



NG 35 – 100

Automatic Gas Burner

Installation
Maintenance

ISSUE 2/90

SAFETY WARNING!

**Any work on gas appliances should
ONLY be undertaken by qualified
and Corgi registered personnel.**

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ADDITIONAL SETTING INSTRUCTIONS MK II NGN GAS BURNERS

1. NGN9 TO NGN100 BURNERS, FITTED WITH PILOT GAS TUBE TO GAS NOZZLE INITIATES PILOT GAS FLAME ON STABILISING DIFFUSER, AND IT IS MOST IMPORTANT THE START GAS RATE IS SET AT 25%.
2. TWO STAGE BURNERS ARE FITTED WITH A HIGH GAS PRESSURE SWITCH TO CLOSE DOWN THE BURNER IF GAS PRESSURE AT THE BURNER HEAD RISES ABOVE THE SET PRESSURE AT MAXIMUM CONTINUOUS RATING. THE GAS SWITCH WILL BE FACTORY SET TO MAXIMUM POSITION, AND WHEN THE BURNER HAS BEEN FULLY COMMISSIONED AND SET ON RATE ON HIGH FLAME ON SITE. THE GAS SWITCH MUST BE ADJUSTED BY MOVING THE DIAL IN AN ANTI-CLOCKWISE DIRECTION UNTIL THE SWITCH TRIPS AND THE PRESSURE SWITCH INDICATING LIGHT IS ILLUMINATED, THEN MOVE THE PRESSURE SWITCH DIAL IN A CLOCKWISE DIRECTION ONE DIVISION. FINALLY RE-SET THE PRESSURE SWITCH USING THE BUTTON SITUATED ON THE PRESSURE SWITCH COVER.

GENERAL

1. The NG35 burner is supplied for single stage (On/Off) or two stage (High/Low) operation. The NG40-100 burner is supplied for two stage (High/Low) operation and for use with three phase electrical supply. Where an instruction or information is applicable to only one of the burner types, single or two stage, then this is indicated in the text.

This manual is structured to enable the user to proceed from the delivery of the burner to its commissioning and use.

The conditions to be fulfilled and the controls and adjustments to be used are dealt with in the sequence that should be followed for the correct assembly installation and use. Pre-commissioning (Dry Run) and Live Run are described and the location of necessary controls and adjustments to undertake these runs are illustrated and supported by appropriate tabular matter and graphs.

Routine Maintenance, Fault Finding, Spare Parts, identification and Wiring Diagrams complete the manual; literature on proprietary components is available on request.

1.1 SAFETY

BEFORE ATTEMPTING TO ASSEMBLE, INSTALL OR COMMISSION THE BURNER, IT IS ESSENTIAL THAT THE FOLLOWING INSTRUCTIONS ARE CAREFULLY READ AND UNDERSTOOD. IT IS ALSO ESSENTIAL THAT SUCH WORK IS CARRIED OUT ONLY BY EXPERIENCED AND QUALIFIED GAS BURNER COMMISSIONING ENGINEERS.

THE MANUFACTURER CANNOT BE HELD RESPONSIBLE FOR ANY CONSEQUENTIAL DAMAGE, LOSS OR PERSONAL INJURY AS A RESULT OF CUSTOMERS FAILING TO FOLLOW THESE INSTRUCTIONS, OR AS A RESULT OF MIS-USE.

1.2 FLUE AND CHIMNEY REQUIREMENTS

The top of the Chimney/Flue should be above all roofs within a radius of 10 metres.

Check that it is suitable for use with gas fired appliances.

Reference should be made to Local Authority and other regulations governing such installations.

Ensure that the flue pipe from the appliance does not protrude into the chimney beyond the wall thickness and is sealed throughout its run.

If more than one appliance is connected to a common flue/chimney, ensure that the cross section of the flue/chimney is adequate for the total volume of flue gases from all the appliances.

1.3 PLANT ROOM VENTILATION

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

1.4 EXISTING APPLIANCES

In preparing the appliance to receive the NG gas burner a careful inspection should be made of its condition. If in doubt as to its suitability for gas firing refer to the appliance manufacturer. In preparing the appliance for gas firing it should be cleaned thoroughly removing all adhering Tars, Scale and Dirt.

1.5 COMBUSTION CHAMBER CONDITIONS

When the burner is fitted to an appliance designed to work under balanced or negative combustion chamber conditions, the over-fire draught must not exceed 0.025 kPa (0.1 inches Wg 0.25 mBar, 2.5 mm Wg).

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

2. SERVICES

2.1 GAS SUPPLY

The piped gas supply to the burner must be constructed and installed to comply with local conditions and appropriate Codes and Standards. It should be of sufficient size to satisfy the pressure/volume requirements of the burner to ensure its operation. It is recommended that a 90° manual shut-off is fitted upstream of the burner gas train for the isolation of the burner during servicing and maintenance. The valve size must not be less than the NG burner valve train or create restriction to gas flow.

2.2 GAS BOOSTERS

When a gas booster is used, the Natural gas pressure at the booster inlet must not fall below 100 mm Wg (4" Wg) under all conditions. It is recommended that the booster is installed as near to the burner equipment as possible. The booster should be positioned on a firm flat horizontal surface using anti-vibration mountings for support. All connecting pipework should be well supported and accurately positioned to prevent strain on the fan chamber. It is strongly recommended that flexible pipe nipples be used between the inlet and outlet parts of the booster pipework. The nipples will serve to reduce the strain on the fan chamber and reduce noise transmitted in the pipework. The supply authority should be asked to recommend the size of the pipework between the meter and the burner or booster to guarantee the pressure and volume required.

3. DESPATCH

To safeguard against transit damage and for Export shipment, the burner may be despatched in partly assembled form in one of two modes.

MODE ONE : Comprising Two Units

(a) Burner Body, complete with Control Package, Hinged Extension and Flame Tube Assembly.

(b) Gas train complete.

MODE TWO : Comprising Three Units

- (a) Burner Body complete with Control Package.
- (b) Gas Train Complete.
- (c) Hinged Extension and Flame Tube Assembly.

3.1 ASSEMBLY

MODE ONE : Fit the Gas Valve Train to the Burner body using the Gasket provided. Ensure that the Gasket is fitted correctly with all holes corresponding with those on the Burner flange. Connect the air inlet/impulse pipe from SKP70 gas valve to left hand side of the hinged extension.

MODE TWO : Fit the Hinged Extension and Flame Tube Assembly to the Burner body with the eight studs provided. Ensure the gas inlet flange is at the bottom.

Fit the gas Valve Train to the Burner body with the four studs and using the gasket provided. Ensure that the gasket is fitted correctly with all holes corresponding with those on the Burner flange. Connect the air impulse pipe from SKP70 gas valve to left hand side of the hinged extension.

MODES ONE AND TWO

Open at Hinged Extension and connect the Ignition cable to the Electrode. Connect the multi-pin plug from the gas Valve Train to the socket located on the rear of the Control Package on the left of the Burner body.

The burner is now completely assembled and ready for fitting to the Appliance.

CHECK THAT BURNER IS APPROPRIATE FOR APPLIANCE RATING BY REFERENCE TO DATA SHEET OR APPLIANCE MANUFACTURERS MANUAL.

3.2 FITTING TO THE APPLIANCE

If the burner is to be fitted to a new packaged unit, refer to the manufacturers recommendations.

If the Burner is to be used with an existing Appliance prepare the mounting Flange as Fig. 1. Ensure the joint between Appliance and Burner is effectively sealed with the Gasket provided.

The Flame Tube should not generally extend beyond the inner face of the Appliance combustion chamber except where extensions are specified by the Appliance manufacturer.

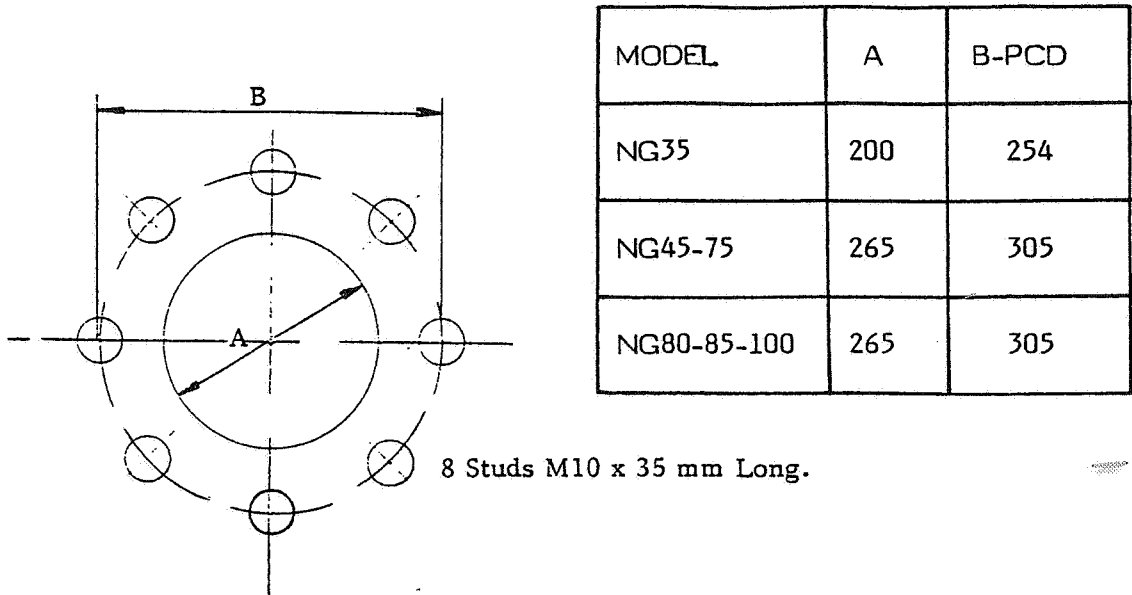


Fig. 1. Boiler Frontplate Drilling.

