

MODEL G

Burner Instruction Manual

FOR

GAS FUEL SYSTEMS

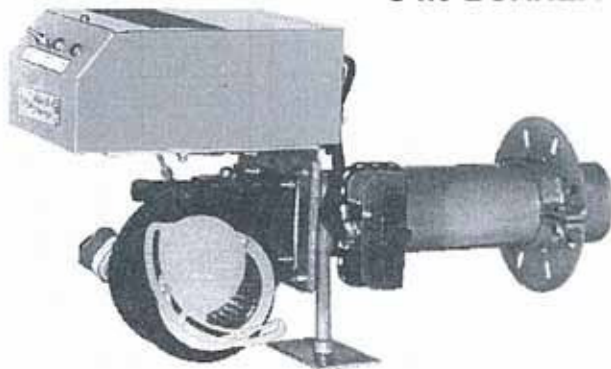


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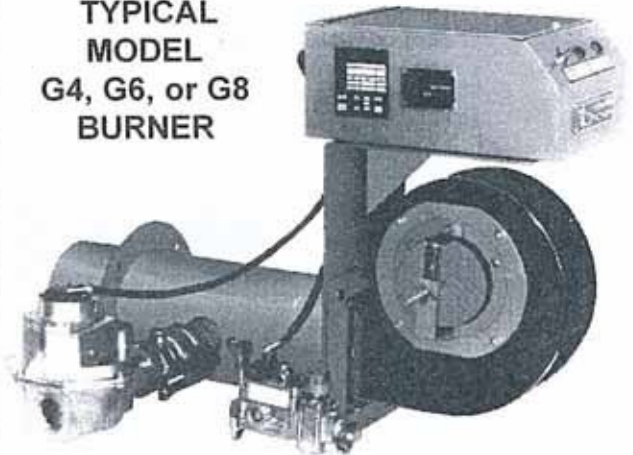
NOTE

YOUR BURNER MAY HAVE A LETTER PREFIX OR SUFFIX ADDED TO THE MODEL DESIGNATION; HOWEVER, THIS IS FOR IDENTIFICATION PURPOSES ONLY AND DOES NOT AFFECT THE INSTRUCTIONS IN THIS MANUAL.

TYPICAL
MODEL
G4.9 BURNER



TYPICAL
MODEL
G4, G6, or G8
BURNER



WARNING

If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

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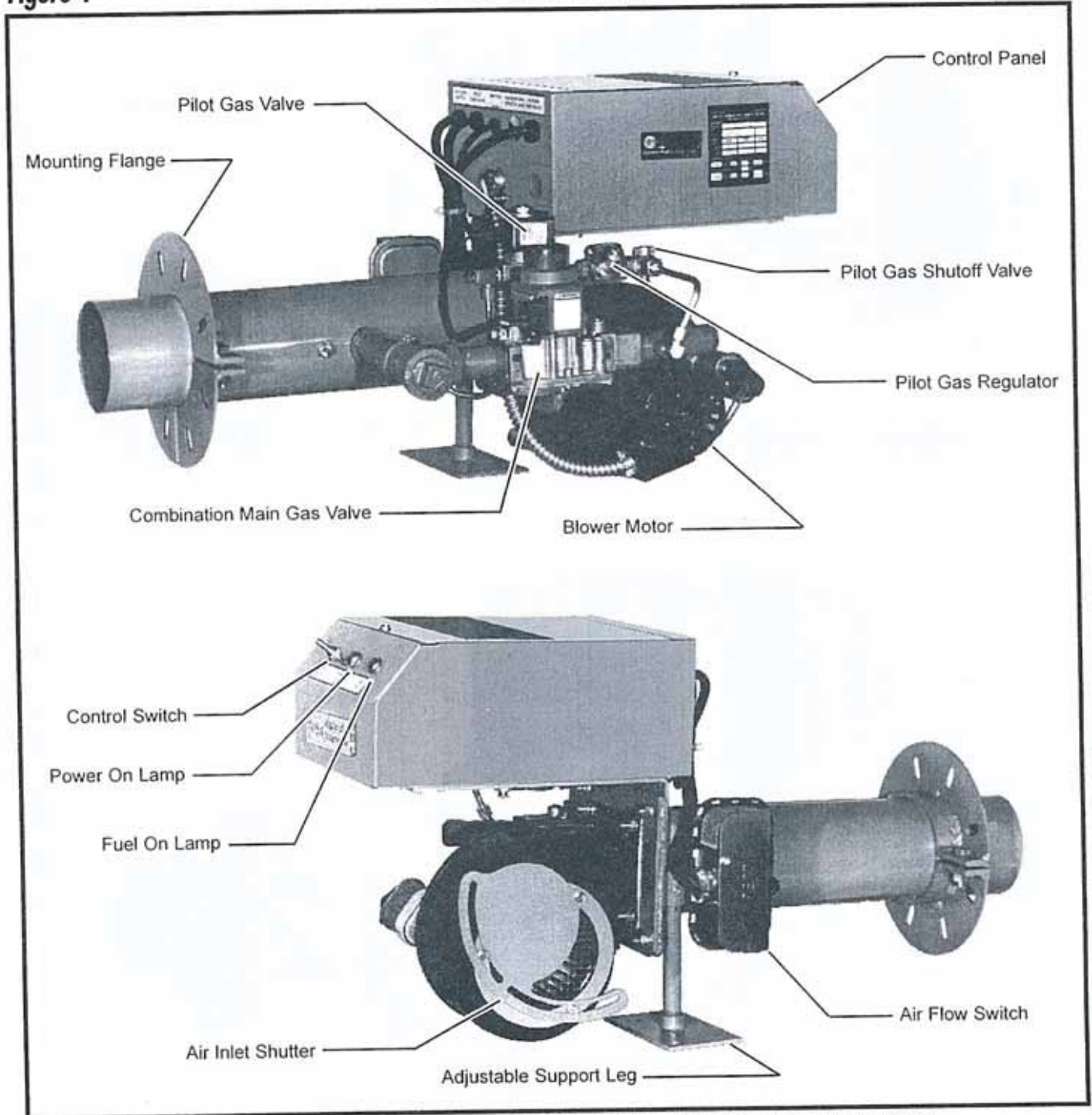
PART I

BURNER FAMILIARIZATION AND PRELIMINARY INSPECTION

BURNER FAMILIARIZATION - Study the following burner illustrations and determine the one which matches your units. Take special note of the PART NAMES shown in the call-outs. Fuel Systems are described in detail in Part III.

Figure 1

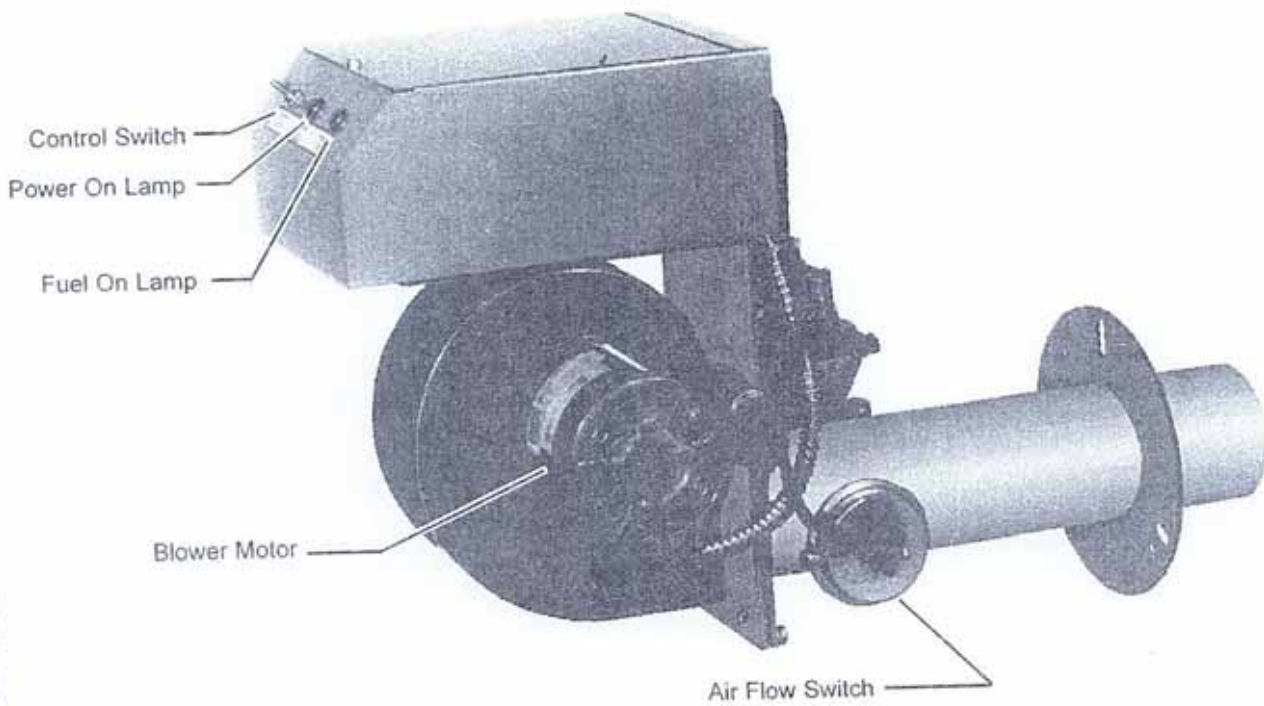
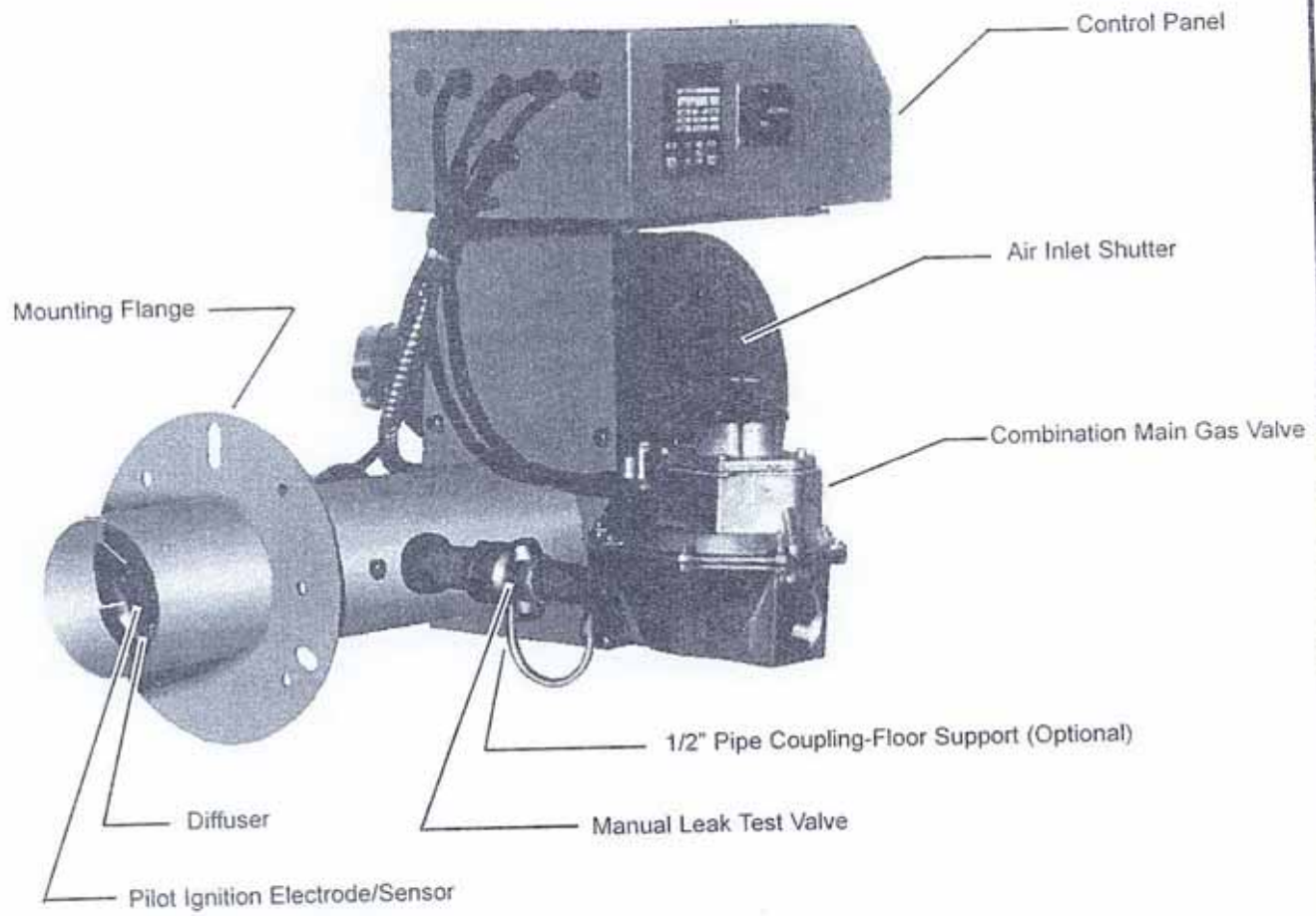
Burner Identification



