

Installation & Maintenance Manual

Series NG automatic gas burner Models NG9 to NG13

Gas Burner



CE

**HANDBOOK
SUPPLEMENT**

for

NU-WAY MODELS

NG 7 to NG 13

GAS BURNERS

PLEASE READ THIS DOCUMENT FIRST

HANDBOOK SUPPLEMENT NGN 7 to 13

REF: The Gas Appliance Directive 90/396/EEC covering gas equipment for European markets as from 1st January 1996

Forced draught Gas Burners 'CE' marked to harmonised standard EN676.

This supplement has been supplied in addition to your Installation and Commissioning handbook to cover the differences between burners constructed to BS5885 and the new range of 'CE' marked burners constructed and tested to EN676.

EN676 – OVERVIEW

The following changes to burner specifications have been actioned in compliance with EN676.

Sequence Control Box

The type designation of the Satronic and Landis & Gyr control boxes have been changed to reflect the shorter ignition safety times quoted within EN676 as follows:

- Burners up to 70 kW, maximum rating – 5 secs max.
- Burners over 70 kW, maximum rating – 3 secs max.

The new control boxes are functionally similar to previous models in all respects.

For further details on the type designation please refer to the burner components list at the end of this supplement.

Gas Line Assembly

All burners are now supplied without manual gas valves, however it is essential that a 90 degree manual shut-off valve is fitted upstream of the burner gas train for the isolation of the burner during servicing and maintenance. A removable link is fitted to the control panel to enable setting of the start rate on both On/Off and High/Low burners.

Closed Position Indicator Switches & Valve Proving Systems

There is no longer a requirement to fit CPI switches to gas burners and are not fitted unless specifically requested. A valve proving system is now mandatory on all burners with a maximum firing rate of 1200 kW and above (NG45 to NG150).

Low Gas Inlet Pressure Switch

This is a mandatory requirement on all burners. Please refer to the section 'Low Gas Pressure Switch' for functional and setting instructions.

Burner Wiring Scheme

In all cases, refer to the individual wiring diagram supplied with the burner.

BURNER COMMISSIONING

IMPORTANT – SAFETY:UNITED KINGDOM

It is essential that the following instructions and adjustments are carried out by qualified engineers that are experienced in blown gas burner commissioning. In the UK it is a legal requirement that these engineers should also be CORGI registered. 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 misuse.

EMERGENCY ISNTRUCTIONS:

This product has been designed and constructed to meet all of the essential requirements of the GAS APPLIANCE DIRECTIVE 90/396/EEC and under normal circumstances should not give occasion to any hazardous conditions. If such a condition should occur during commissioning or subsequent use of this product, be it a fault of the burner, the appliance or of any instrument, machine or service in the proximity of the burner, then the GAS and ELECTRICITY supply to the burner should be IMMEDIATELY ISOLATED until such time that the fault has been investigated and rectified.

INSTALLATION

Check and identify that the burner type is appropriate for the appliance rating and fuel type. Detailed burner performance data is available on request. **Under no circumstances attempt to install or commission a burner of the incorrect fuel type.** If in doubt please contact the manufacturer for assistance.

LOW GAS PRESSURE SWITCH

The low gas pressure switch is located on the inlet side of the gas valve train, normally on the left hand side of the burner, viewed from the rear. It is required to monitor inlet gas pressure during the burner operating cycle. Gas pressure failure at any stage will result in safety shutdown of the burner.

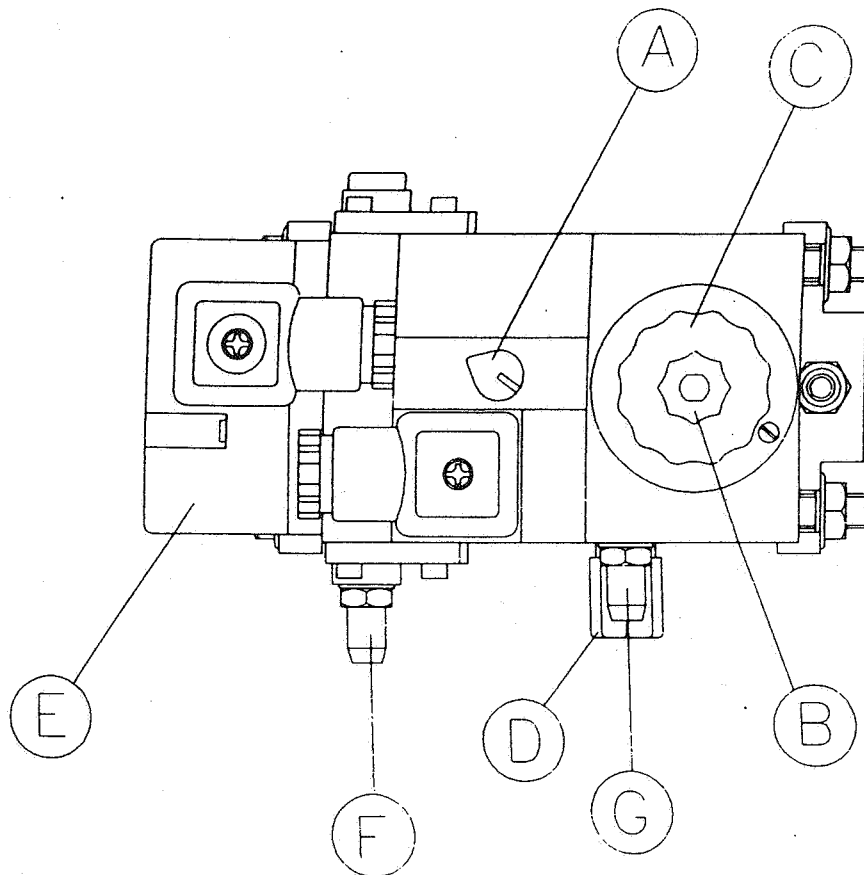
Setting the low gas pressure switch

The low gas pressure switch is wired in series with the appliance controlling instruments and will cause the burner to effect a 'safety shutdown' if a loss of inlet gas pressure is detected.

- Isolate the burner and remove the gas pressure switch cover.
- Switch on the electrical supply and allow the burner to establish main flame.
- Slowly turn the adjustment dial on the gas pressure switch clockwise until the flame is extinguished and the burner SHUTS DOWN.
- Turn the dial slowly anticlockwise one division at a time until the burner restarts and establishes main flame.
- Re-check the performance and then turn the dial a further two divisions anticlockwise.
- Switch off the burner and replace the gas pressure switch cover.

