G14 SERIES UNITS

I–INTRODUCTION

The G14 unit is a condensing furnace utilizing the pulse combustion process. Initially, combustion takes place in an enclosed chamber. Then, as combustion products pass through the heat exchange system into a coil, the latent heat of combustion is extracted and water is condensed from the exhaust gas.

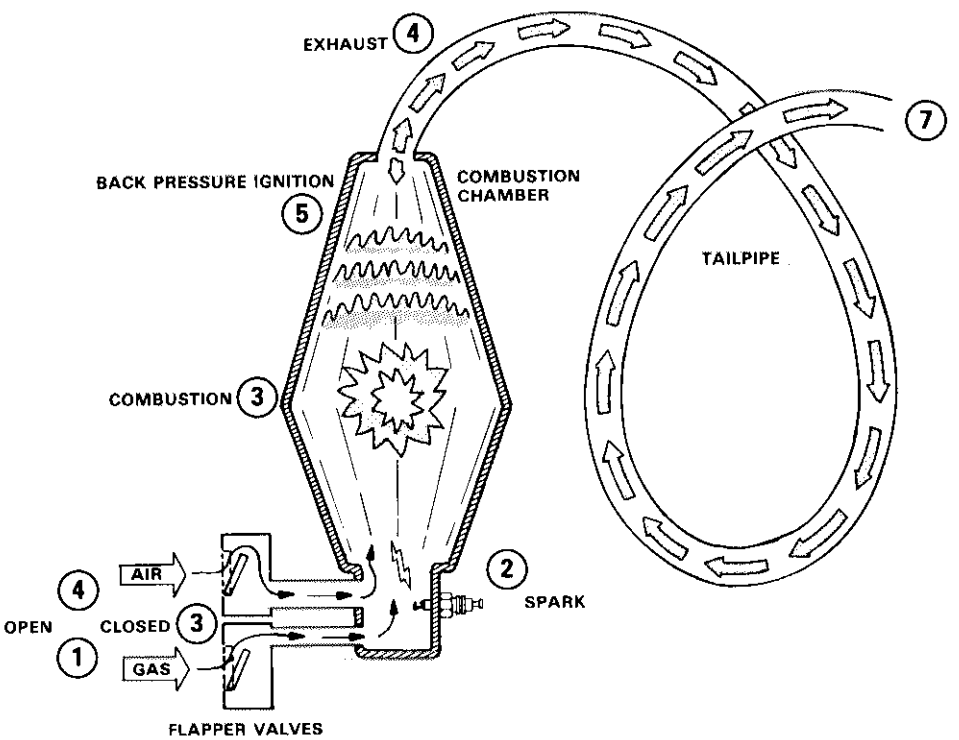
The unit uses a redundant gas valve to assure safety shut–off as required by A.G.A.

Electronic direct spark ignition control is used to initiate combustion. A flame rectification sensor in the control verifies ignition with a protection circuit that permits five trials for ignition before locking out the gas valve and control circuit. The sensor also verifies loss of combustion during a cycle, closing the gas valve and locking out the system. Obstructions to the differential pressure switch or the air intake vacuum switch and the exhaust outlet also shut down the unit immediately.

A small blower is used to purge the combustion chamber before and after each heating cycle to provide proper air mixture for start–up.

The units are manufactured for natural gas application. L.P. kits, for A.G.A units, are available for field changeover.

PULSE COMBUSTION PROCESS



1– Gas and air enter and mix in combustion chamber.

2– To start the cycle a spark is used to ignite the gas and air mixture (This is one "pulse").

3– Positive pressure from combustion closes flapper valves and forces exhaust gases down a tail pipe.

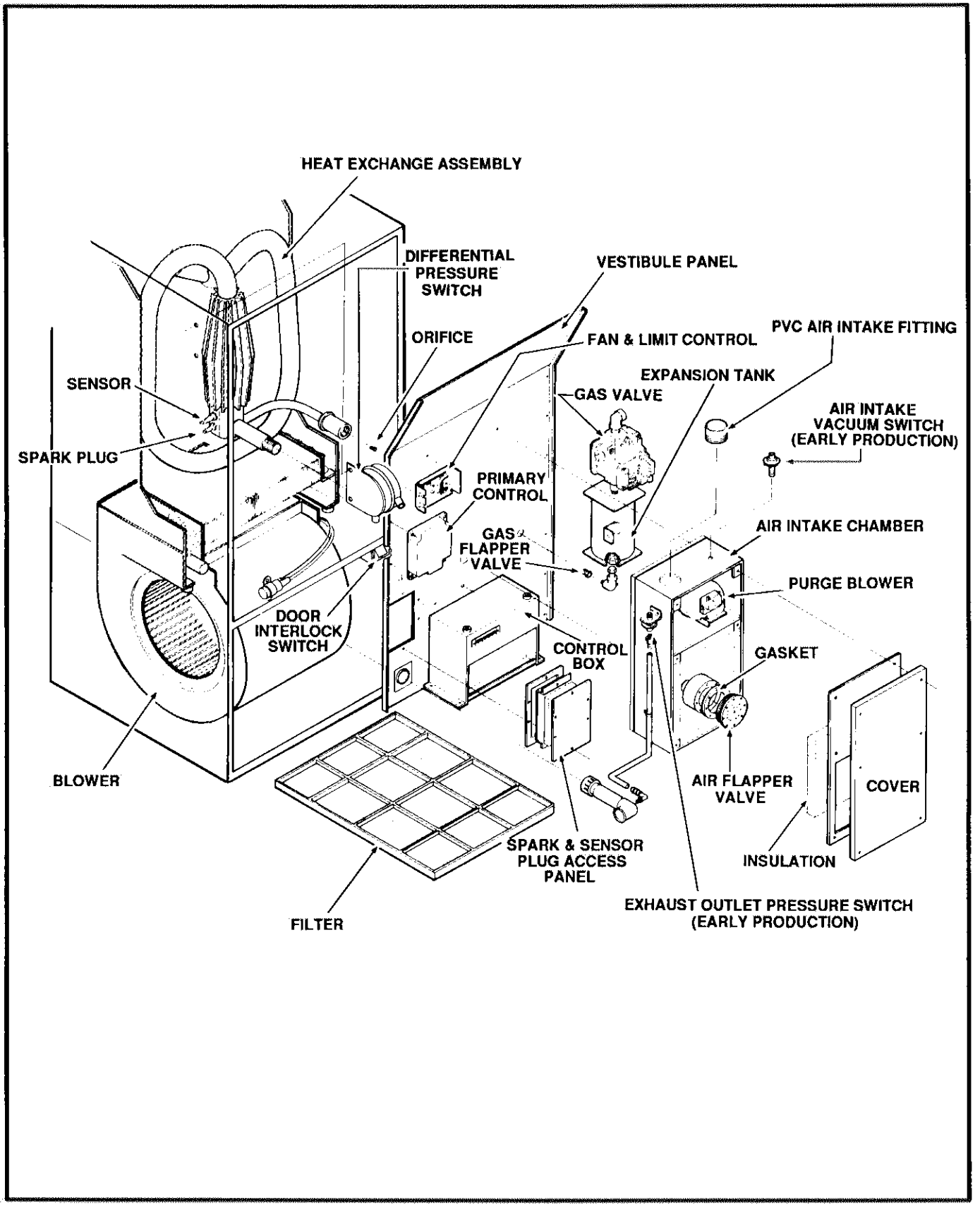
4– Exhaust gases leaving the chamber create a negative pressure. This opens the flapper valve drawing in gas and air.

5– At the same instant, part of the pulse is reflected back from the tail pipe causing the new gas and air mixture to ignite. No spark is needed. (This is another "pulse").

6– Steps 4 and 5 repeat 60 to 70 times per second forming consecutive "pulses" of 1/4 to 1/2 Btuh each.

7– Latent heat is removed from combustion products and condensate (water) is formed in the condensate coil.

II–PARTS ARRANGEMENT



SPECIFICATIONS

Model No.		G14Q3–40	G14Q3–60	G14Q4–60	G14Q3–80	G14Q4–80	G14Q5–80	G14Q3–100	G14Q4/5–100
Input Btuh		40,000	60,000	60,000	80,000	80,000	80,000	100,000	100,000
Output Btuh		38,000	55,000	55,000	74,000	74,000	74,000	93,000	95,000
A.F.U.E.		97.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	95.0%
California Seasonal Efficiency		90.0%	87.2%	85.6%	87.3%	86.4%	86.6%	87.9%	88.0%
High static A.G.A. (in. wg.)		.50	.50	.50	.50	.50	.50	.50	.50
High Static C.G.A. in. wg. (Pa)		.50(124)	50(124)	.50(124)	.50(124)	.50(124)	—	.50(124)	.50(124)
C.G.A. certified efficiency		98.0%	94.0%	94.0%	94.0%	94.0%	—	95.0%	95.0%
Temperature rise range (°F)		35–65	40–70	35–65	45–75	40–70	35–65	55–85	40–70
Air Volume Range (cfm)		805–1585	805–1585	1012–1793	805–1585	1012–1793	1345–2460	1140–1850	1350–2450
Vent/Intake air size (in.)*		2	2	2	2	2	2	2	2
Gas piping size I.P.S.(in.)	Natural	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
	LPG**	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
Condensate drain connection SDR11		1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
Blower wheel nom. diam. x width (in.)		10 X 8	10 X 8	11 X 9	10 X 8	11 X 9	12 X 12	10 X 8	12 X 12
Blower motor hp		1/3	1/3	1/2	1/3	1/2	3/4	1/2	3/4
Size of filters (in.) 1 Per Unit		16X25X1	16X25X1	16X25X1	16X25X1	16X25X1	20X25X1	20X25X1	20X25X1
Tons of cooling (Add-on)		1–1/2 — 3	1–1/2 — 3	2–1/2 — 4	2 — 3	2–1/2 — 4	4 or 5	2 — 3	3–1/2 — 5
LPG kit (optional A.G.A. only)		LB–57973CA	LB–57973CB	LB–57973CB	LB–57973CC	LB–57973CC	LB–57973CC	LB–51702CC	LB–51702CC
Electrical characteristics		120 volts— 60 hertz — 1 phase (All Units)							

*For Vent/Intake air size see table 4 on page 18.
**For A.G.A. LPG units, a field changeover kit is required and must be ordered extra.

III–SPECIFICATIONS & DIMENSIONS

The G14 unit input range covers 40,000 through 100,000 Btuh. See specifications table.

The G14–40/60/80 models use the same cabinet size as the existing G12–110 furnace line. The G14–100 model uses the same cabinet size as the G12–137 unit. All units in the G14 series use direct drive blowers and accept cooling coils in nominal tonnages up to 5 tons for the –100. Consult the Engineering Handbook for proper sizing.

Slab filters are used for either bottom or side return air in all unit sizes.

IV–UNIT COMPONENTS

A–Control Box (Figure 1)

The control box is located below the air intake chamber and is designed to open over the exhaust PVC line when the unit is set up for right–hand discharge of exhaust.

1– Low Voltage Terminal Strip

A low voltage terminal strip with thermostat markings is located outside the control box.

2– Control Transformer

A transformer located inside the control box provides power to the low voltage section of the unit. Transformers on all models are rated at 30VA with a 120V primary and a 24V secondary.

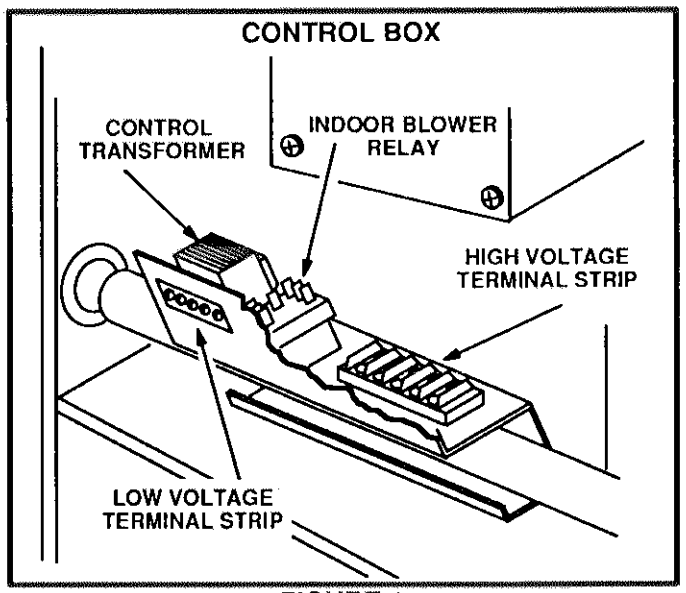


FIGURE 1

3– Indoor Blower Relay

A double–pole, double–throw indoor blower relay is located inside the control box to provide power to the blower. The relay contacts also control the 120VA accessory terminal located on the high voltage terminal strip.

4– Power Supply and Accessory Terminal Strip

Line voltage is routed to the unit through a power supply terminal strip located inside the control box. Also, a 120VA accessory terminal strip is located on the power supply terminal.

B–Fan/Limit Control (Figure 2)

G14 units use a Honeywell fan/limit control with a sure start heater. The heater is energized with the gas valve to close the fan contacts after 30 to 45 seconds. The fan "off" setting is factory adjusted to 90°F. It should not be necessary to change this setting.

NOTE–Fan "off" settings above 90° F will cause the blower to recycle frequently (after a heating cycle) due to residual heat in the heat exchange assembly.

Do not change the limit factory setting. It is fixed in position for a maximum discharge air of 175°F. This is a safety shut down function. The limit will automatically reset when the temperature inside the heat exchange housing drops below the temperature listed above.

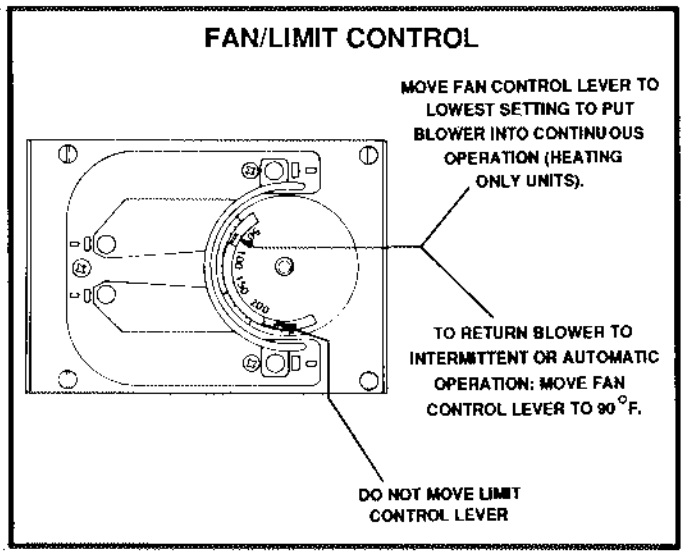


FIGURE 2

C–Ignition Control

An electronic direct spark ignition control with flame rectification sensing is used on all G14 units. The first production units (1981–1982) use ignition controls manufactured by Gas Energy and Watsco (formerly Prestolite). The Gas Energy and the Lennox–built GC–1 ignition control are used in later production units.

DANGER – SHOCK HAZARD. SPARK RELATED COMPONENTS CONTAIN HIGH VOLTAGE. DISCONNECT POWER BEFORE SERVICING. THE IGNITION CONTROL IS NOT FIELD REPAIRABLE. UNSAFE OPERATION MAY RESULT.

The Gas Energy and Lennox GC–1 ignition controls are fully interchangeable. The Watsco is interchangable with all units except G14–100/130. The wiring harness has a six prong plug (identified as JP1) that mates to a jack connected to the control. The Gas Energy control is equipped with an interconnecting harness to mate with unit harness. If a replacement control is needed, the Gas Energy control is available through Lennox Repair Parts.

1– Watsco Control (Figure 3)

The Watsco control is illustrated in Figure 3. The unit wiring harness plugs directly into the jack at the lower right–hand corner of the control. Each of the six jack terminals are identified by number and function. The spark and sensor wire connections are made to quick connect terminals on the control as shown.

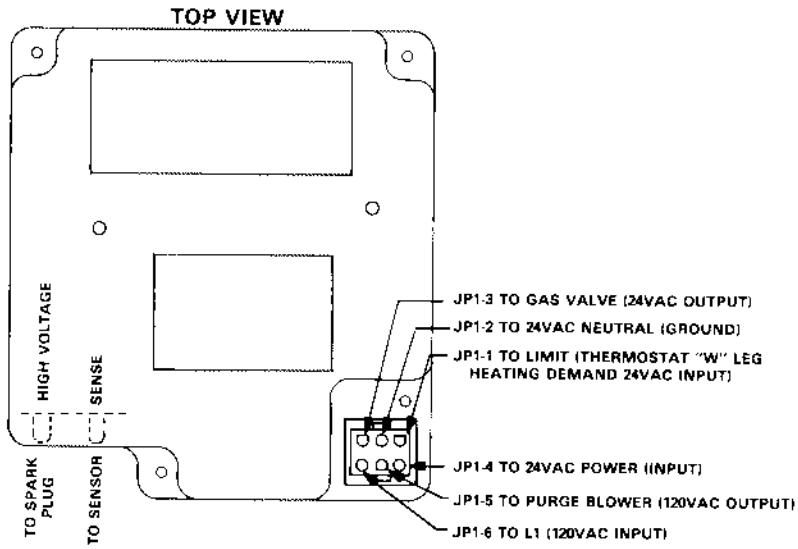
2– Gas Energy Control (Figure 4)

The Gas Energy control is illustrated in Figure 4. This control has a harness used to connect it to the unit wiring harness plug. The terminals and connections are identified by function and number. The spark wire is connected to the spark plug type connector on the control marked "HIGH VOLTAGE." The sensor wire connection is made to a quick connect terminal on the control.