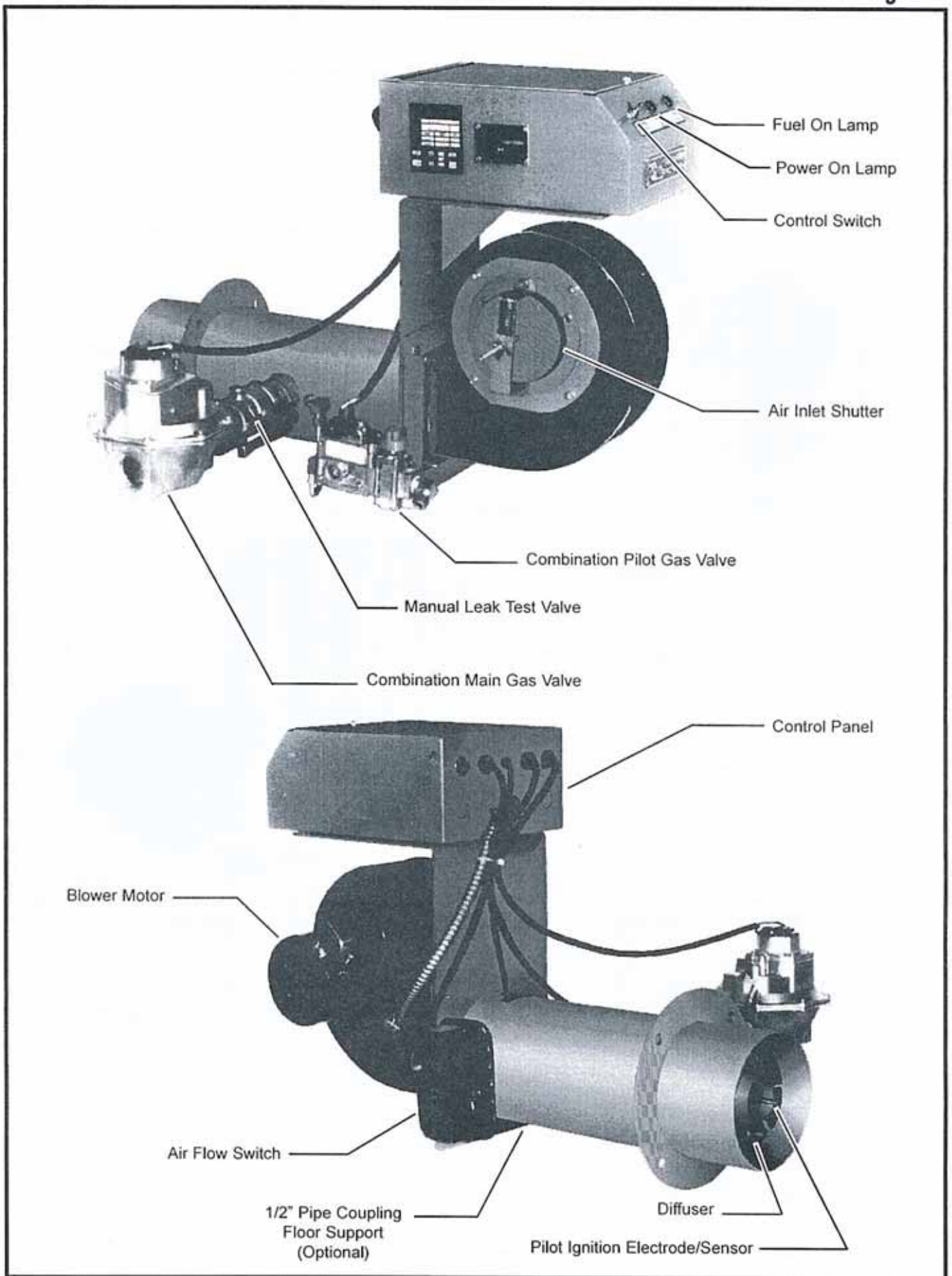
TYPICAL MODEL G4.9 WITH STANDARD EQUIPMENT

Figure 2

Burner Identification



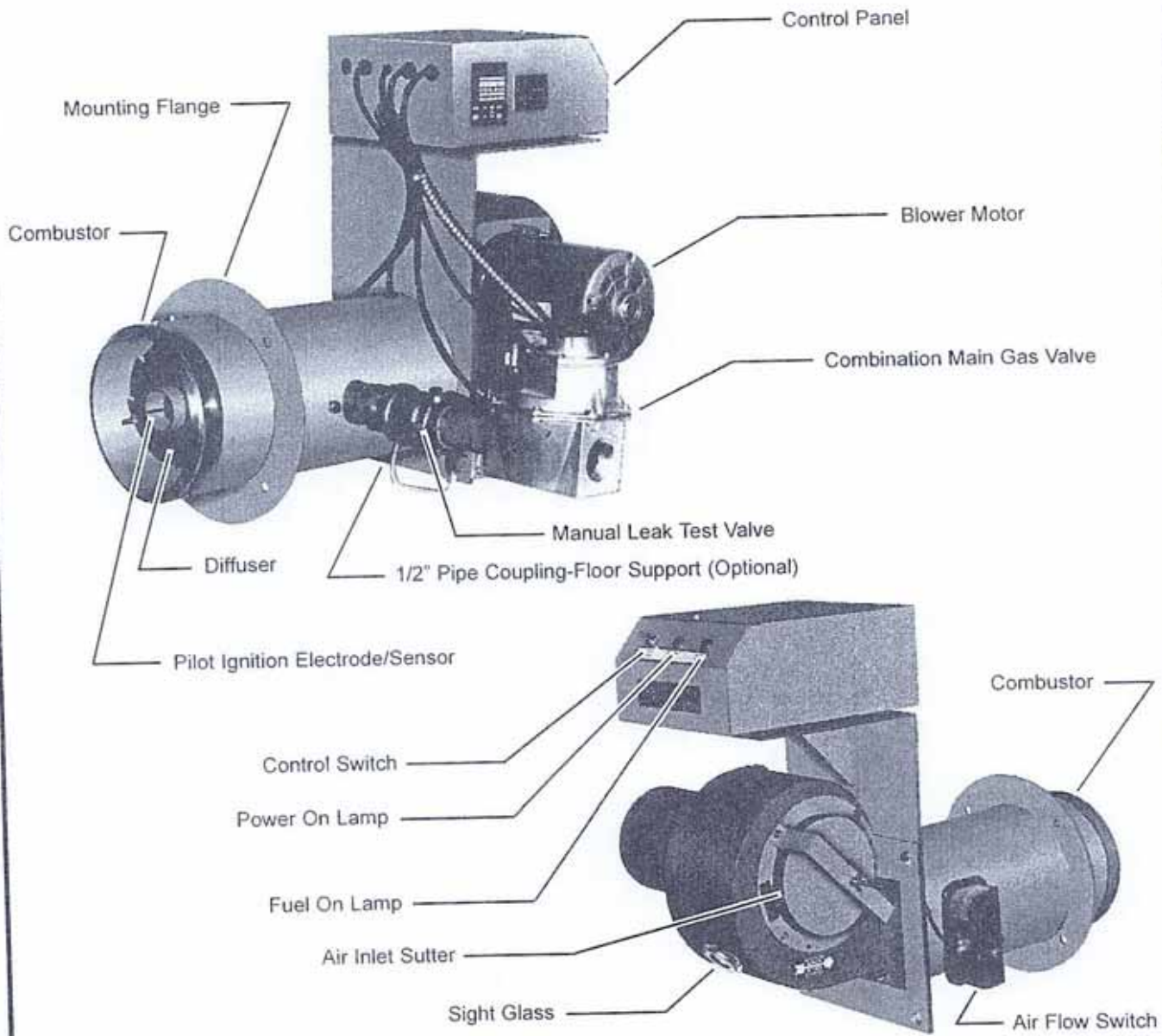
TYPICAL MODEL G4 WITH STANDARD EQUIPMENT



TYPICAL MODEL G6 WITH STANDARD EQUIPMENT

Figure 4

Burner Identification



TYPICAL MODEL G8 WITH STANDARD EQUIPMENT

PRELIMINARY INSPECTION - The burner should be visually checked for damage and loose components. These conditions can occur during shipment, through improper handling, tampering, or through improper care and storage at the job site.

CHECK FOR:

- Obvious damage to housing, air inlet, and components mounted thereon.
- Tightness of fasteners, tube fittings, plugs, etc.
- Tightness of electrical terminals and connections.
- Accumulations of oil, dust, dirt, water and other foreign matter on, in, or near the burner.

PART II

INTRODUCTION

WARNINGS

If you smell gas:

1. Open windows.
2. Don't touch electrical switches.
3. Extinguish any open flame.
4. **EVACUATE** people from building.
5. Immediately call the gas supplier.

The use and storage of gasoline or other flammable liquids and vapors in open containers in the vicinity of this appliance is hazardous.

In accordance with OSHA standard 1910.147, all equipment, machines and processes shall be locked out prior to servicing.

If not installed, vented, operated and maintained in accordance with the manufacturer's instructions, this product could expose you to substances in fuel or from fuel combustion which can cause death or serious illness and which are known to the State of California to cause cancer, birth defects or other reproductive harm.

Improper servicing of this equipment may create a potential hazard to equipment and operators.

SERVICING MUST BE DONE ONLY BY FULLY TRAINED AND QUALIFIED PERSONNEL.

Before disconnecting or opening up a fuel line and before cleaning or replacing parts of any kind.

- Turn **OFF** the manual fuel shutoff valves including pilot gas cock, if applicable. If a multiple fuel burner, shut **OFF** all fuels.
- Turn **OFF** all electrical disconnects to the burner **and any other** equipment or systems electrically interlocked with the burner.

Do **NOT** use **TEFLON TAPE** or compounds with **TEFLON** content as an oil or gas pipe sealant. **TEFLON** can cause valves to fail creating a **SAFETY HAZARD**. Warranties are nullified and liability rests solely with the installer when evidence of **TEFLON** is found.

Rectorseal No. 2 pipe thread compound is used for factory assembly of oil and gas piping.

This manual has been prepared to assist in the installation, operation and maintenance of your burner. It is good practice to know as much as possible about a piece of equipment before trying to install or operate it. Read the contents carefully before proceeding.

NOTE

Installation requirements and instructions should always be covered in appropriate engineering drawings and specifications which detail the applicable building codes, etc. Information contained herein is to be used as a guide **ONLY** and not as the final authority.

GENERAL INFORMATION

- Starting a burner is an event which normally culminates the efforts of several different contractors, manufacturers, utility and engineering concerns, sales and factory representatives, and others.
- In order for the burner to operate safely and meet its design capabilities, the interfacing fuel, air, electrical, exhaust and heating control systems must be properly sized, selected, installed and tested. Additionally, all conditions must be such that the heat generated by the burner can be safely used without endangering personnel or equipment.
- It shall be the policy that no responsibility is assumed by the company nor any of its employee(s) for any liability or damages caused by an inoperable, inadequate or unsafe burner condition which is the result, either directly or indirectly, of any of the improper or inadequate conditions described above. To insure that a safe and satisfactory installation has been made, a pre-start inspection is necessary. This inspection must be performed by an individual who is thoroughly familiar with all aspects of proper boiler/burner installation and how it interfaces with other plant or building control systems.

- Part I of this bulletin sets forth major inspection items that must be considered.

NOTE

This inspection should be performed before the burner startup specialist is called in. An incomplete or inadequate installation may require additional time and effort by startup personnel and cause an untimely and costly delay.

- The results of this inspection will often times identify corrections that must be made prior to start-up as well as point out potential or long range problems that may occur if corrections are not made.
- Burner start-up is a serious matter and should not be viewed as a time for "crowd gathering" by unconcerned, uninformed or unauthorized personnel. The number of persons present should be held to a absolute minimum. Instruction of operating and other concerned personnel should be done after the burner has been successfully fired and adjusted by a qualified service agency or factory start-up specialist.

FUEL

The G4.9, G4, G6 & G8 burner will fire natural gas or LP gas. Maximum inlet gas pressure at dropleg is 10.5 inches of water with natural gas and 13 inches of water with LP gas. The burners must be used only with the gas specified on the rating plate.

FIRING SYSTEM

The burner operates ON-OFF with fixed air inlet shutter. (Figure 11, Pg. 21).

BLOWER MOTOR

The burner uses a capacitor start, 115 volts, 60 cycle, single phase, motor.

BLOWER WHEEL

Squirrel cage type. The tips of the forward curved blades point in the direction of rotation.

COMBINATION GAS CONTROL

This device incorporates the main gas pressure regulator, and automatic main gas valve into a single unit. The coil operating the normally closed automatic main gas valve is 24 volts. (Figure 13, Page 23)

GAS TRAIN

In lieu of the Combination Gas Control, the manual main shutoff cock, manual pilot shutoff cock, pilot gas pressure regulator, main gas pressure regulator, and automatic main gas valve may be supplied as separate components or in different combinations.

GAS VALVE(S)

Normally closed, 24 volt, 0.5 psi maximum operating pressure.

GAS PILOT REGULATOR

Output range 1 to 3.5 inches water column. Maximum inlet pressure is 0.5 psig. (14 inches water column)

BURNER COMBUSTION HEAD

Includes outer cylinder, mounting flange, & panel mounting bracket.

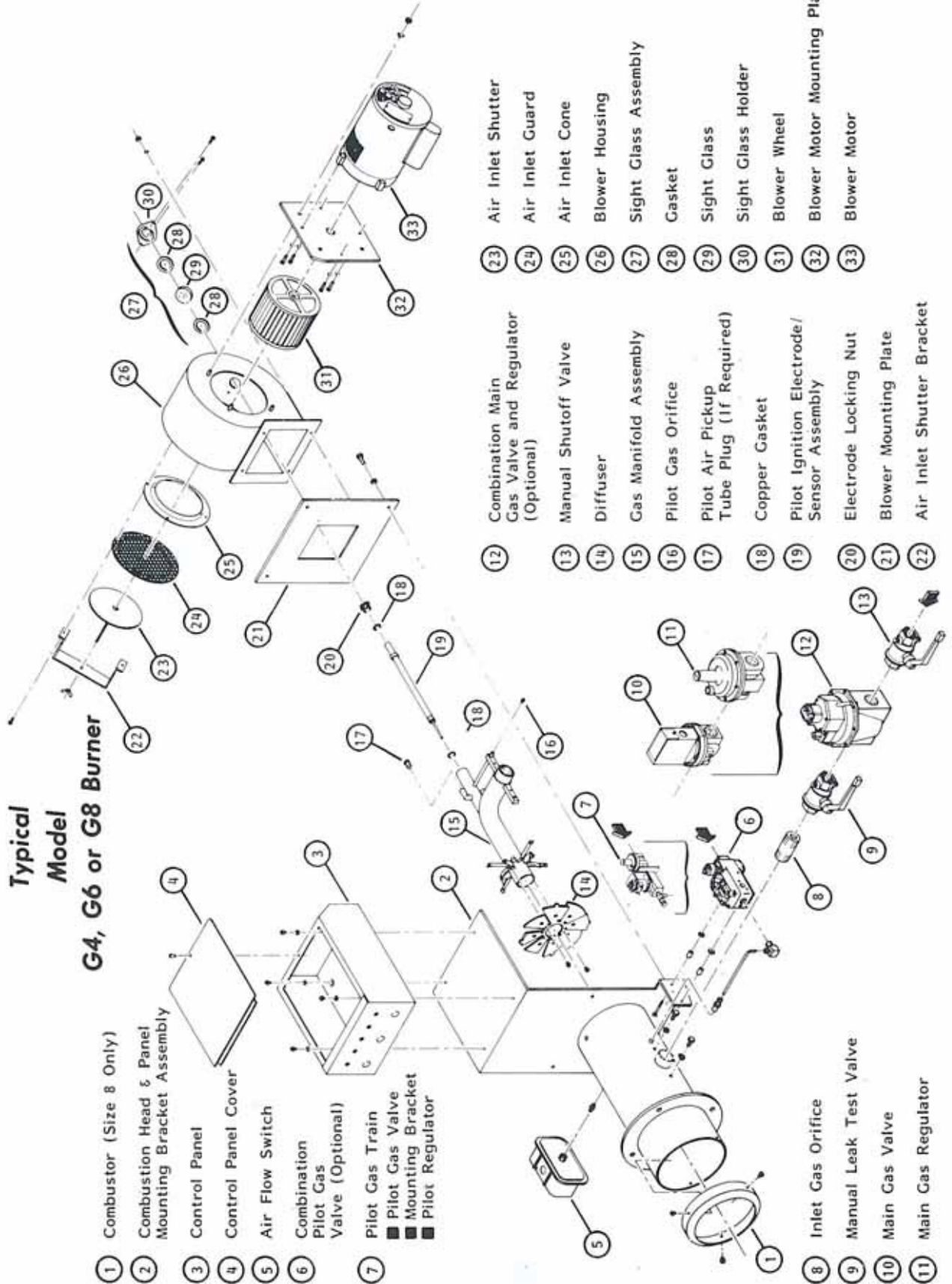
GAS PILOT IGNITION

The intermittent gas pilots are ignited by an interrupted spark approximately 13,000 volts which is supplied internally in the flame safeguard/ignition module.