GAS VALVE SYSTEMS

DUNGS MULTIBLOC – NGN 7-13 ON/OFF

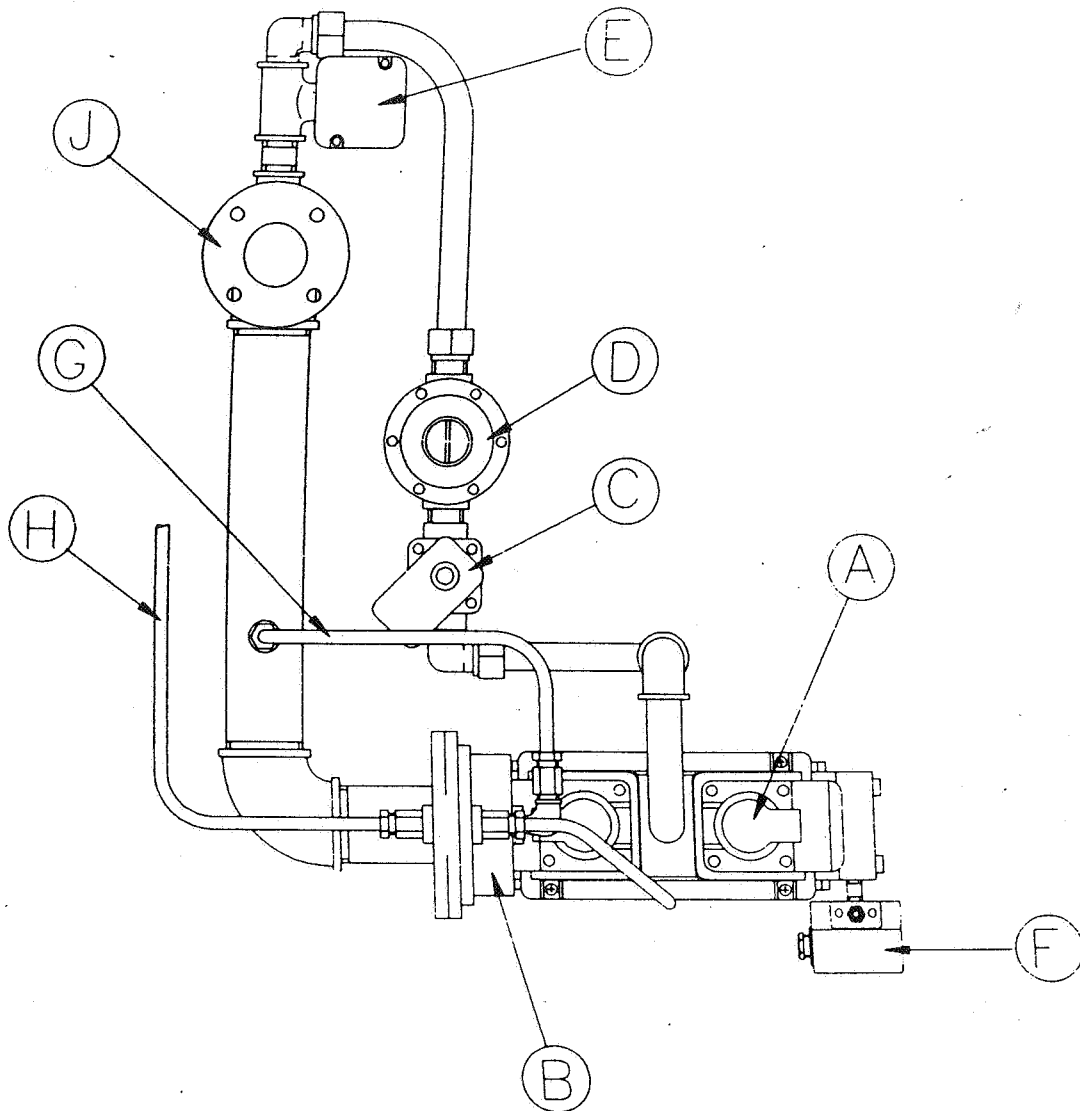


Dungs Multibloc MBDLE 4XX B07

- A - Governed pressure adjuster
- B - Main valve fast initial lift adjuster
- C - Main gas adjustment
- D - Start gas rate adjustment
- E - Low gas pressure switch
- F - Upstream pressure test point
- G - Downstream pressure test point

GAS VALVE SYSTEMS

LANDIS & GYR SKP70 - NGN 7-13



Landis & Gyr SKP70/SKP10 High/Low Gas Train with Pilot

- A - SKP10 main safety valve
- B - SKP70 air/gas ratio valve
- C - Pilot solenoid valve
- D - Pilot governor
- E - High gas pressure switch
- F - Low gas pressure switch
- G - Gas pressure impulse pipe
- H - Combustion air sensing pipe
- J - Mounting flange

**ADDITIONS TO FAULT FINDING SECTION
23.3 IN BURNER HANDBOOK**

SYMPTON	POSSIBLE REASONS	REMEDY
Burner will not run.	No power supply. Appliance controls incorrectly set. Gas supply isolated. Low gas pressure. Low gas pressure switch incorrectly set.	Reinstate power supply Check and re-adjust if necessary Reinstate gas supply. Check and rectify. Check and adjust.

1. GENERAL

The NG9-NG13 burner is supplied for single stage (On/Off) or two stage (High/Low) operation and for use with single phase or 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.

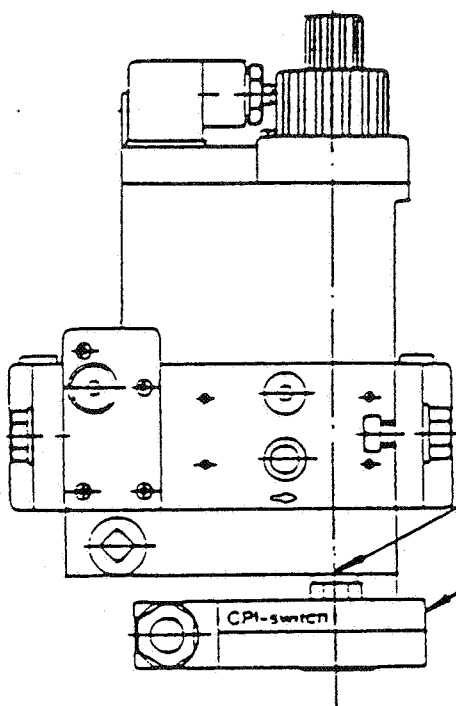
3. DESPATCH

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

- (a) Burner Body, complete with Control Package.
- (b) Gas train complete with hinged extension and flame tube assembly.

