water or G000 for steam.
3. To change to required value press ▲ button, scroll through numbers (1-10) , to move to left press ▼ button and scroll through, this gives numbers and letters.

FIG 29: Siemens RWF40



Nu-way configuration values

Steam:	C111	G000	Hot Water:	C111	9031
	C112	0000		C112	5010
	C113	0100		C113	0100
	SCL	0			
	SCH	25			
	SCL2	0			
	SCH2	100			
	SPL	5.5			
	SPH	6.5			
	OFF 1	0			
	OFF 2	0			
	OFF	0			
	dF 1	1.0			

4. Select required figure/factor.
5. Press **PGM** button to enter value and change to next screen (to cancel and enter - press **EXIT**) Set remaining parameters/settings as recommended by Nu-way.
5. At last screen the **PGM** button will return the controller to the original operating display.
6. Press **EXIT**

Note: - To reset Lockout, press and hold PGM & EXIT keys for 5-10 seconds.
- Change configuration C112 value to 5010 and then EXIT.

Entering the temperature (pressure detector range being used in the RWF unit)

1. Press and hold down **PGM** button until the green set point figure changes to **AL**.
2. Release **PGM** button then re-press and hold, **AL** will change to **C111**.
3. Scroll through the screens using **PGM** until you reach **SCL**. Enter desired minimum range of detector by pressing ▲ ▼ (i.e. 0-20 bar detector). You would enter **0** (zero). Wait for it to flash, it has then accepted the change.
4. Scroll to the next screen using **PGM**, you will see **SLH**, enter the maximum range using ▲ ▼ i.e. in the above case 20. Press **EXIT** when complete.

Ref to scaling after entering configuration

Parameter	Display	Factory Setting	Setting for Hot Water	Setting for Steam
Measurement range start	SCL	0	0	0
Measurement range end	SCH	100	100	25

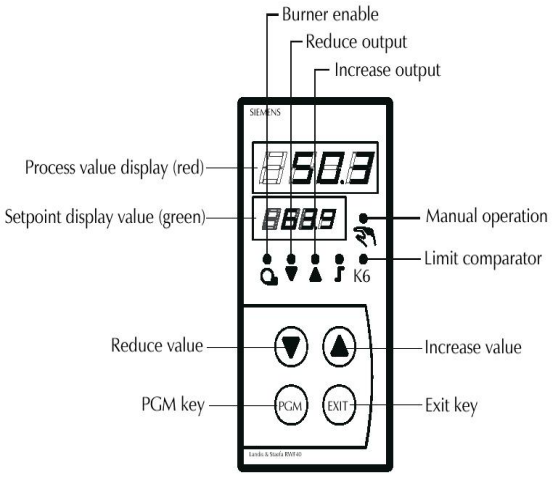
Note: You only have a short time to enter the above.
There is a time-out period. If it times out you have to start again.

Change/Enter New Parameter e.g: Switching differentials

1. Press and hold **PGM** button until the Green set point figure changes to **AL**.
2. Scroll through screens using **PGM** button until you reach Hyst.
3. Use ▲ ▼ to change operating values to desired value.
4. Wait until display flashes, it has accepted the change then press **PGM**.

Table of Parameters and Values for Steam and Hot Water Boilers

Parameter	Display	Landis Settings	Nu-way Factory Settings	
			Hot Water	Steam
Limit comparator	AL	0	0	0
Switching differential	Hyst	1.0	10	1.0
Proportional band	PB1	10	10	1
Derivative time	Dt	80	10	5
Reset (integral) time	Rt	350	50	20
Contact time	Db	1	1	0.1
Actuator time	Tt	15	15	18
Switch on threshold	Hyst 1	-5	0	-0.2
Lower off threshold	Hyst 2	3	3	0
Upper off threshold	Hyst 3	5	999.9	0.2
Response threshold	Q	0	0	0
Heating curve slope	H	1.0	1.0	1.0
Parallel shift	P	0	0	0.0



COMMISSIONING NEW BURNER OR REPLACEMENT RWF UNIT

To change Set Point (SPI) to suit boiler modulating temperature/pressure value.

1. Press PGM key until lower window displays **AL** (limit comparator) in Green.

2. Scroll through screen using **PGM** button until you reach **SPI**.

3. Use to change operating pressure/temperature to desired set point.

4. Wait until display flashes, it has accepted the change, then press **EXIT**.

BURNER OPERATING SEQUENCE

The NDF burner operating sequence (Figure 26) begins with a pre-purge period on full air. When gas is selected this fuel is then supplied to the burner at start rate and ignition initiated. Start gas flame proving is followed by establishment of the main flame.

When oil is selected, on completion of the pre-purge period the appropriate oil valve or valves open, ignition is initiated and the flame is established.

In both cases, the burner controller will then continue to its normal operating position and the operation of the burner will be controlled by the pressure and/or temperature requirements of the appliance.

Modulating Controls

Control Sequence

The standard method of operation is based on the Siemens RWF40 Universal Controller, which has been designed for use in oil and gas fired installation, where it provides temperature or pressure control of modulating burners with continuously adjustable fuel throughput.

The control output of the RWF40 is a potential free 3-position switch, which is used for the control of reversible motors. The control signals for the open (Y1) and closed (Y2) are indicated on the controller face by light emitting diodes. The RWF40 is used in conjunction with passive detectors of type QAE22 (Temperature) and QBE61 (Pressure) achieve configuration of the unit to a control value and setting range.

When the boiler control calls for heat, the modulating servomotor will travel to the 'high flame' position and interlock the control circuit. An air pre-purge will take place at this position for a pre-determined period, at the end of which the burner sequence controller will stop until the modulating servo has travelled to the 'low flame' position and interlocked the control circuit again. The sequence control will now recommence its operational cycle and the burner will light and remain at low flame until the high flame release signal is given by the sequence control. The modulating servo will now move to high flame and remain at this position until the desired boiler temperature/pressure is attained. From this stage the modulating unit will commence to move towards the low flame position, but, depending on the temperature/pressure, will stop in any intermediate position between low and high flame.

Commissioning Controls.

Two switches, Hand/Auto and inching, are included in the burner panel. In Auto mode the burner will respond to the demand of the boiler via the RWF40 modulating controller. In Hand mode, the RWF40 controller is disconnected from the burner modulating servo. This servo can now be 'inched' towards High or Low flame by operating the 3 position bias inching switch, thus allowing combustion settings to be made at these points. Whilst in 'hand' mode, care must be exercised when the burner is in a high firing range so that the boiler demand is not exceeded. It is imperative that the burner control circuit operating and limiting instruments are fitted and functioning correctly.
Some panels may be fitted with a third switch marked 'Low Flame Hold'. This switch, when operated, has the same effect as starting the burner in the 'Hand' mode. That is, the burner will run through its starting sequence, establishing flame at the low flame rate and remaining at this state until manually commanded otherwise. If the Low Flame Hold switch is activated and the Hand/Auto switch is set in the Auto position, releasing of the Low Flame Hold switch will result in the Modulating Servo driving towards the High Flame position as determined by the RWF40 temperature controller.

Temperature Detector.

The immersion temperature detector type QAE22 is used in all Hot Water boiler applications. The detector has a plastic casing to IP42 with a snap on cover and an immersion stem. The connection terminals can be accessed after removal of the cover. Cable entry is made via a cable entry gland Pg11. In all applications an immersion pocket with a flat seal is supplied.
The detector should be installed in an elbow such that the pocket points against the direction of flow. With all detector versions, the immersion length must be a minimum of 60mm.

Pressure Detector.

The Pressure detector type QBE61 is used in all Steam boiler applications. The detector has a plastic casing to IP42. The detector may be mounted on vibrating surfaces, however in all cases it is necessary to mount the water trap pipe supplied.

General.
The detector must not be covered by lagging.
Mounting instructions are printed on the packing.
The permissible lengths of the measuring cable between detector and controller are given in the following table:

Cable Core	Outside Diameter (mm)	Cable Length (m)
0.6 mm diam	5.5	20
1.0 mm^2	6.6	80
1.5 mm^2	7.2	120

Commissioning

Safety

It is essential that commissioning shall be undertaken only by suitably qualified and experienced personnel. In the case of NDF burners, commissioning engineers should be experienced in commissioning forced draught oil and gas burners.
In the UK, it is a legal requirement that anyone working on gas installation, as defined in the "Gas Safety (Installation & Use) Regulations 1994", is Gas Safe registered or whatever scheme is in force at the time.
Nu-way can accept no responsibility for consequential loss, damage or injury which results from a failure to follow the commissioning instructions provided or from commissioning procedures being undertaken by unqualified personnel.

In An Emergency

NDF burners are designed and constructed to meet all essential requirements of the Gas Appliance Directive 90/396/EEC. When used in accordance with the instructions provided, NDF 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 begun it is important to:

1. Check that the electrical wiring is complete and complies with all applicable Codes and Standards.
2. Ensure that the fuses are fitted and of the correct ratings.
3. Check electrical earthing.
4. Verify that the gas and oil supply pipework is correctly sized and that it has been checked for leakage.
5. Ensure that the manual gas isolation valve at the inlet to the gas train and the ball valve on the oil line are operable, fully closed and leak tight.
6. Make all personnel involved in the commissioning aware of the location of the emergency gas, oil and electricity isolation points.
7. Check that fittings such as purge and test points are available.
8. Establish that the appliance is in an appropriate and safe condition to be fired; for example, that there is water in the boiler.
9. Set the appliance controls to call for heat. Check the appliance's ventilation and flueing arrangements.
10. Ensure that any warning notices appropriate to the commissioning procedure are in position.
11. 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, means (which may be permanently installed or provided specifically for commissioning) of measuring the flow rates of oil and gas, equipment for checking the smoke number of the flue products and a means of analysing the flue products for carbon dioxide (CO2), oxygen (O2) and carbon monoxide (CO).
12. Check that all relevant documentation is available, including, where appropriate:
    a. The agreed plant performance specification. - Plant drawings and pipework layouts.
    b. Electrical logic and wiring diagrams.
    c. Certificates confirming satisfactory completion of procedures such as soundness testing, purging and electrical safety tests.
    d. Commissioning, operating, emergency shutdown and maintenance instructions for the plant.
13. 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.
14. Confirm that the operation of adjacent plant and machinery will not constitute a hazard to the personnel involved in commissioning.