AIR FLOW SAFETY SWITCH

Diaphragm switch that closes only when adequate combustion air is delivered to the firing head. Loss of combustion air causes fuel valve(s) to close immediately. See (Fig 15, Page 25)

**Typical
Model
G4, G6 or G8 Burner**



- 1 Combustor (Size 8 Only)
- 2 Combustion Head & Panel Mounting Bracket Assembly
- 3 Control Panel
- 4 Control Panel Cover
- 5 Air Flow Switch
- 6 Combination Pilot Gas Valve (Optional)
- 7 Pilot Gas Train
 - Pilot Gas Valve
 - Mounting Bracket
 - Pilot Regulator

- 12 Combination Main Gas Valve and Regulator (Optional)
- 13 Manual Shutoff Valve
- 14 Diffuser
- 15 Gas Manifold Assembly
- 16 Pilot Gas Orifice
- 17 Pilot Air Pickup Tube Plug (If Required)
- 18 Copper Gasket
- 19 Pilot Ignition Electrode/Sensor Assembly
- 20 Electrode Locking Nut
- 21 Blower Mounting Plate
- 22 Air Inlet Shutter Bracket

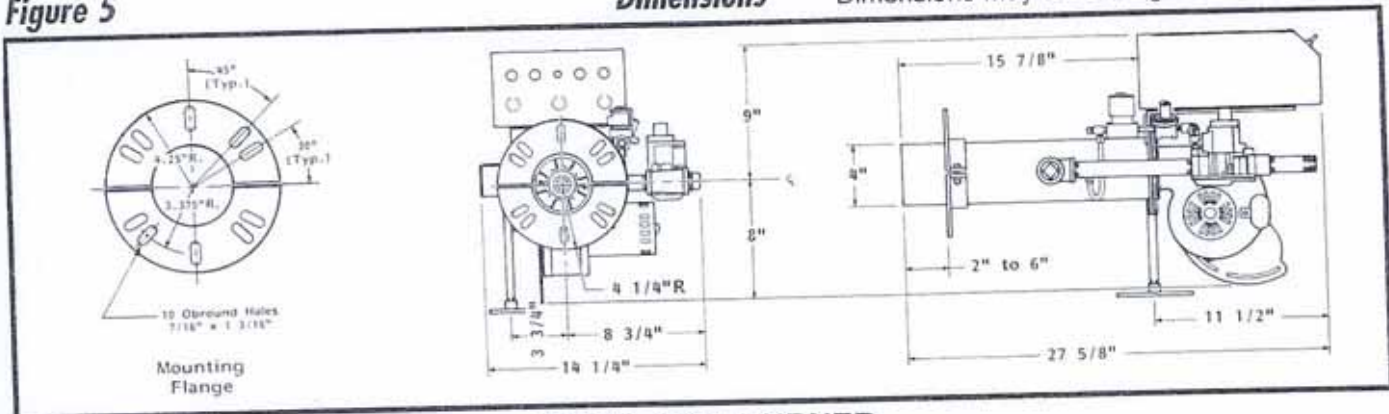
- 23 Air Inlet Shutter
- 24 Air Inlet Guard
- 25 Air Inlet Cone
- 26 Blower Housing
- 27 Sight Glass Assembly
- 28 Gasket
- 29 Sight Glass
- 30 Sight Glass Holder
- 31 Blower Wheel
- 32 Blower Motor Mounting Plate
- 33 Blower Motor

- 8 Inlet Gas Orifice
- 9 Manual Leak Test Valve
- 10 Main Gas Valve
- 11 Main Gas Regulator

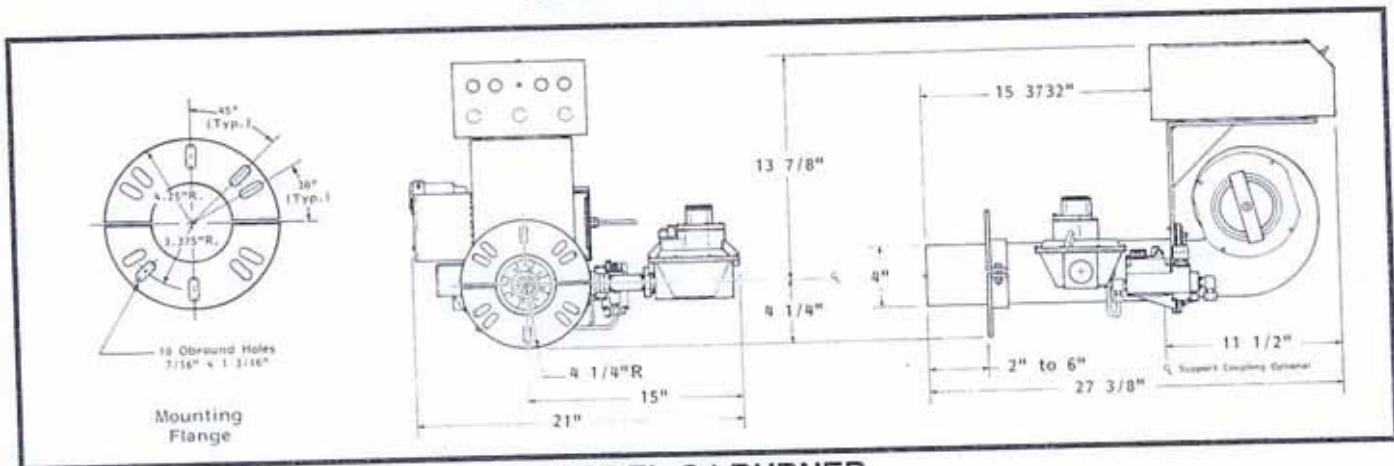
Figure 5

Dimensions

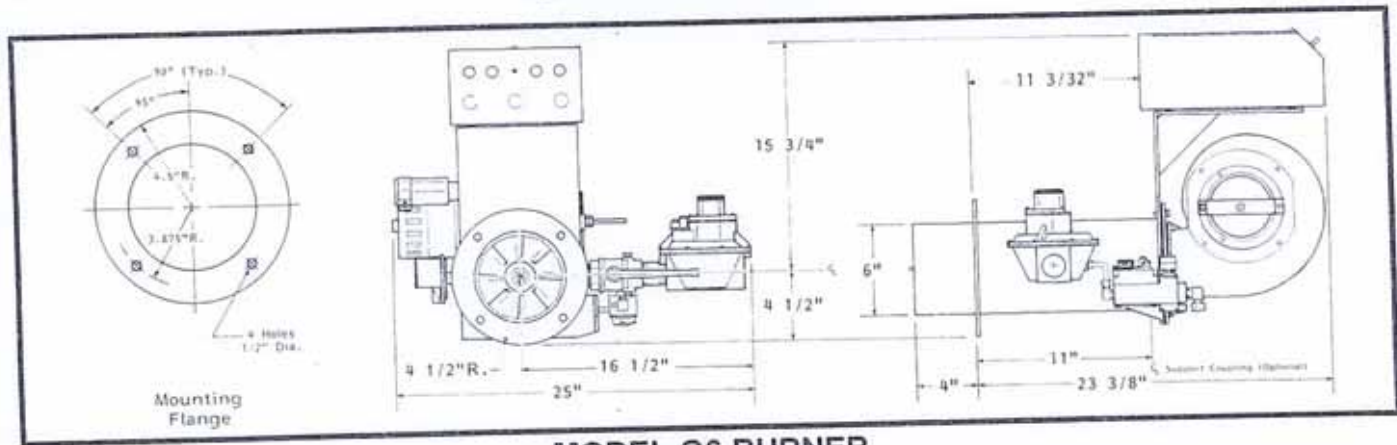
Dimensions May Be Changed Without Notice



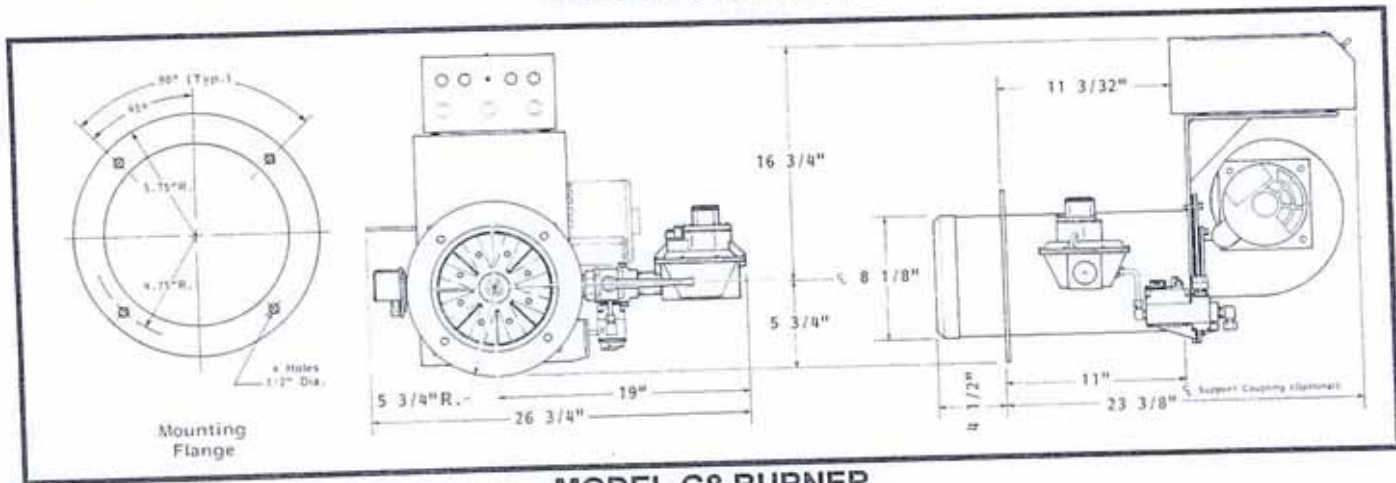
MODEL G4.9 BURNER



MODEL G4 BURNER



MODEL G6 BURNER



MODEL G8 BURNER

LIMIT AND OPERATING CONTROLS

Not included with burner. Must be rated & wired for 115 volts. See wiring diagram 31-000178-40, (Figure 9, Page 13) limit controls should be manual reset type.

PRE-PURGE

Pre-purge timing of 30 seconds is standard on all units.

THERMOSTAT CONTROL

Can be operated with 24V thermostat control. See wiring diagram 31-000178-40. Jumper T1 to T2 if not used. (Figure 9, Page 13).

Table 1

Gas Flow Capacity of Pipe - CHF

PIPE LENGTH IN FEET	WITH PRESSURE DROP OF 0.3" wc and SPECIFIC GRAVITY OF 0.60								
	Pipe Size - Inches (IPS) (Schedule 40)								
	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4
10	132	278	520	1050	1600	3050	4800	8500	17500
20	92	190	350	730	1100	2100	3300	5900	12000
30	73	152	285	590	890	1650	2700	4700	9700
40	63	130	245	500	760	1450	2300	4100	8300
50	56	115	215	440	670	1270	2000	3600	7400
60	50	105	195	400	610	1150	1850	3250	6800
70	46	96	180	370	560	1050	1700	3000	6200
80	43	90	170	350	530	990	1600	2800	5800
90	40	84	160	320	490	930	1500	2600	5400
100	38	79	150	305	460	870	1400	2500	5100
125	34	72	130	275	410	780	1250	2200	4500
150	31	64	120	250	380	710	1130	2000	4100
175	28	59	110	225	350	650	1050	1850	3800
200	26	55	100	210	320	610	980	1700	3500

MULTIPLIERS USED WITH ABOVE TABLE

Specific Gravity Other Than 0.60	
Specific Gravity	Multiplier
0.50	1.100
0.60	1.000
0.70	0.926
0.80	0.867
0.90	0.817
1.00	0.775

Pressure Drop Other Than 0.3" wc			
Pressure Drop	Multiplier	Pressure Drop	Multiplier
0.1	0.577	1.0	1.83
0.2	0.815	2.0	2.58
0.3	1.000	3.0	3.16
0.4	1.160	4.0	3.65
0.6	1.420	6.0	4.47
0.8	1.640	8.0	5.15

WARNING

Use a pipe joint compound resistant to the action of liquified petroleum gases rather than teflon tape as a gas sealant. Teflon tape can cause valves to fail, creating a safety hazard. Warranties are nullified and liability rests solely with the installer when teflon tape is used.

Figure 8

(P1) GAS PRESSURE IN STREET MAIN.
Varies due to several factors (i.e. length of supply piping, total load, etc.) but is usually maintained several inches w.c. or more above P2.

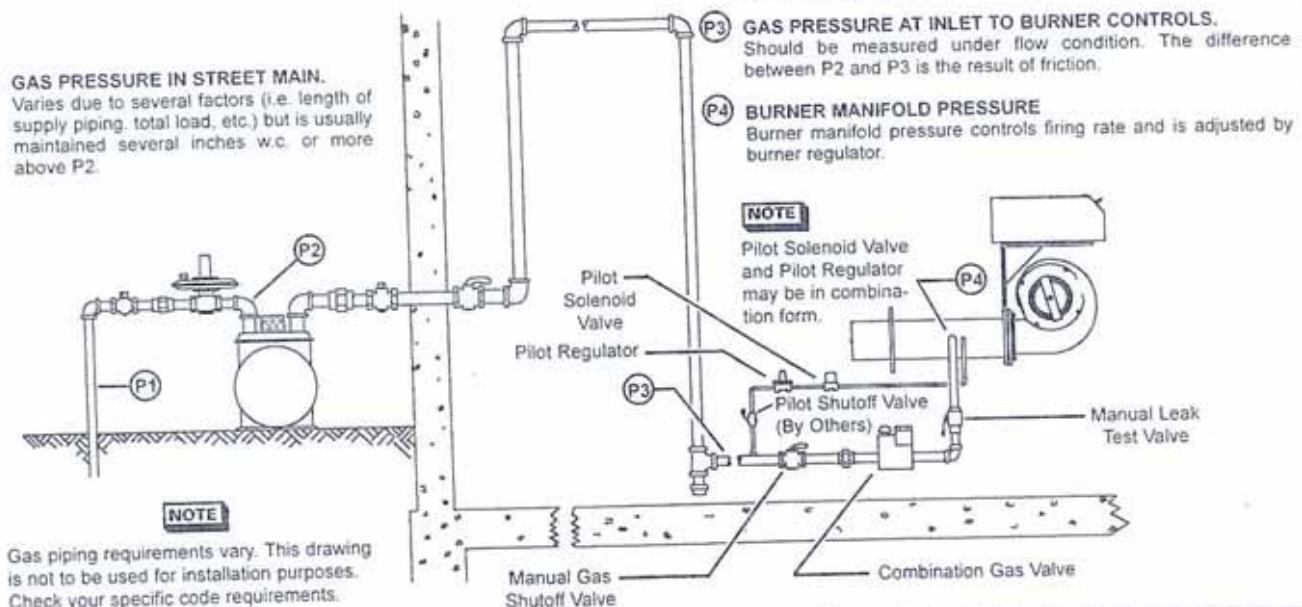
(P2) REGULATED METER PRESSURE.
Standard is 7 inches water column (4 oz./sq. in.) but may be higher or lower. (Check with local utility).