3– Lennox GC–1 Control (Figure 5)

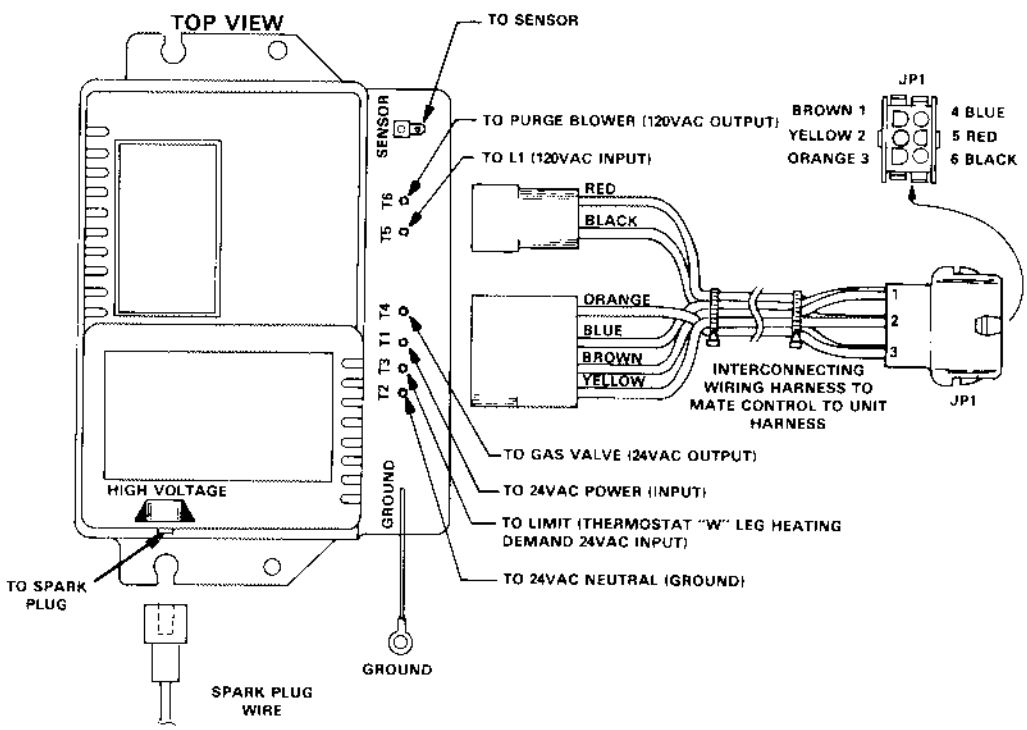
The Lennox GC–1 control is illustrated in Figure 5. The unit wiring harness plugs directly into the jack at the corner of the control. Each of the six jack terminals are identified by number and function. The spark wire connection is made to the spark plug type connector on the control as shown. The sensor wire connection is made to a quick connect terminal on the top left of the control.

The Lennox–built GC–1 gas ignition control was changed in November 1988. The change included the addition of an internal self–test function and a diagnostic lockout indicator light. The indicator light is a red LED visible through a window in the GC–1 cover label (see figure 5). The indicator light helps the service technician troubleshoot the unit by indicating an unusual condition. For additional safety, the GC–1 self–tests its internal safety circuits continuously and uses the diagnostic LED to indicate control failure.



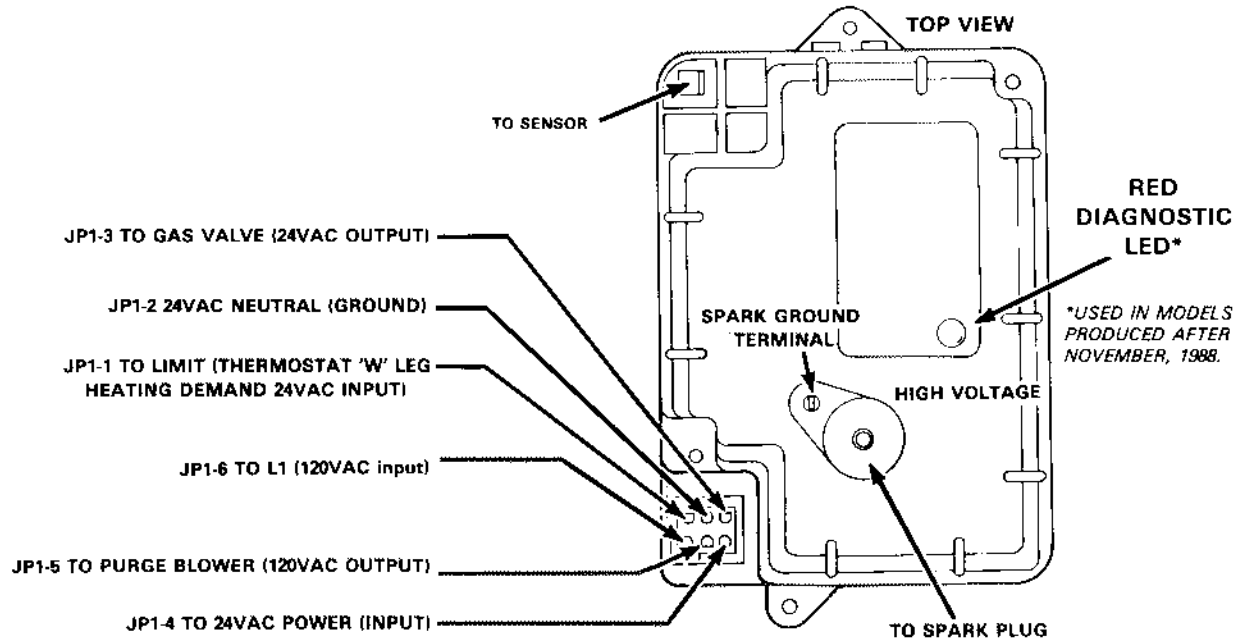
WATSCO PRIMARY CONTROL

FIGURE 3



GAS ENERGY PRIMARY CONTROL

FIGURE 4



LENNOX GC–1 PRIMARY CONTROL

FIGURE 5

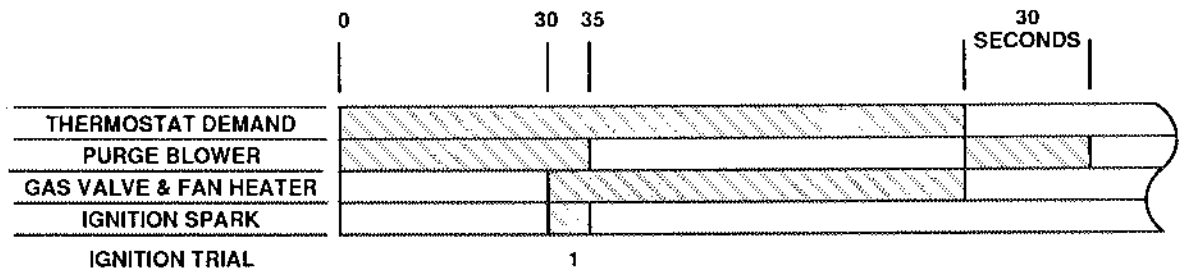
The LED may be lit for the following reasons: lockout condition; post–purge operation; and control failure .

If the lockout is caused by unsuccessful ignition (five tries), breaking and remaking thermostat demand or breaking and remaking power to the unit will reset the control. If the lockout is due to a self–test failure, the control will be in Safety Dormant Lockout and can only be reset by breaking and remaking power to the unit. A Safety Dormant Lockout can be caused by an unusually severe external line voltage transient, such as a lighting strike near the unit.

IMPORTANT–If the Lennox GC–1 control is used, A CERAMIC RESISTOR SPARK PLUG MUST ALSO BE USED.

4–Primary Control Functions (Figures 6 & 7)

The primary control provides four main functions: pre–purge, ignition, flame sensing and post–purge. The ignition attempt sequence of the control provides five trials for ignition before locking out. The unit will usually ignite on the first attempt. See Figure 6 for a normal ignition sequence with nominal timings for simplicity.



NORMAL IGNITION SEQUENCE
TIMINGS–NOMINAL

1– Thermostat demand for heat.
2– Purge blower is energized.
3– At 30 seconds gas valve, fan heater and ignition spark are energized for five seconds.
4– When ignition occurs (sensed by flame rectification), the spark and purge blower are de–energized.
5– At end of heating demand, gas valve and fan heater are de–energized and purge blower is started.
6– Post purge continues for 30 seconds after heating cycle, then is de–energized.

FIGURE 6

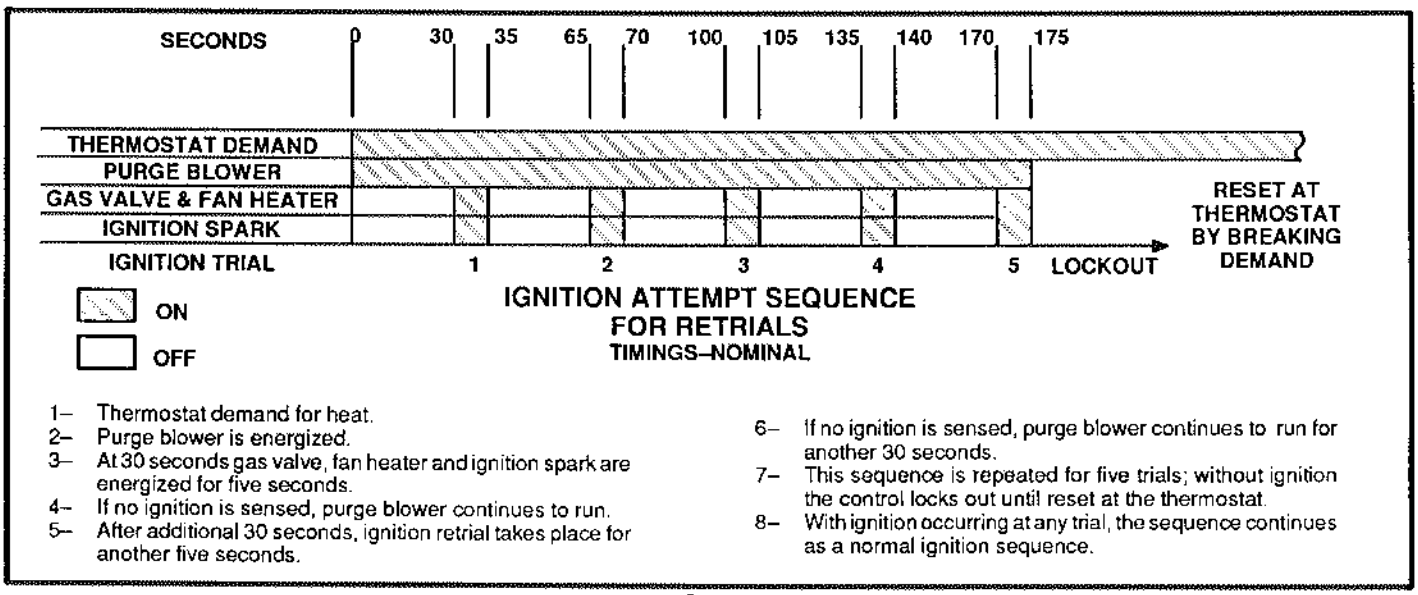


FIGURE 7

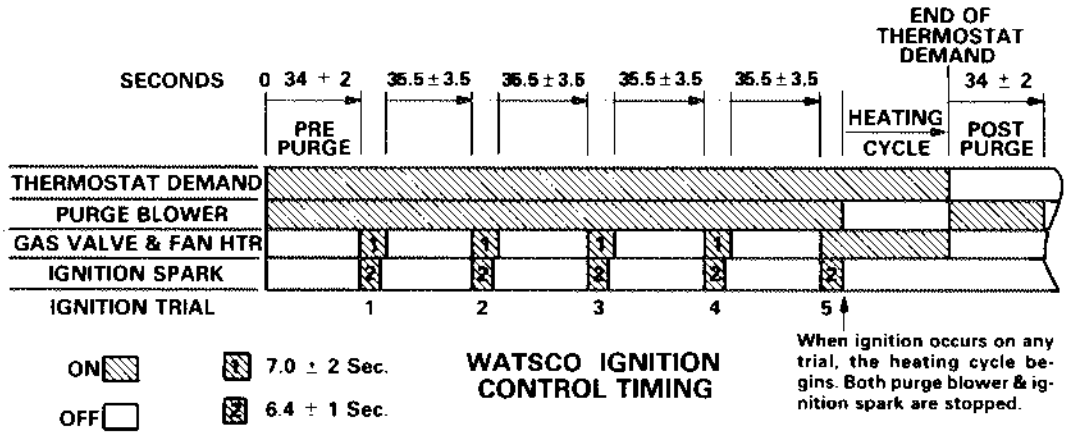
Proper gas/air mixture is required for ignition on the first attempt. If there is slight deviation, within tolerance of the unit, a second or third trial may be necessary for ignition. The control will lock out the system if ignition is not obtained within five trials. Reset after lockout requires only breaking and re–making the thermostat demand. See Figure 7 for the ignition attempt sequence with retrials (nominal timings given for simplicity). Loss of combustion during a heating cycle is sensed through absence of flame signal causing the control to lock out after five ignition retrials.

5– Ignition Control Timings (Figure 8)

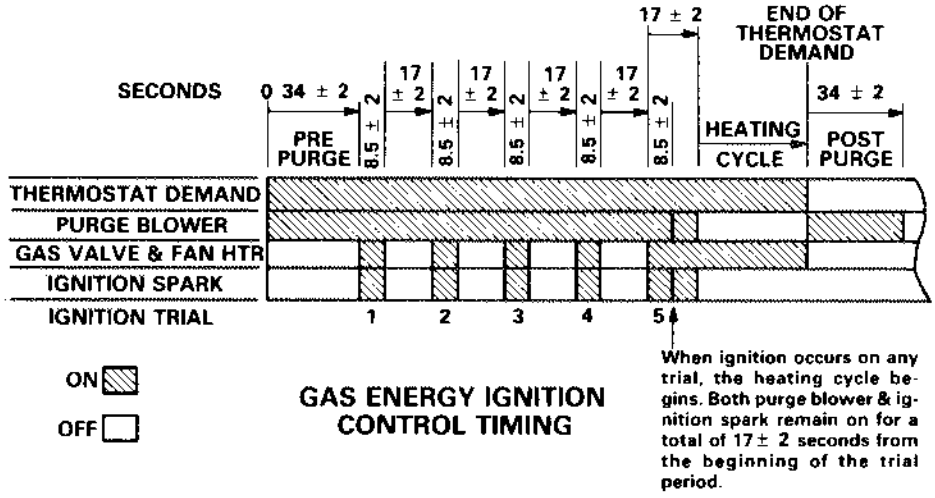
The specific timings for the Watsco, Gas Energy and Lennox GC–1 ignition controls vary, but do not affect operation. All will make five trials for ignition before lockout. The specific timings for each are given in Figure 8.

The Watsco control runs through a post–purge cycle each time power is interrupted to the unit; if main switch is turned off and on again, following intermittent power failures or when replacing blower door which energizes the interlock switch. This is a normal operating characteristic unique to the Watsco control only.

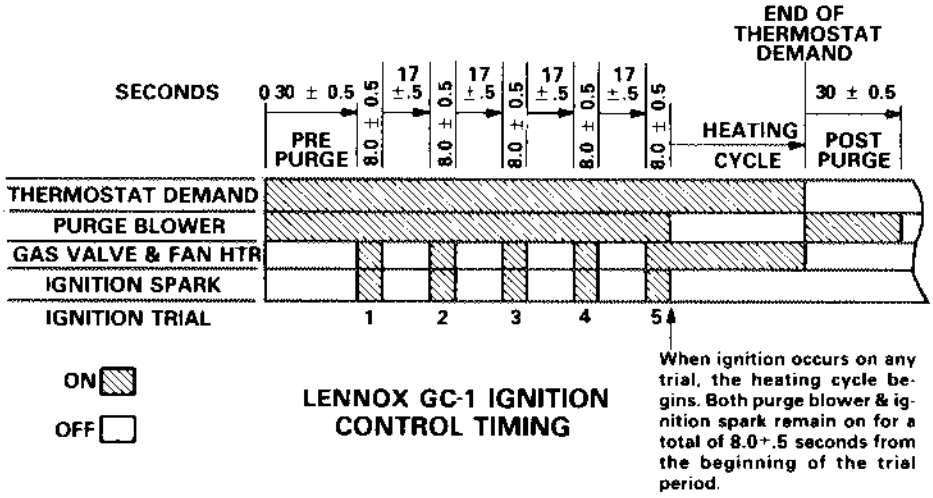
The Gas Energy control uses an externally mounted integral fuse to protect the internal circuitry from accidental shorting while servicing the unit. The fuse, mounted on the lower right corner of the control, is rated 125V, 3A slow blow type. Refer to Lennox Repair Parts for fuse replacement.



WATSCO IGNITION CONTROL TIMING



GAS ENERGY IGNITION CONTROL TIMING



LENNOX GC-1 IGNITION CONTROL TIMING

FIGURE 8

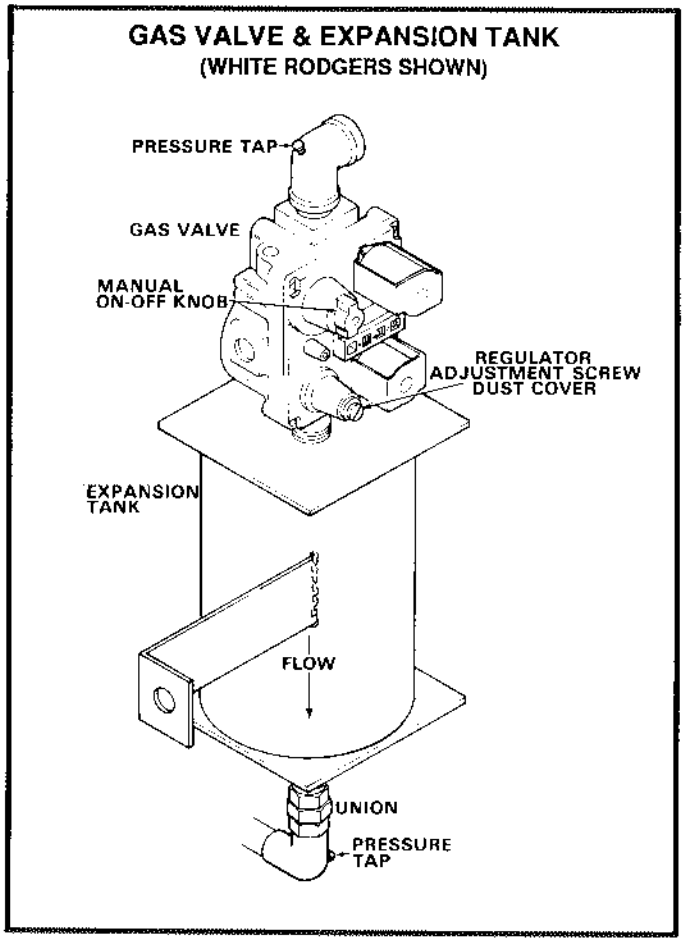


FIGURE 9

D–Gas Valve & Expansion Tank (Figure 9)

1– Gas Valve

The gas valves used on G14 series units have various opening times. All gas valves are internally redundant to assure safety shutoff. An update kit to regulate manifold pressure is available for early produced units. See Service and Application notes for manifold pressure values for specific units. If replacement of the gas valve is needed, the valve must be replaced with the same type of valve. For example, replace a White Rodgers (as shown in figure 9) with a White Rodgers valve.