3.3 ELECTRICAL POWER SUPPLY

Connect a 3 Phase 50 Hz electrical supply to the Burner observing all applicable Codes and Standards. Refer to the specific wiring diagram in this Manual or Instruction Pack attached to the Burners.

If supplied as a Packaged Appliance Burner unit refer to the Manufacturers Instructions.

Connect external auxiliary controls by reference to the appropriate wiring diagram in this Manual.

4. BURNER AIR CONTROLS

4.1 The air for combustion is controlled by an adjustable Air Flap located inside the Air Inlet on the right hand side of the Burner viewed from the rear.

Its purpose is to regulate and control the volume of combustion air flowing through the Burner.

4.2 A reversible Air Damper motor with five cams switches is located on the rear of the Air Inlet casing.

Only Cams No 1 - 2 and 3 are used with this burner model. See Fig. 8.

4.3 AIR DIFFUSER

The Air Diffuser is fitted to the front end of the Inner Assembly and located within the Flame Tube. (Fig. 2).

Its function is to control the volume of combustion air and create a pressure drop over the Burner Head to ensure good fuel/air mixing and flame stability.

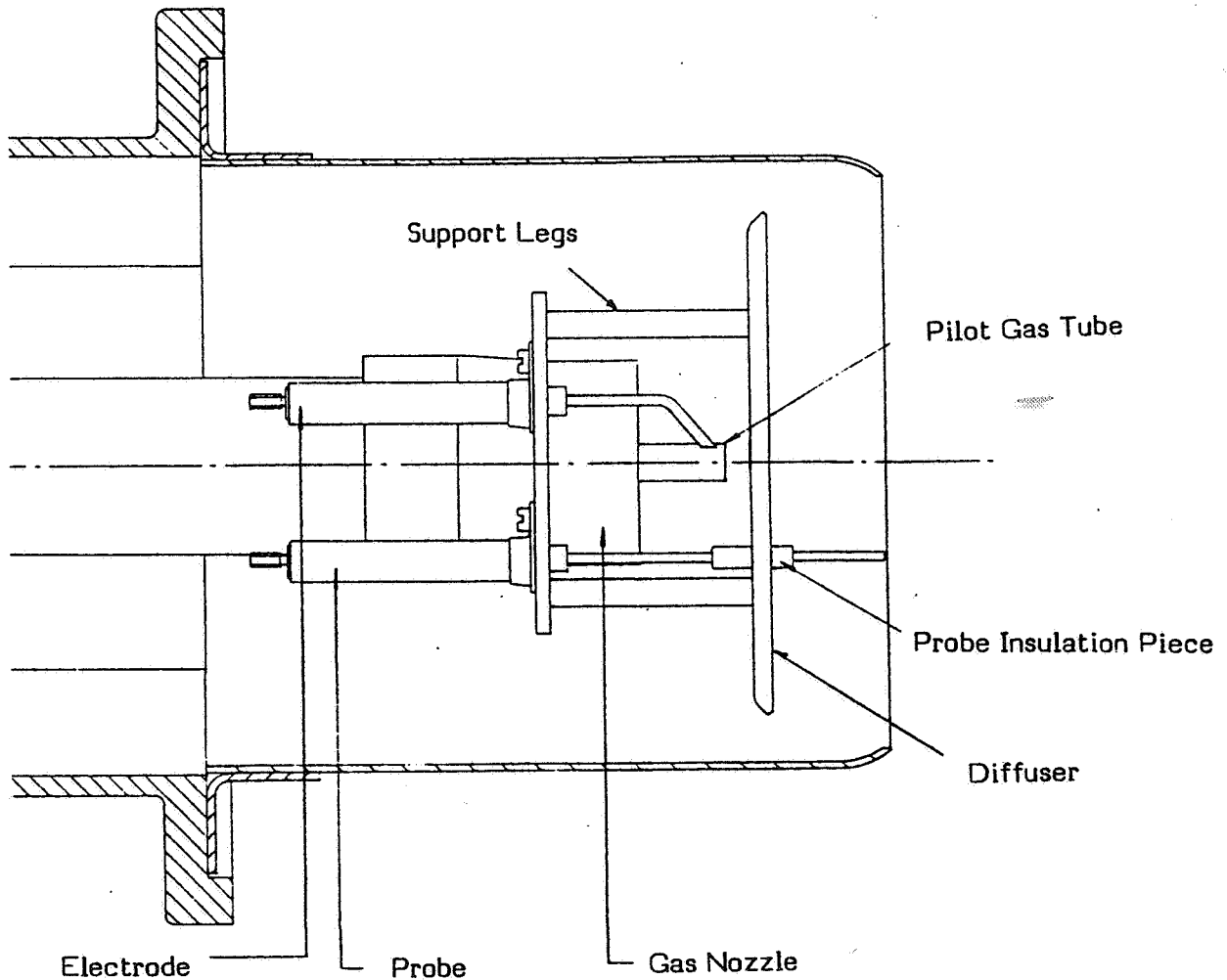


Fig. 2. Burner Head Arrangement.

4.4 AIR PRESSURE SWITCH

The Air Pressure Switch is located on the right side of the Burner Casing viewed from the rear. It is required to prove adequate air flow throughout the Burner operating cycle.

Air flow failure at any stage will result in safety shut down.

5. **BURNER GAS COMPONENTS**

5.1 **GAS NOZZLE**

The Gas Nozzle is fitted to the front of the Inner Assembly and located in the Flame Tube. The holes in the Gas Nozzle are of a size to suit the output of a particular Burner Model depending on the type of fuel used and its pressure. (See Fig. 2).

BURNER TYPE	GAS NOZZLE			AIR DIFFUSER DIA (MM)
	FUEL	SIDE HOLES	END HOLES	
NG35	Natural	8 x 9.5mm	12 x 6.4mm	152
NG40/45	Natural	8 x 9.5mm	12 x 6.4mm	190
NG55	Natural	8 x 11.0mm	12 x 7.0mm	178
NG60	Natural	8 x 11.0mm	12 x 7.0mm	204
NG65	Natural	8 x 11.0mm	12 x 7.0mm	178
NG75	Natural	8 x 11.0mm	12 x 7.0mm	165
NG80/85	Natural	8 x 12.7mm	12 x 8.0mm	165
NG100	Natural	8 x 14.0mm	12 x 8.0mm	200.4

Fig. 3. Gas Nozzle & Diffuser Details.

5.2 **GAS VALVE TRAIN**

The Gas Valve Train is illustrated in Fig. 4. The Two Stage High/Low system includes an Air/Gas Ratio Controller, Safety Shut-Off Valve, Manual Shut-Off Valves and Gas Regulator in the start rate line.

The NGN35 Single Stage (On/Off) Gas Valve Train includes an SKP 20 main gas valve, safety shut-off valve, manual shut-off valve and start rate gas regulator.

Closed Position Indicator switches (CPI) are fitted as standard to all upstream Safety Shut-Off Valves (and downstream valves for NGN45).

CPI Switches are also fitted as standard to the Air/Gas Ratio Controller.