(P3) GAS PRESSURE AT INLET TO BURNER CONTROLS.
Should be measured under flow condition. The difference between P2 and P3 is the result of friction.

(P4) BURNER MANIFOLD PRESSURE
Burner manifold pressure controls firing rate and is adjusted by burner regulator.

NOTE

Pilot Solenoid Valve and Pilot Regulator may be in combination form.



NOTE
Gas piping requirements vary. This drawing is not to be used for installation purposes. Check your specific code requirements.

TYPICAL GAS PIPING INSTALLATION

PART III

FUEL SYSTEM

GAS SYSTEM DESCRIPTION - The Model G burners are equipped with U.L. Listed gas trains as standard equipment.

The following schematics depict U.L. Listed systems used on burners with inputs of 100 through 2,500 MBh.

Figure 6

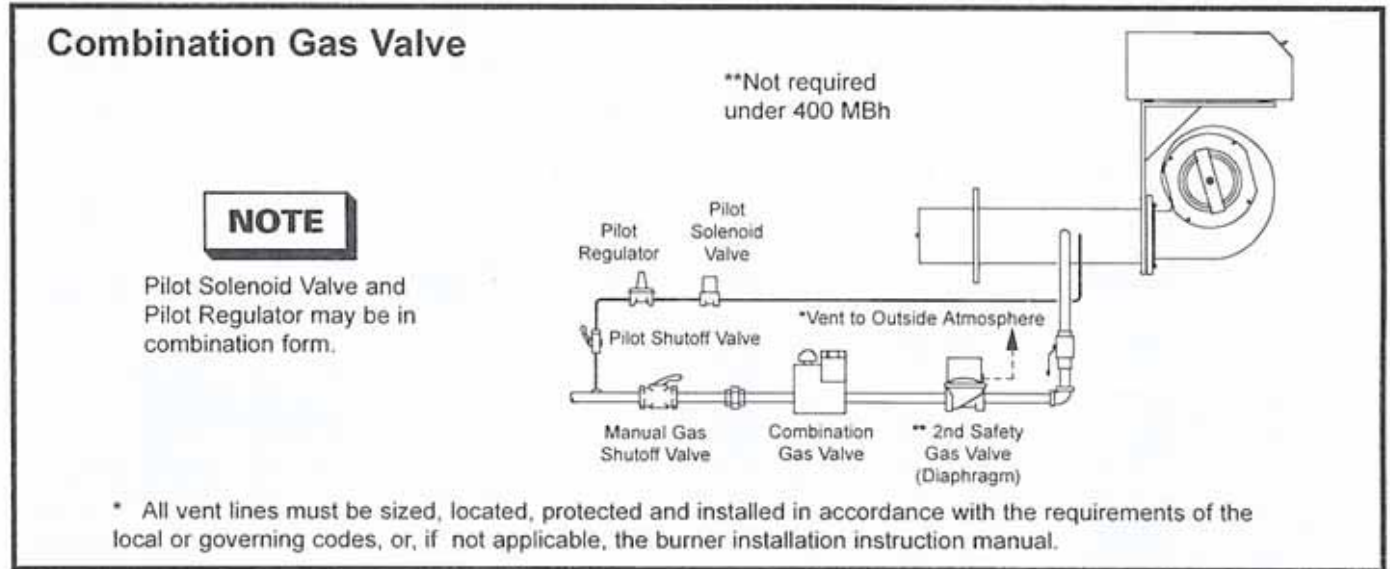
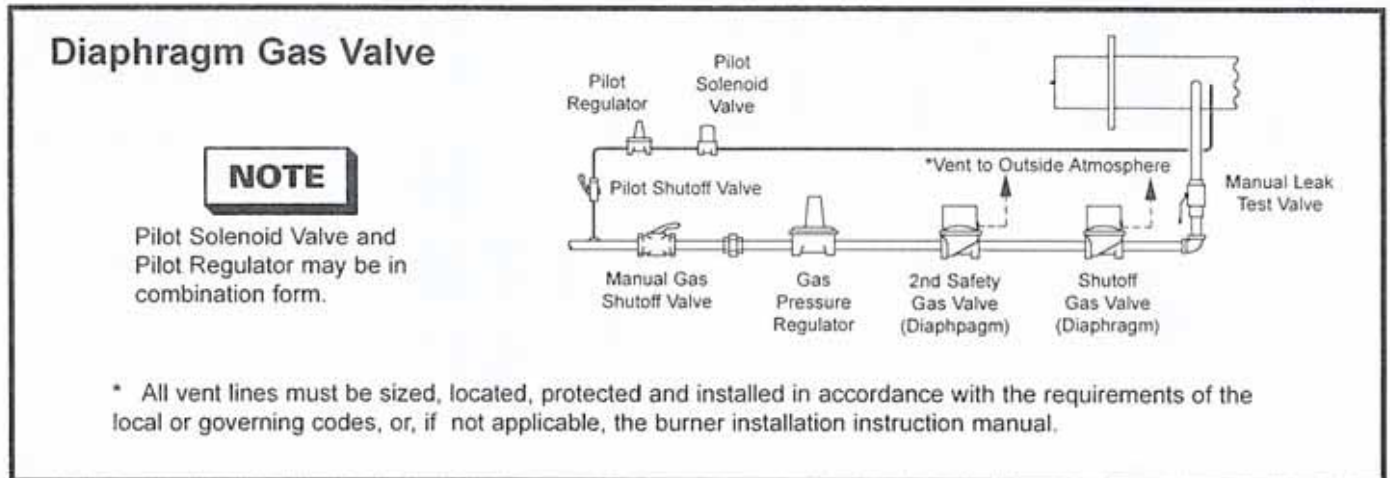


Figure 7



GAS PIPING INFORMATION - Gas piping should be sized to provide at least the required minimum pressure at the inlet to the gas train. Consult your local utility on any questions regarding gas pressure, piping pressure drops allowable, and local piping requirements.

the latest revision of the American National Standard, ANSI Z223.1, and any other local codes which apply. All gas piping should be tested after installation with air pressure or inert gas of at least three times the gas pressure that will be used. The piping ahead of the main manual shutoff shall include a full size dirt pocket or trap (Figure 8).

Gas piping should be installed in accordance with

BURNER OPERATING SEQUENCE



THIS IS NOT A START-UP PROCEDURE.
REFER TO PART VI.

1. Close control switch. With all limit and operating controls calling for heat, the burner will follow sequence below.
2. This is a typical sequence. For exact details of operation, see manufacturer's specification sheets.

S8660D/S8670D MODULE SEQUENCE

External Operation

Pre-Purge

The burner motor starts.

When the air flow switch makes, pre-purge timing begins.

Pilot Ignition

When pre-purge is complete, safety shutoff pilot gas valve and gas pilot ignition generator are energized to ignite pilot.

Pilot flame must be proven or module locks out as in flame failure. Paragraph #1 of Safety Shutdown.

Main Burner

Fuel On lamp, lights. Safety shutoff gas valve(s) open and main burner ignites.

Gas pilot ignition generator is de-energized.

Normal run position. Burner continues to operate unit, heat demand is satisfied.

AUTOMATIC SHUTDOWN

Limit or operating controls open:
Gas valve(s) close.

Burner motor stops. Burner is ready for start-up on the next call for heat.

MANUAL SHUTDOWN

- 1.
2. Turn control switch off. Burner shuts down as in Automatic Shutdown above.

When burner motor stops, close all manual gas valves.

SAFETY SHUTDOWN

1. If at any time during the operating cycle a flame failure occurs, the burner shuts down as in Automatic Shutdown.

The control switch must be opened and must remain open for one minute before the burner will fire again.

2. If a limit or running interlock failure occurs, the burner shuts down as in Automatic Shutdown.

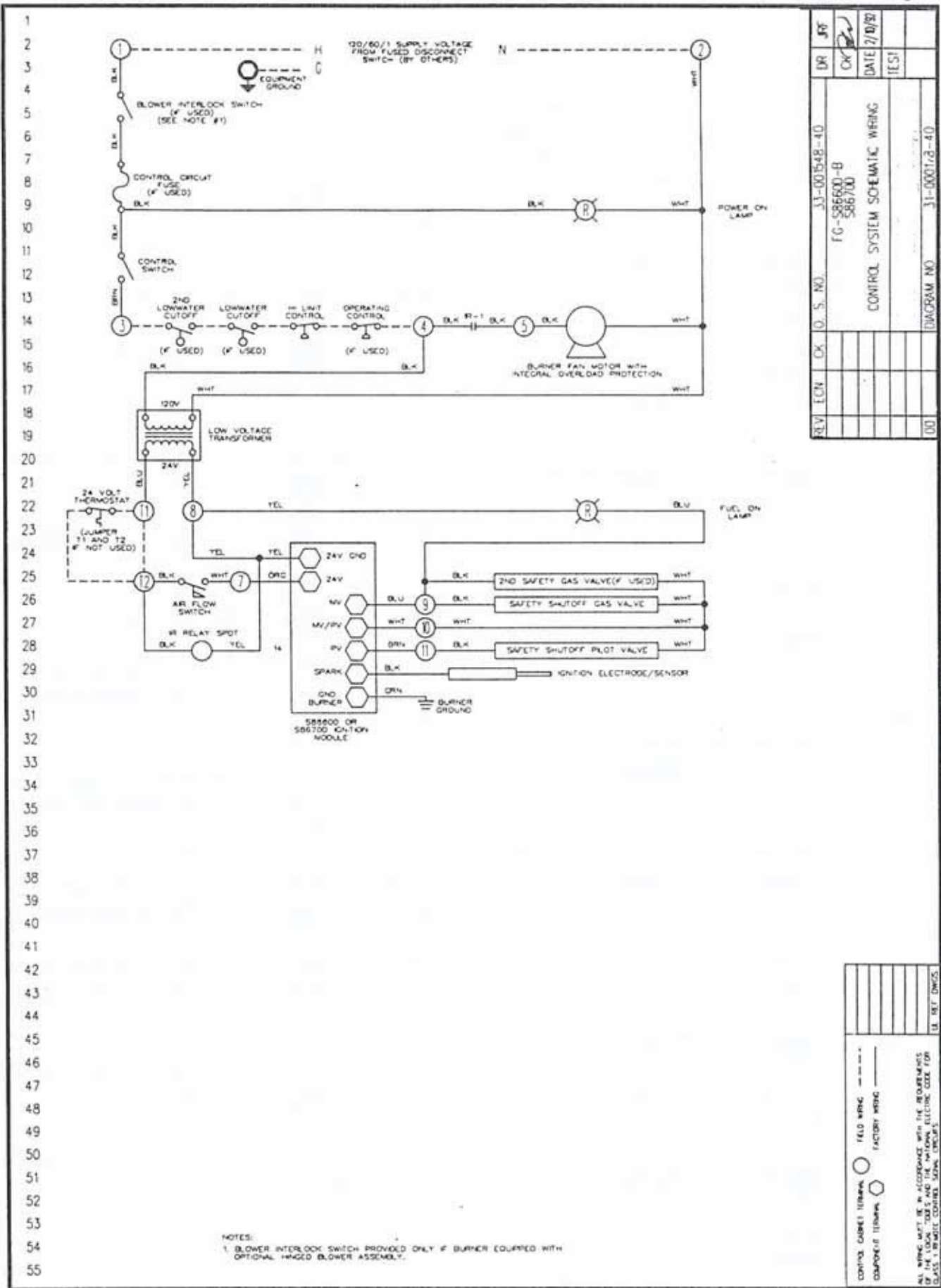
Condition must be corrected before the burner will fire again. Manual reset of a device may be required.

3. If an air flow failure occurs, the gas valves close. The burner motor will continue to run.

Condition must be corrected before the burner will fire again.

WIRING DIAGRAM

Figure 9



DR	JF		
OK	OK	DATE	TEST
REV	CON	OK	O. S. NO.
			33-00548-40
			FC-S86600-B
			S86700
			CONTROL SYSTEM SCHEMATIC WIRING
			DIAGRAM NO.
			31-00017.2-40
			00

WIRING DIAGRAM

NOTES:
 1. BLOWER INTERLOCK SWITCH PROVIDED ONLY IF BURNER EQUIPPED WITH OPTIONAL HAZED BLOWER ASSEMBLY.

CONTROL CABLE TERMINAL	FIELD WIRING
COMPONENT TERMINAL	FACTORY WIRING
ALL WIRING MUST BE ACCORDANCE WITH THE REQUIREMENTS OF ALL LOCAL AND NATIONAL ELECTRICAL CODES FOR GAS APPLIANCE CONNECTIONS. SEE MANUAL.	
U.S. MET. DIMS.	