Initial Settings

To prepare the burner for commissioning on oil and gas:

1. Remove the cover from the air damper motor and check the cam positions referring to the appropriate diagram shown in Figures 12 and 13. Adjust if necessary.
2. Remove the small plate on top of the governor section of the air/gas ratio controller. Referring to the diagram in Figure 15, set the air/gas ratio on scale (1) to 0.8 by adjusting screw (1), anti-clockwise to increase, clockwise to decrease. Set the ratio on the remaining scale to half a division on the positive side of '0' by adjusting screw (2) in the same way; anti-clockwise to increase, clockwise to decrease.
3. Remove the cap from the start gas governor and set the adjusting screw approximately half way between the maximum and minimum settings, turning the screw clockwise to increase the setting and anti-clockwise to decrease it. Replace the cap. Never adjust the governor to its maximum setting.
4. Check and if necessary re-set the ignition electrode gaps to 2.5 to 3 mm. Access to the burner inner assembly is explained in the Routine Maintenance section.
5. Ensure that oil of the correct class is available at the required temperature (on NDFR systems: refer to Figure 8) and pressure.

IT IS RECOMMENDED THAT THE BURNER SHOULD BE COMMISSIONED FOR OIL FIRING IN THE FIRST INSTANCE. SHOULD OIL NOT BE AVAILABLE TO THE BURNER THEN GAS COMMISSIONING CAN PROCEED ONLY IF THE PUMP DRIVE COUPLING IS REMOVED FROM THOSE BURNERS WHERE THE OIL PUMP IS DRIVEN BY THE BURNER FAN MOTOR. IT MUST BE NOTED IN ALL CASES THAT WHEN OIL IS AVAILABLE TO THE BURNER THE UNIT MUST BE RE-COMMISSIONED ON BOTH FUELS. NOTICE SHOULD BE MADE OF THIS FACT, BOTH AT THE BURNER AND WITHIN THE BURNER HANDBOOK AND APPLIANCE LOGBOOK.

Oil Commissioning

Burner Dry Run - NDFL35-25 to 100-38 Two Stage (High/Low)

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

1. Check that the gas, oil and electrical power supplies to the burner are turned off. Turn the fuel selector switch on the control panel to the oil position.
2. Check that the manual gas isolation valve at the inlet to the gas train is closed and that the ball valve between the oil pump and fuel valves in the burner oil line is open.
3. Ensure that oil is available at the oil pump on the burner at the required pressure and class.
4. Prime the oil pump by opening bleed port until air-free oil flows from it. The pump should not be rotated automatically until it has been primed as this may lead to premature wear or pump seizure.
5. Open the panel door and set the burner to low flame hold
6. Set the air pressure switch to minimum.
7. Establish the electricity supply to the burner and momentarily switch on the burner. Observe the rotation of the combustion air fan motor, which should be anti-clockwise, viewed from the motor cowl end. If the direction of rotation of the fan motor is incorrect, refer to the Section of this handbook on Fault Finding.
8. If the fan rotation is correct switch on the burner.
9. The burner motor will begin to run:
    (a) Immediately if the system was switched off during normal operation.
    (b) On resetting the sequence control box using the Off/On/Reset switch.
10. If at this stage the burner goes to lockout, refer to the Section on Fault Finding.
11. The burner will proceed through its pre-purge and ignition sequences. Check that an ignition spark is present. If there is no spark and the burner goes to lockout, the air pressure switch may be at fault - refer to the Section on Fault Finding.
12. Allow the burner to light momentarily. Switch off the burner and the electrical supply to the burner.
13. The burner safety systems have now been proven on oil firing and commissioning can proceed to the next stage.

Burner Live Run - NDFL35-25 to 100-38 2 Stage (High/Low)

The instructions in this section are presented as a continuous sequence. No separate set of actions (for example, checking the flame signal) should be followed in isolation without paying particular attention to any safety precautions such as isolating the electrical supply to the burner which should precede such actions. At all stages, the operation of the burner should be checked against the programming controller sequence diagram in Figures 27 or 28.

Setting Oil Flow Rates and Air/Fuel Ratios

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

AFTER EACH ADJUSTMENT check the flue gas analysis and oil flow rate.
ALWAYS use approved and calibrated test equipment.
NEVER rely on visual observation of the flame as the only guide to combustion quality.

1. Open the manual shut-off valve in the burner oil line.
2. Switch the burner on. Following the pre-purge period the burner will initiate the ignition spark and open the low fire oil valve.
3. The flame will be established and the UV cell will begin monitoring. The burner will operate continuously at low fire.
4. Check the oil pump pressure at the pump. Initially, set the pressure to 20.7 bar (300 PSI). Observe the flame through the inspection window at the rear of the burner casing to ensure the flame is established around the outer edge of the diffuser plate. A continuous halo should be visible.
5. The burner is fitted with a five cam air damper servo (refer to the diagram in Figure 12 or 13). Adjust the low fire air control cam (cam 2) if necessary so that the appearance of the flame is satisfactory.
6. Sample the flue products and check the smoke number. Adjust the low flame air cam until a clean, efficient flame is achieved.
7. Switch off the burner. The flame should go out immediately with the oil pressure gauge falling to just above zero. Switch off the electrical supply to the burner.
8. Open the control panel door and switch the burner from low flame hold to normal run position. Re-secure the panel door.
9. Establish the electrical supply and switch on the burner. Allow the burner to proceed through its operating sequence until it is operating on high fire.
10. Observe that the flame is clear and steady with a continuous halo visible around the diffusers outer edge.
11. Sample the flue products and check the smoke number. Adjust the high flame air cam (cam 3) until a clean and efficient flame is achieved.
12. Check the oil flow rate. The appropriate low fire rate is 55% (1.8:1 turndown) of the high fire rate. The turndown between high and low fire should not exceed 2:1. Re-adjust the pump pressure if necessary to correct the oil flow rate at high flame.
13. The servomotor is fitted with 2 cams (refer to the servomotor details in Figure 12 or 13) which allow independent switching of the high flame oil valve when moving from low to high flame and visa-versa. These switches are factory set but may be adjusted to improve the change over characteristics if necessary.
14. Analyse the flue products on both high and low fire.
15. Repeat the process of checking oil flow rate, smoke number and flue product analysis until satisfactory results are obtained at both high and low fire.
16. Switch off the burner and the electrical power supply to the burner.

Burner Dry Run - NDFL Modulating / NDFR - All Models

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

1. Check that the gas, oil and electrical supplies to the burner are turned off. Turn the fuel selector switch on the control panel to the oil position.
2. Check that the manual gas isolation valve at the inlet to the gas train is closed. Do not close the ball valve at the outlet of the oil pumping set.
3. Ensure that oil is available at the oil pump on the burner at the required pressure and class.
4. NDFL Burners: Prime the oil pump by opening the bleed port until air-free oil flows from it. The pump should not be rotated automatically until it has been primed as this may lead to premature wear or pump failure.
5. NDFR Burners: Fill the oil pre-heater tank by removing the hot oil filter retaining flange in the outlet pocket on top of the tank. Fill to the neck of the outlet with clean fuel oil only.
6. Switch on the electricity supply to the burner and check that the pump rotation is correct to the direction arrows shown on the pump face.

7. Open the manual isolation valve at the outlet of the pumping set.
8. Open the control panel door and set the burner for low flame hold.
9. Set the air pressure switch to minimum.
10. Remove the access lid on the modulating cam box unit.
11. Switch on the burner at the control panel. On NDFR burners a delay may be experienced whilst the system attains temperature. The modulating unit camshaft should now rotate to the high flame setting, and the combustion fan motor will start the air pre-purge phase.
12. Allow the fan motor to run up to speed and switch off the burner. Observe the rotation of the combustion air fan motor, which should be anti-clockwise, viewed from the motor cowl end. If the direction of rotation of the fan motor is incorrect, refer to the Section of this handbook on Fault Finding.
13. If the fan rotation is correct switch on the burner.
14. The burner will proceed through its pre-purge and ignition sequences. Check that an ignition spark is present. If there is no spark and the burner goes to lockout, the air pressure switch may be at fault - refer to the Section on Fault Finding.
15. During this run note the spill and line oil pressures at the point of ignition. Reset the sequence control and repeat the run if necessary to check these functions. If necessary, adjust the line pressure at the burner pump to 27.8 bar (400 psi) and the spill pressures to the correct figures stamped on the burner data plate.
16. Allow the burner to light momentarily. Switch off the burner and the electricity supply to the burner.
17. The burner safety systems have now been proven on oil firing and commissioning can proceed to the next stage.

Burner Live Run - NDFL Modulating / NDFR - All Models

The instructions in this section are presented as a continuous sequence. No separate set of actions (for example, checking the flame signal) should be followed in isolation without paying particular attention to any safety precautions such as isolating the electrical supply to the burner which should precede such actions. At all stages, the operation of the burner should be checked against the programming controller sequence diagram in Figure 27 or 28.

Setting Oil Flow Rates and Air/Fuel Ratios

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

AFTER EACH ADJUSTMENT check the flue gas analysis and oil flow rate.
ALWAYS use approved and calibrated test equipment.
NEVER rely on visual observation of the flame as the only guide to combustion quality.

New NDF Modulating burners are generally supplied against the firing specification of the appliance. In this case the system and spill pressures may be pre-set and require checking and minor adjustments only. The following section describes how to set up the modulating cam box unit from the beginning.