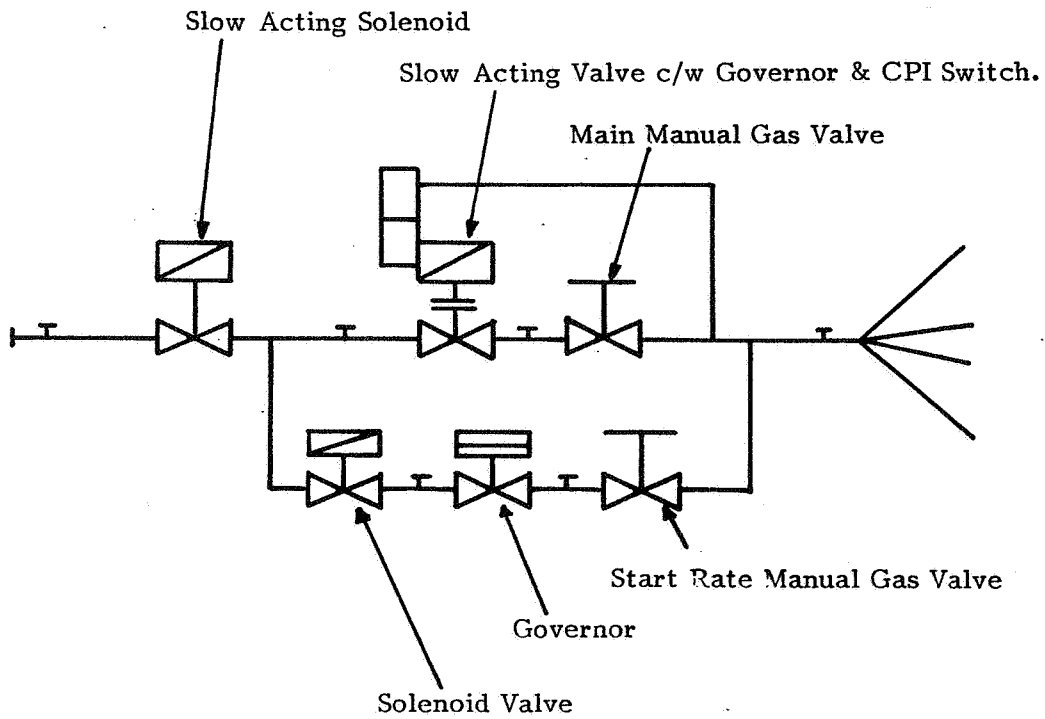


Fig. 4. NG35 On/Off - 3 Valve System

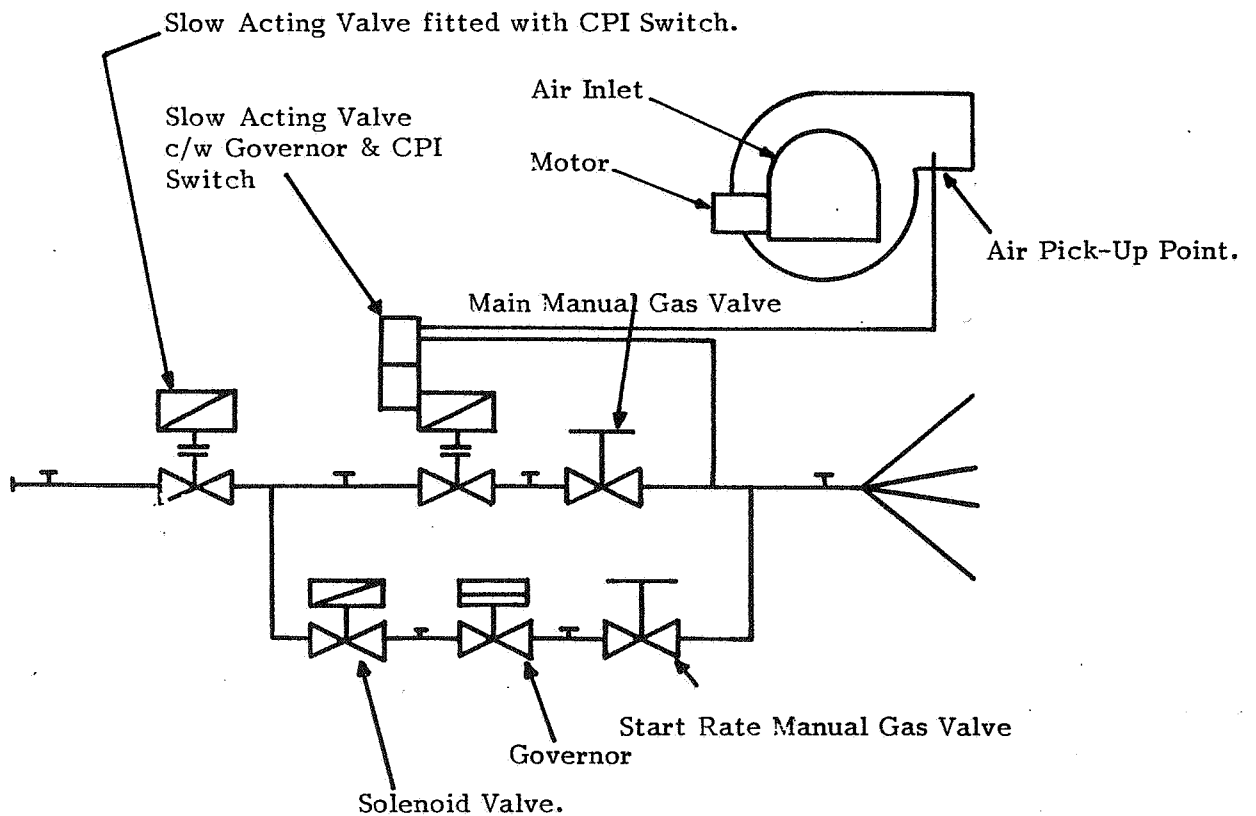


Fig. 5. NG High/Low 3 Valve System

Three Impulse Pipes are connected to the Air/Gas Ratio Controller. All are factory supplied.

One pipe is connected to the Burner Hinged Extension and supplies air pressure to the Ratio Controller.

A second pipe is connected downstream of the S.S.O.V. and supplies gas pressure to the Ratio Controller.

The third pipe is vented to atmosphere.

Other optional and mandatory Gas Train extras include Pressure Proving System which is standard on 6.9 million Btu/h burners and above, and is optional below this rating, when the Proving System is supplied it is mounted and prewired to the gas train at the factory.

5.2.1 PRESSURE PROVING SYSTEM FIG. 6.

When the appliance 'calls for heat', a signal via the Burner sequence control box energises the Pressure Proving System, which then carries out a series of checks before the Burner can start.

Valves V1, V2 & V3 are closed.

The Pressure Proving Sequence first opens V3 in the pilot line and after two seconds closes again.

Valves V1, V2 & V3 all remain closed for 23 seconds whilst the minimum side of the Gas Pressure Switch, factory set at 50 mm Wg (2.0" Wg, 50 mBar, 0.5 KPA) now checks for rise in gas pressure between the three valves.

If there is no rise in gas pressure, V1 is leak proof and the Pressure Proving System will continue to sequence to the next stage.

V1 opens for two seconds and pressurises the line between V1, V2 and V3.

Valve V1 closes.

Valves V1, V2 and V3 remain closed for 23 seconds, whilst the maximum side of the gas pressure switch, factory set at 175mm Wg (7.0" Wg, 17.5 mBar, 1.75 KPA) now checks for a fall in pressure between the three valves.

If there is a fall in gas pressure, check the Gas Train for leaks. Valves V2 and V3 may be leaking and the seats may need cleaning and/or the valves should be renewed.

The Pressure Proving System will lockout.

If there is no fall in the gas pressure, the system is leak proof and the Pressure Proving System will allow the burner to continue on NORMAL OPERATION.

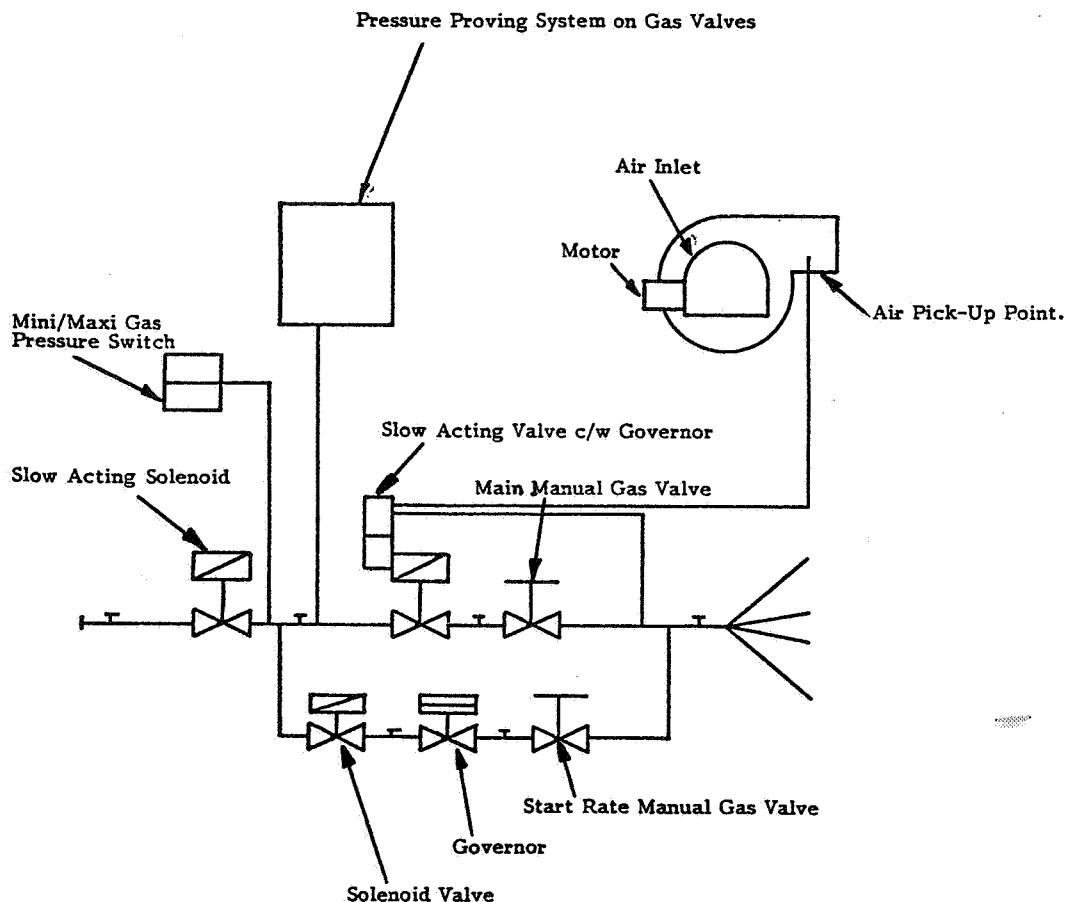


Fig. 6. Burner with Pressure Proving System.