COMBUSTION CHAMBER AND APPLICATIONS DATA

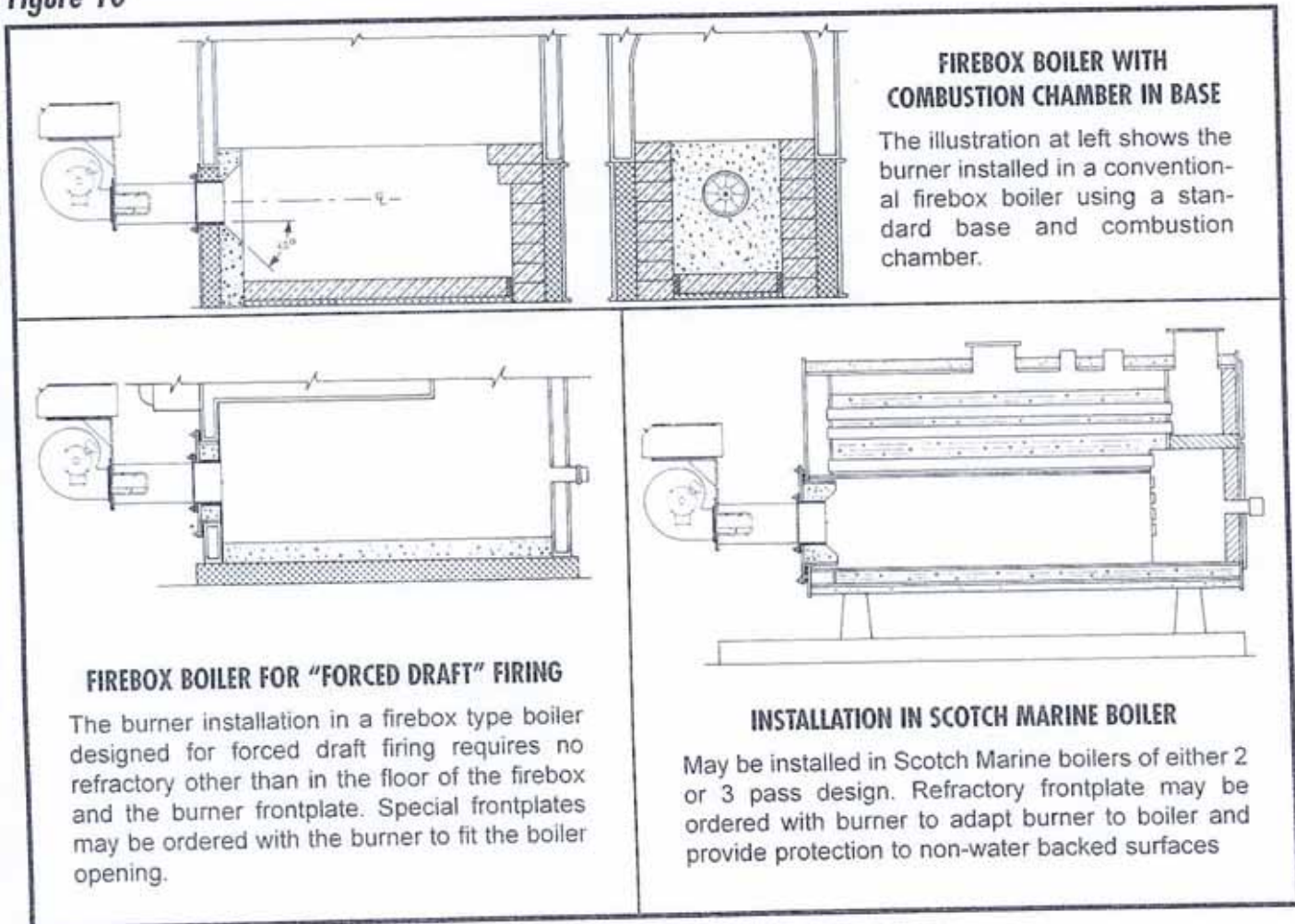
Table 2

Minimum Recommended Combustion Chamber Dimensions (Inches)			
Input MBh	Rectangular Chamber		Round Chamber
	Inside Width	Inside Length	Inside Diameter
100-375	12	14	12
376-600	14	19	14
	15	24	16
801-1000	18	29	18
	20	34	20
1201-1400	21	39	22
	22	44	22
1601-1800	24	49	24 </td
	26	54	26
2001-2200	27	57	28
	28	60	28

NOTE

Combustion chamber dimensions may vary from table to fit job conditions. Floor area should not be less than 50 square inches per 100 MBh input. Larger floor areas are desirable as combustion chamber temperatures will be reduced giving longer refractory life. Combustion chamber length should not be less than 1 1/2 times the width. Combustion chamber height should equal chamber width or approximately twice the center line height of the burner from the floor. Recommended minimum distance from center line of burner head to the floor is 6".

Figure 10



PART IV

INSTALLATION INSTRUCTIONS

GENERAL

Check burner parts illustrated on preceding pages. The burner has been carefully checked at the factory, thus missing or damaged parts must be reported at once in order that appropriate action may be taken to replace them. Give burner model number and serial number when ordering parts.

The installation must conform with the latest revisions of local codes or, in the absence of local codes, with the Standard for the Installation of Domestic Gas Conversion Burners, ANSI Z21.8, and Addenda, Z21.8a and the National Fuel Gas Code, ANSI Z223.1.

The heat transfer surfaces of the furnace or boiler should be cleaned before the burner is mounted. Consult your local gas utility company regarding any special requirements in the preparation of the furnace or boiler.

VENTING REQUIREMENTS

Flue pipe, double acting barometric damper, draft hood, or vent should not be smaller than recommended by the furnace or boiler manufacturer, the size is typically represented by the dimension of the smoke outlet. If existing flue pipe is used, it must be cleared of all soot and other deposits.

GAS REQUIREMENTS

Maximum inlet pressure to gas train must not exceed 10.5 iwc for Natural Gas or 13 iwc for LP Gas. For maximum capacity, natural gas minimum supply pressure must be 7.5 iwc for G8 and G6 models, 5.5 iwc for G4 and G4.9 models. Lower pressures required for reduced inputs, consult factory. Minimum pressures tested were 3.5 iwc Natural and 8.0 iwc LP.

COMBUSTION AIR SUPPLY

The boiler room in which the burner is located must be provided with an adequate fresh air supply to assure proper combustion. The American National Standard ANSI Z223.1 specifies that a

permanent opening or openings having a total free area of not less than one square inch per 5,000 BTU per hour total input rating of all appliances shall be required.

WIRING

The burner is prewired at the factory as far as practical. Refer to burner wiring diagram Figure 9 for complete wiring information and study thoroughly before making any connections. Make sure all connections on the flame safeguard are tight as they may have been loosened during shipment.

Power to the burner must be 120 volts. All wiring, including electrical ground, must be done in accordance with Local Code requirements or, in the absence of local codes, with the latest revision of the National Electric Code, ANSI/NFPA 70. Burner electric power should be provided from a separate fused disconnect switch located in the Boiler Room.

BURNER GASKET

Attach a rope gasket or sheet gasket to the burner mounting flange to prevent leakage or combustion gases from the boiler firebox.

BURNER MOUNTING

Attach burner to the boiler frontplate by firmly tightening nuts on the mounting studs or clamps so that a rigid installation is accomplished. Make sure burner is level before tightening clamps. Support burner housing to base or floor. Provide adequate clearances for servicing and proper operation of the burner.

BURNER PRESTART-UP CHECKLIST



This manual has been prepared as a guide in burner start-up operations. It is written for the start-up specialists who are thoroughly qualified both by training and experience.

1. **GENERAL** - The following data is pertinent to the burner start-up and should be carefully studied before any attempt to operate the burner is made. The following is a part of the manual shipped with the burner.

- Burner Material List
- Burner Wiring Diagram and Operating Sequence (if different from this manual)
- Flame Safeguard/Ignition Module Bulletin
- Misc. Manufacturer's Data on Controls, Valves, Regulators, etc.

NOTE

The above cited manual is ONE OF A KIND in that it contains material covering your SPECIFIC burner. To replace it, considerable time, special handling and significant costs are involved. Accordingly, it should be handled with care and kept in a location free of dust and moisture.

2. **IDENTIFICATION OF CONTROLS** - Review the burner wiring diagram and operating sequence. Study these items and identify the various controls.

NOTE

Do not proceed with start-up unless all applicable check list items in Part IV and preliminary adjustment requirements in Part V have been satisfied.



Be certain combustion chamber, flues, and surrounding areas are free of GAS accumulations, and other combustibles such as paint thinners, cleaning solutions, etc. An explosimeter (Mine Safety Appliances Co. Model No. 2A or equivalent) may be used to make this determination.

3. **REVIEW BURNER MATERIAL LIST IN THE INSTRUCTION MANUAL AND NOTE THE FOLLOWING INFORMATION:**

- A. Firing rate (MBTU)
- B. Cubic feet of gas per hour (CFH)
- C. BTU per cubic foot (BTU/CF)
- D. Required gas pressure at control inlet (inches W.C.)
- E. Required gas pressure at manual leak test valve (inches w.c., taken at port of valve.)

The above information is pertinent to setting up the burner.

SUGGESTED INSTALLATION INSPECTION CHECKLIST

CHECK WHEN COMPLETED

GENERAL

- Is burner installed in accordance with applicable installation drawings?
- If a refractory combustion chamber is part of the installation, is it completely dry, cured, and ready for firing at full boiler input?
- Is the electrical voltage connected to the burner control cabinet 120 volt, 60 cycle, single phase?
- Has the burner wiring been checked for completeness and accuracy?
- Are the boiler mounted limit and operating controls such as low water cutoffs, high limit controls, etc., properly installed and wired?
- Is the boiler water supply, including feed pumps, properly connected and is boiler filled with water?
- Is sufficient load connected to the boiler so that it can be fired continuously at full rating without endangering personnel or equipment?
- If the installation is a hot water boiler, have the circulating pumps been completely installed, wired and tested to assure proper operation so that the burner can be fired continuously at full rating?
- For new boiler installations, has the boiler been boiled out in accordance with the boiler manufacturer's instructions?
- Have the boiler breeching connections to the stack been completed and are they open and unobstructed?
- Is draft control equipment required and, if so, installed?
- Have adequate provisions for combustion air been installed?
- Have the persons listed below been notified of the burner start-up date?
 - Owner's Representative
 - Mechanical Contractor's Representative

- Electrical Contractor's Representative
- Service Organization's Representative
- Boiler Manufacturer's Representative
- Gas Utility Co. or Inspector

- Is all specified auxiliary equipment mounted and wired? This may include outdoor temperature controls, space thermostats, water flow switches, motorized combustion air louvers, etc.?

GAS FIRE

- Has piping into building, meter and service regulator been installed, tested and ready for service?
- Are all gas train components installed and have they been properly selected, sized and assembled?
- Have properly sized vent lines been installed on all gas train components which require venting? This includes such items as pressure regulators, normally open vent valves, diaphragm valves, low and high gas pressure switches, etc.
- Have gas train piping and components been tested and proven gas tight?

CAUTION

The burner and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig.

The burner must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig.

- Have the gas lines been purged?
- Is the proper gas pressure available at the inlet to the controls? Maximum 0.50 psig.

Figure 12

ADJUSTMENT OF PILOT GAS PRESSURE REGULATOR

DESCRIPTION:

Two types of pilot gas trains are supplied, one is a combination valve and regulator & the other is a separate valve & separate regulator.

Gas flow rate to the pilot is controlled by the regulator. The tension on the regulator spring must be adjusted to obtain the exact outlet gas pressure required at the inlet to the pilot.

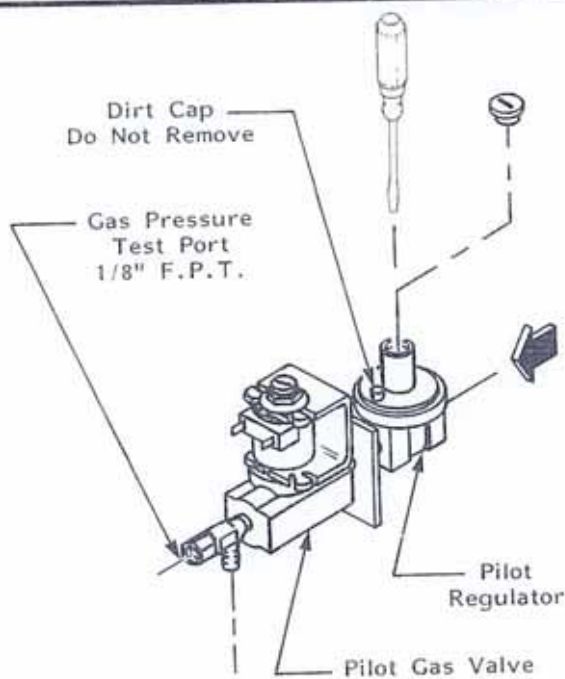
ADJUSTMENT PROCEDURE: See manufacturer's instructions for detailed procedures.

1. For initial start-up, determine set pressure as specified in Table 3, 4, 5 or 6 for appropriate firing rate and fire box pressure.
2. Remove cap from regulator to gain access to adjustment screw.
3. With screwdriver, rotate adjustment screw "clockwise" to increase or "counter clockwise" to decrease pressure.
4. Reinstall cap after adjustment.
5. Remove manometer and plug pressure port.

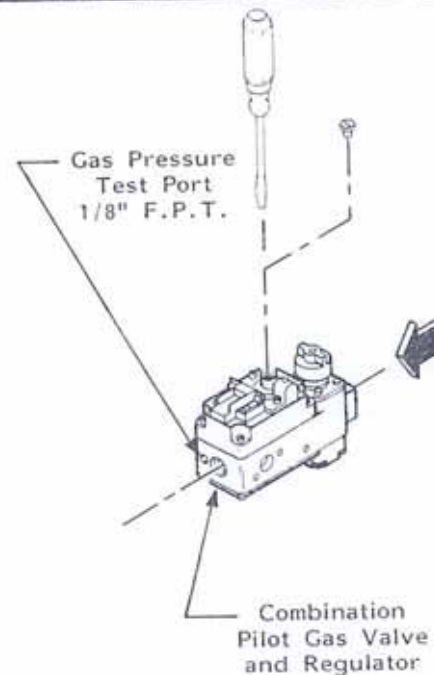
NOTE

Pressure at which gas will be delivered to the burner cannot be determined without gas flowing through the regulator. Be prepared to adjust the regulator as the burner is test fired.

SEPARATE VALVE AND REGULATOR



COMBINATION VALVE AND REGULATOR



NOTE

Pilot gas pressure should be measured with a "U" tube water manometer.

PART V

BURNER ADJUSTMENT

FACTORY ADJUSTMENTS - The burner is not adjusted at the factory and must be set to meet your firing conditions. See Table 3, 4, 5 or 6 for suggested settings. These settings are acceptable for initial start-up, however, final adjustments should be based upon carefully conducted combustion testing of O_2 , CO_2 , CO and stack temperature.

FIELD ADJUSTMENTS - Illustrations which follow show the items which are subject to adjustment. Determine the applicability of each illustration to your burner, then proceed to familiarize yourself with how the item functions. Where a setting is indicated, verify the setting or make preliminary adjustments to facilitate initial start-up.

BURNER AIR AND FUEL ADJUSTMENTS

Figure 11

ADJUSTMENT OF AIR INLET SHUTTER

DESCRIPTION:

This system uses an air shutter to control the flow of combustion air and operates in a fixed position.

G4.9

ADJUSTMENT PROCEDURE:

1. Loosen screws.
2. Turn air shutter plate clockwise to increase air flow or counter clockwise to decrease air flow.
3. Set to desired position & lock in place with the locking nut.

G4, G6 & G8

ADJUSTMENT PROCEDURE:

1. Loosen locking nut.
2. Turn air shutter plate counter clockwise to increase air flow or clockwise to decrease air flow.
3. Set to desired position and lock in place with the locking nut.

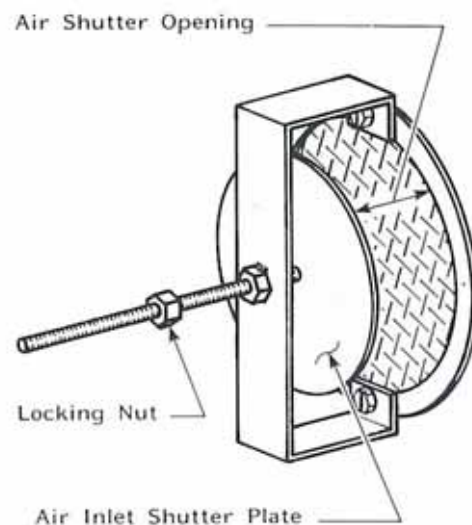
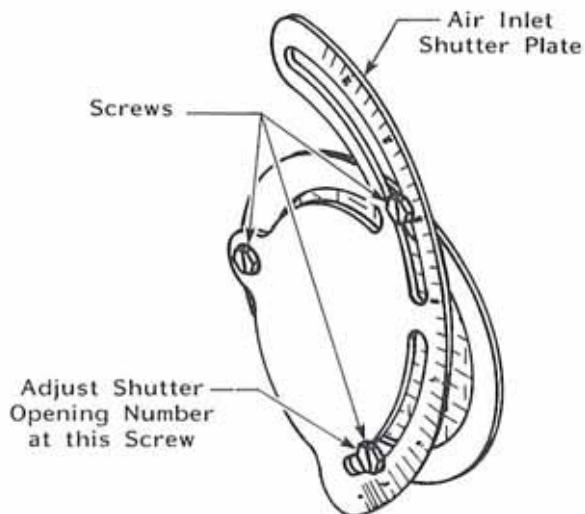


Figure 14

ADJUSTMENT OF GAS PILOT IGNITION ELECTRODE/SENSOR

DESCRIPTION:

The gas pilot ignition electrode assembly is composed of a sensor, insulator, and square ignition washer.