2– Expansion Tank

The expansion tank downstream of the gas valve absorbs any back pressure created during combustion to prevent damage to the gas valve diaphragm.

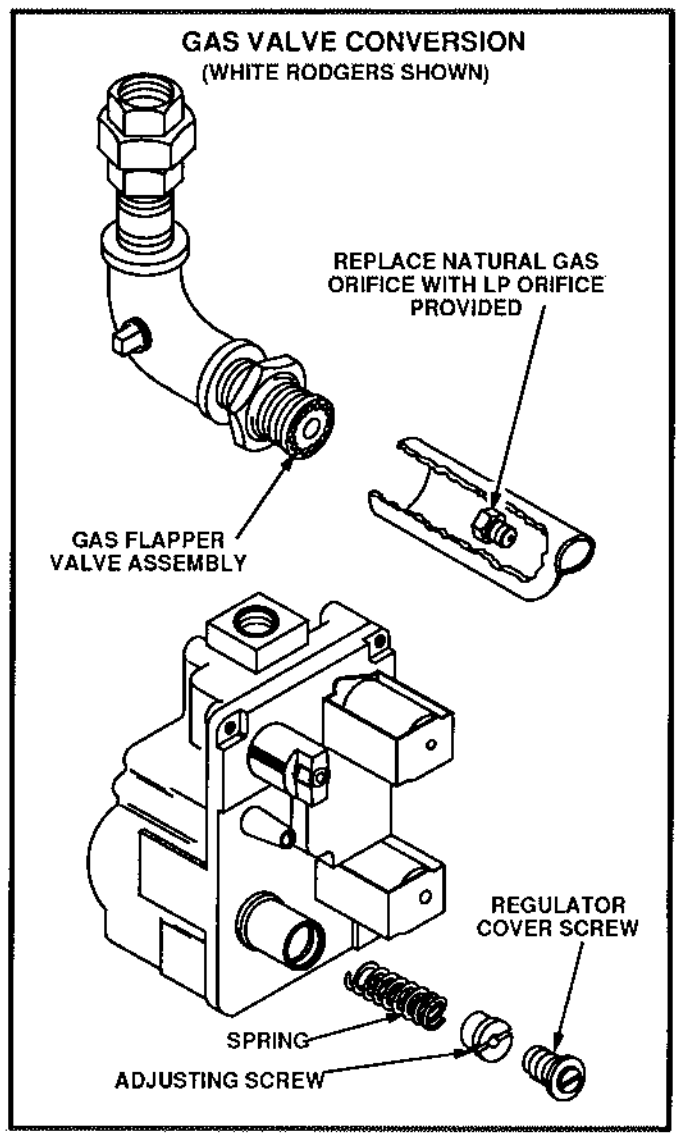


FIGURE 10

3– Gas Valve Conversion (Figure 10)

All A.G.A. G14 units can be converted from natural gas to liquid propane gas using an optional gas changeover kit from Lennox Repair Parts. C.G.A. G14 units are not field convertible but may be purchased already converted to L.P. operation.

A gas changeover kit is available to convert natural gas units to L.P. gas. Refer to the instructions provided in each specific kit for proper installation procedures. The kit includes one orifice, one gas valve conversion kit with heavy spring, one air diaphragm assembly and changeover nameplate.

Using the kit to change unit from natural to L.P. gas, the existing orifice located in the elbow/gas flapper assembly must be removed and replaced with the orifice provided in the kit. See figure 10 for an example of a White Rodgers gas valve changeover.

A spring behind the adjusting screw and regulator cover screw must be replaced by a heavier spring also included in the kit. In G14–100 units, the air diaphragm must be replaced. For G14–40/60/80 units, use existing air diaphragm assembly in L.P. conversion.

CAUTION–After the kit is applied, gas manifold pressure must be checked and properly adjusted as given in the kit's Instructions or Service and Application notes.

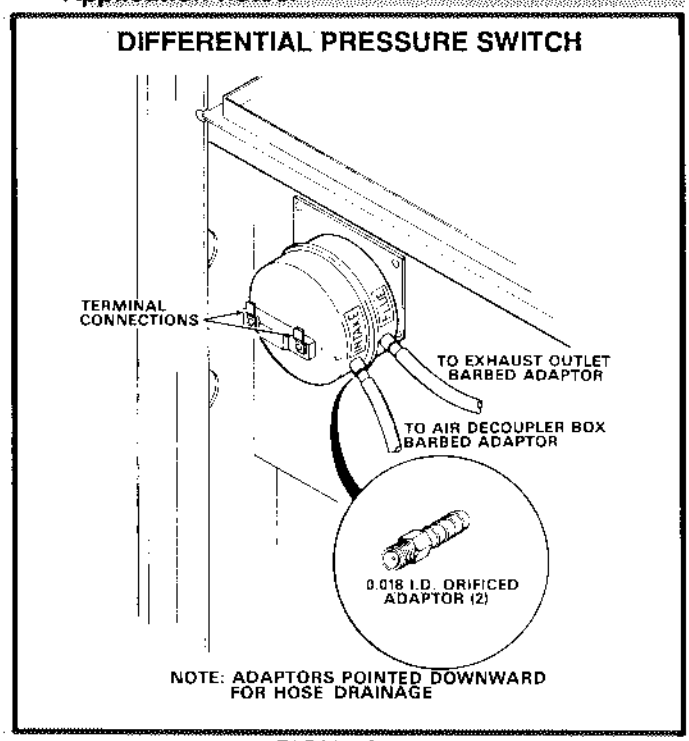


FIGURE 11

E–Differential Pressure Switch (Figure 11)

The use of a differential pressure switch was phased into G14–100 units in October1985 and in G14–40/60/80 units in July 1987.

The differential pressure switch is mounted next to the make–up box (see parts arrangement). It is connected to the air intake and exhaust outlet by separate lengths of flexible plastic tubing. Note that each flexible hose connects to barbed adapter at the differential pressure switch (Figure 10). Each adapter has a built–in orifice of 0.018" I.D.

CAUTION – Each orificed adapter is critical to switch operation. The orifice reduces the extreme positive and negative pressure "peaks" and must be used to prevent erratic switch operation. DO NOT REPLACE WITH NON–ORIFICED ADAPTERS. Replacement adapters are available through Lennox Repair Parts.

F–Air Intake Vacuum Switch (See Parts Arrangement)

All G14–40/60/80 units produced before July 1987 and G14–100 units produced before October 1985 used an air intake vacuum switch instead of the differential pressure switch used in newer units.

A vacuum switch is mounted on top of the air intake chamber, see Parts Arrangement. This switch was used in both A.G.A and C.G.A. units. If necessary, replace with like component. Do not replace with differential pressure switch.

The switch is normally closed and remains closed under normal operating conditions. Obstruction of the air intake pipe causes the switch to open at a 2.0 ± 0.2 in. W.C. on –40,–60 and –80 models and 3.0 ± 0.2in. W.C. on –100 units. When switch opens it breaks the heat demand circuit to shut down the unit. This is a safety shut–down function. The switch automatically resets when the restriction is removed from the air intake.

G–Exhaust Outlet Pressure Switch (See Parts Arrangement)

The exhaust pressure switch was used with the air intake vacuum switch in early units.

This pressure switch is mounted on the side of the air intake chamber and is connected to the exhaust outlet PVC elbow by a length of plastic tubing. Refer to the Parts Arrangement illustration. If necessary, replace with like component. Do not replace with differential pressure switch.

The switch is normally closed and remains closed under normal operating conditions. Obstruction of the exhaust outlet pipe causes the switch to open. On the –40 units the switch opens at 2.75 ± 0.2in. W.C.; on the –60 and –80 units it opens at 4.0 ± 0.2in. W.C.; and on –100 units the switch opens at 5.0 ± 0.2in. W.C. pressure. When the switch opens it breaks the heat demand circuit and shuts down the unit. This is a safety shut–down function. The switch automatically resets when the restriction is removed from the exhaust outlet.

H–Gas Intake Flapper Valve & Orifice (Figure 12)

1– Gas Intake Flapper Valve Assembly

A union at the bottom of the expansion tank provides for removal of the gas flapper valve assembly and access to the orifice.

NOTE–Disconnect gas pipe at union. Tighten until bush seats in orifice housing and gas pipe is in vertical position.

The flapper moves freely over the spacer and is opened against the clearance plate by incoming gas pressure. Back pressure from each combustion pulse forces the flapper against the valve body closing off the gas supply.

Refer to the troubleshooting section for specific information about flapper valve inspection and conditions requiring replacement.

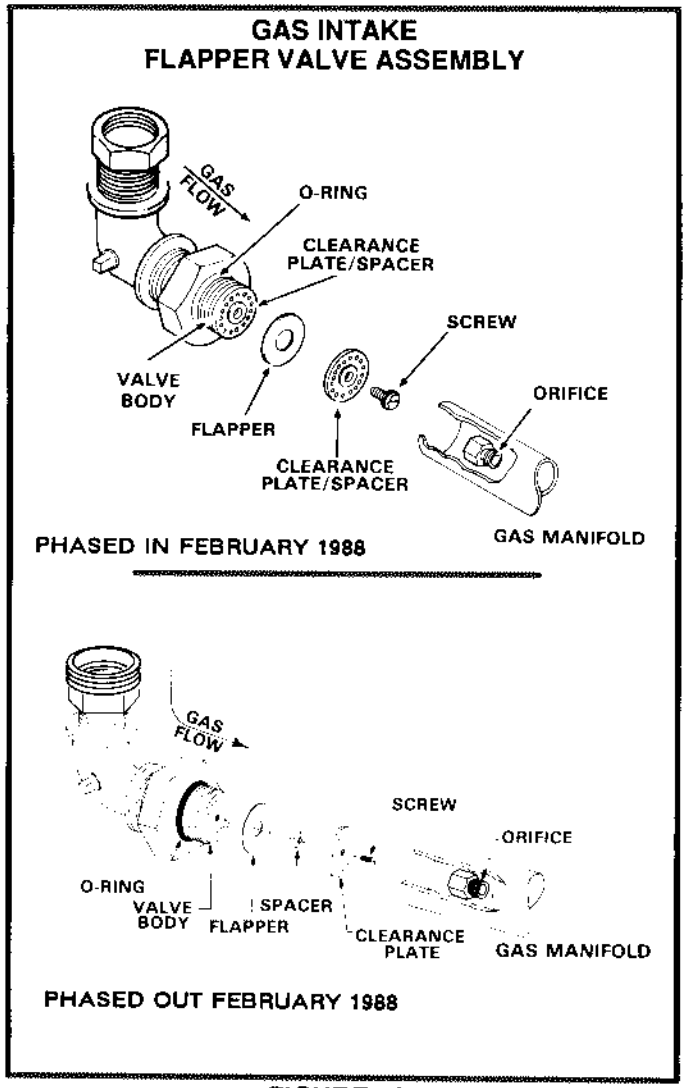


FIGURE 12

2– Orifice

Each G14 unit uses only one orifice located downstream of the flapper valve and is sized specifically for each unit. Refer to the Service and Application notes for specific orifice size for each unit.

NOTE – Standard atmospheric burner orifices or orifice blanks cannot be used as replacements in G14 units.

NOTE – Orifices designed for GSR14 Pulse furnaces cannot be used as replacements in G14 units. For proper orifice sizing please refer to Lennox Repair Parts.

I–Air Intake Chamber & Purge Blower

1– Air Intake Chamber

The air intake chamber houses the purge blower and air intake flapper valve assembly. Air enters through the air intake pipe (center of mullion), passes through the purge blower and through the flapper valve to the combustion chamber. The entire air intake chamber is mounted on either a large seal pad or cushion connectors (earlier models) to eliminate vibration.

2– Purge Blower

The purge blower has a 120 volt motor and is permanently lubricated. It is powered only during pre– and post–purge. During combustion the blower is not powered, but the air is drawn through the blower by negative pressure.

J–Air Intake Flapper Valve

The air intake flapper valve is similar to the gas flapper valve in operation. A flapper moves freely over a spacer between two plates. In actual operation, the flapper is forced against the clearance plate by the purge blower allowing air to enter the combustion chamber. Next, back pressure from combustion forces the flapper against the cover plate closing off the air supply. Finally, as a negative pressure is created in the combustion chamber, the flapper is drawn to the clearance plate and air enters. Once ignition has occurred, the back pressure and negative pressures control the flapper valve with each combustion pulse.

Refer to the troubleshooting section for specific information about flapper valve inspection and conditions requiring replacement.

K–Combustion Chamber & Heat Exchange Assembly (Figure 13)

1– Combustion Chamber

The combustion chamber has gas and air intake manifolds. The gas intake is on the right and the air intake is front–center. The exhaust gas leaves through the tailpipe at the top of the chamber.

2– Tailpipe

The tailpipe connects the combustion chamber to the exhaust gas decoupler. The tailpipe and decoupler create the proper amount of back pressure for combustion to continue and are major heat exchange components. The resonator provides attenuation for acoustic frequencies.

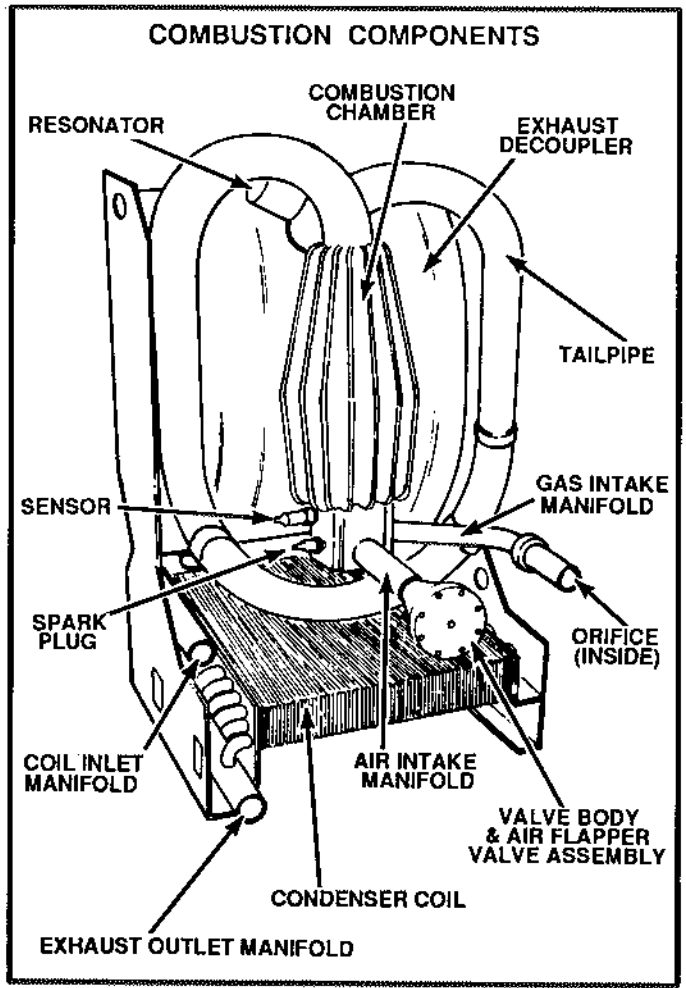


FIGURE 13

3– Exhaust Decoupler

The exhaust decoupler is manifolded into the condenser coil. The latent heat of combustion is extracted from the exhaust gas in the condeser coil. When this is done, condensate (moisture) is produced. The circuiting of the coil allows for proper drainage of the condensate to the exhaust outlet line. The exhaust line is located in the lower left–hand corner of the vestibule panel on –40,– 60 and –80 units and in the lower right–hand corner of the –100 units.

4– Heat Exchange Assembly

The entire heat exchange assembly is mounted on rubber isolation mounts to eliminate vibration.

Each unit input size uses a specific heat exchange assembly. Externally, they are the same physical size and shape BUT THEY MUST NOT BE INTERCHANGED between unit input sizes. Internal characteristics related to unit input properly match each assembly for the unit input rating.

NOTE – If the heat exchanger must be replaced, be sure to keep the orifice from the old heat exchanger. New orifices are not supplied with replacement heat exchangers.

L–Spark Plug & Sensor (Figures 13 & 14)

The spark plug and sensor are located on the lower left side of the combustion chamber, see Figure 13. The sensor is the top plug and is longer than the spark plug. The spark plug is in the lower position. The plugs cannot be interchanged due to different thread diameters.

NOTE – On units using the Lennox GC–1 ignition control, a special resistor type plug MUST BE USED to prevent electrical interference from feeding back into the ignition control.

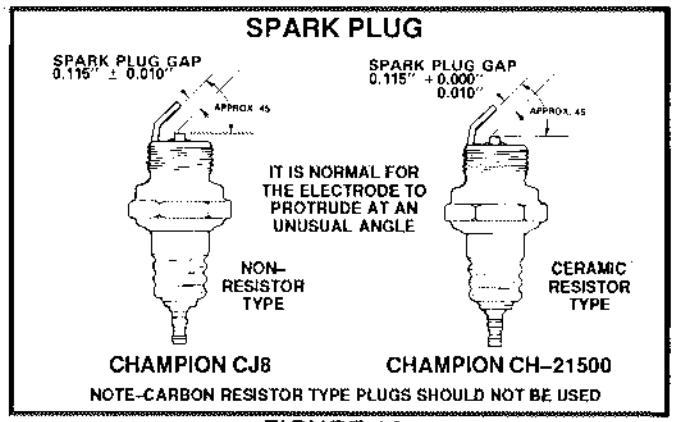


FIGURE 14

Spark plug socket wrench size = 3/4 inch. Sensor plug socket wrench size = 11/16 inch.