Fig. 1. Fitting of CPI Switch on On/Off Burners

Electrical Plug



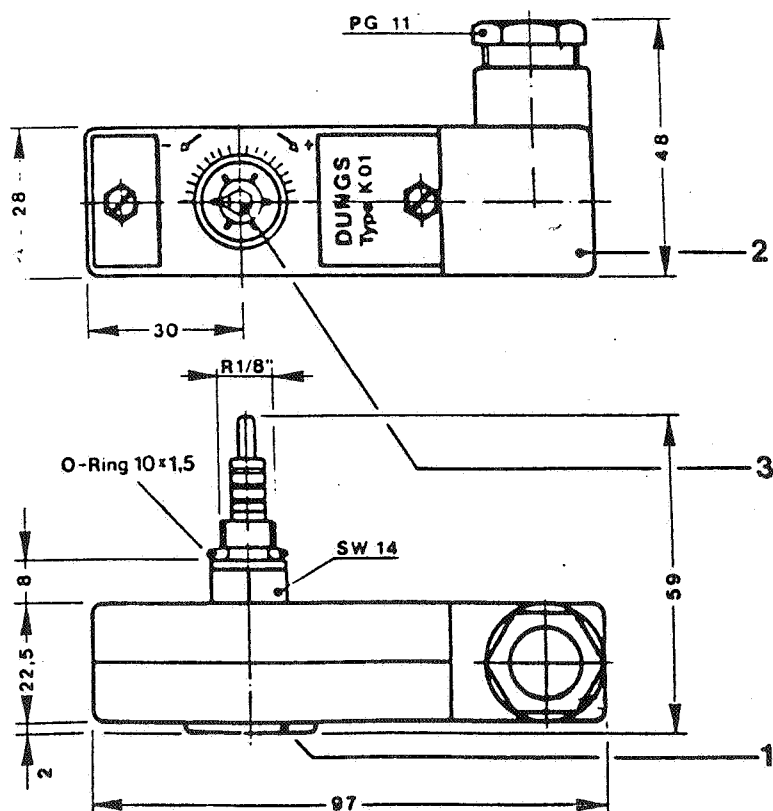
- 1) Fit the CPI Switch (Closed Position Indicator) to the Multibloc Valve as follows:
- 2) By remounting plug and 'O' ring from underside of multibloc.
- 3) Fit CPI Switch in place of removed plug.
- 4) Adjust switch as described in 3.

Remove plug from this point.

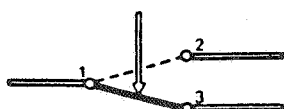
Position when fitted.

Construction of end contacts:

1. Valve disc closed
2. Sealing screw with O-ring on valve base
3. End contact with O-ring 10 x 1,5 fitted in place of sealing screw in valve base
4. Flatted shaft SW14 for fixing
5. Electrical enclosure
6. Seal proving flow check
7. **Adjustment** (switching point)
8. Cover 1 removed when the valve is closed and the circuit between terminal 1 and 3 is open adjust knob 3 towards the plus sign (clockwise) still the switch just operates, then move 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.



Electrical circuit for end contact type K01



Valve closed.

3.1 ASSEMBLY

Fit the burner body and control package to the hinged extension and Gas Valve Train with the two studs using the sealing gasket provided.

Connect the air inlet/impulse pipe from SKP70 gas valve to left hand side of the hinged extension (on two stage burners only).

Insert the Ignition Electrode cable, probe and earth leads into the aperture on the right hand side of the hinged extension, fitting the sealing grommet around the cables.

Open hinged extension. Connect the earth lead (Green and Yellow striped) under the fixing screw for the inner assembly, probe lead (Brown) to the flame probe and connect the Ignition cable to the Electrode. Close hinged extension.

SINGLE STAGE (ON/OFF BURNERS) ONLY

Connect the flying lead complete with plug from the control pack to the Multibloc Valve (see Fig. 1). Also fit the CPI Switch, again as shown and described in Fig. 1.

TWO STAGE (HIGH/LOW BURNERS) ONLY

Connect the multi-pin plug from the Gas 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. Refer Fig.2.

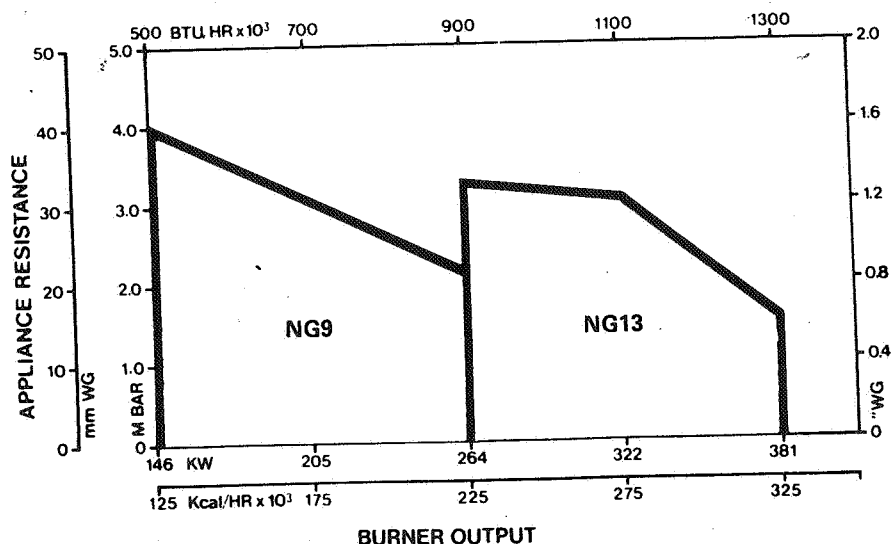


Fig. 2. Burner Output.

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. 3. 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.

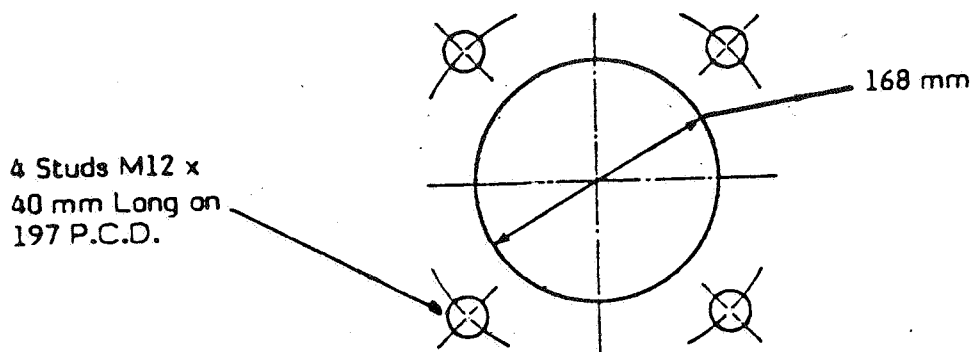


Fig. 3. Boiler Frontplate Drilling.

3.3 ELECTRICAL POWER SUPPLY

	1 PHASE	3 PHASE
Mains Supply (V) ^{+ 10%} _{- 15%}	220-240	380-415
Frequency (HZ)	50	50
Burner Motor (W)	250	250
Start Current (A)	15	3.5
Main Fuse (A)	10	5

Connect a Single or Three 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 **SINGLE STAGE (ON/OFF) BURNER ONLY**

A disc calibrated 0-10 for the visual setting of the air control is located on the top of the air inlet on the right hand side of the burner.

To increase the flow of combustion air slacken the locking screw and turn the air flap quadrant anti-clockwise. To decrease the flow of combustion air turn the air flap quadrant clockwise. Re-tighten the pozi-drive screw after any adjustments are made.

4.2.1 **SINGLE STAGE BURNER WITH FULLY CLOSING AIR DAMPER**

A capacitor start and run Motor driving a three cam stack is located on the Air Inlet casing. Cam No 1 drives the Air Control to the fully closed position when the Appliance temperature/pressure is satisfied and is factory set. Cam No 2 is used to adjust the flow of air to suit combustion requirements on Main flame.