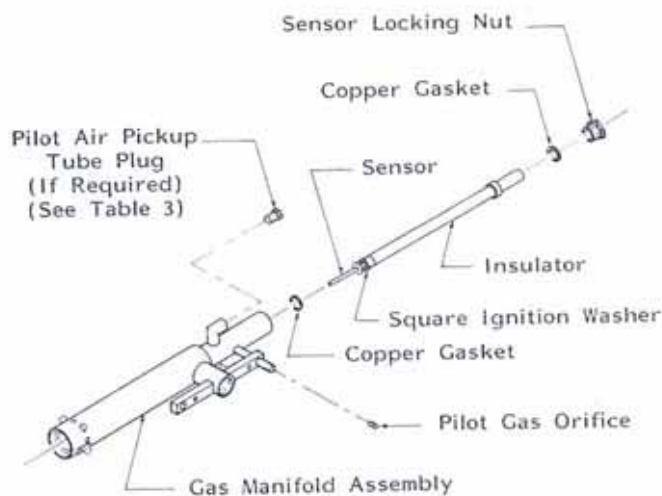
ADJUSTMENT PROCEDURE:

NOTE

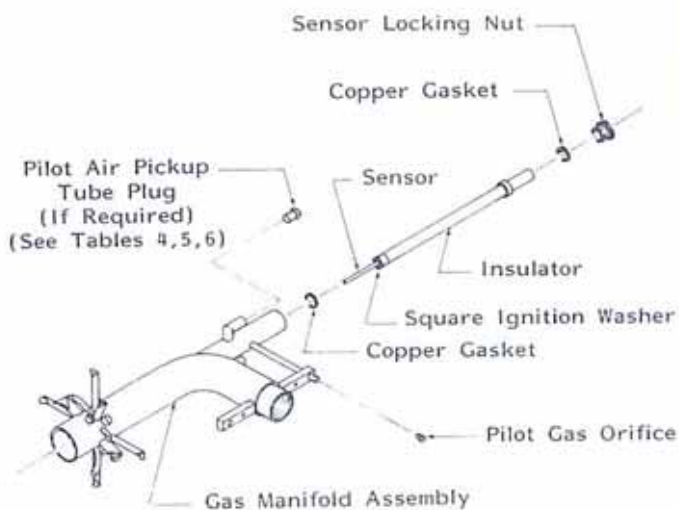
The gas pilot ignitor/sensor assembly is a vital part of the burner and must be kept clean and properly adjusted at all times.

WARNING

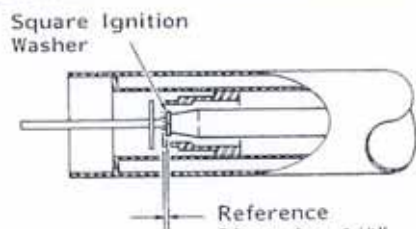
Turn off all electrical disconnects to the burner and any other equipment or systems electrically interlocked with the burner. Turn off the pilot gas cock.



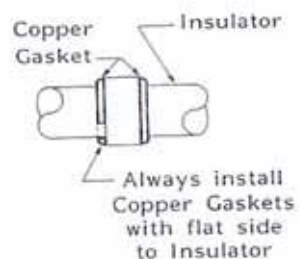
1. Remove manifold assembly from burner.
2. Inspect square ignition washer and sensor for cleanliness and proper adjustment as shown.
3. Remove ignition electrode/sensor assembly and check insulator for cleanliness and/or cracks.
4. Reinstall ignition electrode/sensor assembly and check that square ignition washer is approximately centered in pilot assembly. If not, loosen sensor locking nut and rotate assembly and tighten nut.
5. Reinstall manifold assembly in burner.



Square Ignition Washer Approximately Centered in Pilot Assembly.



G4, G4.9, G6, and G8



ADJUSTMENT OF MAIN GAS PRESSURE REGULATOR

DESCRIPTION:

Two types of main gas trains are supplied, one is a combination valve and regulator, the other is a separate valve and separate regulator.

Gas flow rate is controlled by the regulator. The tension on the regulator spring must be adjusted to obtain the exact outlet gas pressure required.

ADJUSTMENT PROCEDURE: See manufacturer's instructions for detailed procedures.

1. For initial start-up, determine set pressure as specified in Table 3, 4, 5 or 6 for appropriate firing rate & fire box pressure.
2. Connect "U" tube water manometer to 1/4" F.P.T. pressure tap of burner manual leak test valve or outlet pressure tap of combination gas valve.
3. Remove regulator adjustment screw cap.
4. With screwdriver, rotate adjustment screw "clockwise" to increase or "counterclockwise" to decrease pressure.
5. Replace regulator adjustment screw cap.
6. Disconnect manometer and plug pressure tap.

NOTE

Pressure at which gas will be delivered to the burner cannot be determined without gas flowing through the regulator. Be prepared to adjust the regulator as the burner is test fired.

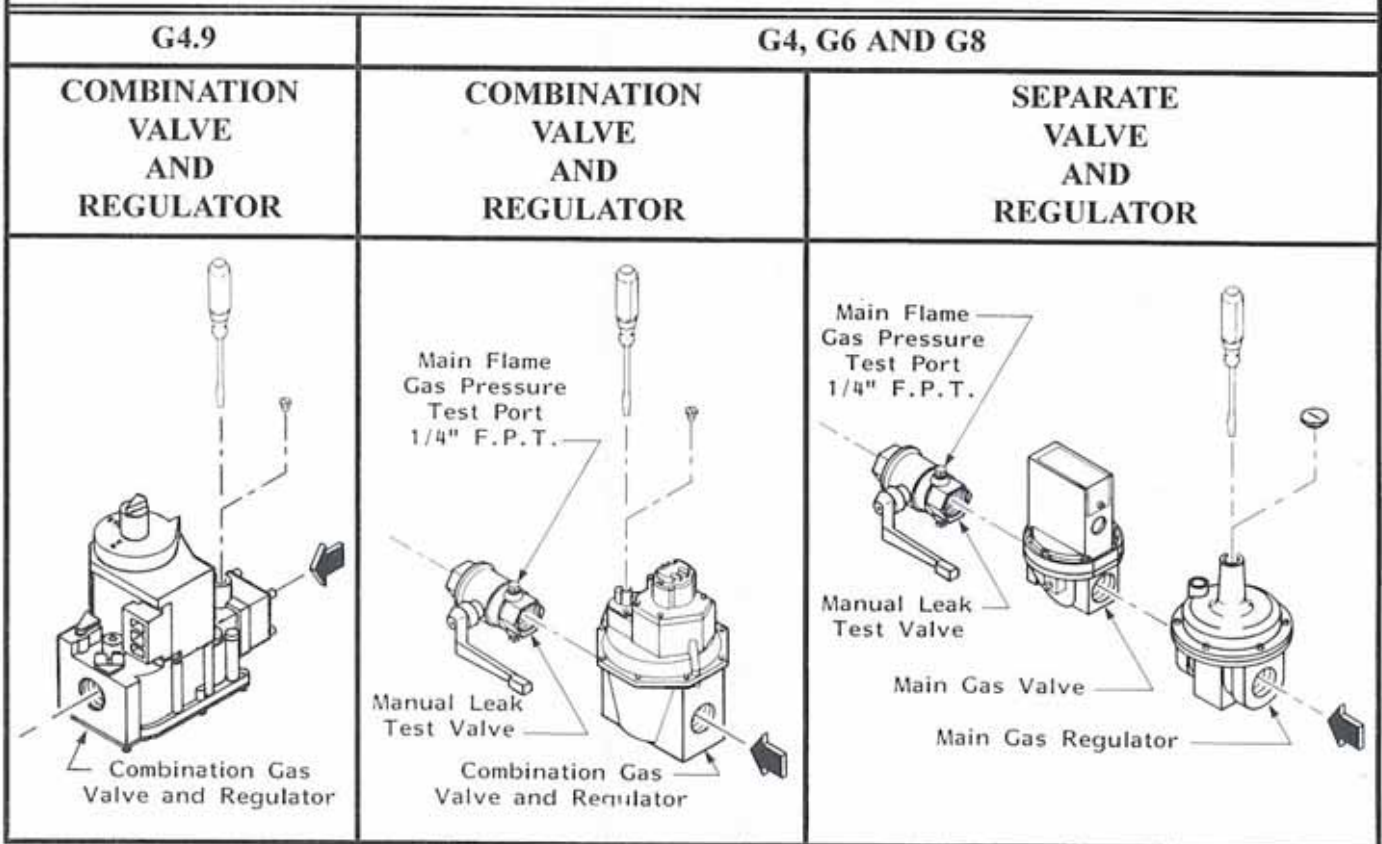


Table 3

G4.9 Table of Suggested Settings

MODEL G4.9 NATURAL GAS																									
FIREBOX PRESSURE iwc																									
MBh FIRING RATE	-.10							0							+.10							+.25			
	SHUTTER OPENING (No.)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.	NO. PILOT AIR INLET TUBES	SHUTTER OPENING (No.)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.	NO. PILOT AIR INLET TUBES	SHUTTER OPENING (No.)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.	NO. PILOT AIR INLET TUBES	SHUTTER OPENING (No.)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.	NO. PILOT AIR INLET TUBES	
AIR DIFFUSER P/N 915006-3940 3 3/4 INCHES O.D.																									
100	--	--	--	--	--	--	0	2.5	1.4	.187	.106	2	0.5	2.4	1.4	.187	.106	2	1.0	2.3	1.4	.187	.106	2	
125	1.5	2.5	1.4	.203	.106	2	2.0	2.7	1.4	.203	.106	2	3.0	2.9	1.5	.203	.106	2	4.0	3.0	1.6	.203	.106	2	
150	5.0	2.3	1.7	.250	.106	2	6.0	2.4	1.3	.250	.094	1	7.0	2.5	1.5	.250	.094	1	8.0	2.6	1.7	.250	.094	1	
175	13.0	2.8	1.4	.281	.106	1	15.0	2.9	1.6	.281	.106	1	20.0	3.0	1.4	.281	.125	1	25.0	3.1	1.5	.281	.125	1	
200	35.0	3.5	1.5	.281	.125	1	38.0	3.6	1.6	.281	.125	1	--	--	--	--	--	--	--	--	--	--	--	--	
AIR DIFFUSER P/N 915006-3930 3 5/8 INCHES O.D.																									
100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
125	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
150	1.5	2.4	1.7	.218	.094	2	2.0	2.6	1.8	.218	.094	2	3.0	2.8	1.8	.218	.094	2	4.0	3.0	1.5	.218	.106	2	
175	3.0	2.2	1.8	.250	.094	2	4.0	2.4	1.5	.250	.106	2	5.0	2.6	1.5	.250	.106	2	6.0	2.8	1.7	.250	.106	2	
200	6.0	2.8	1.7	.281	.106	2	6.5	2.9	1.7	.281	.106	2	7.0	3.0	1.7	.281	.106	2	8.0	3.1	1.5	.281	.094	1	
225	8.0	2.5	1.5	.312	.094	1	9.0	2.6	1.6	.312	.094	1	10.0	2.7	1.6	.312	.094	1	11.0	2.9	1.7	.312	.094	1	
250	14.0	3.0	1.5	.343	.106	1	15.0	3.1	1.5	.343	.106	1	17.0	3.2	1.6	.343	.106	1	20.0	3.3	1.7	.343	.106	1	
AIR DIFFUSER P/N 915006-3910 3 3/8 INCHES O.D.																									
225	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.0	2.7	1.4	.281	.094	2	
250	--	--	--	--	--	--	5.0	3.1	1.4	.281	.094	2	6.0	3.3	1.5	.281	.094	2	7.0	3.4	1.6	.281	.094	2	
275	5.0	2.7	1.4	.312	.094	2	6.0	2.8	1.5	.312	.094	2	7.0	3.0	1.5	.312	.106	2	8.0	3.2	1.5	.312	.106	2	
300	7.0	2.6	1.5	.343	.106	2	8.0	2.8	1.5	.343	.106	2	9.0	3.0	1.4	.343	.125	2	10.0	3.1	1.4	.343	.125	2	
325	8.0	3.1	1.5	.343	.106	2	9.0	3.2	1.4	.343	.125	2	10.0	3.4	1.4	.343	.125	2	11.0	3.5	1.3	.343	.094	1	
350	10.0	2.9	1.4	.390	.125	2	11.0	3.0	1.3	.390	.094	1	12.0	3.1	1.3	.390	.094	1	13.0	3.3	1.6	.390	.094	1	
375	12.0	2.7	1.3	.437	.094	1	13.0	2.8	1.6	.437	.094	1	14.0	2.9	1.8	.437	.094	1	15.0	3.0	1.5	.437	.106	1	
400	14.0	2.9	1.8	.468	.094	1	15.0	3.0	1.5	.468	.106	1	16.0	3.1	1.6	.468	.106	1	20.0	3.2	1.7	.468	.106	1	
MODEL G4.9 PROPANE GAS																									
FIREBOX PRESSURE iwc																									
MBh FIRING RATE	-.10							0							+.10							+.25			
	SHUTTER OPENING (No.)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.	NO. PILOT AIR INLET TUBES	SHUTTER OPENING (No.)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.	NO. PILOT AIR INLET TUBES	SHUTTER OPENING (No.)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.	NO. PILOT AIR INLET TUBES	SHUTTER OPENING (No.)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.	NO. PILOT AIR INLET TUBES	
AIR DIFFUSER P/N 915006-3940 3 3/4 INCHES O.D.																									
100	--	--	--	--	--	--	0	2.6	1.5	.157	.082	2	0.5	2.6	1.5	.157	.082	2	1.0	2.7	1.5	.157	.082	2	
125	1.5	2.6	1.6	.166	.082	2	2.0	2.7	1.7	.166	.082	2	3.0	2.9	2.0	.166	.082	2	4.0	3.0	2.3	.166	.082	2	
150	5.0	3.2	2.5	.187	.082	2	6.0	3.4	1.5	.187	.082	1	7.0	3.6	1.6	.187	.082	1	8.0	3.7	1.7	.187	.082	1	
175	13.0	3.0	2.1	.228	.082	1	15.0	3.2	2.2	.228	.082	1	20.0	3.4	2.4	.228	.082	1	25.0	3.5	2.6	.228	.082	1	
200	35.0	3.7	2.6	.228	.082	1	38.0	3.8	2.6	.228	.082	1	--	--	--	--	--	--	--	--	--	--	--	--	
AIR DIFFUSER P/N 915006-3930 3 5/8 INCHES O.D.																									
100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
125	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
150	1.5	2.6	1.7	.187	.070	2	2.0	2.7	2.1	.187	.070	2	3.0	2.8	2.4	.187	.070	2	4.0	2.9	1.9	.187	.082	2	
175	3.0	2.6	2.4	.203	.070	2	4.0	2.8	1.9	.203	.082	2	5.0	3.0	2.1	.203	.082	2	6.0	3.2	1.8	.203	.070	1	
200	6.0	2.7	1.8	.218	.070	1	6.5	2.8	1.8	.218	.070	1	7.0	2.9	2.0	.218	.070	1	8.0	3.0	2.2	.218	.070	1	
225	8.0	2.5	2.2	.246	.070	1	9.0	2.7	2.4	.246	.070	1	10.0	2.8	1.8	.246	.082	1	11.0	2.9	1.9	.246	.082	1	
250	14.0	2.9	2.2	.272	.082	1	15.0	3.0	2.2	.272	.082	1	17.0	3.2	2.3	.272	.082	1	20.0	3.3	2.4	.272	.082	1	
AIR DIFFUSER P/N 915006-3910 3 3/8 INCHES O.D.																									
225	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.0	3.0	2.1	.228	.070	2	
250	--	--	--	--	--	--	5.0	3.3	2.1	.228	.070	2	6.0	3.5	2.5	.228	.070	2	7.0	3.6	2.0	.228	.082	2	
275	5.0	2.7	2.1	.246	.070	2	6.0	2.8	2.5	.246	.070	2	7.0	2.9	2.0	.246	.082	2	8.0	3.0	2.2	.246	.082	2	
300	7.0	2.5	2.0	.272	.082	2	8.0	2.6	2.2	.272	.082	2	9.0	2.7	2.4	.272	.082	2	10.0	2.8	1.5	.272	.082	1	
325	8.0	3.0	2.2	.272	.082	2	9.0	3.1	2.4	.272	.082	2	10.0	3.2	1.5	.272	.082	1	11.0	3.3	1.7	.272	.082	1	
350	10.0	2.6	1.5	.312	.082	1	11.0	2.8	1.5	.312	.082	1	12.0	3.0	1.7	.312	.082	1	13.0	3.1	1.8	.312	.082	1	
375	12.0	2.7	1.7	.343	.082	1	13.0	2.9	1.7	.343	.082	1	14.0	3.0	1.8	.343	.082	1	15.0	3.1	1.9	.343	.082	1	
400	14.0	3.1	1.8	.343	.082	1	15.0	3.2	1.9	.343	.082	1	16.0	3.3	1.9	.343	.082	1	20.0	3.4	2.1	.343	.082	1	