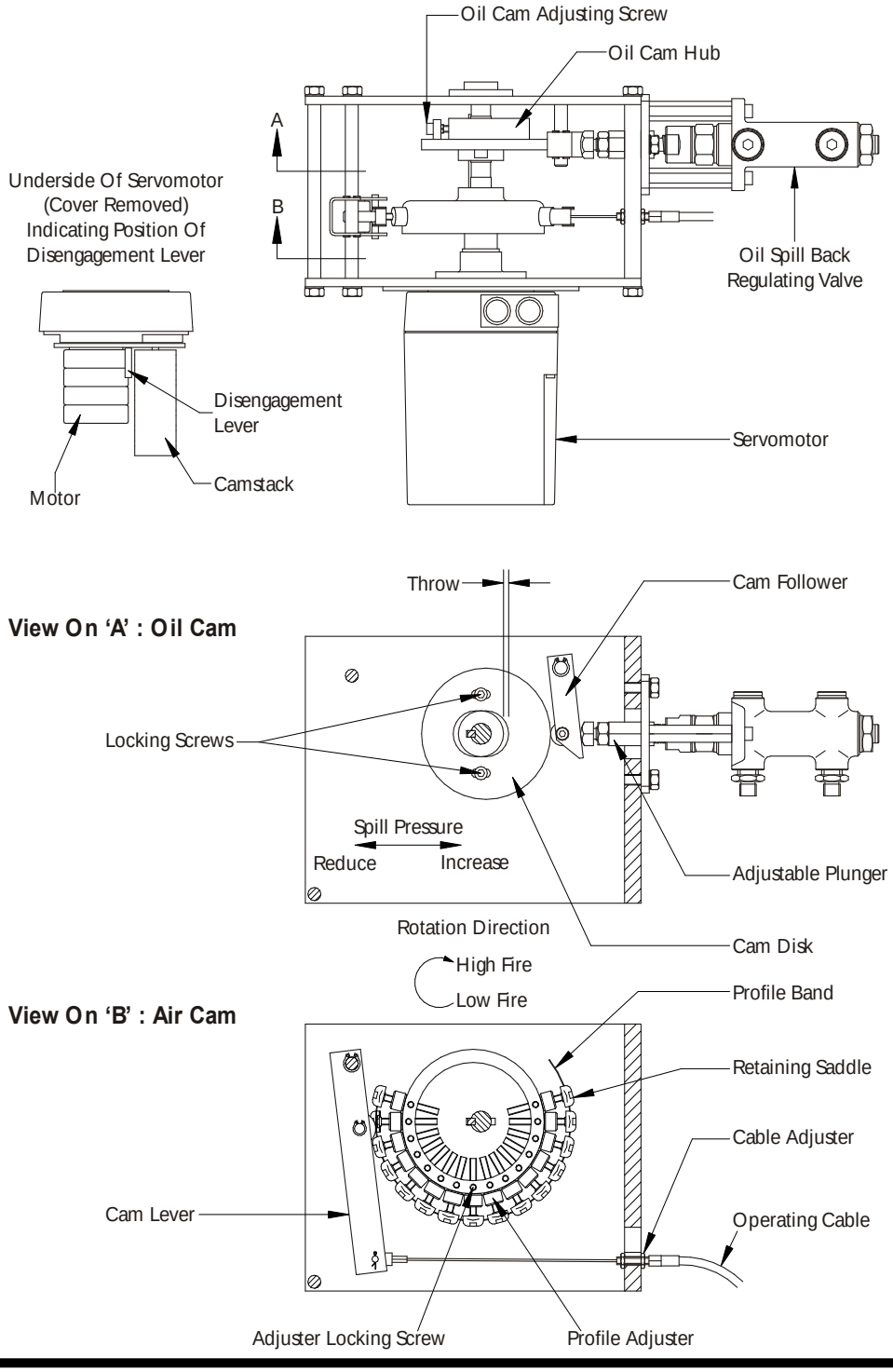
The modulating cam layshaft can be rotated by hand by using the gearbox disengagement lever in the drive servomotor.

1. Ensure that the modulating cam arrangement is in the low flame position. Adjust the oil cam (refer to Figure 30) so that it gives approximately 1.5mm throw (3mm stroke) and lock in position.
2. Check to ensure that the spill valve push rod bears lightly against the oil cam (refer to Figure 30).
3. Turning to the air cam, rotate the thumbscrews in or out so that they give a reasonable amount of adjustment in each direction. Adjust the flexible cable (at either end if necessary) until the air inlet damper is fully closed (i.e. until all the slack is taken up on the cable).
4. Adjust the thumbscrews to give a small opening of the air damper at low flame.
5. Reset the sequence control and allow the burner to start. Immediately the burner starts, switch the hand/auto selector switch to the 'hand' position and hold low flame until the appliance is ready to accept high flame. During this period, check and adjust the low flame oil throughput.
6. Observe the flame through the inspection window at the rear of the burner casing to ensure the flame is established around the outer edge of the diffuser plate. A continuous halo should be visible. If the flame is dirty, adjust the air cam thumbscrews until the flame becomes clean.
7. After a suitable delay, inch the camshaft to the high flame position (i.e. through 180) by means of the inching switch on the control panel. Adjust the air cam profile by means of the thumbscrews until the air damper is now fully open. At this stage it will be found that all of the thumbscrews between low and high position will require adjusting so as to avoid over stressing the cam profile band. Once this has been done, there should be a fairly smooth profile between low and high positions.
8. Ensure that the flame is visually clean throughout the modulation range at all times.
9. Check the oil consumption. If this is not correct for the full burner rating, the oil cam must be adjusted as follows: -
    (a) Inch the burner to low flame and note the spill pressure.
    (b) To increase the minimum rate, adjust as shown in Figure 30.

(c) Adjust the cam to give more eccentricity for more oil at high flame, and visa-versa.
(d) Return to the minimum setting and compensate for any changes.
(e) Inch the burner to high flame and again check the oil flow.
(f) Continue to repeat (a) to (d) until the high flame oil rate is correct.

10. When a satisfactory flame is achieved, again check the line and spill pressures. Check the pre-heater temperature (if fitted) and adjust if necessary.
11. Inch the camshaft back to the low flame position. The oil consumption rate should now be between 40 and 50% of the rated maximum.
12. Sample the flue products and check the smoke number. Adjust the combustion air volume as necessary.
13. Check the burner performance throughout the range adjusting the air cam profile as necessary to give a clean and efficient flame. When a satisfactory setting has been achieved, lock the air cam thumbscrews with the grub screws fitted in the side face of the cam body. Refit the Modulating unit access cover.
14. Switch off the burner and the electricity supply to the burner.

FIG 30: MODULATING CAM BOX



Gas Commissioning

Burner Dry Run - NDFL/R All Models

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

IT IS RECOMMENDED THAT THE BURNER SHOULD BE COMMISSIONED FOR OIL FIRING IN THE FIRST INSTANCE. SHOULD OIL NOT BE AVAILABLE TO THE BURNER THEN GAS COMMISSIONING CAN PROCEED ONLY IF THE PUMP DRIVE COUPLING IS REMOVED FROM THOSE BURNERS WHERE THE OIL PUMP IS DRIVEN BY THE BURNER FAN MOTOR. IT MUST BE NOTED IN ALL CASES THAT WHEN OIL IS AVAILABLE TO THE BURNER THE UNIT MUST BE RE-COMMISSIONED ON BOTH FUELS. NOTICE SHOULD BE MADE OF THIS FACT, BOTH AT THE BURNER AND WITHIN THE BURNER HANDBOOK AND APPLIANCE LOGBOOK.

Important Note Regarding Combustion Air Settings: -
IF THE BURNER HAS ALREADY BEEN COMMISSIONED ON OIL, THE COMBUSTION AIR SETTING MUST NOT BE RE-ADJUSTED. THE GAS RATE MUST BE MATCHED TO THE EXISTING SETTINGS.

1. Check that the gas, oil and electrical power supplies to the burner are turned off. Turn the fuel selector switch on the control panel to the gas position.
2. Check that the manual gas isolation valve at the inlet to the gas train and the ball valve in the oil line (NDFL) are closed.
3. On NDFR burners firing class 'G' fuel, open the hinged extension and remove the oil lance from the gas inner assembly. The lance and nozzle should be flushed through with clean class 'D' oil immediately to prevent blockage by the cooling fuel oil.
   Fit the three port dummy inner assembly manifold supplied with the burner. This will enable the oil pumping and heating unit to continue to keep the oil system up to temperature without danger of oil being released into the appliance whilst firing the burner on gas.
   Fit the inner assembly plug to the back of the gas inner assembly. This maintains the cross sectional area of the annular air passage within the primary air tube, as if the oil lance is fitted.
4. Check that the gas pipework between the plant isolation valve and the safety shut-off valves has been tested for soundness and purged in accordance with an appropriate Procedure, for example IGE/UP/1 Soundness testing and purging on industrial and commercial premises.
5. Open the control panel cover and set the burner for low flame hold. (On modulating burners not fitted with a low flame hold switch, set the "hand / auto" switch to the hand position).
6. If a gas booster is fitted, ensure that it is turned on.
7. Remove the cover from the low gas pressure switch and fit a temporary link between terminals 2 and 3. Replace the cover.
8. Set the air pressure switch to minimum.
9. Establish the electrical supply to the burner and momentarily switch on the burner. Observe the rotation of the combustion air fan motor, which should be anti-clockwise viewed from the motor end. If the direction of rotation of the fan motor is incorrect refer to the Section of this handbook on Fault Finding.
10. If the fan rotation is correct switch on the burner.
11. The burner motor will begin to run:
    (a) Immediately if the system was switched off during normal operation.
    (b) On pressing the reset button on the control box.
    If at this stage the burner goes to lockout refer to the Section on Fault Finding.
12. The burner will proceed through its ignition sequence. Check that an ignition spark is present. If there is no spark and the burner goes to lockout the air pressure switch may require adjustment - refer to the Section on Fault Finding.
13. The ignition spark will cease and the system will go to lockout. Switch off the burner and the electrical power supply to the burner.
14. Switch off the gas booster (if fitted). Remove the temporary link fitted to the low gas pressure switch and replace the cover.
15. The burner's safety systems have now been proven and commissioning can proceed to the next stage.