Cam 3 not used with this Burner Mode. Fig. 9.

4.2.2 **TWO STAGE BURNERS WITH FULLY CLOSING AIR DAMPER**

A capacitor start and run Motor driving a three cam stack is located on the Air Inlet casing. Cam No 1 drives the Air Control to the Fully Closed position when the Appliance temperature/pressure is satisfied and is factory set.

Cam No 2 is used to set the High Flame combustion air requirements.
Cam No 3 is used to set Low Flame combustion air requirements.
Refer to Fig. 9.

4.3 AIR DIFFUSER

The Air Diffuser is fitted to the front end of the Inner Assembly and located within the Flame Tube. (Fig. 4).

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.

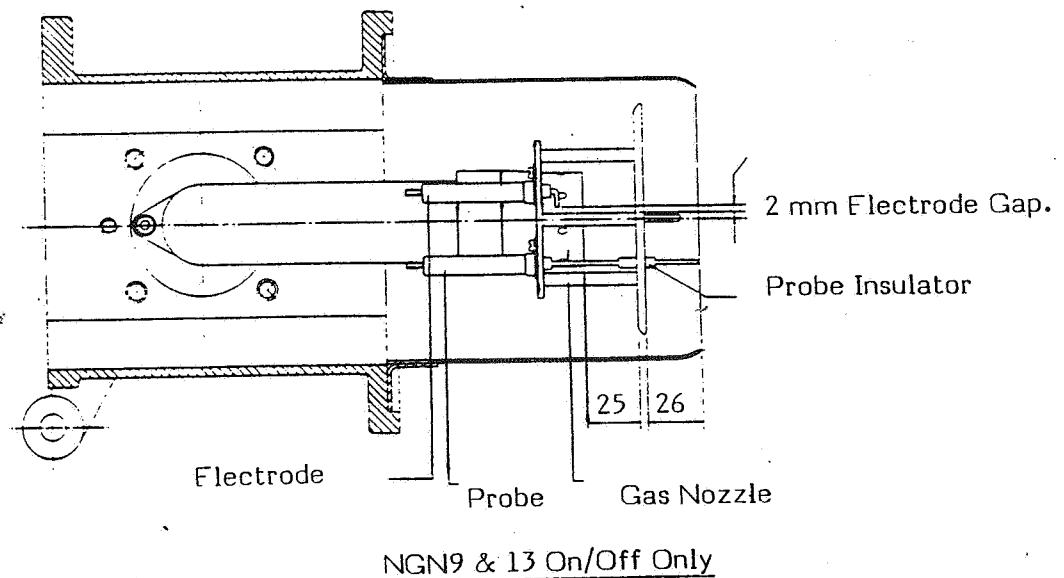
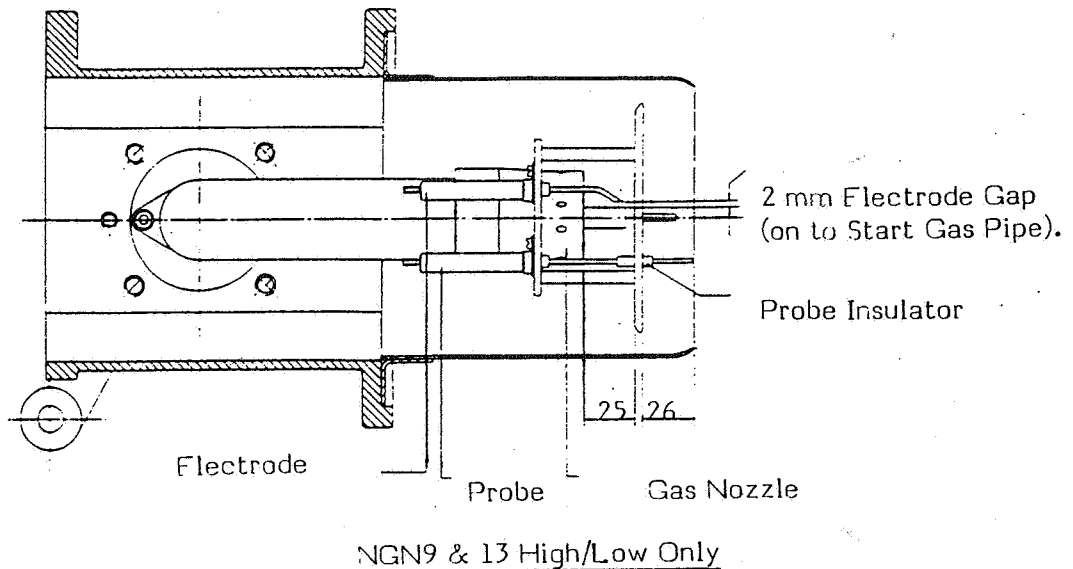


Fig. 4. Burner Head Arrangement.

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 (Fig.4). 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.5).

TYPE	FUEL	NOZZLE HOLES		AIR DIFFUSER	
		SIDE	END	O/DIA	I/DIA
NG9	Natural	8 x 5.0mm	8 x 3.0mm	110mm	13mm
NG13	Natural	8 x 6.0mm	8 x 3.0mm	100mm	28mm

Fig. 5. Gas Nozzle & Air Diffuser Details.

5.2 GAS VALVE TRAIN

5.2.1 SINGLE STAGE (ON/OFF)

The Gas Train is a multibloc valve consisting of one fast acting safety valve, one slow opening main valve and a fast acting pilot valve, all as illustrated in Fig. 6. A Closed Position Indicator switch (CPI) is fitted to downstream safety shut-off valve, which ensures that valve is in the the closed position prior to start-up sequence. A manual shut-off valve is also fitted.

5.2.2 TWO STAGE (HIGH/LOW)

The Gas Valve Train as illustrated in Fig. 6. 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.

A Closed Position Indicator switch (CPI) is fitted to downstream Safety Shut-Off Valve, which ensures that valve is in the closed position prior to start up sequence.

5.2.3 HIGH GAS PRESSURE SWITCH (TWO STAGE HIGH/LOW ONLY)

A High Gas Pressure Switch is fitted and pre-wired to the Gas Train to ensure that if the gas pressure at the burner head increases above the gas pressure at maximum continuous running, then the burner will shut down to a safe condition, thus indicating fault on governing valve (Air/Gas Ratio Valve). The switch is factory set to the maximum position.