The spark plug is used in conjunction with the primary control for igniting the initial gas and air mixture.

The temperatures in the combustion chamber keep the plug free from oxides and it should not need regular maintenance. Compression rings are used to form the seal to the chamber.

Figure 14 gives the proper spark gap setting. Note that the spark plug uses an unusual electrode angle in comparison to other spark plug applications. A feeler gauge can be used to check the gap.

The spark plug type sensor has a single center electrode (no ground strap). Compression rings are used to form the seal to the chamber. It also should not need regular maintenance.

M–Gas & Air Components Applied to Heat Exchanger (Figure 15)

This illustration identifies all the components that make up the basic heating assembly.

Combustion Procedure in G14 units

1–Gas flows through the valve, expansion tank, flapper valve and orifice into the combustion chamber.

2–Air flows through the air flapper valve and directly into the combustion chamber.

3–Combustion takes place and exhaust gas flows through the tailpipe, exhaust decoupler and condenser coil to the exhaust outlet.

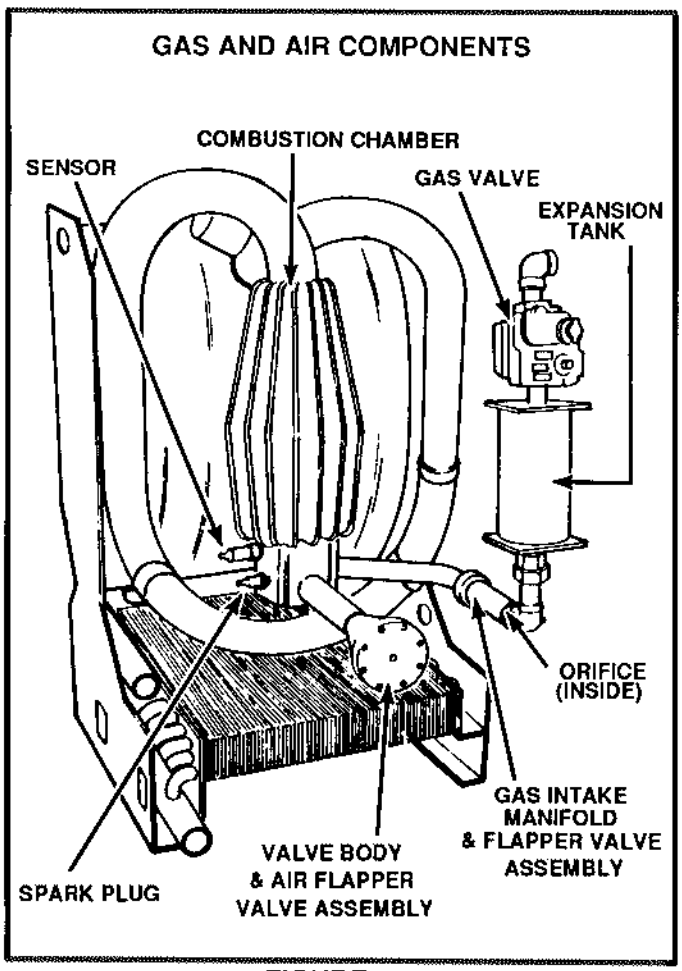


FIGURE 15

N–Blower Motors & Capacitors

All models use 120V permanent split capacitor (PSC) single electric blower motors with run capacitors for efficiency. See table 1.

TABLE 1

BLOWER MOTORS AND CAPACITORS

MODELS	HP	CAPACITOR MFD	CAPACITOR VAC
Q3	1/3	5	370
Q4	1/2	7	370
Q4/5	3/4	40	370

G14s use multi–tap blower motors (see blower speed table 2). Each motor is factory wired using black high speed tap for cooling and red low speed for heating. G14Q3–80/100 have yellow medium speed for heat. See table 3.

TABLE 2

BLOWER SPEED SELECTION

IMPORTANT–TO PREVENT MOTOR BURNOUT, NEVER CONNECT MORE THAN ONE MOTOR LEAD TO ANY ONE CONNECTION. TAPE UNUSED MOTOR LEADS SEPARATELY.

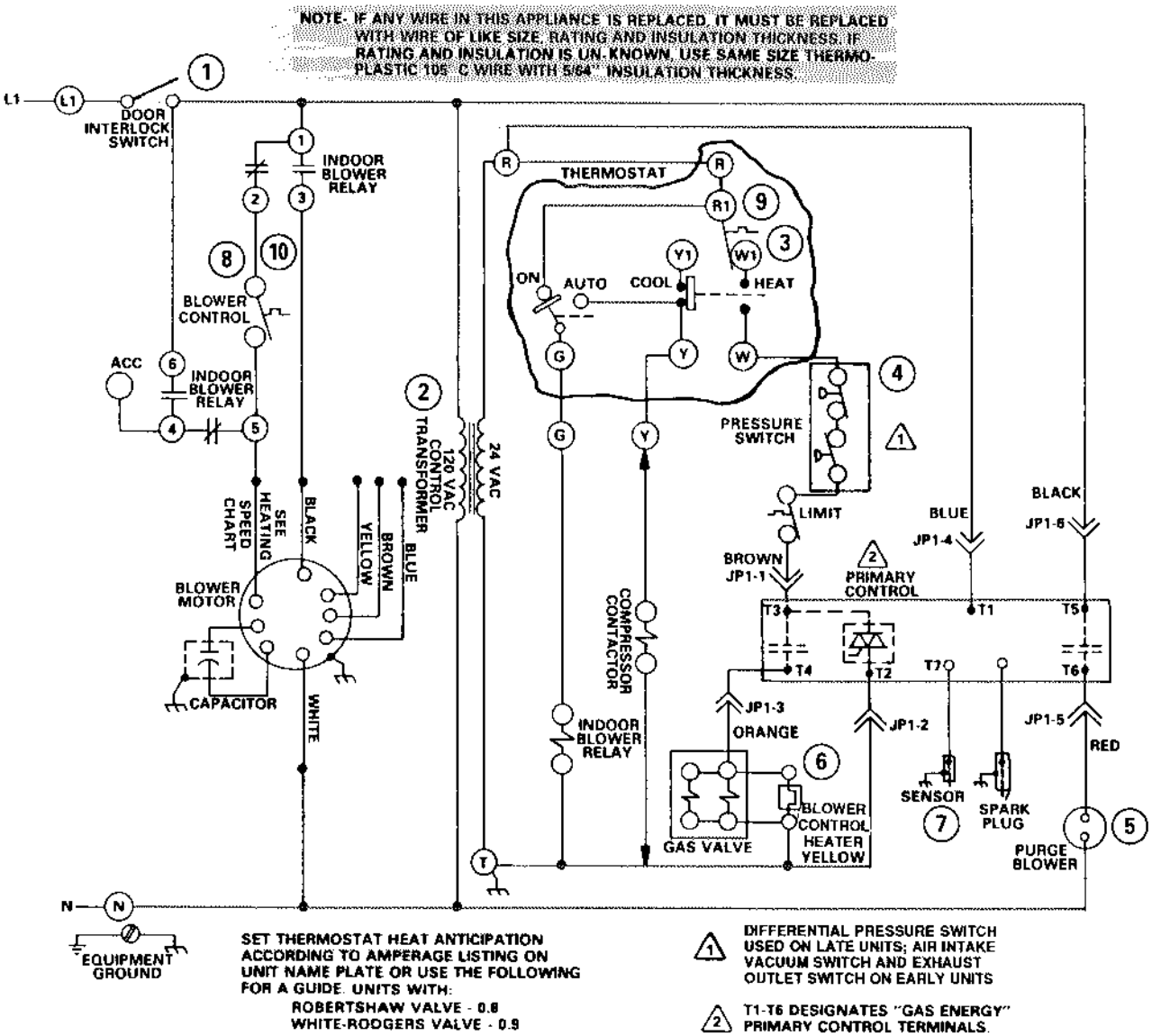
SPEED	BLOWER MOTOR LEAD		
	Q3	Q4	Q4/5
LOW	RED	RED	RED
MEDIUM LOW	–	YELLOW	YELLOW
MEDIUM	YELLOW	–	BLUE
MEDIUM HIGH	–	BROWN	BROWN
HIGH	BLACK	BLACK	BLACK

TABLE 3

HEATING SPEED CHART

UNIT	HEATING SPEED TAP
G14Q3–40	RED
G14Q3–60	RED
G14Q4–60	RED
G14Q3–80	YELLOW
G14Q4–80	RED
G14Q5–80	RED
G14Q3–100	YELLOW
G14Q4/5–100	RED

V–SEQUENCE OF OPERATION



1– Line voltage feeds through the door interlock switch. Blower access panel must be in place to energize unit.

2– Transformer provides 24 volt control circuit power.

3– A heating demand closes the thermostat heating bulb contacts.

4– The control circuit feeds from "W" leg through the differential pressure switch (in older units, air intake vacuum switch and (if used) the exhaust outlet pressure switch) and the limit control to energize the primary control.

5– Through the primary control, the purge blower is energized for approximately 30 seconds prepurge.

6– At the end of prepurge the purge blower continues to run and the gas valve, blower control heater and spark plug are energized for approximately eight seconds.

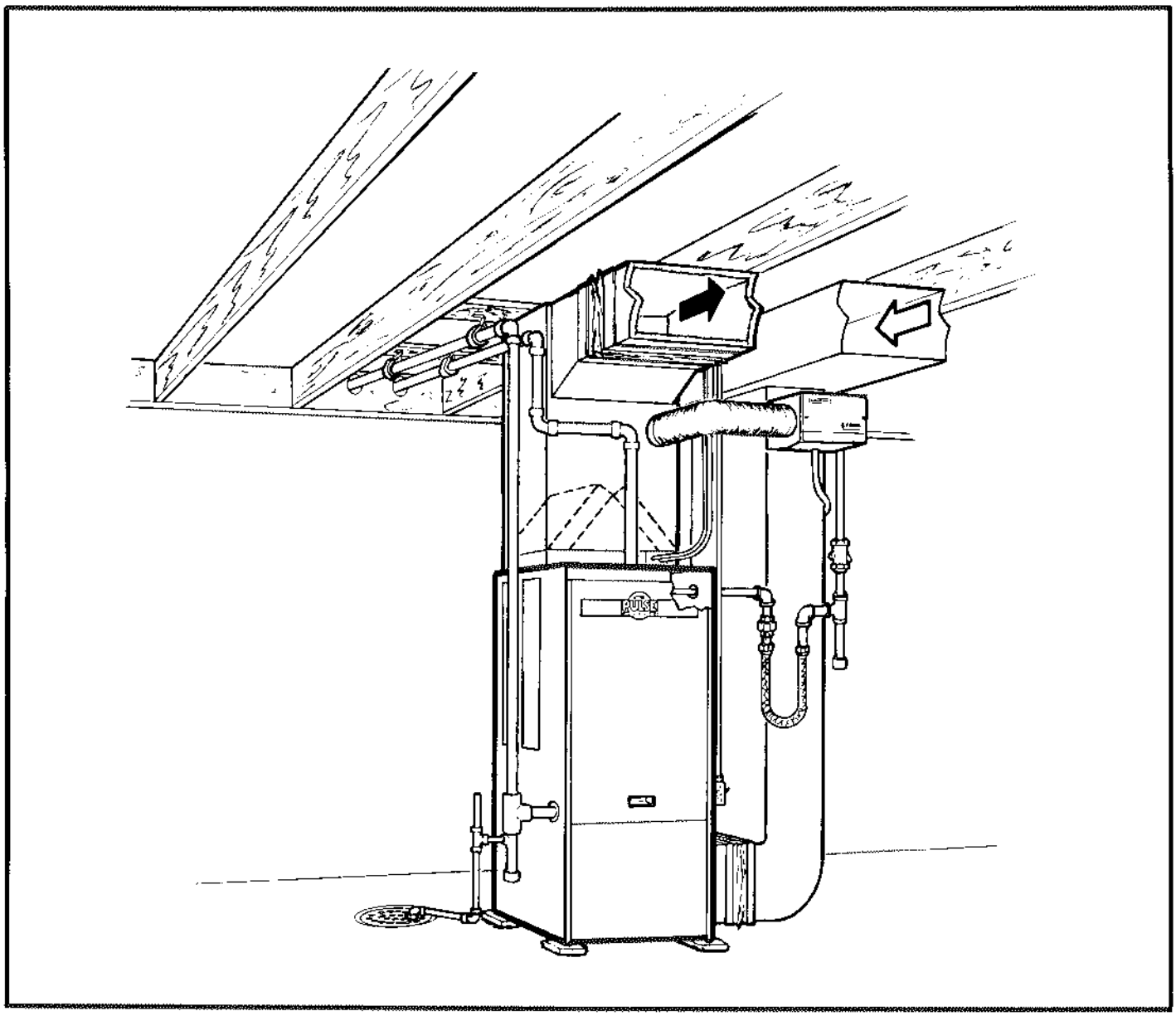
7– The sensor determines ignition by flame recitification and de–energizes the spark plug and purge blower. Combustion continues.

8– After approximately 30 to 45 seconds, the blower control contacts close and energize the indoor blower motor on heating speed.

9– When heating demand is satisfied the thermostat heating bulb contacts open. The primary control is de–energized; removing power from the gas valve and blower control heater. At this time the purge blower is energized for a 30 second post–purge. The indoor blower motor remains on.

10–When the air temperature reaches 90°F, the blower control contacts open – shutting off the indoor blower.

TYPICAL BASEMENT INSTALLATION



VI–PROPER INSTALLATION

Please refer to Lennox G14 series units Installation–Operation–Maintenance Instruction Manual for complete installation instructions.

1– Transporting the Unit

WHEN MOVING OR LIFTING THE UNIT ***ALL*** *ACCESS PANELS* ***MUST*** *BE IN PLACE TO PREVENT DAMAGE (SAGGING) TO THE UNIT.* The blower may be removed to reduce the unit weight while moving.

2– Isolation Mounting Pads

If leveling bolts are not used, vibration isolating pads should be used especially when the unit is installed on wood flooring. Isomode pads or equivalent should be used.

3– Condensate Line (Figure 16)

When installing the unit in areas subjected to freezing temperature, the condensate trap and condensate line must be wrapped with electrical heat cable to prevent the condensate from freezing. A heat cable kit, which is approved for use with PVC pipe is available from Lennox Repair Parts. Refer to G14 heat cable kit installation instructions for proper application.

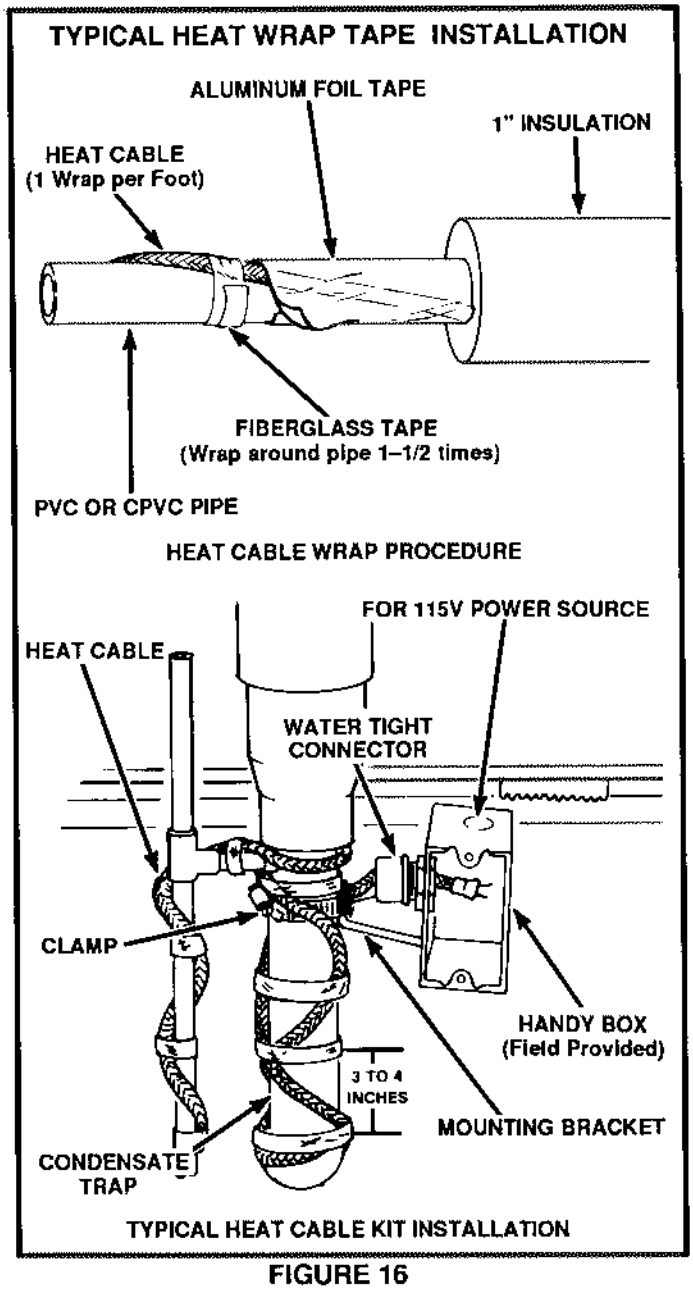


FIGURE 16

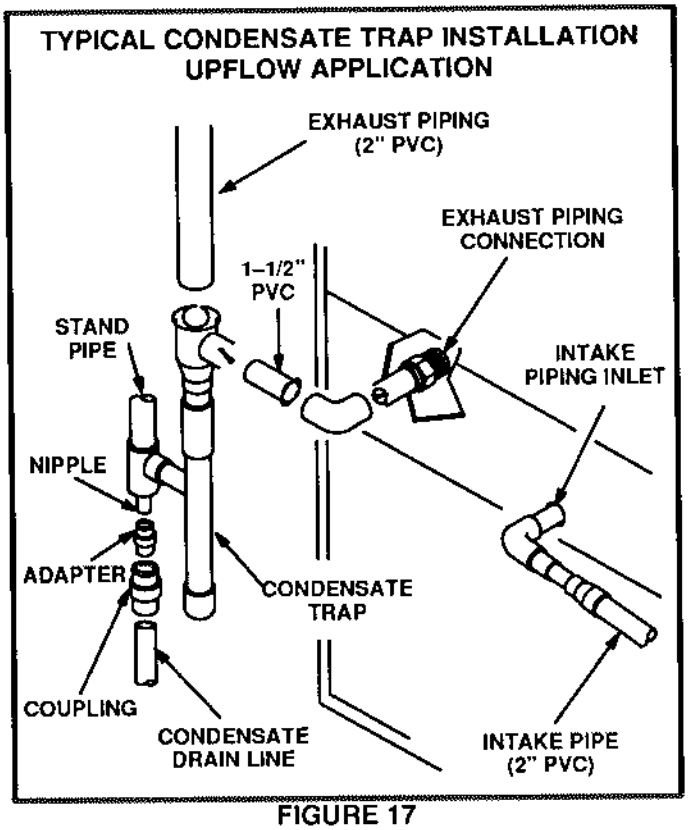


FIGURE 17

4–Condensate Trap Installation (Figure 17)

The condensate trap must be used to remove condensate from the unit. If unit condensate line is clogged or obstructed, excess water may shut down the unit.