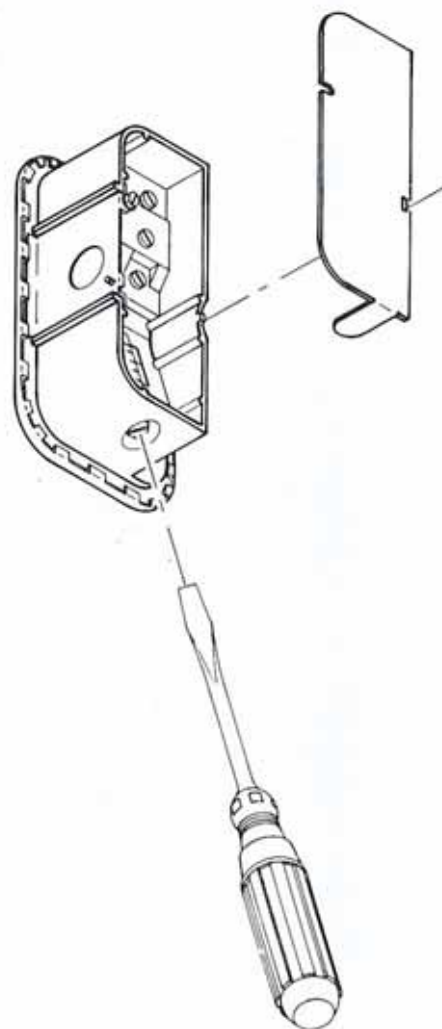
NOTE See Notes on Page 25

ADJUSTMENT OF AIR FLOW SWITCH**DESCRIPTION:**

The air flow switch is used to prove the flow of combustion air from the blower assembly. It causes the fuel valve to close or fail to open upon loss of or inadequate combustion air.

ADJUSTMENT PROCEDURE:

1. Switches should be set to break (open) when combustion air is substantially reduced.
2. If applicable, remove cover to adjusting screw.
3. Turn adjusting screw clockwise to increase set point or counterclockwise to decrease set point.



MODEL G4 NATURAL GAS																													
MBh FIRING RATE		FIREBOX PRESSURE iwc																											
		-.10						0						+.25						+.50				+.75					
		SHUTTER OPENING (inches)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.	SHUTTER OPENING (inches)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.	SHUTTER OPENING (inches)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.	SHUTTER OPENING (inches)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.	SHUTTER OPENING (inches)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.			
AIR DIFFUSER												P/N 915006-3900						3 1/4 INCHES O.D.											
400	3/16	2.4	2.2	1/2	.094	3/16	2.5	2.2	1/2	.094	1/4	2.8	2.4	1/2	.094	1/4	2.8	2.4	1/2	.094	..	..	..	..	..
450	3/16	3.0	2.2	1/2	.094	1/4	3.0	2.4	1/2	.094	5/16	3.0	2.5	1/2	.094	3/8	3.0	2.7	1/2	.094	..	..	..	..	..
500	5/16	3.3	2.5	1/2	.094	1/2	3.0	2.5	OT	.106	1/2	2.9	2.5	OT	.106	5/8	2.9	2.6	OT	.106	..	..	..	..	..
550	5/8	3.0	2.6	OT	.106	13/16	3.2	2.8	OT	.106	1.0	3.4	2.4	OT	.125	1 1/2	3.6	2.5	OT	.125	..	..	..	..	..
600	1 1/2	3.7	2.5	OT	.125	1 1/2	3.6	2.6	OT	.125	..	..	..	..	..	..	..	..	..	..	..	..	..	..

G6 Table of Suggested Settings

Table 5

MODEL G6 NATURAL GAS																													
MBh FIRING RATE		FIREBOX PRESSURE iwc																											
		-.10						0						+.25						+.50				+.75					
		SHUTTER OPENING (inches)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.	SHUTTER OPENING (inches)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.	SHUTTER OPENING (inches)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.	SHUTTER OPENING (inches)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.	SHUTTER OPENING (inches)	MANIFOLD GAS PRESSURE iwc	PILOT GAS PRESSURE iwc	MAIN GAS ORIFICE I.D.	PILOT GAS ORIFICE I.D.			
AIR DIFFUSER												P/N 915006-4000						5 13/16 INCHES O.D.											
500	..	..	..	..	..	5/16	3.5	2.4	5/8	.106	7/16	3.8	2.5	5/8	.106	1/2	2.9	2.5	13/16	.106	11/16	3.3	2.5	13/16	.106
550	3/8	3.7	2.4	5/8	.106	1/2	3.3	2.5	13/16	.106	11/16	3.3	2.6	13/16	.106	13/16	3.4	2.5	13/16	.106	..	..	..	..	..
600	5/8	3.3	2.5	13/16	.106	1 1/8	3.9	3.0	13/16	.106	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
650	1 1/8	3.7	3.0	13/16	.106	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
AIR DIFFUSER												P/N 915006-0406						5 9/16 INCHES O.D.											
600	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5/16	3.7	2.3	5/8	.094	3/8	2.2	2.5	OT	.094
650	..	..	..	..	..	5/16	3.7	2.8	5/8	.094	3/8	2.3	2.5	OT	.094	7/16	2.5	2.6	OT	.094	1/2	2.7	2.7	OT	.094
700	3/8	2.3	2.5	OT	.094	7/16	2.3	2.6	OT	.094	1/2	2.6	2.7	OT	.094	5/8	2.8	2.2	OT	.106	13/16	3.1	2.4	OT	.106				
750	1/2	2.5	2.7	OT	.094	1/2	2.6	2.7	OT	.094	11/16	3.0	2.3	OT	.106	7/8	3.2	2.4	OT	.106	1 3/8	3.5	2.5	OT	.106				
800	5/8	2.8	2.2	OT	.106	11/16	3.0	2.3	OT	.106	13/16	3.4	2.7	OT	.106	1 7/16	3.6	2.6	OT	.106	..	..	..	..	..
850	13/16	3.2	2.5	OT	.106	1 3/8	3.5	2.5	OT	.106	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
900	2 1/16	4.3	2.8	OT	.106	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
AIR DIFFUSER												P/N 915006-0404						5 5/16 INCHES O.D.											
700	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1/2	3.1	3.0	13/16	.081
750	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7/16	3.1	2.7	13/16	.081	11/16	2.4	2.6	OT	.094
800	..	..	..	..	..	3/8	2.9	2.6	13/16	.081	1/2	3.2	3.0	13/16	.081	5/8	3.5	2.5	13/16	.094	3/4	2.7	2.7	OT	.094
850	7/16	3.2	2.7	13/16	.081	1/2	3.4	3.0	13/16	.081	5/8	3.7	2.5	13/16	.094	3/4	2.8	2.7	OT	.094	7/8	3.0	2.9	OT	.094				
900	9/16	3.6	2.4	13/16	.094	5/8	3.9	2.5	13/16	.094	3/4	2.8	2.7	OT	.094	1.0	3.2	2.3	OT	.106	1 1/4	3.4	2.6	OT	.106				
950	11/16	2.8	2.6	OT	.094	13/16	2.9	2.7	OT	.094	15/16	3.1	2.9	OT	.094	1 7/16	3.5	2.8	OT	.106	1 15/16	3.7	3.0	OT	.106				
1000	7/8	3.1	2.9	OT	.094	15/16	3.2	2.9	OT	.094	1 3/8	3.5	2.7	OT	.106	2 1/16	3.9	3.1	OT	.106	..	..	..	..	..
1050	1 1/8	3.4	2.5	OT	.106	1 3/8	3.6	2.7	OT	.106	2 1/16	3.9	3.1	OT	.106	..	..	..	..	..	..	..	..	..	..
1100	1 9/16	3.7	2.8	OT	.106	2 1/16	3.9	3.1	OT	.106	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1150	2.0	4.0	3.0	OT	.106	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Top pilot air inlet uses plug P/N 230610-0001 and bottom inlet Open Tube.

NOTE

1. Maximum capacities and air shutter settings are based on 2,000 ft. altitude and 1,000 BTU per cubic foot natural gas at .60 sp. gravity /2500 BTU/cu. ft., 1.55 sp. gravity propane gas.
2. Burner models are suffixed with G for Gas, 03 for 1/3 hp motors, flame safeguard model/ignition module, and gas system. Example: G4-G-03-S8660D-B
3. Pilot gas pressure measured at outlet of pilot valve.
4. Dimensions and pressures given in above table are for reference only. Actual settings must be determined at time of burner start-up by fully trained and qualified personnel.

ABBREVIATIONS: iwc = Inches Water Column, O.T. = Open Tube, NA = Not Applicable.

START-UP



Gas piping must be checked for leaks prior to startup. See Page 19, Gas Fire.

1. With the operating control set to on and all manual gas valves closed, turn control switch on observe prepurge and ignition spark. Allow flame safeguard control to proceed to a safety lockout, thereby checking the control for flame failure. NOTE: Burner fan will not shutoff, must turn control switch off and wait one (1) minute for control to reset.
2. Turn pilot gas cock on and turn control switch on. With pilot running, set pilot pressure in accordance with firing rate in table of suggested settings and visually inspect pilot flame.
3. Turn manual gas shutoff valve ON. If supplied, establish main flame by manually opening the leak test cock. If not supplied, let automatic gas valve establish main flame with normal operation. Visually inspect main gas flame. Set manifold gas pressure to that shown on material list or that shown for your firing rate in the table of suggested settings. Check gas piping for leaks. Clock the firing rate of the burner with the gas utility company meter and adjust burner pressure regulator, if necessary, to obtain rated capacity.
4. Adjust combustion air inlet louver to obtain 8 1/2% to 9 1/2% carbon dioxide (CO₂) on natural gas or 10% to 11% carbon dioxide (CO₂) on propane gas without forming carbon monoxide (CO).



Do not adjust flame visibly. Instruments are the only safe and reliable means to determine the proper adjustments.

BURNER SAFETY CHECK

1. Start and stop burner several times to insure proper operation.
2. Check operation of combustion safeguard control by simulating a flame failure, making certain the burner locks out on safety within the proper time limit. See flame safeguard/ignition module instructions for procedure.
3. Check operation of the air flow switch, making certain fuel valve closes when the air flow diaphragm switch opens. Adjust per Figure 15.
4. Set the high limit control 2 to 3 psi or 10 degrees F. to 15 degrees F. higher than the desired operating pressure or temperature. Set the operating control pressure or temperature higher than the high limit control for this test. Permit burner to run until desired HIGH LIMIT pressure or temperature is indicated and then adjust high limit control, if necessary, to shut off the burner at the desired high limit pressure or temperature.
5. Reset operating control to desired pressure or temperature. Permit burner to run until it is shut off by the operating control. Adjust operating control, if necessary until it causes burner to stop and start within desired range.
6. With the burner running, open the blow-down valve on the low water cutoff (if used). The burner should shut off immediately. The burner should restart automatically when the proper level of water in the low water cutoff is reestablished.
7. Conduct minimum pilot turn down test, reduce gas pressure to pilot with manual shutoff cock to the point pilot flame is extinguished or fails to prove. Increase gas flow slightly, main flame must be ignited with this pilot flame.
8. The following readings should be taken and recorded after final adjustments have been made.

PART VI

BURNER START-UP

CAUTION

Burner start-up, adjustment and service must be done by fully trained and qualified personnel.

A representative of the owner or the operator of the equipment should be present to receive instruction in care and adjustment of the unit. Upon completion of the initial start-up, he should sign the start-up form acknowledging that instruction has been received and a date established for start of free service period, if provided.

Proper combustion adjustments involve setting the fuel input rate and the combustion air to achieve maximum practical efficiency. The gas input is adjusted by regulating the main gas pressure regulator (Fig. 13).

The operator should become familiar with the location and purpose of all controls covering the burner's operation. Schematic wiring diagrams and identification photographs in this manual show the most important valves, instruments and electrical controls which regulate the burner operation.

CAUTION

Examine the material list, wiring diagram and other information supplied with your burner.

BEFORE START-UP

1. **VOLTAGE CHECK - 115 VOLT MOTOR & 120 VOLT CONTROLS** - With burner control switch OFF turn on burner power at disconnect switch or breaker. Check voltage with meter between terminals 1 and 2. If voltage is not within +10% -15% of 120 volts, contact local utility.

2. **CALL FOR HEAT** - Operating and limit controls must be calling for burner operation. These controls may include the low water cut-off, steam pressure or hot water temperature controls, end switch on automatic draft control, combustion air damper switch and other remote switches or controls, if used.
3. **PURGE GAS LINE** -

CAUTION

Purging of gas lines must be done in accordance with American National Standard, ANSI Z223.1.