6. CONTROLS

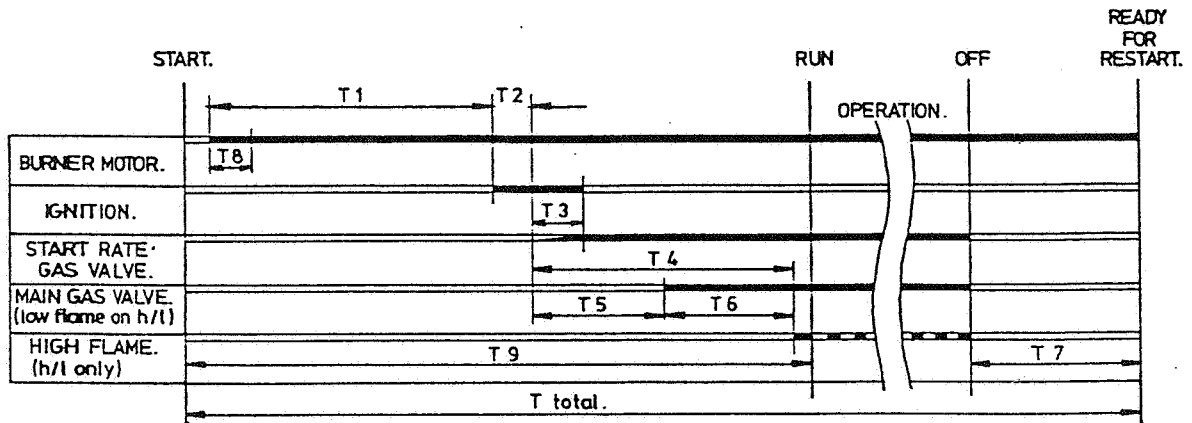
The control package is fitted on the left hand side of the burner viewed from the rear. It includes a sequence control box of the cyclic or thermal type depending upon the application, transformer and necessary contactors, terminal strip, motor starter, On/Off switch and two neon lights. The amber light indicates 'BURNER ON' and the red light is illuminated when the burner stops as a result of 'EXCESS TEMPERATURE' in the appliance.

7. FLAME MONITOR

The Ultra Violet (UV) flame monitor is located on the burner body and is required to supervise the safe operation of the burner under all working conditions.

8. BURNER OPERATING SEQUENCE

The Operating Sequence begins with an air pre-purge on full air, followed by start rate gas flame which when proved allows the Burner to operate on the High/Low Flame/Off principal. The sequence is determined by the demand of the Appliance Control instruments.



TIME (SECS)	CONTROL TYPE						DESIGNATION
	TMG 740-2	TTG 760-1	LFM 1.45	LFM 1.65	LFL 1.335	LFL 1.635	
T1	44	55	30	60	40	70	Pre-Purge.
T2	3	1	0.5	0.5	5	5	Pre-Ignition.
T3	5	5	5	3	2.5	2.5	Safety Lockout Time
T4		30	12	12			Delay Start Rate to Main Flame
T5	6				10	10	Delay Start Rate to Main Flame
T6	10				12.5	12.5	Delay between Main Flame, Low & Main Flame High (Two Stage Burners Only).
T7	10				15	15	Post-Purge
T8	8	5	3-10	3-10	10	10	Air Pressure Switch Interlock
T9	80	61	53	81	95	125	Total Start Time
Total	90	61	53	81	110	140	Total Cycle Time of Controller

Fig. 7. Sequence Diagram and Timing Chart (Control Box Only).

8.1 The pre-purge times shown above refers to the Control Box only. The Air Damper Control will extend the total Burner purge time up to a maximum of 127 seconds depending upon the firing rate and air requirements of the Appliance.

9.0 COMMISSIONING

Re-Check Electrical Wiring is complete and complies with all Codes and Standards. Check fuses are fitted and correctly sized.

Re-check Gas pipework is correctly installed and leakproof.

Check the Appliance is in a proper and safe state to be fired. (For instance is there water in the Boiler).

Set Appliance controls to call for heat.

Momentarily switch on power to the burner and check the motor rotation which should be anti-clockwise viewed from the motor end. If the direction of rotation is incorrect see Fault Finding for the procedure to correct it.

9.1 INITIAL BURNER SETTING

Remove the cover from the air control driving motor at the lower end of the air inlet casing. Check the cam positions and adjust if necessary as illustrated. Fig. 8.

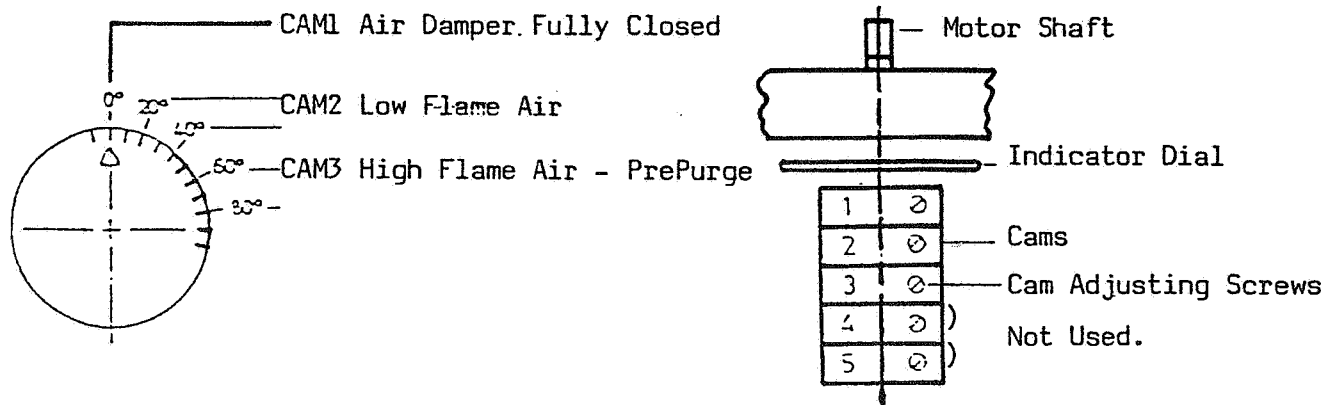


Fig. 8. Air Damper Cam Arrangement.

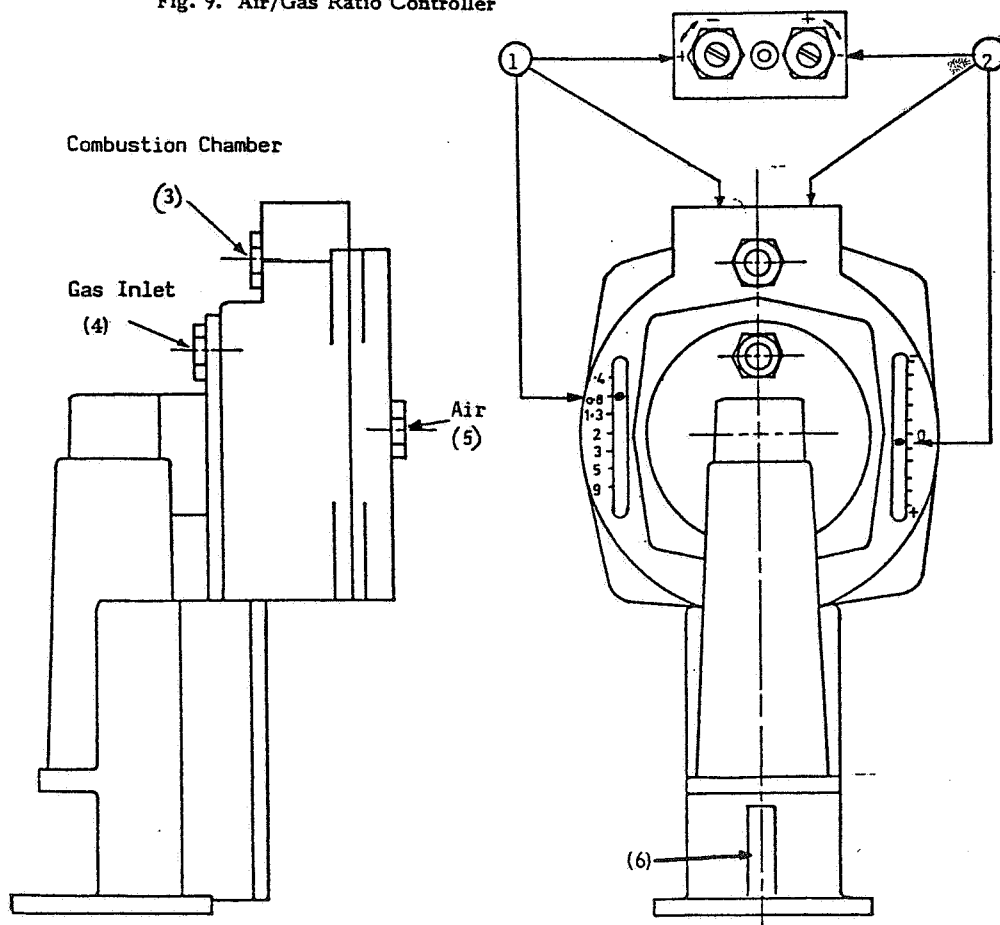
9.1.1 AIR/GAS RATIO CONTROLLER (FIG. 9).