5– Flexible Boot Supply Air Plenum

A flexible canvas boot or equivalent should be used in the supply air plenum, above cooling coil or future coil location.

6– Flexible Boot Return Air Plenum

A flexible canvas boot or equivalent should be used and located as close to the furnace as possible. It is preferred to locate the boot between the furnace and external electronic air cleaner, if used.

7– Supply Air Plenum Insulated Past First Elbow

A 1.5 to 3 lb. density, matte face, 1 inch thick insulation should be used and all exposed edges should be protected from air flow.

8– Return Air Plenum Insulated Past First Elbow

A 1.5 to 3 lb. density, matte face, 1 inch thick insulation should be used and all exposed edges should be protected from air flow.

9– Gas Supply Piping Centered In Inlet Hole (Figure 18)

The gas supply pipe should not rest on the unit cabinet.

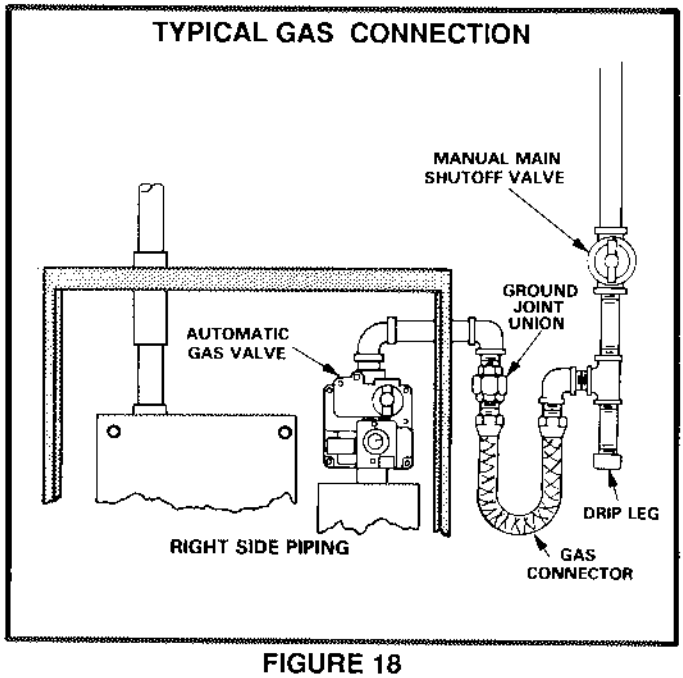


FIGURE 18

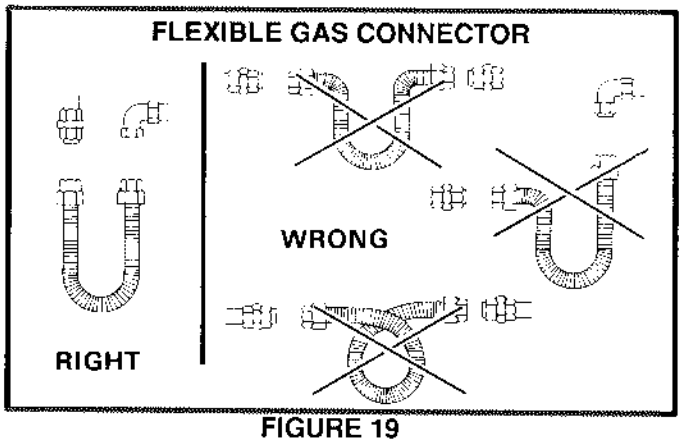


FIGURE 19

10– Gas Connector (A.G.A. Units Only)

CAUTION – The flexible gas connector (if used) MUST be mounted external to the unit. The connector must hang freely and must not contact or rub outside objects. See figure 19.

11– Electrical Conduit Isolated from Duct System and Joists

The electrical conduit can transmit vibration from the cabinet to duct system or joists if clamped to either one. It may be clamped tightly to the unit cabinet but should not touch ductwork or joists.

12– Field Wiring (Figure 20)

Field wiring is to terminal strips. Multi–speed blower motors are factory wired with low speed (red) tap for heating, (G14Q3–80 and –100 have medium speed (yellow) tap for heating), and high speed (black) tap for cooling. See tables 2 and 3.

The units include an accessory terminal for wiring accessories such as humidifiers or electronic air cleaners. This terminal is energized only when the blower motor is operating (either through fan control circuit or when indoor blower relay is energized).

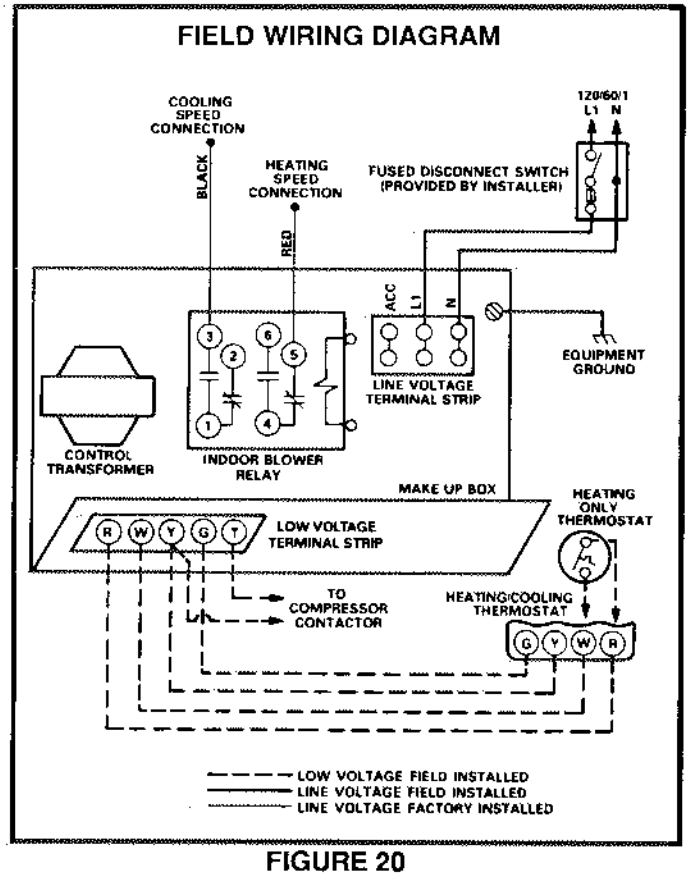


FIGURE 20

13– Muffler

All C.G.A. units and the A.G.A. G14–100 are shipped with an intake line muffler and an exhaust line muffler. It is required that both be used. The mufflers are optional on A.G.A. G14–40/60/80 series units. *ANY TIME AN EXHAUST MUFFLER IS USED IN AREAS SUBJECTED TO FREEZING TEMPERATURE, A HEAT CABLE KIT MUST BE USED ON THE MUFFLER TO PREVENT CONDENSATE FROM FREEZING.* Use only Lennox heat cable kits which are approved for use with PVC pipe.

14– Exhaust Insulation

In areas subject to freezing temperature, the exhaust pipe must be insulated with 1/2" Armaflex or equivalent when run through unconditioned space. In extreme cold climate areas, 3/4" Armaflex insulation is recommended.

15– Concentric Termination (Figure 21)

In concentric termination, intake and exhaust piping are centrally located. See figure 21.

Exhaust piping must terminate straight out or up at a level 12 inches above normal snow accumulation. Termination must not be within six feet of other vents or three feet of structure openings. For proper vent size see table 4.

Refer to G14/GSR14 Exhaust/Intake Air Termination Kits installation instructions for installation procedures which meet local and national codes.

WARNING – DUE TO THE HIGHLY VOLATILE AND INFLAMMABLE NATURE OF THE PVC GLUE FUMES USED TO CONNECT THE INTAKE AND EXHAUST LINES, SOME SAFETY PRECAUTIONS SHOULD BE USED IF THE FURNACE IS TO BE STARTED IMMEDIATELY AFTER COMPLETING THE PVC LINE HOOKUP.

ON INITIAL POWER-UP OF THE IGNITION CONTROL, IT IS POSSIBLE TO GET A SPARK FROM THE SPARK PLUG WITHOUT ANY HEATING DEMAND FROM THE THERMOSTAT. THIS IS AN INHERENT PROPERTY OF IGNITION CONTROLS USED IN ALL PULSE FURNACES. A SPARK COULD IGNITE ANY FUMES ACCUMULATED IN THE COMBUSTION CHAMBER AND COULD RESULT IN DAMAGE TO THE DRAIN TRAP OR INTAKE LINE. IF IT IS NECESSARY TO START THE UNIT IMMEDIATELY REMOVE THE SPARK PLUG WIRE FROM THE IGNITION CONTROL AND ALLOW SEVERAL PURGE CYCLES TO REMOVE GLUE FUMES FROM THE HEAT EXCHANGER.

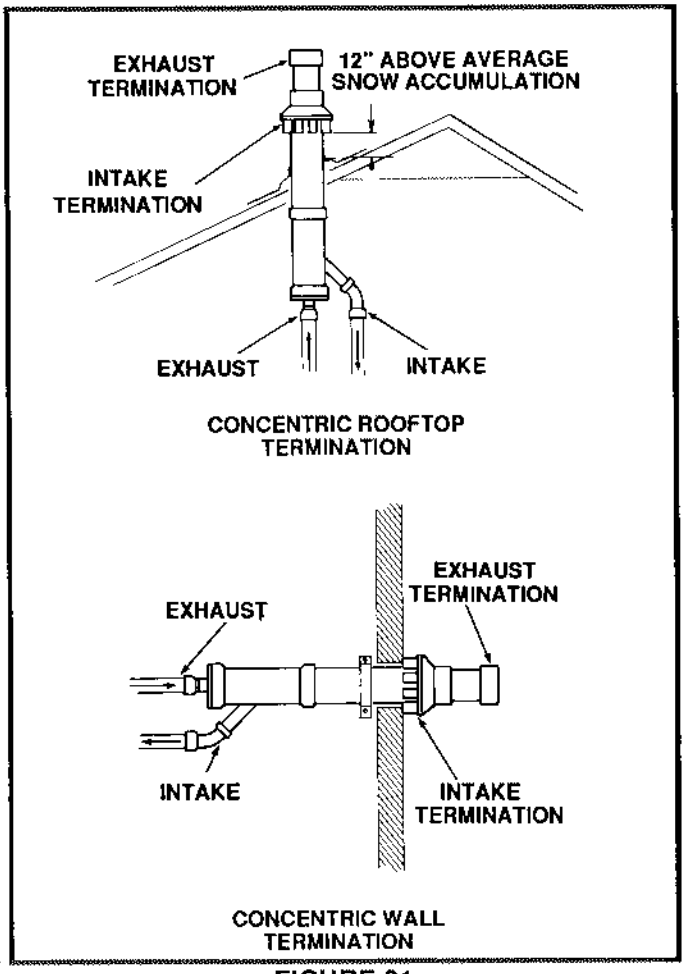


FIGURE 21

TABLE 4

MINIMUM DIAMETER FOR G14 VENTING					
Pipe Length (Max. Feet)	Number of 90° Elbows				
	0	2	4	6	8
5	2	2	2	2	2
10	2	2	2	2	2
20	2	2	2	2	2-1/2"
30	2	2	2	2-1/2"	2-1/2"
40	2	2	2-1/2"	2-1/2"	2-1/2"
50	2	2-1/2"	2-1/2"	2-1/2"	2-1/2"
60	2-1/2"	2-1/2"	2-1/2"	2-1/2"	3
70	2-1/2"	2-1/2"	2-1/2"	3	3
80	2-1/2"	2-1/2"	3	3	3
90	2-1/2"	3	3	3	3

NOTE– The exhaust line must be reduced at wall termination to 1–1/2".

16– Standard Intake/Exhaust Termination (Figures 22,23,24)

Intake and exhaust pipes should be placed as close together as possible at termination end. MAXIMUM SEPARATION IS 3 IN. ON ROOF TERMINATION AND 6 IN. ON SIDE WALL TERMINATIONS. END OF EXHAUST PIPE MUST EXTEND AT LEAST 8 IN. PAST END OF INTAKE PIPE. Intake MUST be upwind (prevailing wind) of exhaust pipe. Both intake and exhaust MUST be in the same pressure zone (Do not exit one through the roof and one through the side of the house). These precautions are to ensure exhaust gas recirculation does not occur.

Exhaust piping must terminate straight out or up and termination must not be within six feet of other vents or three feet of structure openings. For proper vent sizing see table 4.

Refer to the G14 operation and installation instructions for detailed instruction of proper termination installations which meet local and national codes.

CAUTION – Solvent cements for plastic pipe are flammable liquids and should be kept away from all sources of ignition. Good ventilation should be maintained to reduce fire hazard and to minimize breathing of solvent vapors. Avoid contact with skin and eyes.

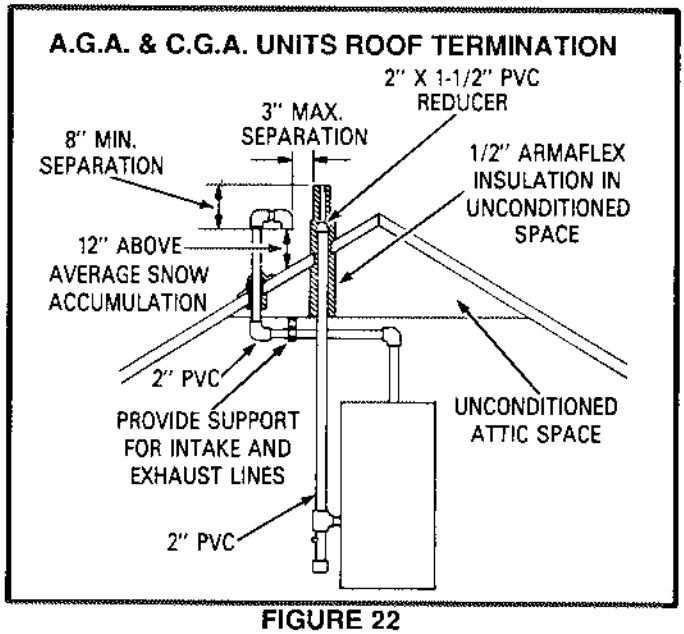


FIGURE 22

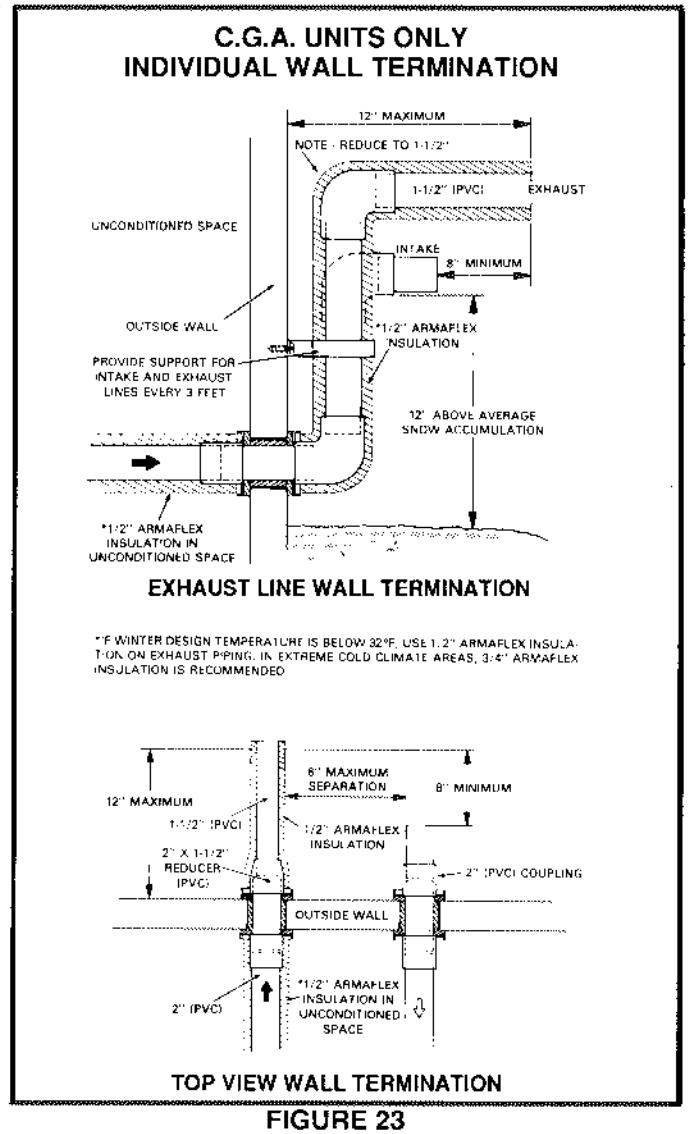
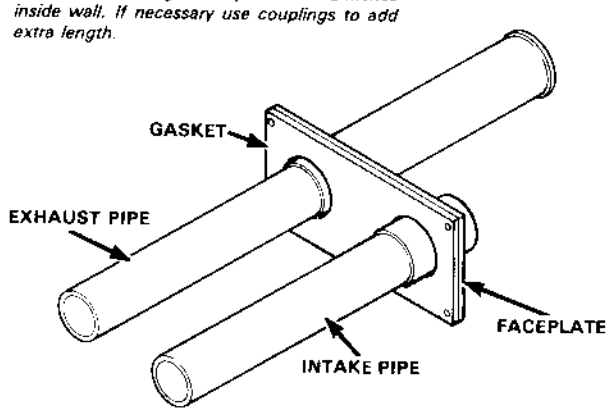


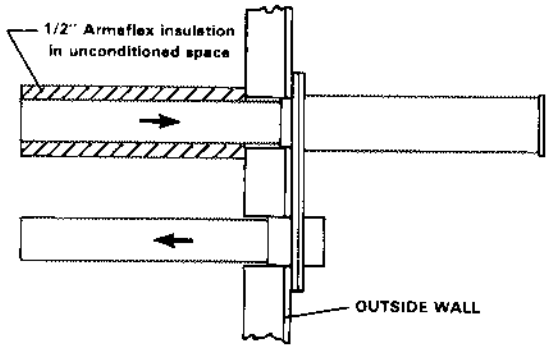
FIGURE 23

A.G.A UNITS ONLY
WALL TERMINATION KIT

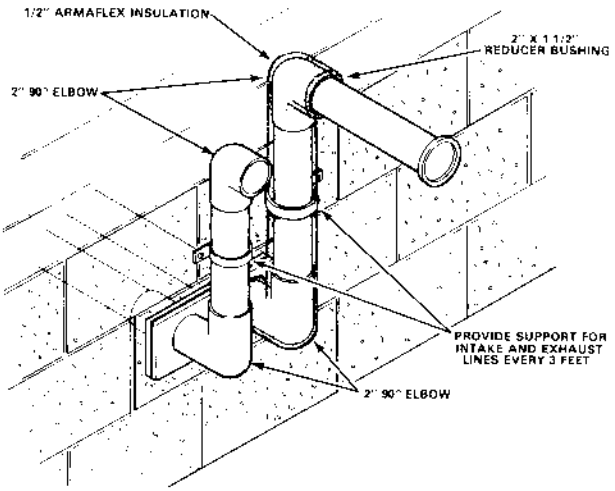
NOTE - Kit is designed to penetrate 12 inches inside wall. If necessary use couplings to add extra length.