Burner Live Run – NDFL/R All Models

General

The instructions in this section are presented as a continuous sequence. No separate set of actions (for example, checking the flame signal) should be followed in isolation without paying particular attention to any safety precautions such as isolating the electrical supply to the burner which should precede such actions. At all stages, the operation of the burner should be checked against the programming controller sequence diagram in Figure 27 or 28.

Before proceeding, check again that:

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

Selecting Gas

1. Ensure that the ball valve in the oil line is closed.
2. Turn the fuel selector switch on the control panel to the gas position.

Gas Supply Pressure

The supply pressure at the inlet to the burner shall not be less than that required for the maximum required continuous output from the burner, and not more than 100 mbar (up to NDF100-38) or 200 mbar (NDF100-41 and upwards). Refer to the gas inlet pressure graphs (running pressures) contained in the appendix of this handbook.

Before proceeding with commissioning:

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

Establishing the Start Gas Flame

1. Remove the control panel cover and remove the pilot check link. Replace the cover.
2. Establish the electrical supply to the burner and switch on the burner.
3. The burner controller will run through its sequence, initiating the ignition spark and opening the start gas safety shut-off valve.
4. The start gas flame will be established and the UV cell will begin monitoring. The burner will operate continuously at start gas rate. If the burner goes to lockout, increase the start gas rate slightly at the governor and reset the burner.
5. Confirm the leak tightness of the pipework downstream of the start gas safety shut-off valve using a proprietary detection fluid.
6. Switch off the burner. Switch on the burner and allow the ignition sequence to be repeated, confirming that the start gas flame is reliable.
7. Switch off the burner and the electrical power supply to the burner. Remove the control panel cover and replace the pilot check link. Replace the cover.

Setting Main Flame Rates and Air/Gas Ratios

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

AFTER EACH ADJUSTMENT check the flue gas analysis and gas flow rate.
ALWAYS use approved and calibrated test equipment.
NEVER rely on visual observation of the flame as the only guide to combustion quality.

1. Fit a manometer or other approved pressure measuring instrument to the gas pressure test point nearest to the burner head. The relationship between the pressure at this point and burner heat input is shown in the graphs in the Appendix. This information is provided only as a guide and it should not be used in conjunction with pressure measurements as a substitute for accurate measurement of gas flow rate using, for example, a gas meter.
2. Ensure that the flue gas analysis equipment is functioning.
3. Close the manual gas isolation valve at the inlet to the gas train to an opening of approximately 20%.
4. Set the gas inlet pressure switch to its minimum value.
5. With the burner set for low flame hold (hand operation), re-establish the electrical supply and switch on the burner.

6. The burner controller will run through its sequence, initiating the ignition spark and opening the start gas safety shut-off valve. The start gas flame will be established and the UV cell will begin monitoring.
7. The main gas control valve will open and low fire will be established. Open the upstream manual valve slowly until it is fully open, observing the CO level.
8. If the CO level is too high (see below) reset the low fire adjusting screw (2) on the air/gas ratio controller (refer to the diagram in Figure 15) until an acceptable figure is achieved. In extreme cases the adjustment on screw (2) may be exhausted without achieving an acceptable CO level. In this event, reset the high fire adjusting screw (1) until an acceptable CO level is achieved.
9. Confirm the leak tightness of the pipework downstream of the main gas safety shut-off valve using a proprietary detection fluid.
10. Switch off the burner and the electrical power supply to the burner.
11. Open the control panel cover and switch the burner from low flame hold to normal run position. On modulating and sliding high/low burners select the auto position of the hand / auto switch. Close the cover.
12. Establish the electrical supply to the burner and switch on the burner. The burner controller will run through its sequence. Low fire will be established, expanding to main flame. Monitor the flame visually during the transition from low to high fire. If the flame becomes more intense and compact this indicates an excess of combustion air. If the flame becomes large and shapeless, this indicates an excess of fuel. Either condition is acceptable at this stage provided that the flame is stable and the commissioning process continues immediately. If in doubt, switch off the burner and adjust screw (1) on the air/gas ratio controller appropriately before restarting the burner.
13. With the burner running on high fire, measure the flue CO2 level and adjust screw (1) to bring the level to an acceptable level. Note that at this stage the burner may be overfiring the appliance and producing excessively high levels of CO. Check the level of O2 to confirm the CO2 reading.
14. Set the burner for low flame hold (hand operation) and switch on the burner. Allow the burner controller to run through its cycle until the burner is running on low fire.
15. Adjust the low fire adjusting screw (2) to bring the CO2 level to an acceptable level.
16. Changing the low fire setting on the air/gas ratio controller will have a slight effect on the high fire setting. It may therefore be necessary to repeat steps 40 to 42 several times in order to achieve acceptable levels Of CO2 at both firing rates.
17. With the burner running on high fire, check the gas flow rate with an appropriate instrument, ensuring that the instrument has been calibrated before use. If the flow rate is to be measured using the main site gas meter or a supplementary meter, ensure that all other gas appliances served by that meter are isolated.
18. Check the gas flow rate with the burner running on low fire. The appropriate low fire rate is governed by the low fire combustion air setting achieved during the oil commissioning phase. The turndown between high and low fire should therefore mirror the figure achieved during this phase. If oil is unavailable and the burner is commissioned for gas firing only, then the gas rate can be adjusted by varying the low and high fire positions of the air damper. In this case care should be taken not to exceed the limits of the burner performance envelope shown in the Appendix.
19. Analyse the flue products on both high and low fire.

Setting the Start Gas rate

Warning: -

Extended firing on start gas rate only can lead to a build-up of volatile gases within the appliance combustion chamber. Running should be kept to a maximum of 5 MINUTES ONLY.

1. Switch off the burner and the electrical power supply to the burner.
2. Remove the control panel cover and remove the pilot check link. Replace the cover.
3. Establish the electrical supply to the burner and switch on the burner. Allow the burner to light and establish the start gas flame.
4. Check the gas flow rate. The appropriate setting is usually found between 25 & 30% of the main flame gas rate. The start gas rate must never be set at a level higher than 33%.
5. If it is necessary to adjust the start gas rate, turn the adjusting screw in the start gas pressure governor clockwise to increase the gas rate and anti-clockwise to reduce it. Make small adjustments and check the gas rate after each change.
6. Switch off the burner and the electrical power supply to the burner. Remove the control panel cover and replace the pilot check link. Replace the cover.

Setting the High Gas Pressure Switch

1. Remove the cover from the high gas pressure switch.
2. Establish the electrical supply to the burner and switch on the burner. Allow the burner to proceed through its operating sequence until it is operating on high fire.
3. Turn the adjusting dial on the pressure switch anti-clockwise slowly until the switch trips, causing the pressure switch indicating light to be illuminated and the burner to shut down.
4. Turn the adjusting dial approximately 20% clockwise.
5. Refit the cover and reset the pressure switch by pressing the button on the cover. The burner will restart.

Setting the Low Gas Pressure Switch

1. Switch off the burner and the electrical power supply to the burner.
2. Remove the cover from the low gas pressure switch.
3. Establish the electrical supply to the burner and switch on the burner. Allow the burner to proceed through its operating sequence until it is operating on high fire.
4. Turn the adjusting dial on the pressure switch clockwise slowly until the switch trips, causing the burner to shut down. Turn the adjusting dial anti-clockwise slowly until the burner restarts and main flame is established.

Final commissioning stages - oil & gas

Checking the Flame Signal

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

Setting the Air Pressure Switch

1. Remove the air pressure switch cover.
2. Fit a manometer or other approved pressure measuring instrument to the pressure switch to enable a comparison to be made between the pressure switch indicator and the measured pressure.
3. Remove the control panel cover and remove the low fire hold link. Replace the cover.
4. Establish the electrical supply to the burner and switch on the burner. Allow the burner to proceed through its sequence until it is operating on low fire.
5. Turn the adjusting dial on the pressure switch clockwise slowly until the flame is extinguished and the burner goes to lockout.
6. Turn the dial one division anti-clockwise and reset the burner. If lockout occurs again, turn the dial a further division anti-clockwise and reset the burner. Repeat this process until the burner lights and runs satisfactorily.
7. Turn the adjusting dial a further two divisions anti-clockwise.
8. Switch off the burner and the electrical power supply to the burner. Remove the manometer. Replace the pressure switch cover.
9. Remove the control panel cover and replace the low fire hold link. Replace the cover.

Modulating Controller: Siemens RWF40

The RWF40 controller has been specifically designed for the control of boiler temperature or steam pressure in Oil & Gas fired plant. All the settings can be adjusted whilst the burner is in operation.

The detailed instructions to set up the Siemens RWF40 modulating controller are shown with Figure 29.

A data sheet containing in depth information on the RWF40 and its operation is available upon request.

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 IS NOW COMPLETE**.
5. Establish the electrical supply to the burner and switch on the burner. Allow the burner to proceed through its operating sequence until it is operating on high fire. The burner will now operate normally until:
    (a) It is switched off by the appliance controls.
    (b) It is switched off manually.
    (c) There is an electrical power failure. In this event the burner will restart and run normally when power is restored. No manual intervention is required.