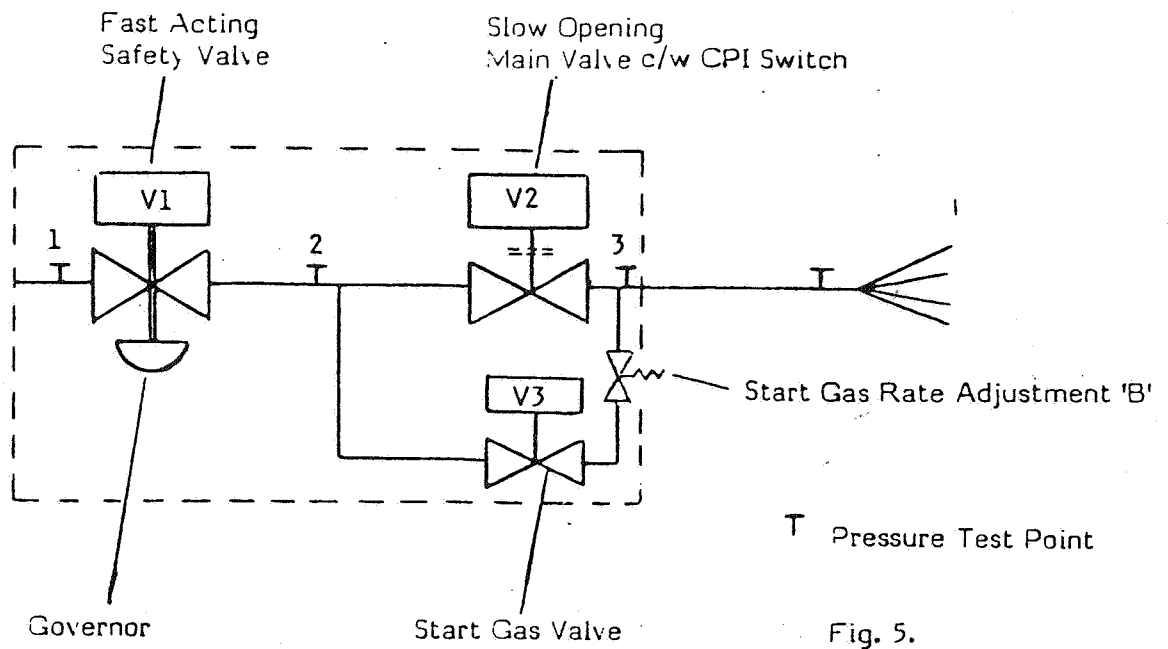


Fig.5. NG9-13 Single Stage On/Off Gas Valve Train with Integral Governor

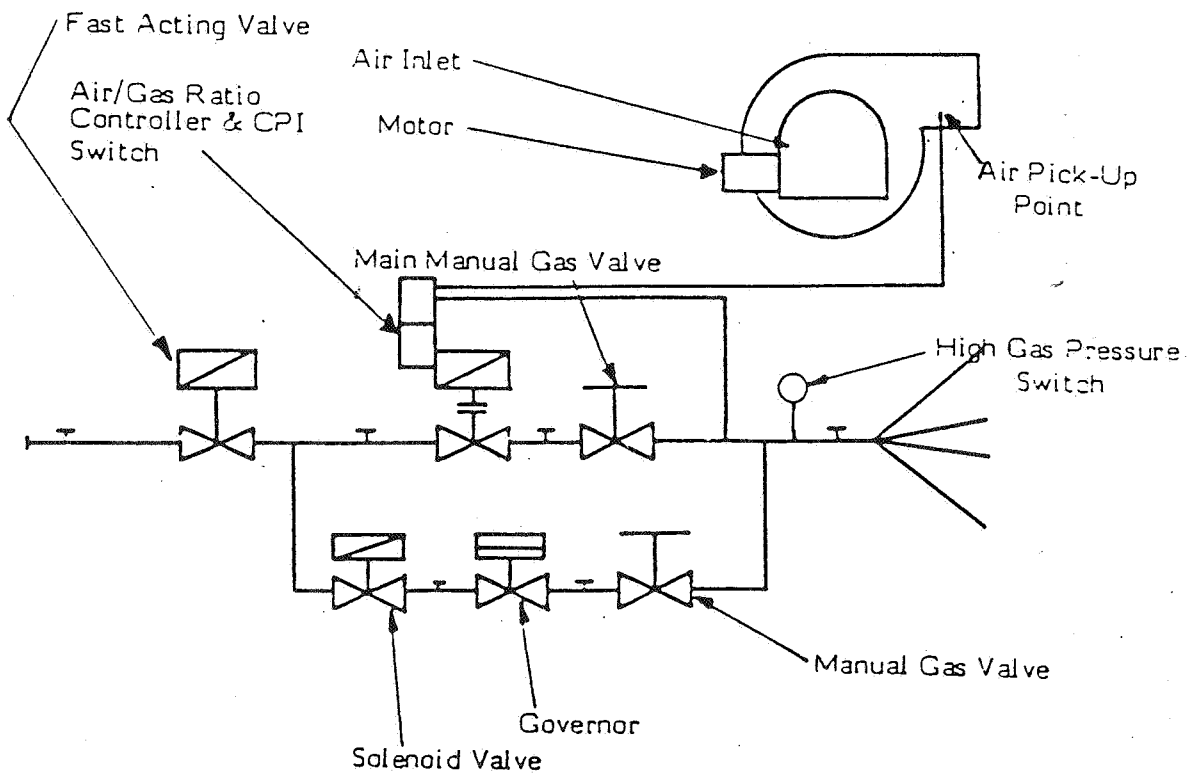


Fig.6. NG9-13 Two Stage High/Low 3 Valve System

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 two CPI switches from 3.4 - 6.8 million Btu/hr or 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.

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. For sequence diagram and timing chart (See Fig.8).

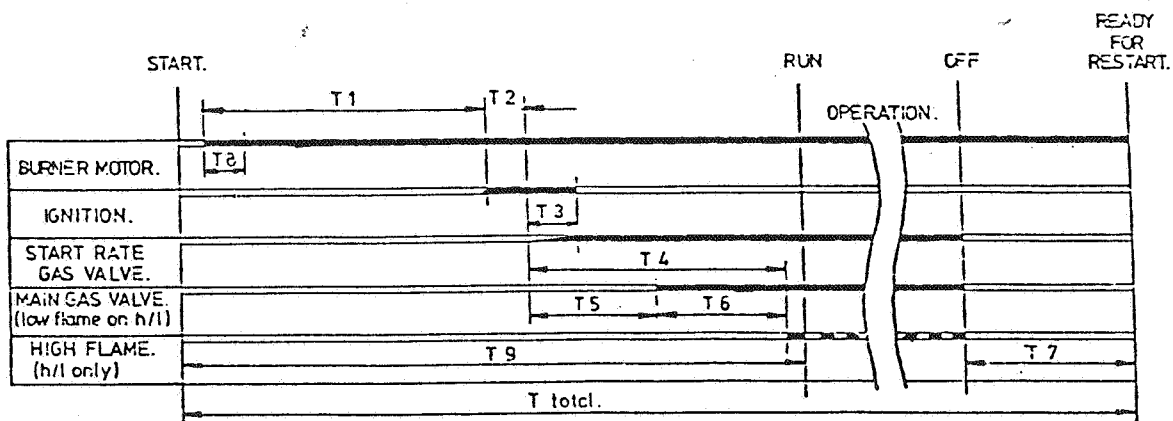


Fig. 7. Timing Chart

TIME (SECS)	CONTROL TYPE						DESIGNATION
	TMG 740-2	MMI 810	LFM 1.45	LFM 1.65	LFL 1.335	LFL 1.635	
T1	44	40	30	60	40	70	Pre-Purge.
T2	3	0	0.5	0.5	5	5	Pre-Ignition.
T3	5	5	5	3	2.5	2.5	Safety Lockout Time
T4		10	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	60	53	81	95	125	Total Start Time
Total	90	60	53	81	110	140	Total Cycle Time of Controller

Fig. 8. Sequence Diagram and Timing Chart (Control Box Only).