WALL TERMINATION KIT



TOP VIEW
WALL TERMINATION



NOTE - Insulation on outside runs of exhaust pipe must be painted or wrapped to protect insulation from deterioration.

FIGURE 24

VII–MAINTENANCE

At the beginning of each heating season, the system should be checked as follows:

A–Supply Air Blower

1– Check and clean blower wheel.

2– Motor Lubrication – Always lubricate the blower motor according to the manufacturer's lubrication instructions on each motor. If no instructions are provided, use the following as a guide.

a. *Motors without oiling ports* – Pre–lubricated and sealed – no further lubrication needed.

b. *Direct Drive Motors with oiling ports* – Pre–lubricated for an extended period of operation. For extended bearing life, relubricate with a few drops of SAE 10W non–detergent oil once every two years. It may be necessary to remove the blower assembly for access to the oiling ports.

B–Filters

1– Filters must be cleaned or replaced when dirty to assure proper unit operation. Replace with 20x25x1 inch filters.

2– The filters supplied with the G14 can be washed with water and mild detergent. When dry, they should be sprayed with Filter Handicoater before reinstalling in the unit. Filter Handicoater is from RP products coating No. 418 and is available from Lennox Repair Parts (No. P–8–5069).

C–Fan & Limit Controls

Check fan and limit controls for proper operation and setting. For settings, refer to the "Fan and Limit" section in this manual.

D–Electrical

1– Check all wiring for loose connections.

2– Check for correct voltage.

3– Check amp–draw on blower motor.

E–Intake/Exhaust Lines

Check intake and exhaust PVC lines and all connections for tightness and make sure there are no leaks or blockage. Also check condensate line for free flowing operation and complete drainage.

F–Typical Operating Characteristics

Follow the maintenance procedures outlined in section VIII, "Typical Operating Characteristics."

VIII–TYPICAL OPERATING CHARACTERISTICS

A–Temperature Rise

Temperature rise for the G14 units depends on unit input, blower speed, blower horsepower and static pressure as marked on the unit rating plate. The blower speed must be set for unit operation within the range of "AIR TEMP. RISE °F" listed on the unit rating plate.

To Measure Temperature Rise:

1– Place plenum thermometers in the supply air and return air plenums. Locate the thermometer in the warm plenum where it will not pick up radiant heat from the heat exchanger.

2– Set thermostat to highest setting.

3– After plenum thermometers have reached their highest and steadiest readings, subtract the two readings. The difference should be in the range listed on the unit rating plate. If this temperature is too low, decrease blower speed; if too high, increase blower speed. To change blower speed taps see tables 2 and 3 on page 13.

To Measure Discharge Static Pressure:

1– Measure tap locations as shown in Figure 25.

2– Punch a 1/4" diameter hole. Insert manometer hose flush with inside edge of hole or insulation. Seal around the hose with permagum. Connect the zero end of the manometer to the discharge (supply) side of the system. On ducted systems, connect the other end of the manometer to the return duct as above. For systems with non–ducted returns, leave the other end of the manometer open to the atmosphere.

3– With only the blower motor running, observe the manometer reading. Adjust blower motor speed to deliver the air desired according to the job requirements.

4– Seal around the hole when the check is complete.

B–Manifold Pressure

Checks of manifold pressure are made as verification of proper regulator adjustment. Manifold pressure for the G14 can be measured at any time the gas valve is open and is supplying gas to the unit. Normal manifold pressure is 2.0 ± 0.2 in. W.C. for natural gas and 9.0 ± 0.2 in. W.C. for L.P. gases.

To Measure Manifold Pressure:

1– Remove the 1/8" pipe plug from the pressure tap on the elbow below the expansion tank. See Figure 9 for location of tap.

CAUTION – For safety, connect a shut–off valve between the manometer and the gas tap to shut off gas pressure to the manometer, if desired.

2– Insert hose adapter in tap and connect gauge.

3– Set thermostat for heating demand (the demand can be started at the unit by jumping "R" and "W" on the low voltage terminal strip). BE SURE TO REMOVE THE JUMPER AFTER THE TEST IS COMPLETE.

4– Check the manifold pressure after the unit has ignited and is operating normally.

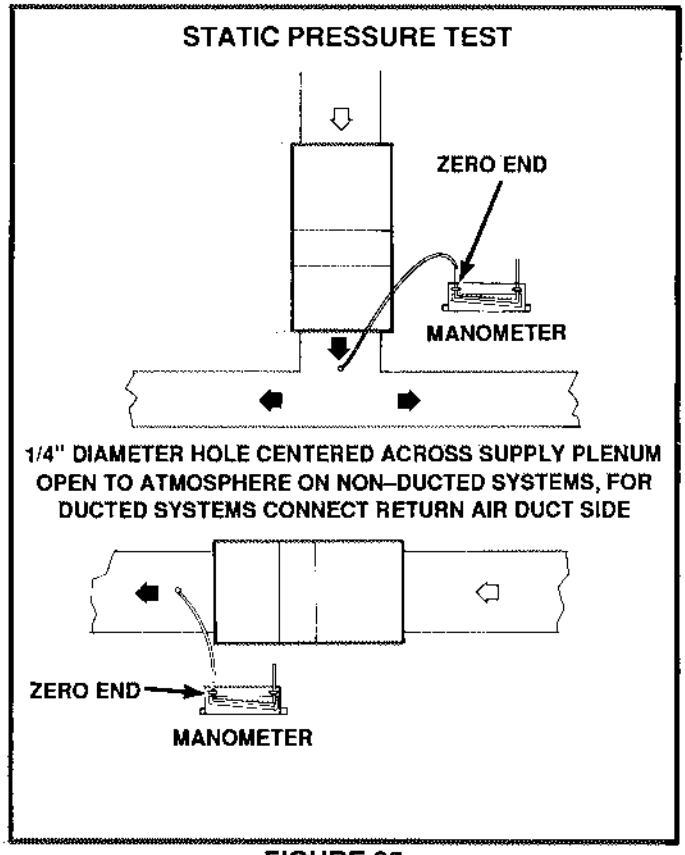


FIGURE 25

5– If the unit is not operational SEE CAUTIONS AND WARNINGS BELOW. Check the manifold pressure immediately after the gas valve fully opens.

CAUTION – Disconnect the heating demand as soon as an accurate reading is obtained and allow the unit to post–purge the heat exchanger before proceeding.

WARNING – THE COMBUSTION CHAMBER ACCESS PANEL AND THE AIR DECOUPLER BOX COVER MUST BE IN PLACE FOR THIS TEST. DO NOT ALLOW LONG PERIODS OF TRIAL FOR IGNITION. UNSAFE CONDITIONS COULD RESULT.

WARNING – IF THE UNIT IS NOT OPERATIONAL, THE MANIFOLD PRESSURE CHECK SHOULD BE USED ONLY TO VERIFY THAT GAS IS FLOWING TO THE COMBUSTION CHAMBER AT THE CORRECT MANIFOLD PRESSURE. ALWAYS ALLOW PURGE BLOWER TO EVACUATE THE COMBUSTION CHAMBER BEFORE PROCEEDING.

6– The gas valve can be adjusted using the regulator adjustment screw. This screw is located under the dust cover screw on the face of the valve nest to the electrical terminals and manual on/off knob. Refer to figure 10.

C–Line Pressure

Gas supply pressure should not exceed 13.0 in. W.C. and should not drop below 3.5 in. W.C. The normal level for natural gas G14 units is 7.0 in. W.C. and for L.P. units, 11.0 in. W.C. The supply pressure should only be checked with the unit running. A 1/8" pipe plug and tap are supplied in the elbow on the inlet side of the gas valve. Line pressure ratings are also listed on the unit rating plate.

D–Flame Signal

A 50 microamp DC meter is needed to check the flame signal on the primary ignition controls.

Flame signal or microamp is an electrical current which passes from the ignition control through the sensor electrode during unit operation. The current passes from the sensor through the flame to ground to complete a safety circuit.

In a standard gas furnace, flame sensing is measured in a steady flame. A "Pulse" furnace does not have a steady flame to measure. Current can only be measured during pulse cycles. Between pulses, no current can be measured. Since the pulse rate approximates 60 pulses per second, the flame sensor measures an electrical average of the flame pulses.

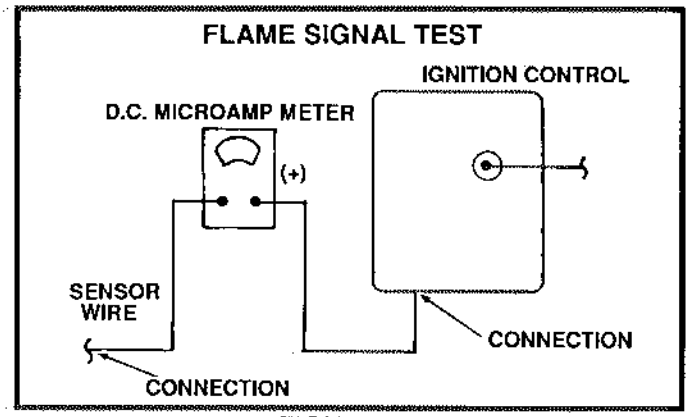


FIGURE 26

To Measure Flame Signal:

1– Place the meter in series between the ignition control and sensor wire. Connect the positive (+) lead of the meter to the ignition control sensor connection and negative (–) lead of the meter to the sensor wire. See figure 26.

2– Set thermostat for a heating demand and check the flame signal with the unit operating.

3– Normal flame signals are as follows:

Watsco Primary Control–3 to 5 Microamps DC

Gas Energy Primary Control–25 to 35 Microamps DC

Lennox GC–1 Primary Control–18 to 35 Microamps DC

The flame signal may rise above these values for the first few seconds after ignition and then level off within the ranges given.

E–Exhaust Temperature Range

The exhaust temperature should not exceed 130°F for any of the G14 series units. If it does, the low air flow will cause the unit to trip out on limit.

Most units run with maximum exhaust temperatures of 110°F to 125°F for lower to higher unit inputs. Maximum temperatures are as follows: –40 units is 110°F; –60 units is 120°F; and –80 units is 125°F. Exhaust temperatures lower than these values are possible and normal.

F–Exhaust CO_2 Content

Carbon Dioxide is a colorless and odorless gas produced in small amounts by all furnaces, including the G14, during the combustion process. When the unit is properly installed and operating normally, the CO_2 content of the exhaust gas is within 8.0–10.0 percent for natural gas and 9.0–11.5 percent for L.P. gases. If the unit appears to be

operating normally at or beyond the upper limit of the CO_2 range, the unit should be checked for abnormally high CO (Carbon Monoxide) output which might indicate other problems in the system.

One method of measuring the CO_2 content is to use the Bacharach CO_2 test with a Fyrite CO_2 indicator. Other methods of testing CO_2 are available. Closely follow the instructions included with the test kit you choose. A method for connecting the CO_2 test kit to the G14 is outlined in the next section.

G–Exhaust CO (Carbon Monoxide) Content

If the unit appears to be operating normally with CO_2 output at or near upper limits listed in Section F, the unit should be checked for abnormally high CO content. When the unit is properly installed and operating normally, the CO content of the exhaust gas is less than 0.04 percent regardless of the type of gas used.

Conditions Which May Cause Abnormally High CO:

1– Partial blockage of the exhaust pipe and intake pipe;

2– Abnormally high exhaust back pressure and intake restriction due to pipe length or routing;

3– Dirty or worn air flapper. (Air flapper should be checked and replaced if needed.)

WARNING – HIGH CO OUTPUT MAY BE FATAL. DO NOT ALLOW THE UNIT TO OPERATE AT CO OUTPUT LEVELS ABOVE 0.04 PERCENT. BEFORE ALLOWING THE UNIT TO OPERATE, THE SOURCE OF IMPROPER COMBUSTION MUST BE LOCATED AND CORRECTED.

Testing for Abnormally High CO_2 and CO Content

There are two methods of measuring the CO_2 and CO content of the exhaust gas, depending on when the unit was produced and type of pressure switch it uses.

G14 units equipped with air intake vacuum switch and exhaust outlet pressure switch:

1– Drill size "R" or 11/32 in. hole on top of the exhaust outlet PVC elbow (inside unit cabinet) and tap 1/8–27 NPT as shown in figure 26. This hole is used as the CO_2/CO test port.

2– Install a hose barb connector into the test port. Refer to figure 27.

3– Attach end of Fyrite sampling tube to hose barb on exhaust outlet elbow.

4– Set thermostat to highest setting and allow unit to run for 15 minutes.

5– When CO_2 or CO testing is completed, turn off unit, remove hose barb from exhaust outlet elbow and use a 1/8 inch plastic pipe plug to close off the test port.

CAUTION: The exhaust vent pipe operates under positive pressure and must be completely sealed to prevent leakage of combustion products into the living space.

CO_2 AND CO TEST PROCEDURE (EQUIPPED WITH AIR INTAKE VACUUM AND EXHAUST OUTLET SWITCHES)

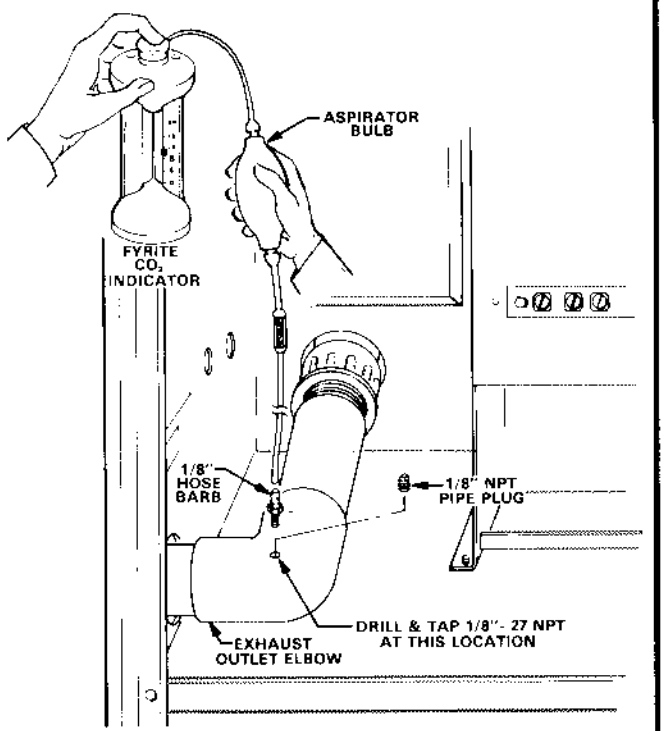


FIGURE 27

G14 units equipped with differential pressure switch:

1– Disconnect the differential pressure switch hose from the 1/8 inch differential pressure switch outlet adapter and connect the sampling device to the hose shown in figure 28.

2– Set thermostat to highest setting and allow the unit to run for 15 minutes before taking a sample.

3– Take CO_2 or CO sample.

4– When CO_2 or CO test is completed, turn off unit, remove test hose from pressure switch hose and SECURELY reconnect the differential pressure switch hose to the pressure switch adapter.

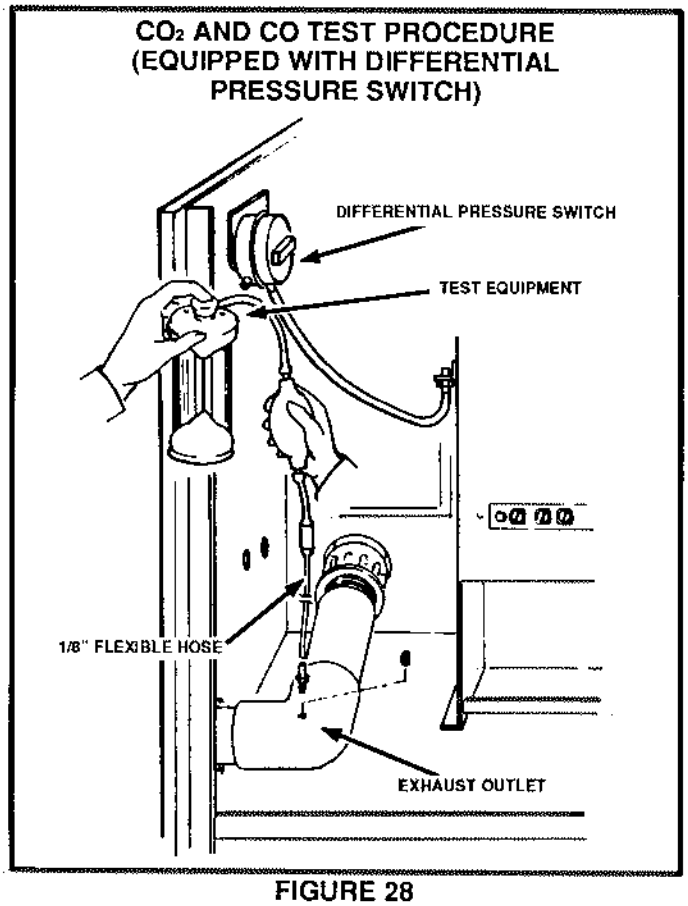


FIGURE 28

CAUTION– The exhaust vent pipe operates under positive pressure and must be completely sealed to prevent leakage of combustion products into the living space.