Remove the small plate on top of the Regulator and keep it in a safe place.

Set the Air to Gas ratio at 0.8 on the visual scale by adjusting the screw (1). Anti-Clockwise to increase. Clockwise to decrease.

Set the Air Gas ratio on the visual scale (2) to half a division on the "+" side of "0". Turn the adjusting screw clockwise to decrease. Anti-clockwise to increase.

Fig. 9. Air/Gas Ratio Controller



- (1) Adjustment and indication of the gas air ratio (Main Flame Setting).
- (2) Adjustment of indication of the parallel displacement of the characteristic (Low Flame Setting).
- (3) Vented to atmosphere.
- (4) Connection to the Gas Line.
- (5) Connection to the combustion air supply at the burner head.
- (6) Indication of the valve stroke.

Fig. 9. Air / Gas Ratio Controller.

9.2 AIR/GAS RATIO CONTROLLER

(Combined Governor / Safety Shut-Off Valve).

9.2.1 APPLICATION

The Air/Gas controller controls the gas pressure as a function of the pressure of the combustion air so that the gas to air ratio remains constant over the entire output range of the burner (shifting of the desired value for the gas pressure according to the pressure of the combustion air).

When using the air/gas controller, a separate gas pressure governor is not required.

IN INSTALLATIONS WITH **NEGATIVE AIR PRESSURE** IN THE COMBUSTION CHAMBER THE AIR IMPULSE PIPE FROM THE BURNER TO AIR/GAS RATIO VALVE MUST ALWAYS BE UNDER A POSITIVE PRESSURE CONDITION.

9.2.2 OPERATION

When the gas valve is closed, i.e. during the pre-purge and pre-ignition time, only the pressure of the air supplied by the fan acts on the controller.

When the gas valve opens, the pressure downstream of the valve increases immediately and thus the pressure at the gas diaphragm. As soon as the forces acting on both diaphragms are balanced (taking the lever ratio into account), the bypass valve in the actuator is open to such an extent that the return flow through the bypass valve and the flow supplied by the pump are identical. This means that the piston of the actuator and thus the disc of the valve remains in the position reached.

If the heat demand increases and the air damper opens further, the controller closes against the bypass valve - due to the greater pressure on the air diaphragm - so that the actuator opens the gas valve further until the forces acting on the diaphragms are in balance again.

The gas to air pressure ratio and thus the gas to air volume ratio remains constant over the entire output range, provided the orifices in the burner head do not change during output variations, neither for the combustion air or for the gas.

IMPORTANT NOTE

9.2.3 PRESSURE IN THE COMBUSTION CHAMBER AS A DISTURBANCE VALUE.

In installations where the resistance of the "COMBUSTION CHAMBER - FLUE -STACK complex" is constant, the pressure in the combustion chamber changes in proportion to the gas and combustion air pressure, as the output of the burner is varied. With NG burners, it is therefore **NOT** necessary to compensate for the pressure in the combustion chamber, i.e. no disturbance value must be fed to the air/gas ratio controller.

In installations with **Negative air pressure** in the combustion chamber the air impulse pipe from the burner to air/gas ratio valve must always be under a positive pressure condition.

9.3 DOWN-STREAM SAFETY SHUT-OFF VALVE.

SINGLE STAGE (ON/OFF BURNER) (FIG. 10).

The opening speed of the initial lift is adjustable.

To adjust the speed of the initial lift first remove the Cap (1). Invert it and use as a key on the Adjusting Spindle (3) under the Cap.

If the Appliance has high overpressure characteristics turn the key fully clockwise to slow down the speed of the initial lift.

If the Appliance is of low or negative resistance turn the key fully anti-clockwise to accelerate the speed of the initial lift.

It may be necessary to make further adjustments between the extremes before commissioning is complete.

9.3.1 UPSTREAM SAFETY SHUT-OFF VALVE (HIGH/LOW BURNER) (FIG. 10)

The opening speed of the initial lift is adjustable.

To adjust the speed of the initial lift first remove the Cap (1). Invert it and use as a key on the Adjusting Spindle (3) under the Cap.

Turn the key fully anti-clockwise to accelerate the speed of the initial lift.

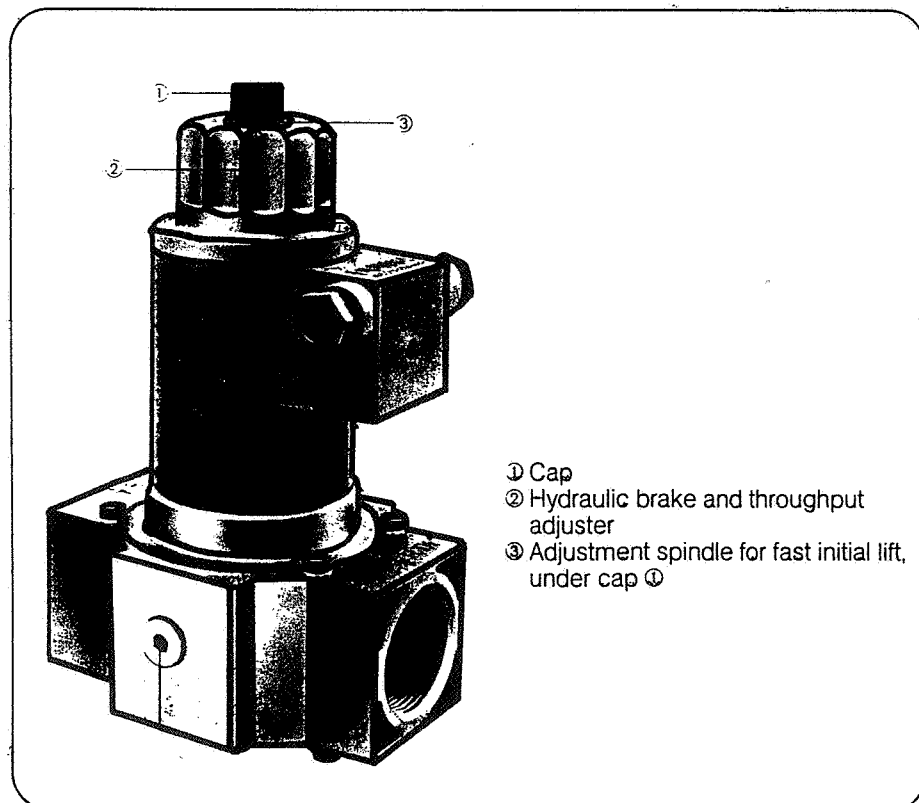


Fig. 10. Second Safety Shut-Off Valve.

9.4 ADJUSTMENT OF THE CLOSED POSITION INDICATOR SWITCH
ON DOWNSTREAM VALVE (SINGLE STAGE) AND UPSTREAM VALVE
(TWO STAGE) BURNERS FIG. 11.

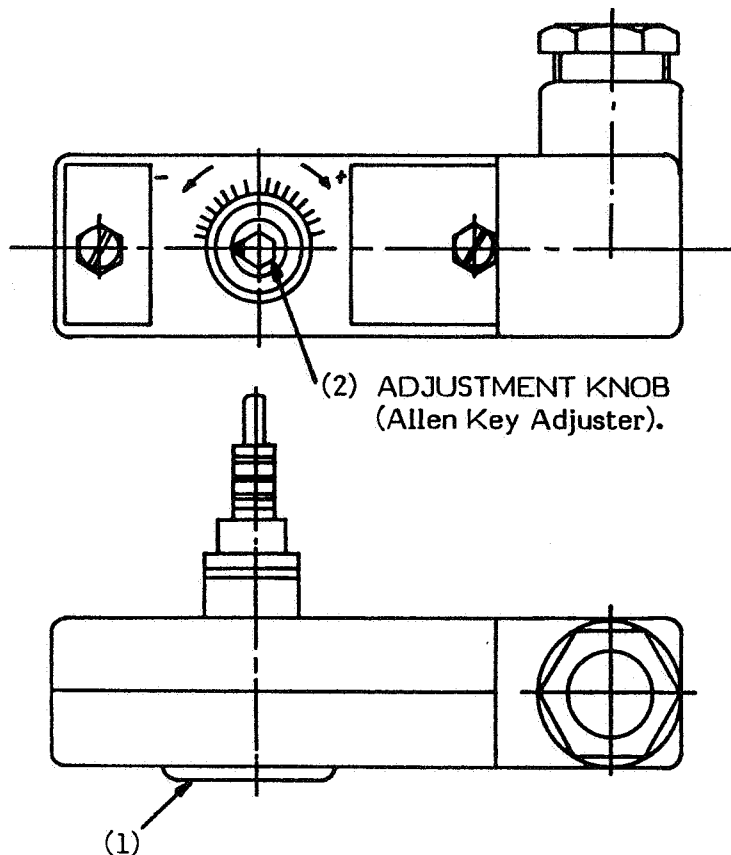


Fig. 11. Closed Position Indicator Switch.