NOTE 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.

7. FLAME MONITOR

The Flame Probe (Flame Rectification Probe) is located on the burner head and is required to supervise the safe operation of the burner under all working conditions.

8. BURNER OPERATING SEQUENCE

8.1 SINGLE STAGE (ON/OFF) BURNERS

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 main flame, then to the 'OFF' position. The sequence is determined by the demand of the appliance control instruments.

8.2 TWO STAGE (HIGH/LOW) BURNERS

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/Off principal. The sequence is determined by the demand of the Appliance Control instruments.

9.0 GAS VALVES

9.1 MAIN GAS VALVE WITH INTEGRATED GOVERNOR FOR SINGLE STAGE (ON/OFF) BURNERS

9.1.1 APPLICATION

The gas valve type BO7 multibloc is only used for on/off operation and is suitable for all types of gases. The usual components of the gas line are assembled in one compact functional unit. Input pressure range 0-100 mbar (40" Wg).

When a multibloc is used, a separate gas pressure governor is not required.

9.2 AIR/GAS RATIO CONTROLLER - TWO STAGE (HIGH/LOW)

(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 IN THE 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.

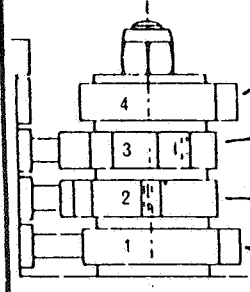
IMPORTANT NOTE**9.2.3 PRESSURE IN THE COMBUSTION CHAMBER AS A DISTURBANCE VALUE.**

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 INITIAL BURNER SETTING

Remove the cover from the cam stack at the lower forward end of the air inlet casing. Check the cam positions and adjust if necessary as illustrated. Fig. 9.

	CAM ARRANGEMENT AND SETTINGS					
	FRICTION CAMS	SINGLE STAGE	TWO STAGE			
	NATURAL CAM	DUMMY CAM	DUMMY CAM			
	BLACK CAM	—	LOW FLAME			
	WHITE CAM	MAIN FLAME	HIGH FLAME			
	NATURAL CAM	FULL AIR SHUT-OFF	FULL AIR SHUT OFF			

	BURNER RATING					
	KW	KCAL/HR	BTU/HR	KW	KCAL/HR	BTU/HR
	146 264	125,000 225,000	500,000 900,000	264 381	225,000 325,000	900,000 1,300,000
BURNER AIR CONTROL DAMPER						
MAIN FLAME SINGLE STAGE (ON/OFF)	3			8		
LOW FLAME TWO STAGE (HIGH/LOW)	1.5			4		
HIGH FLAME TWO STAGE (HIGH/LOW)	3			8		

Fig. 9. Air Damper Cam Arrangement.

9.3.1 AIR/GAS RATIO CONTROLLER (FIG. 10).

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, adjusting screw (2) to half a division on the "+" side of "0". Turn the adjusting screw clockwise to decrease. Anti-clockwise to increase.

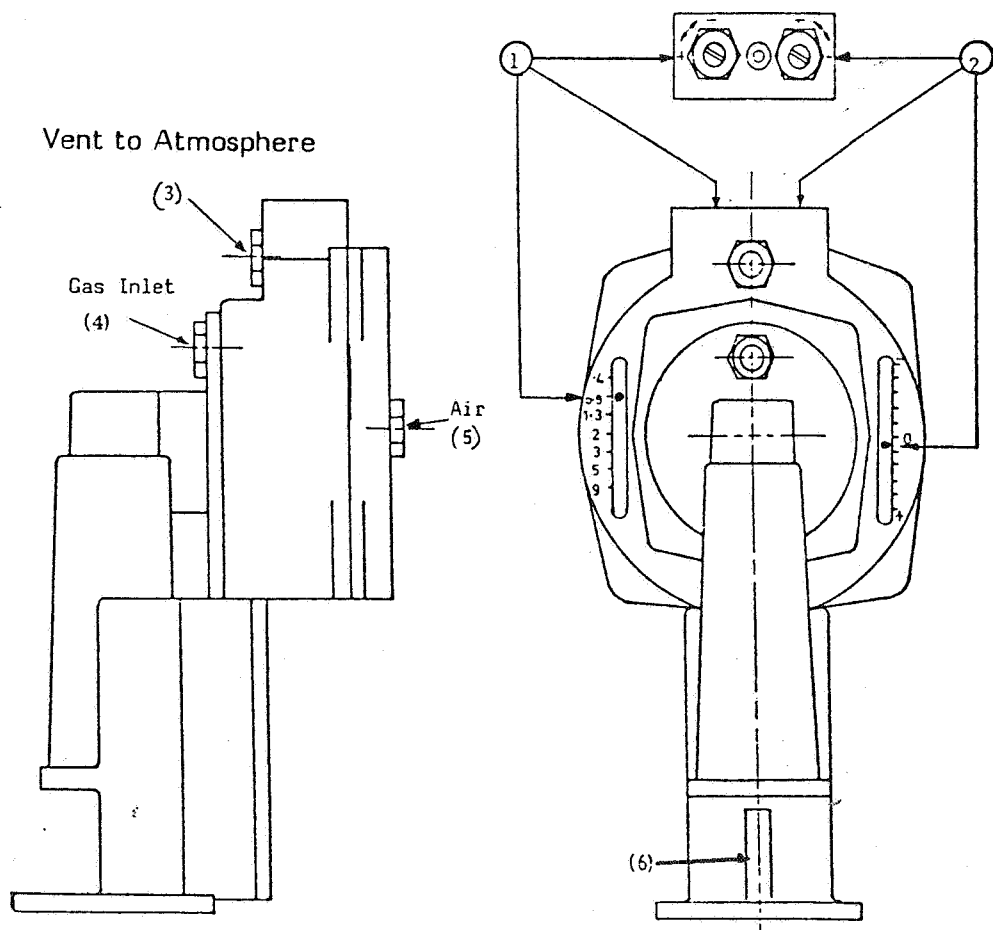


Fig. 10. Air/Gas Ratio Controller.

- (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.