H–Safety Shutdown

Safety shutdown occurs when any of the following problems are encountered:

1– Loss of combustion during heating cycle caused by:
   a. Obstruction to air intake piping;
   b. Obstruction to exhaust outlet piping;
   c. Low gas pressure;
   d. Failure of gas flapper valve;
   e. Failure of air flapper valve;
   f. Failure of main gas valve;
   g. Loose spark plug or sensor creating pressure loss;
   h. Loose sensor wire.

2– High limit cutout:
   a. Blower failure;
   b. Temperature rise too high;
   c. Restricted filter or return air;
   d. Restricted supply air plenum.

I–Internal Component Temperature

During operation, temperature at the top of the combustion chamber and tailpipe is 1,000 to 1,200°F. At the tailpipe entrance to the exhaust decoupler, temperature has dropped to approximately 600°F. Temperature from the exhaust decoupler outlet to coil intake manifold is 350°F. At the coil exhaust outlet manifold, temperature range is approximately 100 to 110°F. These are average temperatures and will vary with blower speed and input.

J–Condensate pH Range

The condensate is mildly acidic and can be measured with pH indicators. The pH scale as shown in figure 29 is a measurement of acidity or alkalinity.

The concentration of the acidity of all these fluids including the condensate is very low and harmless.

The following scale shows the relative pH of some common liquids as compared with the condensate of G14 units.

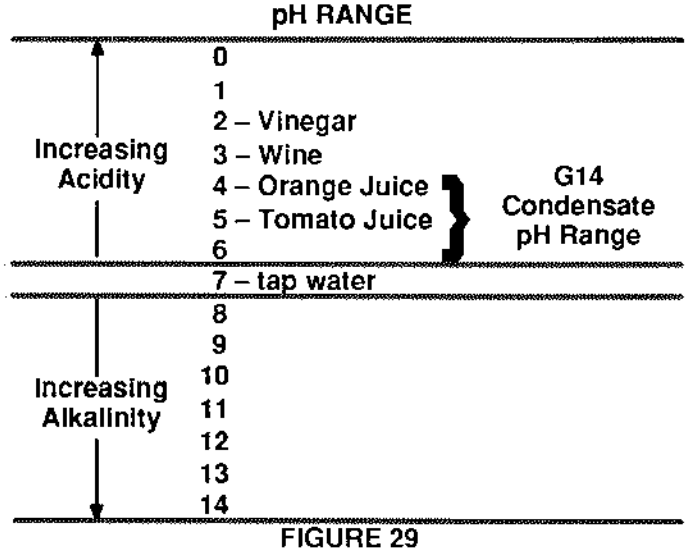


FIGURE 29

K–Acceptable Operating Input

Field adjustments to the unit are not normally needed due to the specifically sized components for each input rating.

The unit may run up to ± 3 to 4 percent of rated input (listed on unit nameplate) due to installation variables such as temperature rise, external static pressure and return air temperature combined with allowable tolerances of components within the unit. This is an acceptable operating range.

Operation of the G14 above or below this acceptable operating range may cause continuity, start–up and lock–out problems (erratic operation). *OVERFIRING THE UNIT CAN SHORTEN THE LIFE OF THE HEAT EXCHANGE ASSEMBLY.* Overfiring can be checked by measuring the unit's input.

For new units, approximate input measurements may be obtained after allowing unit to run continuously for 15 minutes. If accurate input measurements are required, the following procedure may be used. To achieve accurate input measurements requires time for the unit to "run in." The run in time allows the flapper valves to seat and combustion to clean the protective layer of oil residue that may be present from inside surfaces of the heat exchange assembly. This process stabilizes the combustion rate and may take one to two hours of continuous operation. Since it is impractical to operate an installed unit for one to two hours continuously, the unit should be allowed to operate normally, (cycle on demand) for a period to accumulate several total hours of run time. Overnight operation should provide enough total run time to obtain an accurate measurement of input. *Just prior to any input check the unit should be run continuously for 15 minutes.*

Checking Gas Input –Determine Gas Flow at Meter

1– Turn off all other gas appliances, including pilot lights or appliances if used.

2– Set thermostat to highest setting and allow the unit to run continuously for 15 minutes. The 15 minute run time is needed to allow the unit to stabilize operating rate.

3– At the gas supply meter and using either the one–, two– , three– or five–foot dial on the meter, time one full revolution (in seconds) with a watch. See figure 30.

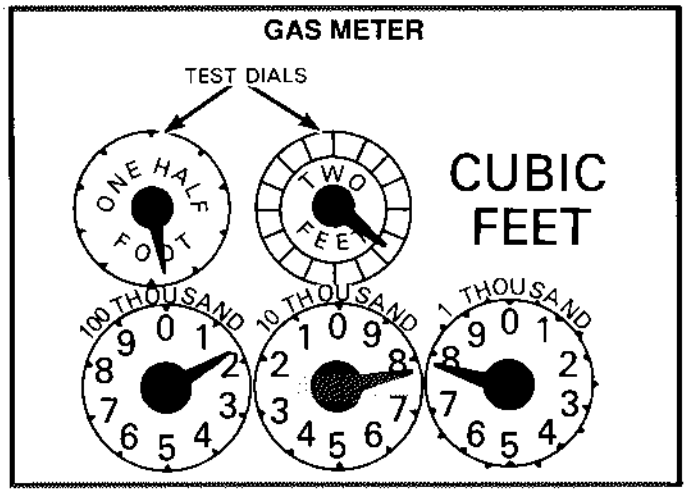


FIGURE 30

4– Find the number of seconds for one revolution on the Gas Rate chart, see table 5. Read the cubic feet for the matching one–, two–, three– or five–foot dial size from table 5, multiply this times the Btuh per cubic foot content of the gas. The result is the total gas Btuh input.

EXAMPLE:

a. One revolution on the two–foot dial = 90 seconds.
b. Using the gas rate chart, table 5, note that 90 seconds = 80 cubic feet of gas per hour.
c. Nominally there are 1000 Btuh in each cubic foot of gas. Make adjustment to this figure where the gas heating value is other than 1000 Btuh per cubic foot (contact the local gas supplier for local Btuh per cubic foot gas ratings).
d. 80 cu. ft./hr. x 1000 Btuh/cu. ft. = 80,000 Btuh input.

5– Check the Btuh input figure against the Btuh listed on the unit nameplate.

TABLE 5

METER FLOW RATE

GAS RATE – CUBIC FEET PER HOUR

Secs. for One Rev.	Size of Test Dial			Secs. for One Rev.	Size of Test Dial			Secs. for One Rev.	Size of Test Dial		Secs. for One Rev.	Size of Test Dial	
	1 cu. ft.	2 cu. ft.	3 cu. ft.		1 cu. ft.	2 cu. ft.	3 cu. ft.		2 cu. ft.	5 cu. ft.		2 cu. ft.	5 cu. ft.
10	360	720	1800	34	106	212	529	62	116	290	110	–	164
11	327	655	1636	35	103	206	514	64	112	281	112	64	161
12	300	600	1500	36	100	200	500	66	109	273	116	62	155
13	277	555	1385	37	97	195	486	68	106	265	120	60	150
14	257	514	1286	38	95	189	479	70	103	257	125	–	144
15	240	480	1200	39	92	185	462	72	100	250	130	–	138
16	225	450	1125	40	90	180	450	74	97	243	135	–	132
17	212	424	1059	41	–	176	439	76	95	237	140	–	129
18	200	400	1000	42	86	172	429	78	92	231	145	–	124
19	189	379	947	43	–	167	419	80	90	225	150	–	120
20	180	360	900	44	82	164	409	82	88	220	155	–	116
21	171	343	857	45	80	160	400	84	86	214	160	–	113
22	164	327	818	46	78	157	391	86	84	209	165	–	109
23	157	313	783	47	–	153	383	88	82	205	170	–	106
24	150	300	750	48	75	150	375	90	80	200	175	–	103
25	144	288	720	49	–	147	367	92	78	196	180	–	100
26	138	277	692	50	72	144	360	94	–	192	–	–	–
27	133	267	667	–	–	–	–	96	75	188	51	141	353
28	129	257	643	52	69	138	346	98	–	184	53	136	340
29	124	248	621	54	67	133	333	100	72	180	55	131	327
30	120	240	600	56	64	129	321	102	–	176	57	126	316
31	116	232	581	58	62	124	310	104	69	173	59	122	305
32	113	225	563	60	60	120	300	106	–	170	–	–	–
33	109	218	545	–	–	–	–	108	67	167	–	–	–

IX–NEW UNIT START–UP

Normal setup conditions of a new unit installation require running the unit through several tries for ignition before the unit will run continuously. Initially the unit may start and die several times until air bleeds from the gas piping. Break and remake the thermostat demand to restart ignition sequence at 2 to 3 minute intervals until continuous operation is obtained.

X–TROUBLESHOOTING

Effective troubleshooting of the G14 depends on a thorough understating of all unit components and their functions as described in this manual. Symptoms of unit operation break down problems into four main categories:

1– UNIT WILL NOT RUN.

2– UNIT STARTS CLEAN BUT RUNS LESS THAN 10 SECONDS.

3– UNIT RUNS BUT SHUTS OFF BEFORE THERMOSTAT IS SATISFIED – INSUFFICIENT HEAT.

4– UNIT SPUTTER STARTS AND DIES.

EACH OF THE FOUR PROBLEM CATEGORIES ABOVE ARE BROKEN DOWN INTO TROUBLESHOOTING FLOW CHARTS in the following section with additional information provided to explain certain checks. Steps in the flow charts for measuring manifold pressure, flame signal, exhaust CO_2 content, exhaust CO content and operating input are explained in previous sections.

CHOOSE THE FLOW CHART THAT BEST DESCRIBES THE UNIT'S PROBLEM. FOLLOW THE FLOW CHART STEP BY STEP. At any point a "NO" answer is reached and a repair is made, reassemble the unit and retest for operation. If the unit does not operate, recheck to that point and then continue through the chart. Occasionally more than one specific problem may exist.

When troubleshooting a unit, be sure that all of the basic checks are covered carefully and double check your diagnosis before replacing components. DO AS LITTLE DISASSEMBLY AS POSSIBLE during troubleshooting to prevent introducing additional problems such as gas or air leaks or damage to components.

CAUTION – Before servicing unit:

1– If unit has been operating, internal components will be HOT. Allow the unit to cool for at least 15 minutes before placing hands into the heat section access opening.

2– To cool completely to room temperature, the blower should run continuously for about 40 minutes.

3– When servicing the air intake flapper valve, keep in mind that it is only moderately warm during unit operation. After the unit cycles off, the residual heat in the combustion chamber will transfer back to the valve causing it to become very hot! Allow it to cool for 10 to 15 minutes before handling. The blower can also be run to cool the air intake.

4– The spark plug is torqued to 28 ± 2 feet/lbs. The sensor is torqued to 14 ± 1 foot/lbs. Allow metal to cool before measuring torque.

A–Checking Air Intake Flapper Valve

1– Remove air intake chamber cover and check for foreign materials that may have accumulated, clean purge blower and upper and lower chamber compartment if necessary.

2– Do not remove the air flapper valve unless suspected of being faulty. If the air flapper valve is removed, new screws must be used to resecure the valve to the valve body.

NOTE – The special screws used with the air flapper valve are treated with a non–hardening seizing compound. DO NOT REUSE OLD SCREWS. NEW SCREWS ARE SUPPLIED WITH REPLACEMENT AIR FLAPPER VALVES. If reinstalling the old air flapper valve in the unit, REPLACEMENT SCREWS ARE AVAILABLE IN KIT FORM FROM LENNOX REPAIR PARTS. DO NOT USE Loctite OR SIMILAR THREAD SEIZING COMPOUNDS TO SECURE SCREWS.

If the valve must be removed, carefully remove the eight screws holding the air intake flapper valve to the valve body. DO NOT TURN OR REMOVE THE CENTER SCREW. Remove the valve from the unit being careful not to damage gasket (if used, refer to items 5 and 6 below). CAUTION – DO NOT DROP.

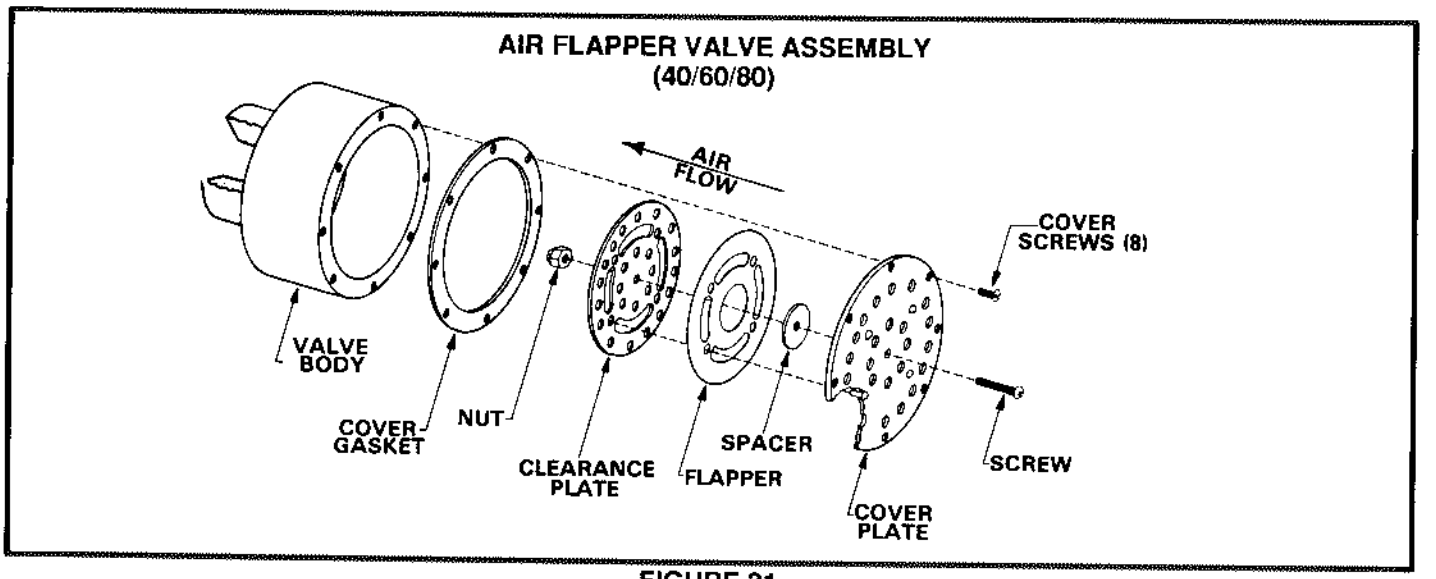


FIGURE 31

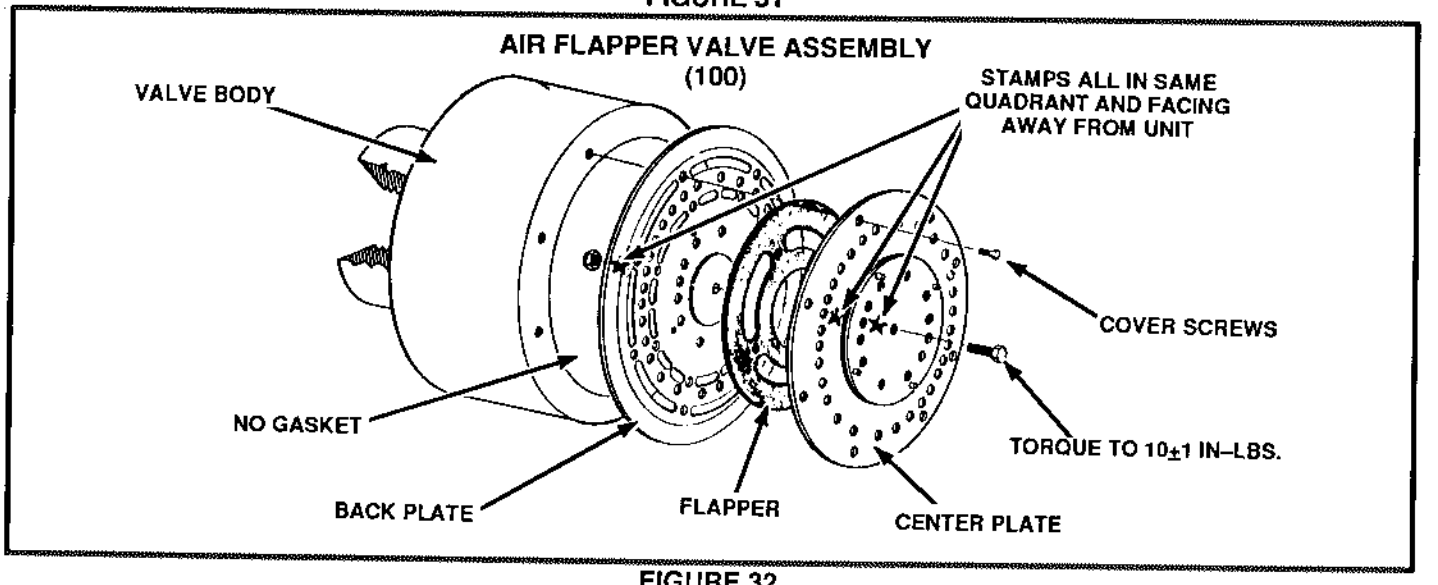


FIGURE 32

3– EXTREME CARE SHOULD BE TAKEN WHEN DISASSEMBLING THE INTERNAL COMPONENTS OF THE VALVE. If taken apart, the plates can be rotated out of phase or reversed. The spacer thickness has an extremely low tolerance. Note that each plate has a stamp of the spacer thickness and a star or the words "THIS SIDE OUT." These stamps should all lie in the same quadrant (figure 32) and face the outside of the unit.