Remove cover (1) on the closed position indicator switch, accessible through the cover plate on the base of the valve.

When the valve is closed and the circuit between terminals 1 and 3 is open adjust knob (2) with an allen key towards the plus sign (clockwise) until the switch just operates, then turn the adjustment knob back 1 scale mark.

With all new installations this procedure should be adopted, always begin adjustment with the circuit between terminals 1 and 3 open.

9.4.1 AIR/GAS RATIO CONTROLLER - CPI SWITCH ADJUSTMENT

The CPI switch forms an integral part of the controller and is accessible after removal of the plastic cover on the controller actuator. The method of adjustment is indicated on the inside of the cover plate.

9.5 **START RATE GAS GOVERNOR**

Remove the metal cap from the top and turn the Adjusting Screw until it is approximately halfway between maximum and minimum setting. Clockwise to increase. Anti-clockwise to decrease. Never adjust to its maximum limit.

10.0 **BURNER DRY RUN**

Check gas supply to the Burner is TURNED OFF.

Check both Manual Gas Valves on the Burner are CLOSED.

Remove Control Panel Cover and remove Low Flame Hold Link.

Replace Control Panel Cover.

Switch on the power to the Burner.

Switch on the Burner.

If the burner is fitted with a pressure proving system, the proving system will lockout through lack of gas - Safety System Proved.

If there is no Pressure Proving System, depending on the type of Control Box fitted the Burner will go through its operating sequence.

- (a) Immediately if it has previously been working but switched off during a normal operating cycle.
- (b) On pressing the reset button on the Control Box.

Burner motor will run.

Check the ignition spark is present. For actual timing refer to Sequence Diagram Fig. 7.

If at this stage there is no ignition spark and the Burner goes to Lock-out the Air Pressure Switch may require adjustment. See Para. 18.0. Ignition spark ceases and Burner goes to lockout.

Switch off electrical supply to the Burner. Remove control panel cover and re-fit low flame hold link. Replace control panel cover.

SAFETY SYSTEM PROVED. BURNER COMMISSIONING CAN PROCEED.

SWITCH OFF POWER TO THE BURNER.

11. **BURNER LIVE RUN**

11.1 **NATURAL GAS SUPPLY PRESSURES**

A supply pressure of not less than 44.8 mBar (4.5 Kpa, 457 mm Wg, 18" Wg) (24" Wg for NG75 to NG100) and not more than 200 mBar (20 Kpa, 2032 mm Wg, 80" Wg) is required at the inlet to the Burner.

The exception to these conditions is the NG35 with a capacity limited to 850 kW (2,900,000 Btu) which will operate on a supply pressure of 17.4 mBar (1.75 Kpa, 178 mm Wg., 7" Wg).

11.2 When a Gas Booster is required certain regulations and recommendations must be followed (see Para. 2.2). A low gas pressure switch must be fitted on the upstream side of the Booster to prevent it starting unless there is adequate pressure.

A further pressure switch is fitted on the delivery side of the booster to monitor the gas pressure. The pressure switch is wired into the Burner Control System and prevents High Flame operation in the event of low gas pressure.

11.3 Turn the Main Manual Gas Valve nearest to the burner head to the CLOSED position. Fit a manometer or other approved pressure measuring instrument at the test point on the upstream side of the first safety shut-off valve.

Open the Manual Gas Valve nearest to the burner head.

Check there is adequate gas pressure to enable commissioning to proceed.

12. **ESTABLISHING START RATE GAS FLAME**

Open Start Rate Manual Gas Valve.

Switch on the power supply to the Burner.

Switch on the Burner.

Burner motor will run - ignition spark will be established - Start Rate Gas Valve will open.

With the Start Rate Flame established the UV cell monitor will take over. The Burner will now operate continuously on Start Rate Flame. For timing see Sequence Diagram Fig. 7.

Switch off the Burner.

13.0 ESTABLISHING MAIN FLAME

Open start rate and main manual gas valves. Switch on electrical supply to the burner. Burner motor will run, ignition spark will be established start rate gas valve will open.

With start rate flame established the flame monitoring cell will take over, the control valve will open and low flame will be established expanding to main flame. The burner will run continuously on high flame until switched off by the appliance controlling instruments or manually. For timings refer to sequence diagram (see Fig. 7).

13.1 SETTING MAIN FLAME GAS RATE

If the gas rate is to be checked from the gas meter firstly ensure that all other appliances fed by the meter are isolated.

Check the gas rate with suitable and approved instruments. Should adjustments to the gas rate be necessary refer to paragraphs 9.1, 13.1.1 and Fig. 9.

If the Burner runs smoothly with a stable flame check and record combustion conditions. Figures of 9% CO₂ and 4.5% O₂ with CO measured at 100 ppm are acceptable.

At this stage it may be necessary to make some small adjustments to improve the quality of combustion and gas flow.

Before doing so refer to Fig. 12 giving pressure/flow information. Adjust the Burner according to Appliance rating.

MODEL PRODUCTS	GAS INPUT RATE			GAS PRESSURE AT BURNER HEAD MM
	KW	KCAL/HR	BTU/HR	NATURAL GAS ONLY
NG35	586	500,000	2,000,000	110+ Appliance Resistance
	732	625,000	2,500,000	120+ Appliance Resistance
	879	750,000	3,000,000	150+ Appliance Resistance
NG40/45	879	750,000	3,000,000	120+ Appliance Resistance
	1025	825,000	3,500,000	160+ Appliance Resistance
	1172	1,000,000	4,000,000	200+ Appliance Resistance
NG60/65	1172	1,000,000	4,000,000	150+ Appliance Resistance
	1465	1,250,000	5,000,000	180+ Appliance Resistance
	1758	1,500,000	6,000,000	200+ Appliance Resistance
NG75	1831	1,562,500	6,250,000	200+ Appliance Resistance
	2051	1,750,000	7,000,000	Appliance Resistance
	2198	1,850,000	7,500,000	Appliance Resistance
NG80/85	1319	1,125,000	4,500,000	Appliance Resistance
	1905	1,625,500	6,500,000	Appliance Resistance
	2491	2,125,000	8,500,000	Appliance Resistance
NG100	2344	2,000,000	8,000,000	Appliance Resistance
	2637	2,250,000	9,000,000	Appliance Resistance
	2930	2,500,000	10,000,000	Appliance Resistance

Fig. 12. Head Pressure Setting.

IMPORTANT

ALWAYS USE APPROVED TEST INSTRUMENTS.

NEVER RELY ON VISUAL INSPECTION OF THE FLAME AS A GUIDE TO COMBUSTION CONDITIONS.

13.1.1 **SETTING/ADJUSTMENT OF THE CONTROLLER**

Set the gas to air ratio to the desired value using the setting screw (1) on the left (coarse setting) (Fig.9).

Start burner and run it at 90% of the required burner output.

Measure CO₂ or O₂ content in the flue gases and correct the setting for the pressure ratio until optimum values are reached (fine setting).

Return to low fire operation, check CO₂ or O₂ content in the flue gases and, if necessary, correct the characteristic until optimum values are reached, using the setting screw (2) on the right (Fig.9). Direction "+" = increase in gas volume (lack of air), direction "-" = parallel displacement of characteristic towards lack of gas (excess air).

Limit air damper position to low fire operation.

If a considerable parallel displacement of the characteristic is required for achieve optimum CO₂ or O₂ values with low fire operation, the adjustment of the pressure ratio with full output must be checked again and corrected if necessary.

Run the burner to the required output and limit the air damper position for full output.

Check the flue gas values at several levels of the output range. If corrections are necessary, note the following:

- With high-fire operation : change pressure ratio (setting screw (1) and the left).
- With low-fire operation : parallel displacement of characteristic towards "+" or "-" (setting screw (2) on the right).

Due to reciprocal physical actions in the air and gas flow in the burner head it might be necessary to move the working characteristics of the controller into the area of excess gas, although the flue gas analysis proves that there is excess air!