9.4 The upstream gas valve is factory set and should not be adjusted.

9.5 GAS VALVE WITH INTEGRAL GOVERNOR

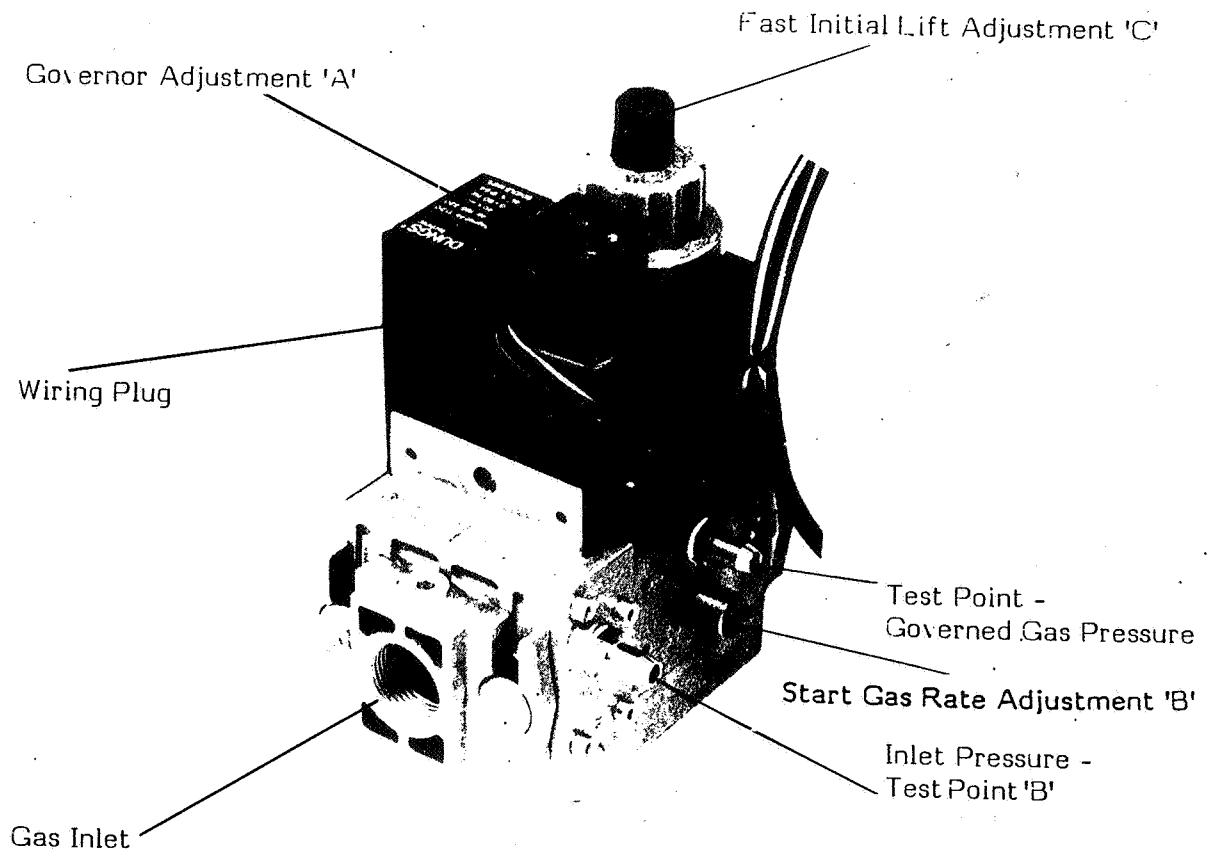


Fig. 11. Gas Valve with Integral Governor.

The Multibloc shown above contains as shown in Fig. 5 Governor Safety Shut-Off Valve, Main Shut-Off Valve and Start Gas Solenoid Valve.

ADJUSTMENTS

- (A) Governor adjustment (Main and Pilot/Start Gas) clockwise increases pressure - range 4-20 mbar (1.6 to 8.0" wg).
- (B) Start gas adjustment clockwise decreases, anti-clockwise increases rate.
- (C) Fast initial lift adjustment of Main Valve remove cap and invert to adjust (factory set to give slow opening) this does not need altering.
- (D) Main throughput (only used during pressure test of valve). Slacken off Cheese-Head Screw, turn fluted knot clockwise to close.
- (E) CPI Switch (Closed Position Indicator) fitted as standard on burners above 200 kW input (fit and adjust burner manual) Fig. 5 indicates the line diagram of the valve with the appropriate pressure test points.

TESTING

In order to test the gas soundness of the valve the following procedure should be followed:-

Firstly the valve is fitted with Pressure Test Points to check (1) supply pressure to valve, (2) governed pressure and (3) pressure after all valves (as shown in Fig. 11).

- (a) To test gas tightness of V1 fit Manometer to Pressure Test Point 2, then with gas supply on to inlet of Multibloc check if pressure is recorded at P.T.P.2, if not then V1 not gas tight. To ensure zero pressure at Test Point 2 it may be necessary to close off manual valve at inlet to Multibloc. Bleed off any pressure locked in then refit manometer and open manual valve.
- (b) Remove manometer from P.T.P.2 and fit at P.T.P.3. By introducing air via P.T.P.2 at low pressure max, 20 mbar - 8 Wg check for gas tightness of V2 and V3, if pressure is recorded at P.T.P.3 then to identify which valve is leaking manually close main gas valve via adjustment 'D' Fig. 11. Reintroduce air pressure as before, if no pressure recorded then V3 gas tight, and V2 suspect valve, if pressure still recorded then V3 leaking.

If any of V1, V2 or V3 valves are leaking, then the complete valve must be replaced.

Alternative

With the burner running the V1 can be checked by using the fuel by following (a) and V3 can be checked by closing manually V2 as described in (B). V2 can only be checked in Run position for gas tightness when the CPI Switch is fitted, as this assuming set correctly would prevent the burner starting.

You will note from Fig.5 that there is no longer a manual gas valve downstream of the Multibloc, this is not a mandatory requirement, and serves no purpose in the commissioning or soundness of the Multibloc Gas Train.

Finally once pressure test complete ensure that V2 is fully adjusted open via Point 'D' Fig. 11.

9.5.1 **GAS VALVE WITH INTEGRAL GOVERNOR & AIR/GAS RATIO CONTROLLER**
- CPI SWITCH ADJUSTMENT

The CPI switch forms an integral part of the valve 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.

9.6 **START RATE GAS GOVERNOR**

9.6.1 **SINGLE STAGE BURNER (ON/OFF)**

With a screwdriver, turn the adjusting screw fully anti-clockwise to give maximum gas flow rate. Refer to Fig. 11. Note B.

9.6.2 **TWO STAGE BURNER (HIGH/LOW)**

Remove the metal cap from the top of the start rate governor 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. (Two Stage Burner Only).

Replace Control Panel Cover.

Switch on the power to the Burner.

Momentarily switch on 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.

Switch on the Burner.

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. 8.

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 - 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.

11.1 NATURAL GAS SUPPLY PRESSURES

A running (not static) supply pressure of not less than 17.8 mBar (1.78 kPa, 178 mm Wg, 7" Wg) and not more than 200 mBar (20 Kpa, 2032 mm Wg, 80" Wg) is required at the inlet to the burner.