On Completing Commissioning

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:
    a. The way in which the plant operates and the locations and functions of the plant's safety systems.
    b. The correct light-up and shutdown procedures.
    c. Adjustment of operating variables.
    d. Checking of plant interlocks.
    e. The plant's maintenance requirements.
    f. The actions to be taken in the event of a fault condition.
2. Clear light-up and shutdown procedures are displayed on the plant and that the pipes, valves and switches involved are clearly marked.
3. CLEAR AND CONCISE EMERGENCY SHUTDOWN PROCEDURES ARE DISPLAYED.

Fuel Changeover Procedure

Note that on completion of the commissioning procedure detailed above the burner is set for gas firing. The procedure to be followed when switching fuels during normal operation is as follows:

Switching From Gas to Light Oil

1. Switch off the burner and the electrical power supply to the burner.
2. Close the manual gas isolation valve.
3. Open the ball valve in the oil line.
4. Turn the fuel selector switch on the control panel to the oil position.
5. If the burner has been operated on gas for a prolonged period, it may be necessary to refit the burner oil pump coupling and re-prime the pump.
6. Establish the electrical supply to the burner and switch on the burner. Allow the burner to proceed through its operating sequence until it is operating on high fire.

Switching From Gas to Heavy Oil

1. Switch off the burner and the electrical power supply to the burner.
2. Close the manual gas isolation valve.
3. On burners which are to be operated on Class G oil, remove the dummy inner assembly manifold and inner assembly plug. Replace them with the normal inner assembly.
4. Ensure that oil is available at the required temperature (refer to the table in Figure 8) and pressure.
5. Turn the fuel selector switch on the control panel to the oil position.
6. If the burner has been operated on gas for a prolonged period it may be necessary to bleed the oil pump as described in the sections on Initial Settings and Burner Dry Run.
7. Establish the electrical supply to the burner and switch on the burner. Allow the burner to proceed through its operating sequence until it is operating on high fire.

Switching From Light Oil to Gas

1. Switch off the burner and the electrical power supply to the burner.
2. Close the ball valve in the oil line.
3. Open the manual gas isolation valve.
4. Turn the fuel selector switch on the control panel to the gas position.
5. Establish the electrical supply to the burner and switch on the burner. Allow the burner to proceed through its operating sequence until it is operating on high fire. If the burner has been operating on oil for a prolonged period it may be necessary to purge the gas line of air.

Switching From Heavy Oil to Gas

1. Switch off the burner and the electrical power supply to the burner.
2. On burners which have been operated on Class G oil, remove the inner assembly and replace it with the dummy manifold and plug assemblies provided.
3. Open the manual gas isolation valve.
4. Turn the fuel selector switch on the control panel to the gas position.
5. Establish the electrical supply to the burner and switch on the burner. Allow the burner to proceed through its operating sequence until it is operating on high fire. If the burner has been operating on oil for a prolonged period it may be necessary to purge the gas line of air.

Routine Safety Checks

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

Combustion Air

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

Flame Detector

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

Valve Proving System (if fitted)

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

Routine Maintenance

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

Combustion Air Fan - All Models

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

Replacing the Air/Gas Ratio Controller - All Models

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

Burner Inner Assembly – Twin Nozzle Burners

To gain access to the burner inner assembly, first remove the multi-pin plug from the socket on the control system. Remove the locking nut securing the hinged extension and open this extension. Disconnect the ignition leads. Remove the caphead screw which secures the burner inner assembly to the hinged extension and withdraw the inner assembly, taking care not to damage it. Clean the air diffuser and gas nozzle with a stiff brush. Clean and reset the ignition electrodes and check that they are not cracked or worn. Renew the electrodes if necessary. 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. Reverse the order of actions detailed above to replace the inner assembly and prepare the burner for normal operation.

Burner Inner Assembly – Single Nozzle Spill Back Burners

To gain access to the burner inner assembly, first remove the multi-pin plug from the socket on the control system. Remove the locking nut securing the hinged extension and open this extension. Disconnect the ignition leads. Remove the two screws which secure the oil manifold within the hinged extension. Remove the four bolts which locate the inner assembly and withdraw the assembly, taking care not to damage it. Clean the air diffuser and gas nozzle with a stiff brush. Clean and reset the ignition electrodes and check that they are not cracked or worn. Renew the electrodes if necessary. Remove the oil gun, complete with nozzle, from the centre of the inner assembly. Remove the nozzle from the gun and wash it in a suitable solvent, removing any remaining deposits with a clean, lint-free cloth. The oil nozzle should be replaced after 5000 hours operation. Reverse the order of actions detailed above to replace the inner assembly and prepare the burner for normal operation.

Oil Filters - NDFL

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 reusable it should be cleaned at appropriate intervals.
After filter cleaning operations it will be necessary to remove air from the system by bleeding the pump.

Oil Filters - NDFR

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

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

Fault Finding

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

Burner Motor Fails To Start

Possible Reason	Remedy
No power supply yo burner	Reinstate power supply
	Check fuses
	Check burner is correctly wired
Power supply to burner OK	Check appliance controls calling for heat
	Check burner not Locked Out
	Check motor overload not tripped
Gas train disconnected	Check and reconnect
Appliance controls incorrectly set	Check and adjust as necessary
Gas supply isolated	Restore supply
Low gas pressure	Check and rectify
Air pressure switch not in Start position	Check as below
Fuel selector switch incorrectly set	Check and reset
Valve proving system Locked Out	Check and reset
Oil preheater limit thermostat tripped	Check and rectify
Low oil temperature	Check thermostat setting

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

1. Switch off the electrical power supply to the burner.
2. Remove the plug-in assembly from the control box base.
3. Using a suitable instrument, check for electrical continuity between the following terminals:
    a. Satronic TMG 740 Terminals 16 and 17
    b. Siemens (Landis & Gyr) LFL 1.333 Terminals 13 and 14
4. If the air pressure switch is not in the start position turn the setting dial clockwise fully to the maximum setting. Check again for continuity between the above terminals. If there is no continuity the pressure switch is faulty and should be renewed.

If a gas booster is fitted:

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

Fan Starts And Burner Goes To Lockout

(1) No ignition

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

(2) No Flame - Gas Firing

Possible Reason	Remedy
Gas supply isolated	Check gas supply to burner
Gas pressure too low	Investigate and remedy
Air flow incorrect for gas flow	Check and adjust as necessary
Valves fail to open	Check wiring and replace valves if necessary
Manual isolation valve closed	Open valve
Carbon deposits on diffuser	Clean

(3) No Flame - Oil Firing

Possible Reason	Remedy
Oil supply interrupted	Check oil supply to burner
Pump coupling failed	Replace
Pump drive motor failed (if fitted)	Check wiring, fuses or replace
Oil pressure too low	Investigate and remedy
Vlaves fail to open	Check wiring or replace
Oil pump faulty	Replace
Filter blocked	Clean or replace
Nozzle blocked	Clean or replace
Carbon on diffuser	Vlean
Oil temperature too low	Check and rectify

Start Flame Failure

Failure of the start rate flame will produce lockout. Confirm start flame failure by checking the flame signal at the appropriate stage. If the flame signal is low, the cause may be:

1. A dirty or wrongly positioned (it must face towards the flame) glass envelope on the UV cell. - A fault in the UV cell or its wiring - check and replace if necessary.
2. The flame signal check link has been removed - check and replace.
3. There is insufficient fuel under ignition conditions to allow the flame to be detected adequately - adjust the flow rate.
4. Partial blockage of the oil nozzle - check and clean if necessary.
5. Carbon on the air diffuser - check and clean if necessary.

Incorrect Rotation Of Burner Motor

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

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

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

Main Flame Is Not Established

Possible Reason	Remedy
Fuel pressure or flow too low	Check fuel supply to burner
Mains gas / oil valve fails to open	Check wiring or replace if faulty
Programming controller faulty	Check and replace as necessary
Low fire hold link removed	Replace link
Gas train gasket incorrectly positioned	Reposition
Air setting incorrect	Reset

Burner Motor Only Runs Continuously

Possible Reason	Remedy
Air control damper motor failed	Replace
Air control damper cam loose	Tighten
Microswitch failes to changeover	Replace
Damper motor incorrectly wired	Check and correct wiring

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.

APPENDIX

This appendix contains additional information and documentation including:

- Burner head details and dimensions
- Electrode setting details
- Burner performance envelopes
- Commissioning sheets (oil and gas). Blank sheets are provided which must be filled in by the engineer on completion of commissioning.

  For two stage (high/low) burners the pressure, combustion quality and temperature data should be obtained for both high and low fire settings for both oil and gas firing.

  For fully modulating burners additional data at intermediate positions in the operating range between high and low fire are required.

Burner Head Dimensions (see Figures 31 and 32).