4. **LUBRICATION** - If blower motor is equipped with lubrication devices, add (2) drops of SAE20 lubricating oil to each bearing.
5. **AIR INLET SHUTTER** - Adjust air inlet shutter to position indicated in Table 3, 4, 5 or 6 for firing rate of your burner.

NOTE

In order to determine which table of settings applies to your burner, you must know the burner model, firing rate, air diffuser part number, which can be obtained from the order entry form and material list, and firebox pressure. If the firebox pressure is unknown an approximate value can be obtained by measuring the firebox pressure during the burner prepurge cycle, with a "U" tube water manometer.

PART VII

BURNER MAINTENANCE and TROUBLE SHOOTING

Frequency of maintenance depends on the condition of the heating plant area. For dusty or adverse conditions, preventive maintenance should be performed once a month, or as often as necessary for proper burner operation. **PREVENTIVE AND**

YEARLY MAINTENANCE can be performed by building maintenance personnel. **ALL SERVICE AND ADJUSTMENT OF THE BURNER SHOULD BE PERFORMED ONLY BY QUALIFIED BURNER SERVICE PERSONNEL.**

CAUTION

Always turn electrical power and gas fuel supply OFF before undertaking any maintenance that does not require the burner to be in operation.

FLAME SENSOR CIRCUIT

The S8660/S8670 provides ac power to the igniter/sensor which the burner flame rectifies to direct current. If the flame signal back to the S8660/S8670 is less than $1.5 \mu\text{A}$ dc, the system will lock out.

The output of the flame sensing circuit cannot be checked directly on the S8660/S8670. Check the flame sensing circuit indirectly by checking the flame sensing current from the sensor to the S8660/S8670 as follows.

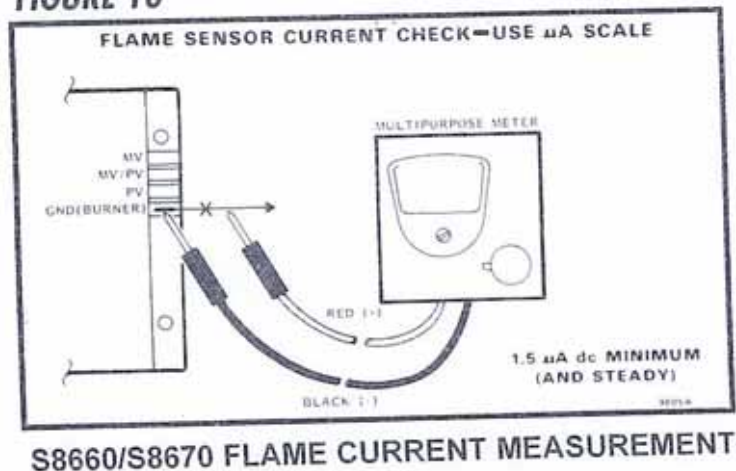
1. Connect a meter (dc microammeter scale) in series with the flame signal ground wire as

shown in Fig. 16. Use the Honeywell W136A Test Meter or equivalent. Disconnect the ground wire at the S8660/S8670. Connect the red (positive) meter lead to the free end of the ground wire. Connect the black (negative) meter lead to the quick-connect ground terminal on the S8660/S8670.

2. Restart the system and read the meter. The flame sensor current must be at least $1.5 \mu\text{A}$ and steady. If the reading is less than $1.5 \mu\text{A}$ or unsteady, check the burner flame and flame sensor location and electrical connections, adjust pilot flame to achieve desired flame signal.

If a flame is present at sensor and a reading of $0 \mu\text{A}$ is obtained, check for a secondary ground connection to the 25 V (GND) terminal. If secondary connection exists, temporarily remove connection and measure flame current.

FIGURE 16



- A. Burner input (CFH Gas)
- B. Percent CO₂ or O₂
- C. CO indication
- D. Stack Temperature
- E. Firebox Pressure (iwc)
- F. Fuel Pressure (iwc - Gas) (main and pilot)
- G. Voltage to burner

9. Give instruction to owner (operator).

WARNING

"Should overheating occur: (1) Shut off the manual gas control(s) to the burner, (2) Do Not shut off the control switch to the pump or blower."

PERIODIC TESTING RECOMMENDED CHECK LIST

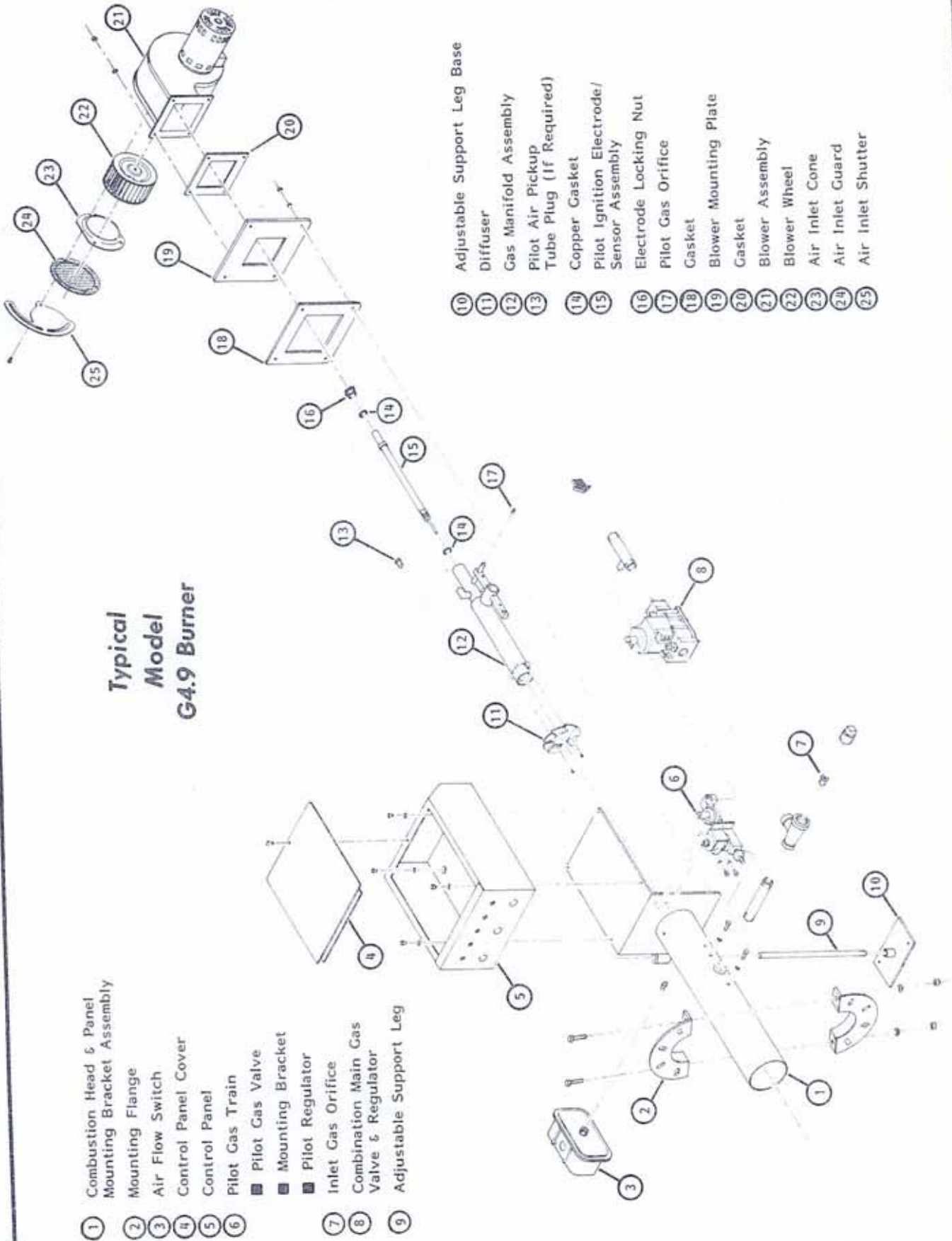
ITEM	FREQUENCY	ACCOMPLISHED	REMARKS
Low-water fuel cutoff and alarm	Daily/Weekly Semiannually	Operator Operator	Refer to instructions Perform a slow drain test in accordance with ASME Boiler and Pressure Vessel Code Section VI
High limit safety control	Annually	Service Technician	Refer to instructions
Operating control	Annually	Service technician	Refer to instructions
Low draft, fan, air pressure, and damper position interlocks	Monthly	Operator	Refer to instructions
Atomizing air/steam interlock	Annually	Service technician	Refer to instructions
High and low gas pressure interlocks	Monthly	Operator	Refer to instructions
High and low oil pressure interlocks	Monthly	Operator	Refer to instructions
High and low oil temperature interlocks	Monthly	Operator	Refer to instructions
Fuel valve interlock switch	Annually	Service technician	Refer to instructions
Purge switch	Annually	Service technician	Refer to instructions
Burner position interlock	Annually	Service technician	Refer to instructions
Low fire start interlock	Annually	Service technician	Refer to instructions
Automatic changeover control (dual fuel)	At least annually	Service technician	Under supervision of gas utility
Safety valves	As required	Operator	In accordance with procedure in Section VI, ASME Boiler and Pressure Vessel Code, Recommended Rules for Care and Operation of Heating Boilers
Inspect burner components	Semiannually	Service technician	Refer to instructions
Clean burner fan	Annually or as required	Operator	Remove buildup on fan blades

PERIODIC TESTING RECOMMENDED CHECK LIST

ITEM	FREQUENCY	ACCOMPLISHED	REMARKS
Check burner and boiler control linkage	Daily	Operator	Make visual inspection
Check fuel system for leaks	Daily	Operator	Make inspection visually and with leak detection instrumentation
Gauges, monitors and indicators	Daily	Operator	Make visual inspection and record readings in log
Oil pump inlet vacuum	Daily	Operator	Make visual inspection and record readings in log
Oil pressure at pump, burner, and/or regulating valve	Daily	Operator	Make visual inspection and record readings in log
Instrument and equipment settings	Daily	Operator	Make visual check against recommended specifications
Check burner flame	Daily	Operator	Visual inspection for changes
Firing rate control	Weekly Semiannually Annually	Operator Service technician Service technician	Verify factory settings Verify factory settings Check with combustion test
Stack temperature	Daily	Operator	Record in log
Flue, vent, stack or outlet dampers	Monthly	Operator	Make visual inspection of linkage, check for proper operation
Igniter	Weekly	Operator	Make visual inspection, check flame signal strength if meterfitted (see "Combustion safety controls")
Oil nozzle(s) and Strainers	Semiannually	Operator	Check for dirt and wear
Fuel Valves			
Pilot and main	Weekly	Operator	Open limit switch - make aural and visual check - check valve position indicators and check fuel meters if so fitted
Pilot and main gas or main oil	Annually	Service technician	Perform leakage tests - refer to instructions
Combustion safety controls			
Flame failure	Weekly	Operator	Close manual fuel supply for (1) pilot, (2) main fuel cock, and/or valve(s); check safety shutdown timing; log
Flame signal strength	Weekly	Operator	If flame signal meter installed, read and log; for both pilot and main flames, notify service organization if readings are very high, very low, or fluctuating; refer to instructions
Pilot turndown tests	As required/annually	Service technician	Required after any adjustments to flame scanner mount or pilot burner verify annually- refer to instructions
Refractory hold in	As required/annually	Service technician	See "Pilot turndown tests"

FIGURE 17

Typical Model G4.9 Burner



TROUBLE	PROBABLE CAUSE	ACTION
Blower Motor does not operate when switch is closed.	Power disconnected	Check voltage between terminals 1 & 2. If no voltage, check power supply, 120 volt, 60 hertz.
	Operating control not calling for heat or high limit control open.	Check voltage between terminals 2 & 3, 2 & 4 or T2 & 2. If no voltage, check for open operating, limit control or thermostat.
	Overload tripped out on motor.	Reset. Check motor current for possible overload.
	Defective motor.	If voltage at motor terminals is correct, replace motor.
Motor runs but ignition spark does not occur.	Air flow switch fails to make.	Adjust per instruction manual. See Figure 15.
	Ignition cable or electrode loose or grounded.	Check to insure that ignition cable is securely plugged into electrode. Check cable and clean if necessary. Remove and check electrode insulator for cracks.
	Low voltage control Transformer defective	Check for 24 volts on flame safeguard/ignition module. Replace transformer if required.
	Defective flame safeguard-ignition module	Replace flame safeguard/ ignition module.
Motor runs, ignition spark occurs, but gas pilot does not ignite	No gas being supplied to pilot.	Check all manual gas valves leading to burner to insure that they are open or that separate manual pilot valve is open. Pilot orifice plugged, clean.
	Pilot gas valve does not open.	Check for 24 volt to coil on trial for ignition. Check valve action by sound and feel. Replace coil or valve body as needed. If no voltage to coil, replace the flame safeguard control.
	Improper pilot air supply - Should be between .25 to .40 iwc on pilot line during prepurge.	Adjust air shutter / Check pilot air inlet tubes.
Motor runs, gas pilot establishes, pilot flame does not prove	Improper gas flow	Increase or decrease gas pressure to pilot.
	Flame sensor dirty/scaled.	Clean/descale or replace sensor rod.
	Defective flame safeguard-ignition module.	Replace module.
<p>NOTE</p> <p>Failure to prove pilot by indication of fuel on light within 2 seconds may indicate poor flame signal.</p> <p>See Ignition Module manual for instructions or See Flame Sensor Circuit section.</p>	Manual valve(s) not in proper position.	Turn to On or Open position.
	Main Gas Valve does not open.	Check for 24 volt to coil of main gas valve. Check valve action by sound and feel. Replace coil or valve body as needed. If no voltage to coil, replace the flame safeguard module.
	Excessive air to fuel ratio.	If gas flow rate is less than 50% of rated capacity, increase gas pressure or decrease air inlet shutter.
	Manifold gas pressure low.	Adjust pressure regulator to value shown on burner material list or Table 3, 4, 5 or 6. Inlet pressure to combination gas control or main shutoff cock too low. If it is , consult your local gas utility company.
	Incorrect gas inlet orifice size	See material list or Table 3, 4, 5 or 6 for proper size.
Lockout on flame failure.	Interrupted fuel supply.	Establish fuel supply to burner.
	Improper combustion.	Adjust burner to obtain a clean flame.
	Weak flame signal.	Refer to flame safeguard control manufacturer's bulletin. Adjust pilot if necessary.
Carbon Monoxide (CO) formation	Flame impingement on cold surface due to excessive firing rate.	Check gas flow rate. Adjust flow rate, if necessary. Check gas orifice size versus burner material list.
Check CO with reliable instrument. Be certain to check for CO before leaving burner location.	Flame impingement on a cold surface due to undersized chamber.	See Specification Table.
	Insufficient combustion air.	Increase air shutter opening or decrease gas pressure.

PART VIII SUPPLEMENTARY DATA

This manual should be kept with other literature on your boiler room equipment as a complete reference source for maintenance and service.