- 11.2 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 (on single stage burners, disconnect start gas test link and open main 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 Flame Probe will take over. The burner will now operate continuously on Start Rate Flame. For timing see Sequence Diagram Fig. 8.

Switch off Burner.

13. ESTABLISHING MAIN FLAME

13.1 SINGLE STAGE ON/OFF BURNERS

Ensure Main Manual Gas Valve is fully open.

Switch on Burner.

Burner will operate to start gas rate (See 12).

The downstream safety valve will open and main flame will be established. The burner will now run until switched off manually or by the appliance control instruments.

13.2 TWO STAGE (HIGH/LOW) BURNERS

Open 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 probe 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. 8).

13.3 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 9.3.1, 13.3.1 and Fig.10 for Two Stage High/Low, and paragraphs 9.5, 13.3.2 and Fig. 11 for Single Stage On/Off burners.

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	GAS INPUT RATE			GAS PRESSURE AT BURNER HEAD MM
	KW	KCAL/HR	BTU/HR	NATURAL GAS ONLY
NG9	146	125,000	500,000	45+ Appliance Resistance.
	205	175,000	700,000	75+ Appliance Resistance.
	264	225,000	900,000	110+ Appliance Resistance.
NG13	264	225,000	900,000	65+ Appliance Resistance.
	322	275,000	1,100,000	90+ Appliance Resistance.
	381	325,000	1,300,000	120+ Appliance Resistance.

Fig.12. Head Pressure Settings.

IMPORTANT

ALWAYS USE APPROVED TEST INSTRUMENTS.

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

13.3.1 SETTING/ADJUSTMENT OF THE MULTIBLOC VALVE

(SINGLE STAGE ONLY)

Slide the plastic cap covering governor adjustment to one side with a screwdriver, turn the adjusting screw fully anti-clockwise to give minimum gas flow rate. Fig. 9.

13.3.2 SETTING/ADJUSTMENT OF THE AIR/GAS RATIO CONTROLLER

(TWO STAGE ONLY)

Set the gas to air ratio to the desired value using the setting screw (1) on the left (coarse setting) (Fig. 10).

Start burner and run it at 90% of the required burner output. It may be necessary to adjust Cam 2 (High Flame) on cam stack.

Measure CO_2 or O_2 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 CO_2 or O_2 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. 10). 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 to achieve optimum CO_2 or O_2 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) on 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.

13.3.3 TWO STAGE (HIGH/LOW) BURNERS

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. 10). However once satisfactory combustion figures are achieved the burner rate may then be adjusted, by increasing air it will automatically increase gas rate to that required with the combustion figures remaining in the same ratio.

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. 9.

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. 10).

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.

NOTE: Any adjustment to air flow will effect gas rate.

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, 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 GAS VALVE WITH INTEGRAL GOVERNOR
(SINGLE STAGE ON/OFF BURNER ONLY)**

Adjust governor until it is established that it is actually governing, i.e. turn the adjusting screw anti-clockwise until the valve starts to close, 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 in the wiring diagram section 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 uA 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**

17.1 **SINGLE STAGE (ON/OFF) BURNERS**

Switch off the electrical supply to the burner, remove control panel cover and disconnect start test link, replace panel cover. Switch on electrical supply to the burner and allow burner to establish start gas flow. Start gas can now be adjusted to suit by turning the adjusting screw located on the side of the multibloc gas valve indicated in Fig. 11 Item 'B'. A start gas rate of approximately 25% and not more than a maximum of 30% is allowed.

17.2 **TWO STAGE (HIGH/LOW) BURNERS**

Switch off the electrical supply to the burner, deconnect the gas train multi-pin plug, close the main manual gas valve and remove control panel cover. Disconnect low flame hold link then replace panel cover and gas train plug.

Switch on electrical supply to burner and allow burner to establish start gas flame. Start gas rate can now be adjusted by turning the adjusting screw in the start gas governor clockwise to increase and anti-clockwise to decrease. A start gas rate of approximately 25% and not more than a maximum of 30% is allowed of the Low Flame Rate.

17.3 SINGLE & TWO STAGE

NEVER exceed the stated percentage start gas rate.

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

Once start rate set switch off electrical supply, and on on/off refit start test link, and high/low burners refit low flame hold link and fully open main manual gas valve.

Switch on electrical supply to 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 anti-clockwise and reset burner lockout. The burner will then continue through its cycle until either the start rate flame is established or burner goes to its lockout position. If the burner goes to lockout repeat the procedure 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 anti-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.

18.1 HIGH GAS PRESSURE SWITCH SETTING (HIGH/LOW ONLY)

When the burner is finally commissioned and set on rate on high flame required the Gas Switch must be adjusted with the burner running. Remove cover and moving dial in an anti-clockwise direction until the switch trips and the pressure switch indicating light is illuminated (burner shuts down). Move the pressure switch dial in a clockwise direction one division, fit cover, reset the pressure switch via the button situated on the pressure switch cover. The burner will now re-start.

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.

21. FLAME DETECTION SYSTEM**21.1 FLAME PROBE (FLAME RECTIFICATION ROD)**

Switch off the electrical supply to the Burner. Remove Control Panel Cover and disconnect Flame Signal check link. Refit Control Panel Cover.

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

Switch off the electrical supply. Remove Control Panel Cover and refit Flame Signal check link. Replace Control Panel Cover, switch on the electrical supply. Reset lockout.

21.2 UV (ULTRA VIOLET) CELL (IF FITTED)

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 electrical 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 and flame rectification probe 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 and flame rectification probe, reset if necessary. Refer to Fig. 4.

22.5 Replace all components and covers, secure all fittings.

Burner is now ready for operation.

Switch on the electricity supply 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 or replacement of 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

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 the motor capacitor.

Check that the CPI switch is in the 'start' position. (Check wiring).

Check that the Burner probe is not grounded to earth.

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

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

For Satronic 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 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 (See Fig.4). 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 9.3.1 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 Flame Rectification Probe. Alternatively the flame signal check link has been removed.

TYPE OF DEVICE	POSSIBLE REASON	REMEDY
Probe (FRR)	Probe Wrongly Positioned Bad Earth Continuity) Faulty Wiring) Transformer - Crossed Polarity Test Link not Refitted	Reposition. Elec. Test Rqd. Change Polarity Refit.

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.9.3.1

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) 1 Phase motor should be renewed.
- (b) 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 NG9 - NG13 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/multibloc.

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.

MODEL	MOTOR		OVERLOAD	CABLE	FUSES
	KW	HP	AMP	mm ²	AMP
N.G.9.	0.25	0.33	—	1.0	4
N.G.13	"	"	—	"	"
ALL CURRENT RATINGS RELATE TO 415 V. ALL MAIN FUSES MUST BE TO BS. 88.					
MODEL	MOTOR		OVERLOAD	CABLE	FUSES
	KW	HP	AMP	mm ²	AMP
N.G.9.	0.33	0.25	—	1.0	10
N.G.13.	"	"	—	"	"
ALL CURRENT RATINGS RELATE TO 240 V.					

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Nu-way 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.

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