	Dimensions					
	A	**B**	**C**	**D**	**No. E**	**F**
NDF 35-25	178	171	149	70	6	6.0
NDF 35-34	178	171	149	70	6	6.0
NDF 35-38	178	171	149	70	6	6.0
NDF 50-28	219	206	190	89	8	9.5
NDF 50-34	219	206	190	89	8	9.5
NDF 50-38	219	206	190	89	8	9.5
NDF 60-28	219	206	190	89	8	9.5
NDF 60-34	219	206	190	89	8	9.5
NDF 60-38	219	206	190	89	8	9.5
NDF 80-28	254	228	203	89	8	9.5
NDF 80-34	254	228	203	89	8	9.5
NDF 85-38	254	228	203	89	8	9.5
NDF 100-38	254	228	203	89	8	9.5
NDF 100-41	305	279	248	89	8	12.7
NDF 100-44	305	279	248	89	8	12.7
NDF 125-36	305	279	248	89	8	12.7
NDF 125-41	305	279	248	89	8	12.7
NDF 125-44	305	279	248	89	8	12.7
NDF 150-36	305	279	248	89	8	12.7
NDF 150-41	305	279	248	89	8	12.7
NDF 150-44	305	279	248	89	8	12.7
NDF 170-44	305	279	248	89	8	12.7
NDF 180-44	305	279	248	89	8	12.7

FIG 31: Burner Head Details: Twin Pressure Oil Jet Models

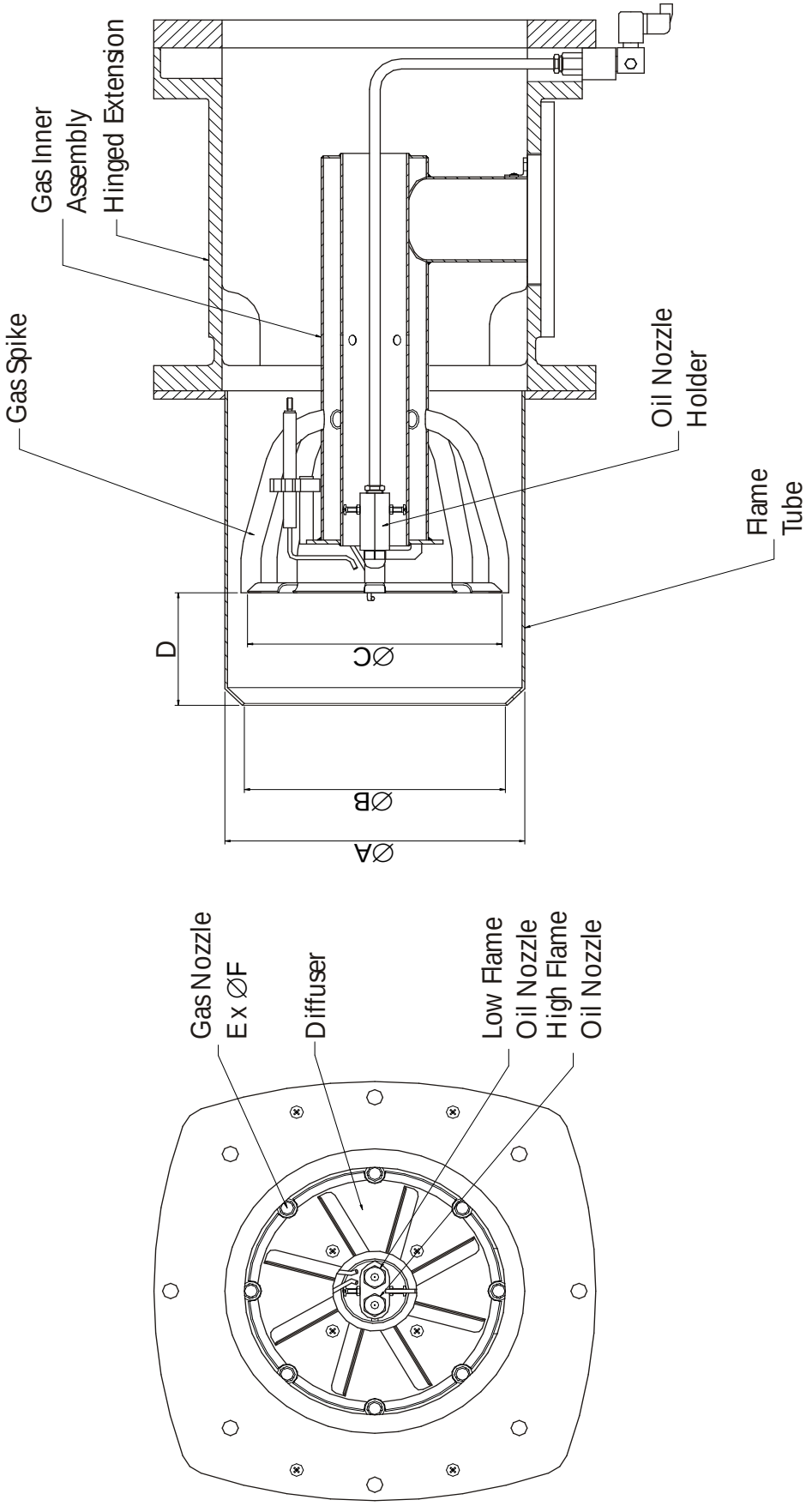


FIG 32: Burner Head Details: Single Spill-back Oil Nozzle Models

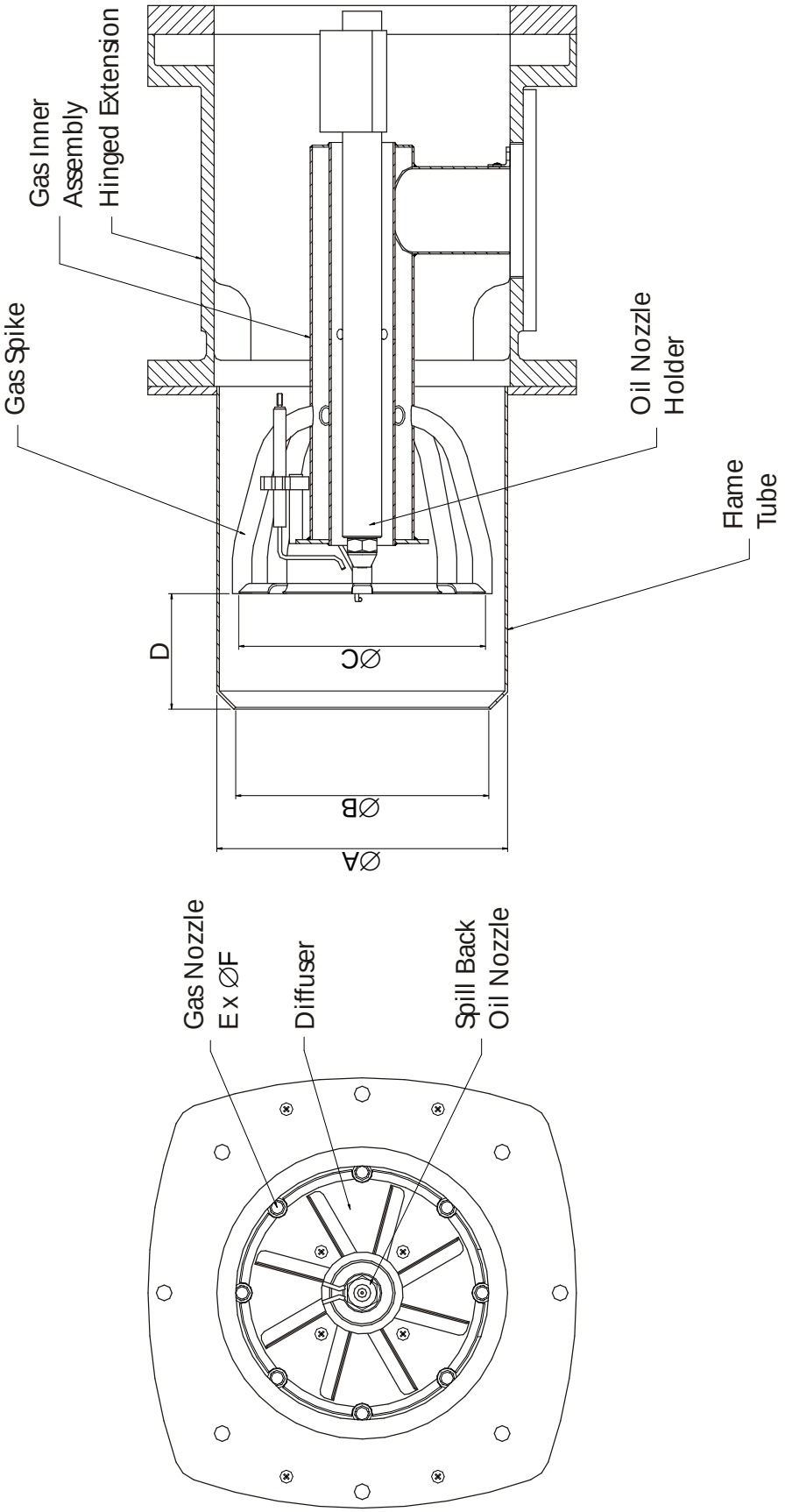
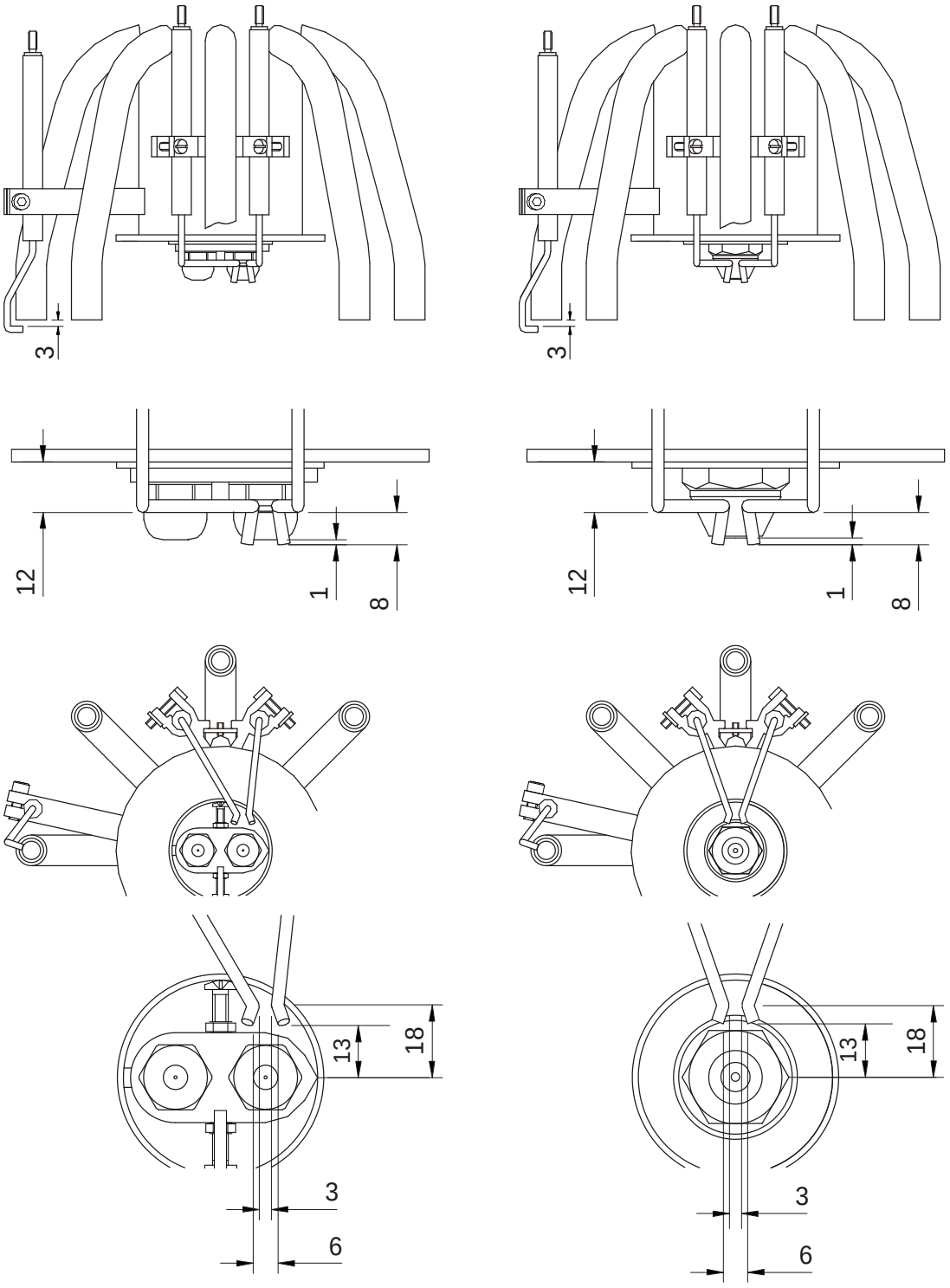