If the gas to air pressure ratio lies outside the setting range, the gas pressure at the measuring point must be increased by means of an orifice in the gas or air flow. In order to be able to do this a sufficiently large gas or air pressure reserve at the inlet must be available.

13.2.1 **NG35 SINGLE STAGE (ON/OFF)**

To increase gas flow adjust the main governor by turning the adjusting screw on the face of the Governor/Valve. Anti-clockwise to increase or clockwise to decrease gas flow.

13.2.2 NG35-100 TWO STAGE HIGH/LOW

To increase gas flow adjust the air gas ratio controller by turning the adjusting screw (1) anti-clockwise. Clockwise to decrease gas flow (See Fig. 9).

Following adjustments to the gas rate it will be necessary to increase or decrease the air flow through the Burner. This can be done by adjusting Cam No 1 on the Air Control driving motor. Fig. 8.

After each adjustment to gas or air a further check on the combustion condition should be carried out.

14. SETTING LOW FLAME

With the electricity supply switched off, remove control panel cover and remove low flame hold link and replace control panel cover. Switch on the electrical supply to the burner.

Check gas flow rate. This should be approximately 50% of the high flame or a rate recommended by the appliance manufacturer. The turndown ratio between high and low flame should not exceed 2 to 1.

The Burner will remain on Low Flame until switched off manually or by the Appliance Control Instruments.

Check the gas flow rate. If adjustments are required they can be made on the Adjustment Screw marked (2) on the top of Air/Gas Ratio Controller. (Fig. 9).

Turn Adjusting Screw (2) anti-clockwise to increase and clockwise to decrease.

Following adjustments to the gas rate it may be necessary to increase or decrease the air flow through the Burner. This can be done by adjusting Cam No 3 on the Air Control driving motor. After each adjustment to gas or air a further check on combustion conditions and gas rate should be carried out.

Switch off electrical supply to the burner, refit low flame link, switch on electrical supply to the burner and allow high flame to be established.

Recheck high flame gas rate, switch on the burner and re-check low flame gas rate. This operation should be repeated several times to ensure that low and high flame rates are constant.

IMPORTANT

After each adjustment, gas flow rate and flue gas analysis should be re-checked.

Refit control panel cover.

15. FINAL ADJUSTMENT OF THE AIR/GAS RATIO CONTROLLER

Adjust governor valve until it is established that it is actually governing, i.e. turn the adjusting screw anti-clockwise until the valve starts to close, (there is an indicator on the front of the valve) and head pressure drops. Reset the head pressure to its original setting by turning the adjusting screw clockwise. Re-check gas rate.

16. CHECK FLAME SIGNAL

Switch off burner. Remove control panel cover and disconnect flame signal check link.

Connect a D.C. micro-ammeter, range as shown on the wiring diagram in this manual.

Refer only to the wiring diagram appropriate to the control fitted on the burner.

Switch on the burner and observe on the micro-ammeter the flame response signal. A steady reading in excess of 7 μ A indicates the burner is in a reliable run situation.

If the current recorded is too low, it may be due to some maladjustment of the flame and intermittent lockout may occur. Check and reset if necessary. Refer to fault find section. Switch off burner and disconnect micro-ammeter. Refit link and control panel cover.

17. BURNER START GAS RATE

Switch off the electrical supply to the burner, close main manual gas valve, remove control panel cover, disconnect low flame hold link, replace control panel cover.

Switch on electrical supply to the burner and allow burner to establish start rate flame.

Start gas rate can now be adjusted by turning the adjusting screw in the start gas pressure governor clockwise to increase and anti-clockwise to decrease. A start rate of approximately 6% and not more than a maximum of 10% of main flame is adequate.

Too great a start gas rate will result in burner lockouts on changeover during the initial and final running.

NEVER adjust the start rate gas governor to its maximum setting.

Switch off electrical supply, remove control panel cover, re-connect low flame hold link, replace control panel cover. Open main manual gas valve.

Switch on the electrical supply to the burner.

18. AIR PRESSURE SWITCH SETTING

Switch off electrical supply to the burner.

Remove air pressure switch cover. Fit a manometer to the pressure switch to check actual air pressure against the pressure switch dial setting.

Remove control panel cover and disconnect low flame hold link to hold burner in the low flame position (two stage burners only).

Switch on electrical supply and allow two stage burners to establish low flame and single stage burners to establish main flame.

Slowly turn adjusting dial clockwise until flame is extinguished.

The burner will go to lockout.

Turn the dial one division clockwise and reset burner lockout. The burner will then continue through its cycle until either the start rate flame is established or burner goes to its lockout position. If the burner goes to lockout repeat the procedure once per burner cycle until start rate flame is established. Allow the burner to cycle to low flame (two stage) and main flame (single stage) and then turn the adjusting dial a further two divisions clockwise.

Switch off electrical supply to the burner, reconnect low flame hold link, replace control panel cover and also air pressure switch cover, remove manometer.

19. FINAL CHECK

Check that all covers to components have been replaced and locking devices are properly secured.

Check that appliance control instruments are set to safe limits.

COMMISSIONING IS NOW COMPLETE.

Switch on electrical supply.

Burner will now operate until switched off.

- (a) By controlling instruments of the appliance.
- (b) Manually.
- (c) By Power Failure. Upon restoration of power, burner will re-start automatically and follow sequence.

20. ROUTINE SAFETY CHECKS

TO BE CARRIED OUT ONLY BY QUALIFIED AND EXPERIENCED PERSONNEL.

Check that the Plant Room is well ventilated at all times.

Frequently inspect air inlet of the burner and ensure there are no obstructions to air flow.

If a pressure proving system is fitted, introduce a gas leak by slackening the pressure test nipple between the main valves to check that the proving system locks out through a dropping gas pressure when the burner commences its starting cycle.

Following the completion of the safety check, re-tighten the pressure test nipple and reset the lockout button on the pressure proving system.

21. FLAME DETECTION SYSTEM

UV (Ultra Violet) Cell.

Switch off the Power supply to the Burner. Remove UV Cell from the Burner casing and cover the quartz glass envelope to exclude any light. Do not touch the quartz glass with fingers.

Switch on the Power supply. Check that the Burner locks out at the end of the ignition cycle.

Switch off the Power supply. Replace UV Cell switch on the Power supply. Reset lockout.

22. ROUTINE MAINTENANCE

Switch off Power supply and gas supply to the Burner.

22.1 COMBUSTION AIR FAN

Clean blades regularly with stiff brush. Access is obtained through the Burner top cover. Care should be taken to avoid damaging fan blades. Check that the air inlet into the fan is clean.

22.2 INNER ASSEMBLY

NOTE:

TO OPEN THE HINGED EXTENSION FIRST REMOVE THE GAS TRAIN MULTI PIN PLUG FROM ITS SOCKET ON THE CONTROL PACKAGE.

REMOVE THE LOCKING NUT SECURING THE HINGED EXTENSION.

Open hinged extension, disconnect ignition electrode lead.

Remove cap head screw securing the inner assembly gas pipe to the inside of the hinged extension. Carefully withdraw the inner assembly from the hinged extension.

22.3 AIR DIFFUSER AND GAS NOZZLE

Clean using a stiff brush.

22.4 IGNITION ELECTRODE

Clean and check the electrode is not cracked or worn. Renew if necessary.

Check settings of ignition electrode, reset if necessary. Refer to Fig.2.

22.5 UV (ULTRA VIOLET) CELL

Clean UV Cell with a clean dry cloth. Do not touch the glass envelope of the cell with fingers. Replace the UV cell making sure the glass envelope faces direction of flame.

Replace all components and covers, secure all fittings.

Burner is now ready for operation.

Switch on the Power and gas supply to the Burner.

22.6 REPLACEMENT OF AIR/GAS RATIO CONTROLLER

Should the air/gas ratio valve need replacing due to any mechanical/electrical fault etc., it must always be taken into consideration that the burner output decreases as the pressure in the combustion chamber increases, and vice versa. Any change of combustion settings/replacement components must be carried out by a qualified combustion engineer.

23. FAULT FINDING

Any modifications to the installation or component settings resulting from actions suggested below may require the re-establishment of the various settings as indicated earlier in this manual.

23.1 BURNER MOTOR FAILS TO START

If a Gas Booster is fitted :

- (a) Check low inlet gas pressure switch is not locked out.
- (b) Check that the booster belt is fitted.
- (c) Check the booster motor is rotating correctly.

Check electrical supply is available and burner is correctly wired.

Check all fuses for continuity and size.

Check that all control instruments are 'calling for heat'.

Check that gas train is electrically connected i.e. plugged in correctly.

Check that the control box is not locked out (e.g. signal lamp may be faulty). If the control box is locked out press reset button.

Check that the motor overload has not tripped.

Check that the CPI switches are in the 'start' position. (Check wiring).

Check leak detection system (if fitted) is not locked out. If the leak detection system is locked out press reset button. Check that the pressure test nipples are correctly fitted.

23.2 Check that the air pressure switch is in the 'start' position.

The following procedures will assist in this check. Switch off Power supply.

For Satronic TTG, MMI and Landis & Gyr LFM see 23.2.1 and for Satronic TMG and Landis & Gyr LFL see 23.2.2.

23.2.1 Remove the plug-in assembly from control box base.

Using a suitable instrument, check for open circuit (no continuity) between the following terminals:

Satronic TTG & MMI	Terminal 5 & 7
Landis & Gyr LFM	Terminal 4 & 5

If there is continuity between terminals, turn dial on the air pressure switch fully clockwise to minimum setting.

Check again between appropriate terminals to open circuit. If this condition is fulfilled the air pressure switch is in order.

However, if continuity is obtained, the air pressure switch is faulty and must be renewed.

23.2.2 Remove the plug-in assembly from control box base.

Using a suitable instrument, check for continuity between the following terminals:

Satronic TMG 740	Terminals 17 & 16
Landis & Gyr LFL1.335	Terminals 13 & 14

If the air pressure switch is not in the start position, turn the setting dial fully clockwise to minimum setting. Check again between appropriate terminals for continuity. If this condition is fulfilled the air pressure switch is in order.

However, if no continuity is obtained, the air pressure switch is faulty and must be renewed.

23.3 FAN STARTS AND BURNER GOES TO LOCKOUT

SYMPTOM	POSSIBLE REASON	REMEDY
No Ignition	Air Pressure Switch Electrode Setting Incorrect Cracked Electrode Porcelain HT Lead disconnected/damaged Transformer Faulty Control Box Faulty	See Para 18. Reset Re-New Re-Connect/Re-New Re-New Re-New
No Flame	Gas Supply Interrupted) Gas Pressure too Low) Air Setting Incorrect for) Low Fire/Start Rate) Gas Supply) Valves Fail to Open Manual Shut-Off Valve Closed	See 2:1 Reset See Para 9.1.1 Check Coils and Associated Wiring Open

23.4 STARTING FLAME FAILURE

If the start rate flame is not properly established, the safety circuit of the Sequence Controller will cause lockout in one second.

The cause may be insufficient signal to the flame detection device which is the U V Cell. Alternatively the flame signal check link has been removed.

TYPE OF DEVICE	POSSIBLE REASONS	REMEDY
UV Cell	Glass Envelope Dirty, cell wrongly positioned. Faulty UV Cell. Faulty Wiring.	Clean the glass - should face towards the flame. Re-New Re-Wire.

Insufficient gas to allow the flame monitoring device to take over and signal the sequence controller to continue its cycle. This may be remedied by adjusting the fast initial lift of the downstream S.S.O.V (see Para. 9.3) Single Stage (On/Off) Burners only.

23.5 **BURNER RUNS AND FAILS TO ESTABLISH MAIN FLAME**

SYMPTOM	POSSIBLE REASONS	REMEDY
No Main Flame	Gas Pressure/Volume too low Main Flame Gas Valves Fail to Open Control Box Faulty Gas Train Plug Disconnected. Main Manual Gas Valve Closed Low Flame Hold Link Removed. Cam Bank Loose H/L Only. Gas Train Gasket incorrectly Positioned Air Setting Incorrect	See 2:1 Check Coils and Associated Wiring. Check/Renew. Reconnect. Open. Refit. Re-Tighten. Re-Position. ResetSeePara.9.1.1

23.6 **BURNER MOTOR ONLY RUNS CONTINUOUSLY**

POSSIBLE REASON	REMEDY
Failure of Air Control Damper Motor. Air Control Damper Cam Slipping. Micro Switch Fails to Change Over. Damper Motor Incorrectly Wired.	Re-New. Tighten to Shaft. Re-New. Re-Wire.

23.7 **INCORRECT ROTATION OF BURNER MOTOR**

Burner motor rotates clockwise viewed from shaft end. If burner motor rotation is incorrect :

- (a) 3 Phase motor, first interchange any two phases, then if rotation is not corrected the motor should be renewed.

24. **SPARE PARTS IDENTIFICATION**

Separate illustrated lists, containing an Item Number. Description and Code Number, are included in this Section for the NG35 - NG100 Burners.

The variations on a component are included and care must be taken when making any reference to a component to use the correct description and Code Number.

25. **NOTE** Should the motor or combustion air fan need replacing the following procedure can be followed.

Disconnect the Gas Valve Train multi-pin plug from the socket on the control package.

Remove the retaining screw securing the Control Package to its mounting bracket.

Lift the complete Control Package from the mounting bracket and rest it on the Gas Valve Train.

All securing studs and fixing nuts and bolts on the motor mounting flange are readily and easily accessible.

ADDENDUM

NG15/25 HANDBOOKS NG35 TO 100 HANDBOOKS

INTRODUCTION OF VGD 20 DOUBLE BLOCK VALVES

The current 1½" x 1½" and 2" x 2" gas trains, as fitted to burners from NG15 to NG65 are being modified to replace the two separate main valves with one double block unit.

Dungs MVD solenoid valves will no longer be used. The Landis & Gyr VGD 20 body is fitted with standard SKP type actuators, i.e., SKP10 & SKP20 for On Off burners, SKP10 & SKP70 for H/L burners.

The new gas train dimensions will remain within the overall sizes given for the current version.

Existing gas trains can be replaced with the new arrangement as a complete assembly only, although the actuator heads are directly interchangeable.

Setting instructions for the SKP actuator are as shown in the burner handbooks.

Design Features

Valves

The valves are of the normally closed single-way type and have two discs, one (non-contoured) for the inlet valve and one (contoured) for the outlet valve. The stems are guided on both sides of the discs, ensuring precise alignment and tight shut-off. The closing force of the return spring is supported by the pressure exerted by the gas. An interchangeable strainer in the inlet valve made of stainless steel protects seats and discs as well as downstream controls against contamination.

On both sides of the valve connecting flanges can be mounted by means of four screws.

The valve body is made of die-cast aluminium, the seals of nitrile rubber and the stems of stainless steel. The valve has a pilot connection Rp3/4" located in the middle at the top.

Valve, flanges and actuators are supplied as separate units. Assembly of the two items is very straightforward. There are no special tools required.

Mounting Advice

The gas valve's mounting orientation in the gas train is optional. However, if the SKP actuators are mounted at an angle of 30° to 60°, there will be a dead time of up to 1 second. The direction of flow of gas must correspond with the arrow on the valve body.

When fitting the actuators to the valve body, it must be ensured that the terminal covers do not point at the pilot gas connection (3/4") in the middle of the valve.

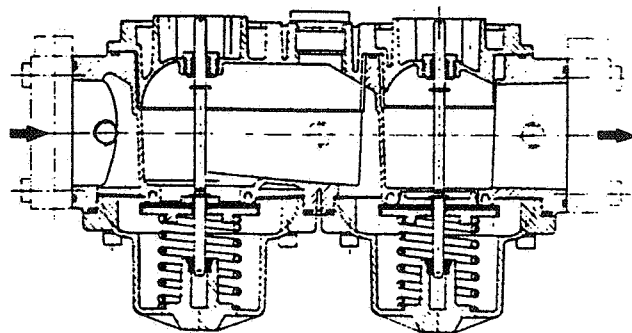
The electro-hydraulic actuator type SKP10, which is used for the shut-off valve, must always be mounted on the inlet side of the valve, the actuators with integrated governor (SKP20, SKP27, SKP50, SKP70) always on the outlet side (contoured disc). Caution: when using the valve in connection with the SKP20 actuator, the minimum gas pressure switch must always be mounted upstream of the valve.

Mounting of the valve requires 2 flanges

In order to prevent cuttings from getting inside the valve, it is recommended to first mount the flanges to the pipes and then clean the parts. It must also be ensured that the O-rings are fitted between the flanges and the valve body.

Connecting flanges

Connecting flanges are available with the respective valve body dimensions, with or without test point. They are internally threaded and are supplied separately, together with the necessary accessories such as bolts, nuts, seals, etc. The overall flange dimensions and bore-holes are identical so that all types of flanges can be fitted to the valve body, independent of the nominal size. This means that a 1½" flange can be fitted to a 2" gas valve type, VGD..., and vice versa. Each double valve may have 2 connecting flanges, which must be ordered separately.



Sectional view of VGD20...



Nu-way Limited is the largest manufacturer of oil, gas and dual fuel burners in the United Kingdom and has a range of burners with outputs from 15 kW to 20 MW. Products are exported to over 70 countries.

Nu-way is a BSI registered firm, manufacturing and testing to BS EN ISO 9001 procedures.

Environmental Products Division

- Fully automatic packaged oil, gas and dual fuel burners
- On/Off, High/Low, Modulation and Speed Control operation
- Low NOx
- Gas boosters, electrical panels, acoustic covers
- Training School

Process Heating Division

- Combustion systems for industrial process heating
- High and low temperature recuperative systems
- Dual fuel systems

Selectos Burner Division

- Fully automatic packaged oil and gas burners
- Class C2 and D distillate oils
- Towns, Natural and LP gas

Parts and Components Division

- First line spare parts
- Combustion test kits

Service Division

- Commissioning / Warranty / Technical Support