FIG 33: Electrode Setting Detail

Twin Pressure Jet
Oil Nozzle Models

Single Spill Back
Oil Nozzle Models



All dimensions are mm

Oil Commissioning Sheet

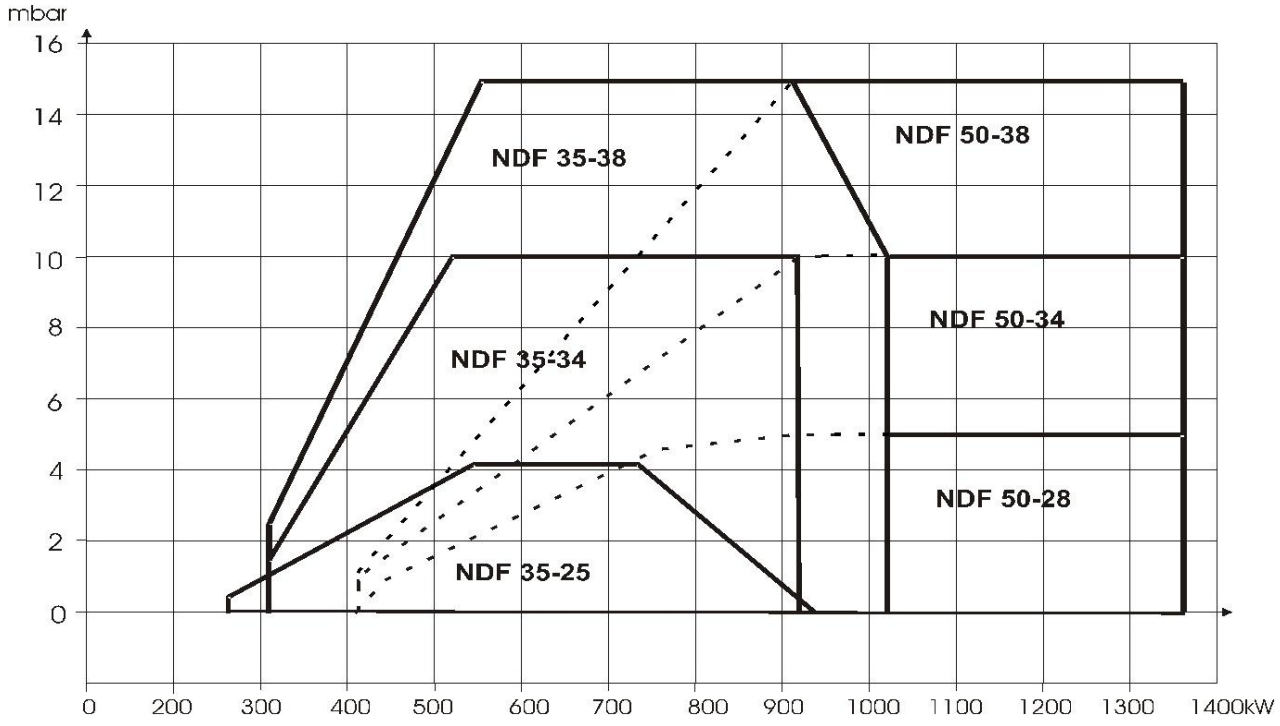
The details below are to be completed by the Commissioning Engineer. The completed sheet should be photocopied and a copy sent to the appliance manufacturer.									
Installers Name:									
Address:									
Site Address:									
Appliance	Type:			Size:			Serial No.		
Burner	Type:			Size:			Serial No.		
Commissioning Date:									
Guarantee Expiry Date:									
Fuel Oil Type:									
Pump inlet oil pressure		Standing (bar / psi):				Running (bar / psi):			
Firing Rate	High Fire	Intermediate Positions						Low Fire	Units[1]
Pressure at Burner	Oil								bar / psi
	Air								mbar / in WG
Oil Rate									Kg/h / l/h
Heat Input									kW
O2									% dry
CO2									% dry
CO									ppm dry
Flue Temp									^{o}C
Ambient Temp									^{o}C
Temp Difference									^{o}C
Efficiency									%
[1]Note: Where a choice of measurement units is shown, delete if not applicable.									

Gas Commissioning Sheet

The details below are to be completed by the Commissioning Engineer. The completed sheet should be photocopied and a copy sent to the appliance manufacturer.									
Installers Name:									
Address:									
Site Address:									
Appliance	Type:			Size:			Serial No.		
Burner	Type:			Size:			Serial No.		
Commissioning Date:									
Guarantee Expiry Date:									
Fuel Gas Type:									
Gas inlet pressure to Gas Train		Standing (mbar / ins wg):				Running (mbar / ins wg):			
Firing Rate	High Fire	Intermediate Positions						Low Fire	Units[1]
Pressure at Burner	Gas								mbar / ins wg
	Air								mbar / ins wg
Oil Rate									m3/h / ft3/h
Heat Input									kW
O2									% dry
CO2									% dry
CO									ppm dry
Flue Temp									^{o}C
Ambient Temp									^{o}C
Temp Difference									^{o}C
Efficiency									%
[1]Note: Where a choice of measurement units is shown, delete if not applicable.									

Performance Envelopes

FIG 34: Performance Envelopes: NDF 35, 50 & 60



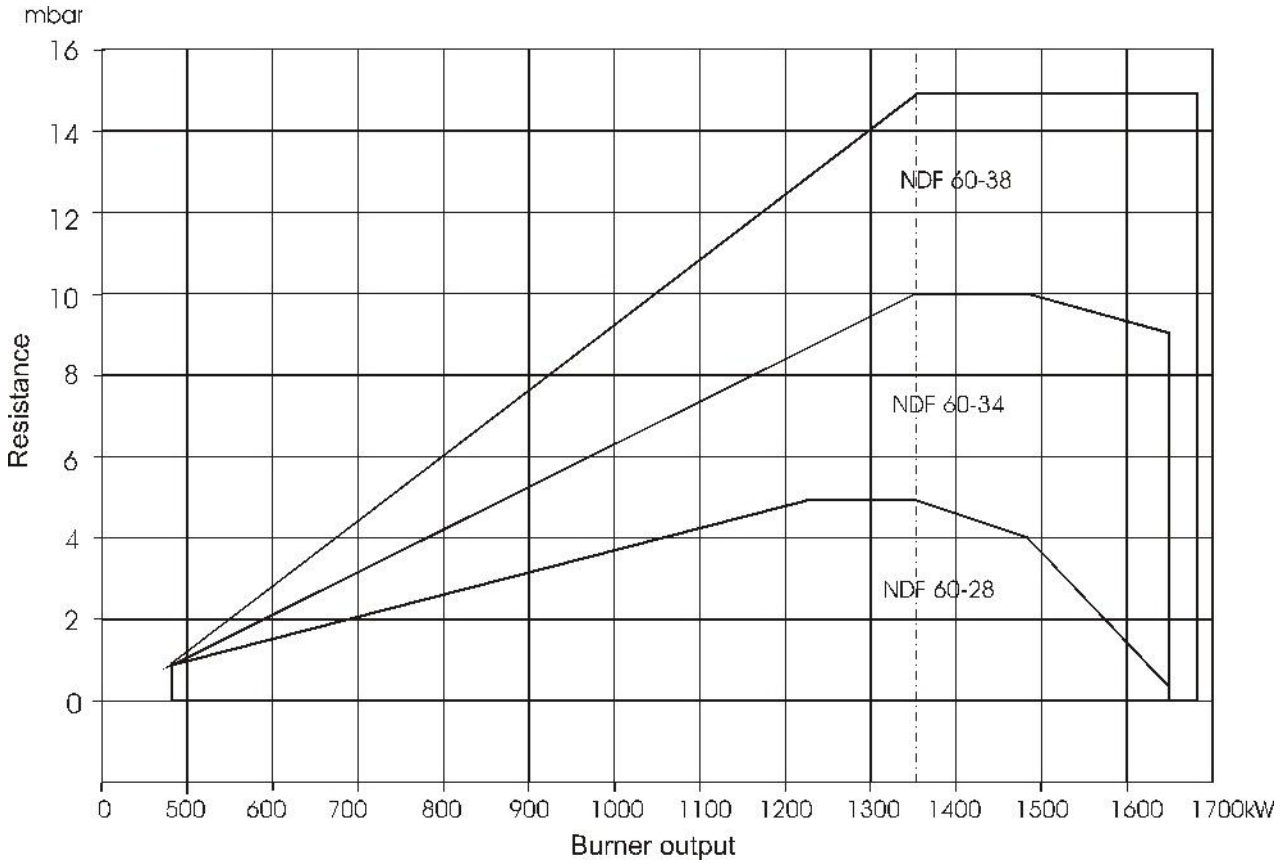
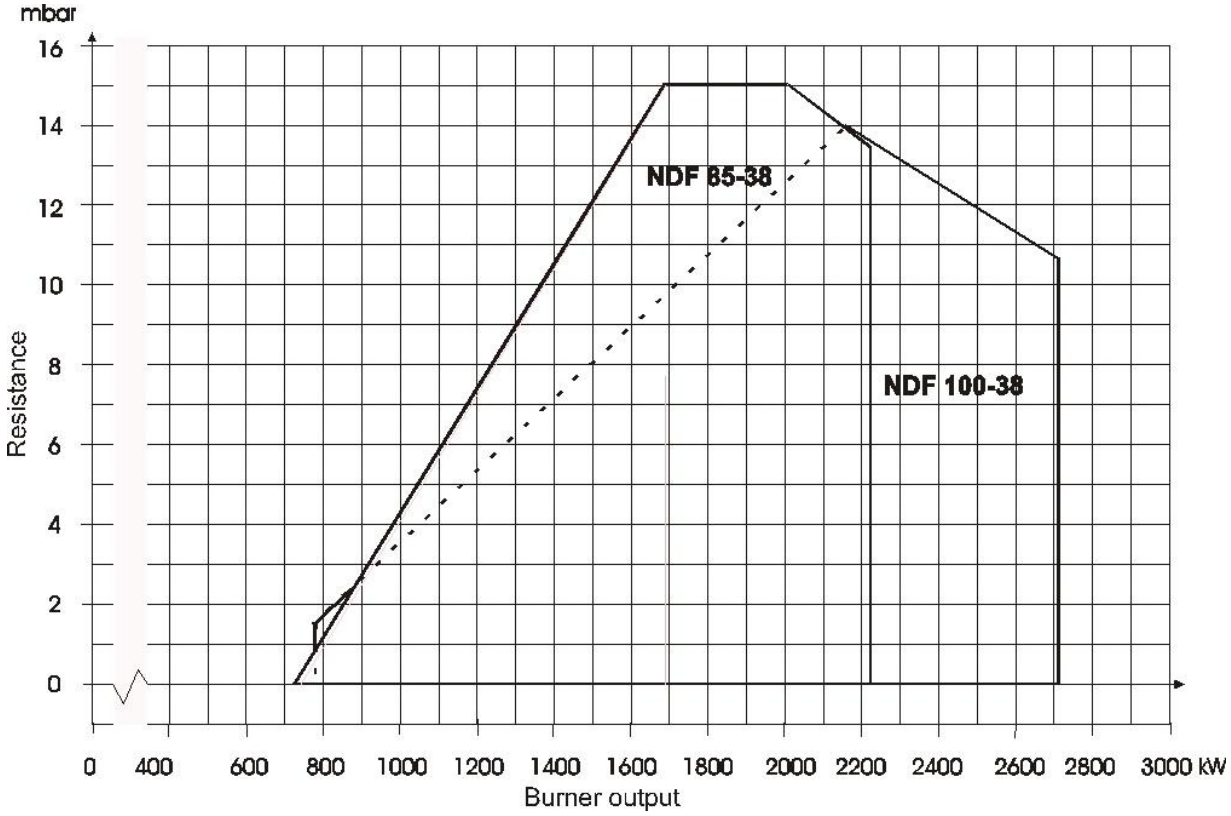


FIG 35: Performance Envelopes: NDF 85, 100, 125 & 150



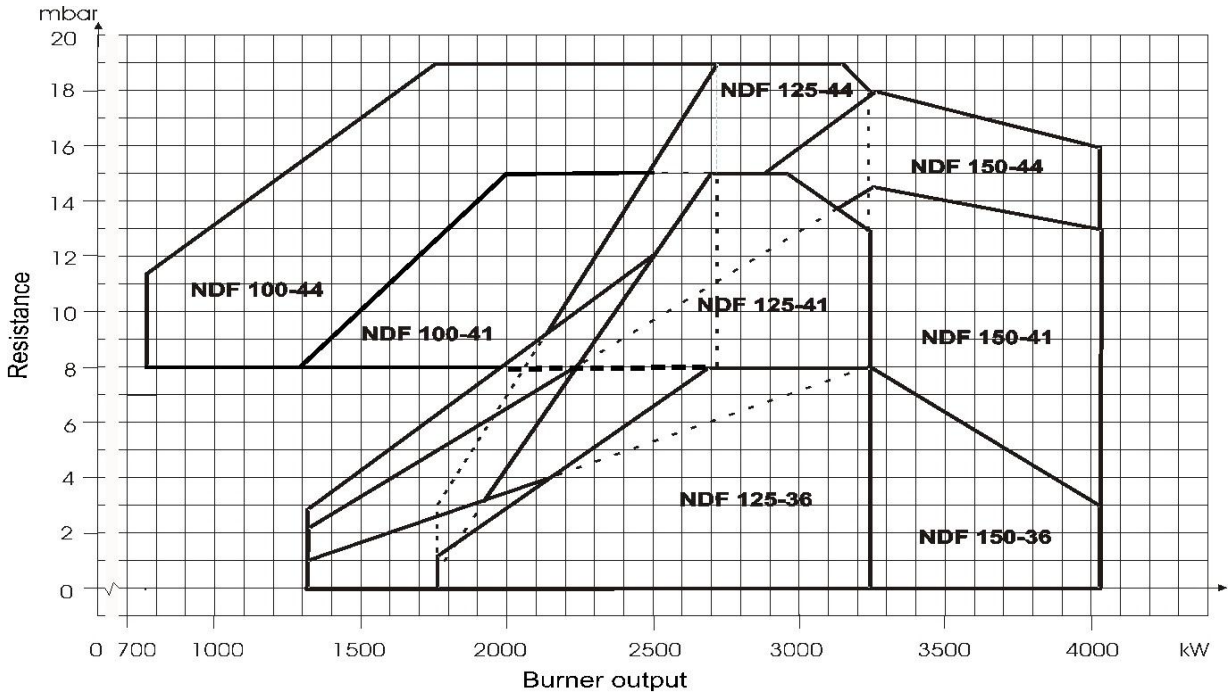
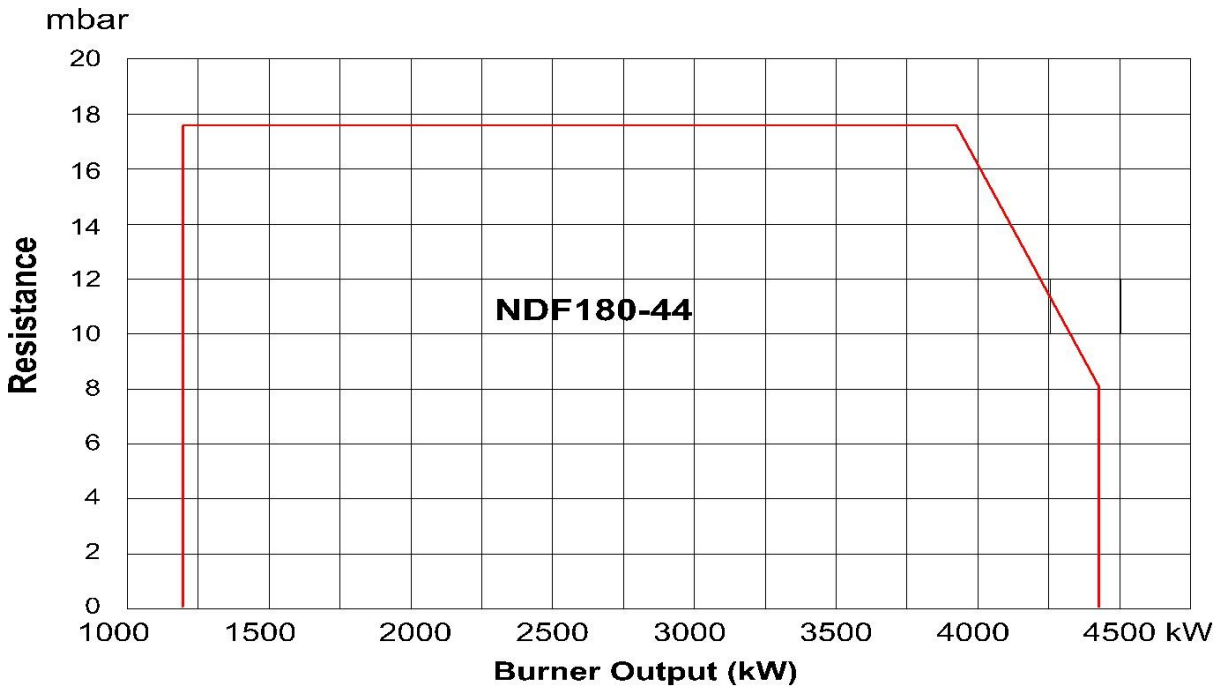


FIG 36: Performance Envelope: NDF 180



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