4– Visually inspect the flapper. On new units, the flapper may not be perfectly flat, it may be curved or dished between the plates – this is normal. On units that have had sufficient run in time, the flapper will be flat. If the flapper is torn, creased or has uneven (frayed) edges, the material must be replaced. A flapper material replacement kit is available from Lennox Repair Parts.

5– To find potential warpage in the plates, check for the required clearance between the flapper and back plate in several places around the circumference of the valve. See figure 33. Use a feeler gauge, starting small and working up to the clearance dimension until the gauge is just about snug. BE VERY CAREFUL NOT TO DAMAGE THE FLAPPER MATERIAL BY FORCING THE FEELER GAUGE.

The clearance should be checked in six or eight places around the valve. If the valve is out of the clearance at any point around the valve, simply replace the assembly. Required clearance values are updated regularly in the Service and Application notes.

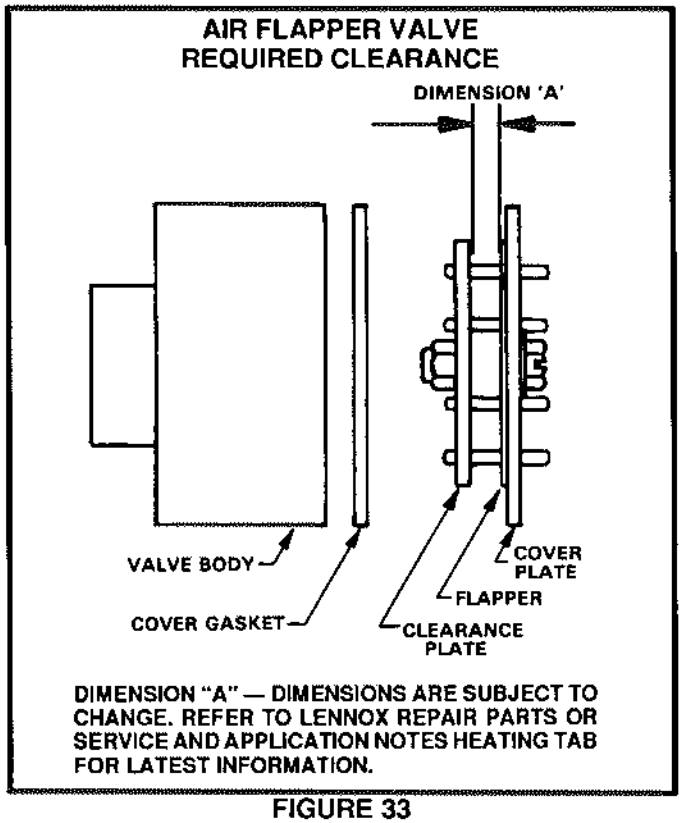


FIGURE 33

6– When placing a new or old valve back into the unit, line up the gasket, if used, and start all eight screws in place by hand. Then tighten the screws evenly to a maximum of 9 inch pounds. Do not overtighten screws; if threads are damaged the entire valve body will have to be replaced. All eight screws must be in place for proper operation.

B–Checking the Gas Flapper Valve

1– Disconnect union at bottom of expansion tank and remove entire gas flapper valve, nipple and elbow assembly as one piece. It is not recommended to remove elbow and nipple from flapper valve unless the valve is being replaced. Use care not to damage o–ring when handling valve out of unit. DO NOT DROP.

2– Do not turn or remove center screw of valve assembly. Visually inspect the flapper. The flapper may be dished or curved on new units, this is normal. In units with "run in" time, the flapper will be flat. If the flapper is torn, creased or has uneven (frayed) edges, the valve assembly must be replaced.

3– Check for free movement of the flapper over the spacer. Use a feeler gauge blade to carefully move the flapper between the plates. Be sure the flapper is not trapped between the spacer and either the valve body or clearance plate. If the flapper does not move freely or is trapped under the spacer, the valve assembly must be replaced.

4– Check for the required clearance between the flapper and valve body. Required clearance values for G14 units are updated regularly in the Service and Application notes. Use a feeler gauge, starting small and working up to the clearance dimensions until the gauge is just about snug. BE VERY CAREFUL NOT TO DAMAGE THE FLAPPER MATERIAL BY FORCING THE GAUGE. The clearance should be checked around the valve in several places. If the valve is out of the required clearance dimension given in figure 34 at any point around the valve, it must be replaced.

5– When placing a new or old valve back into the unit, use care not to damage the o–ring. DO NOT USE PIPE SEALERS ON THE FLAPPER VALVE THREADS.

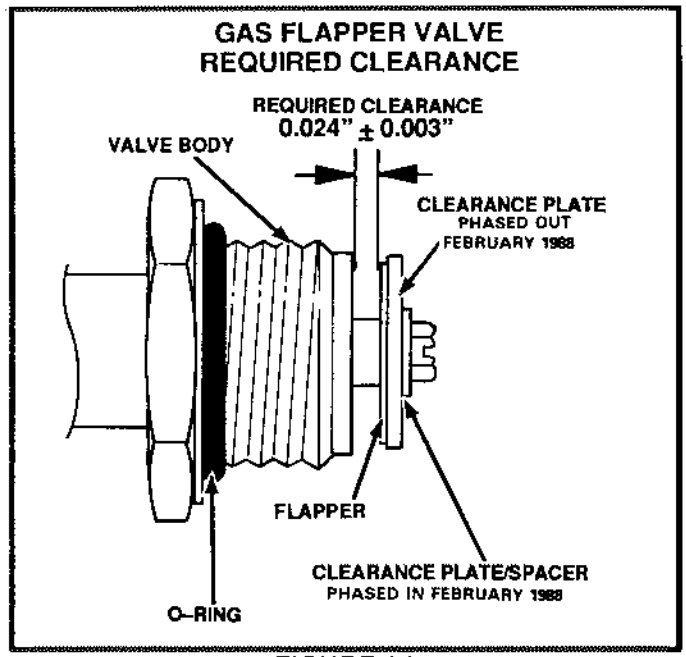


FIGURE 34

C–Checking Gas Orifice

1– With gas flapper valve assembly removed, use a flashlight to check for blockage of the orifice in the manifold. To remove the orifice, most units use a 1/2 inch shallow socket with an extension. Some older models of G14–100 may use a 9/16 inch shallow socket.

2– Check the orifice drill size for the unit as given in the Service and Application notes. If the orifice is incorrect it must be replaced.

3– Refer to figures 35 and 36 for the physical characteristics of the orifice. The surface must be flat and the orifice opening must not be chamfered. The orifice taper must be centered and not recessed. If any defects are found the orifice must be replaced.

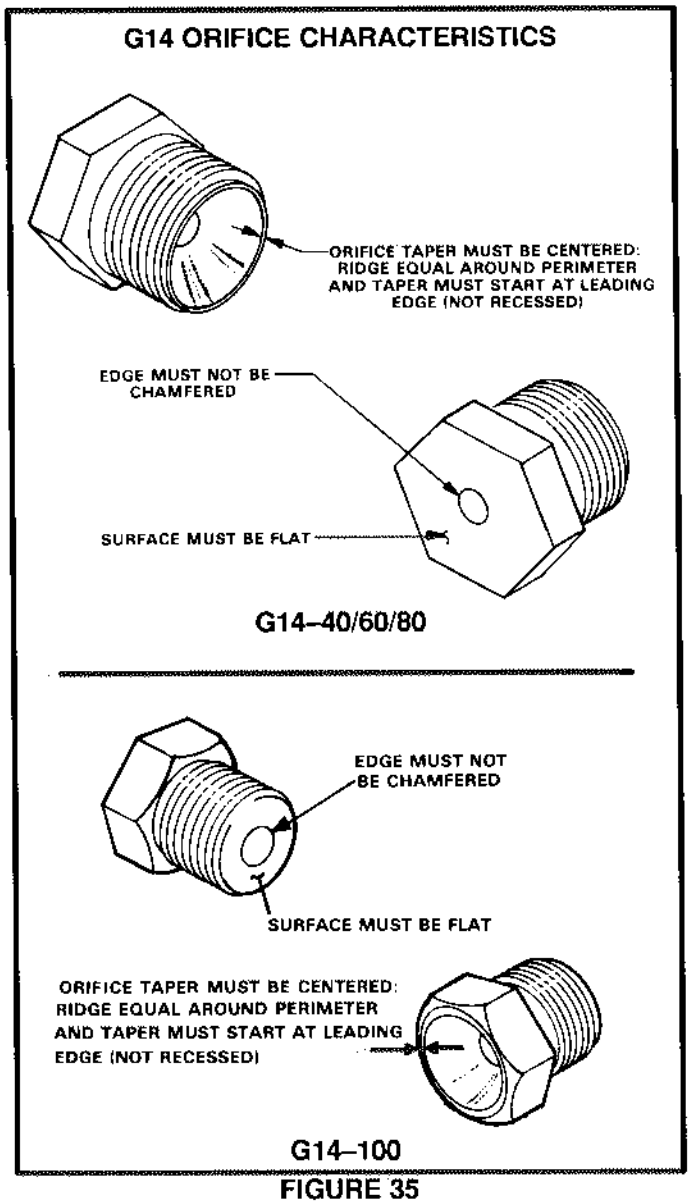


FIGURE 35

In mid to late 1984, a double–tapered orifice was phased into G14 units.In early models,(those units produced before July 1984), the orifice was single–tapered as shown in figure 35. G14 units began using a double coned orifice primarily to improve operating characteristics. See figure 36. If the orifice needs replacing, it should be replaced with its like component.

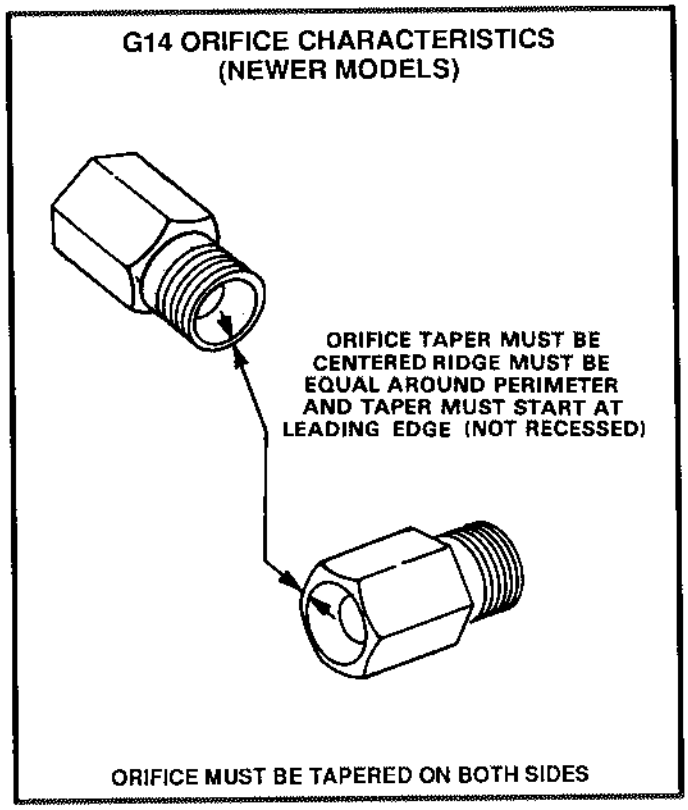


FIGURE 36

4– Standard atmospheric burner orifices or orifice blanks cannot be used as replacements for the G14. Only replacement orifices supplied through Lennox should be used.

5– When threading the orifice into the manifold use a socket to hold threads beyond end of socket. CAREFULLY ALIGN THREADS BY HAND TURNING THE SOCKET EXTENSION UNTIL ORIFICE IS IN PLACE. AVOID CROSS–THREADING THE ORIFICE.

D–Other Problems

The following is a list of problems which might occur, but are not covered under the four main troubleshooting categories. The steps for troubleshooting these problems are covered in the paragraphs following the list.

1–Blower Runs Continuously
2–Frequent Recycling of Blower After Heat Cycle
3–Supply Air Blower Does Not Run
4–Unit Does Not Shut Off
5–Abnormal Sounds

Troubleshooting Other Problems:

1– Blower Runs Continuously

Step 1– Is thermostat blower switch set to "ON?" If so, switch to "AUTO."

Step 2– Is blower control "OFF" setting below ambient air temperature? If so, readjust to 90°F.

Step 3– Is primary blower control operating normally? Replace if necessary.

Step 4– Are blower relay contacts operating normally? Replace if necessary.

2– Frequent Recycling Of Blower After Heat Cycle

Check the primary fan control for correct adjustment. The primary control should be adjusted to 90°F. Settings above 90°F do not allow the heat exchanger assembly to cool down enough before the blower is stopped. The residual heat in the unit when the airflow is stopped builds up causing a recycling problem.

3– Supply Air Blower Does Not Run

Step 1– Check voltage at the blower motor taps after about 45 seconds.

Step 2– Check for loose wiring.

Step 3– Blower relay operating properly? Check for 120VAC between terminal 2 and neutral immediately after ignition. See electrical schematic.

Step 4– Blower control relay operating properly? Check for 120 VAC between terminal 5 and neutral after the unit has been operating 35 to 40 seconds. See electrical schematic.

Step 5– Blower motor and /or capacitor operating normally? Check 120VAC between the heating motor tap and neutral after the unit has been operating 35 to 40 seconds. See electrical schematic. Use standard motor troubleshooting techniques if voltage reaches this point and blower still operates.

4– Unit Does Not Shut Off

Step 1– Thermostat operating normally?

Step 2– Shorted 24 VAC control circuit wiring – check and repair.

Step 3– Gas valve stuck open?

5– Abnormal Sounds

Corrective action is required if abnormal hissing sounds around the air decoupler are heard. This problem may be caused by:

1– Air leakage around the air decoupler box cover.

2– Air leakage around the air decoupler box cover mounting screws.

3– Air leakage out of the purge blower lead strain relief.

4– Air leakage around the intake air connection to the air decoupler box.

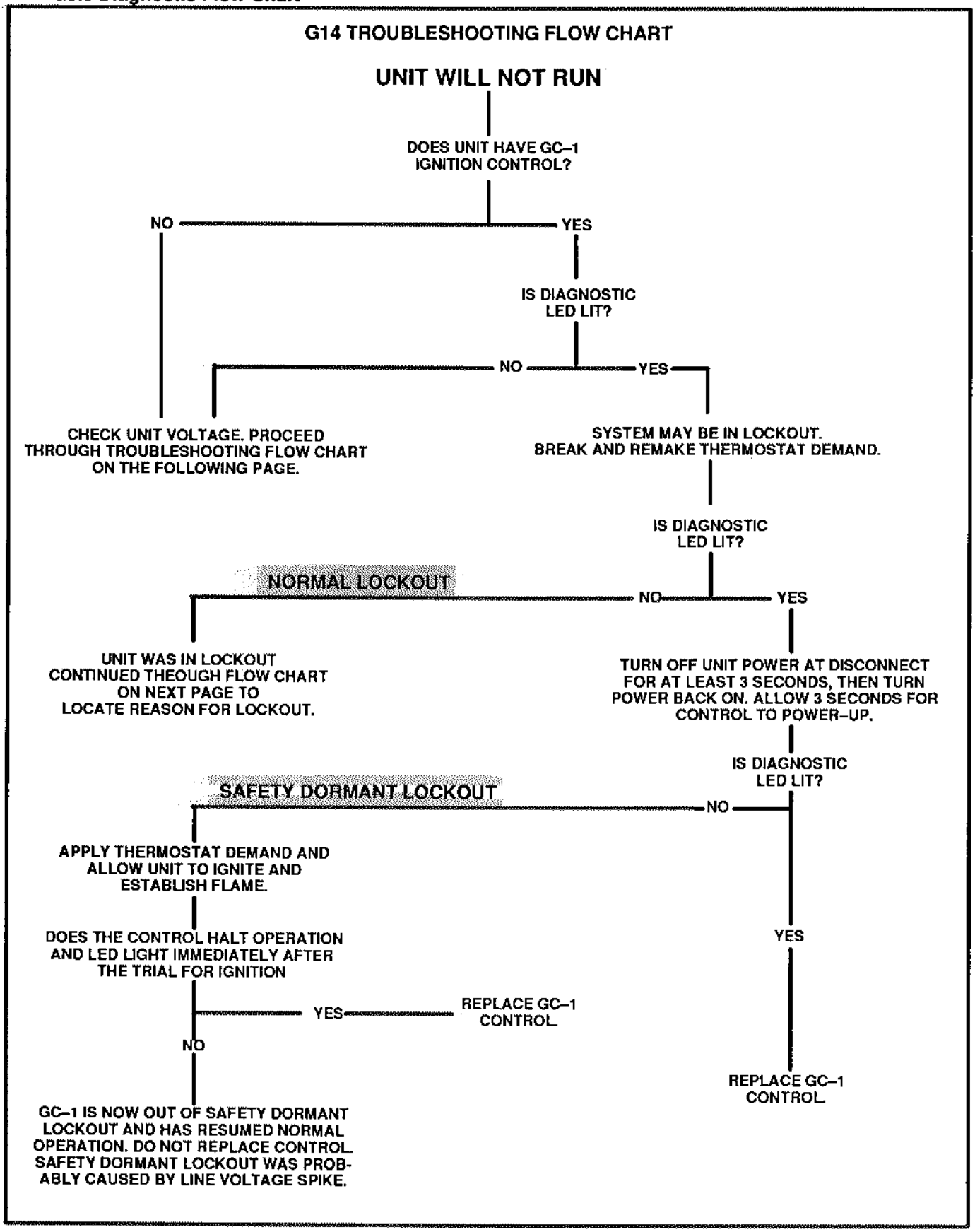
5– Air leakage out the back of the air decoupler box.
   a. Around the intake pipe.
   b. Around the air decoupler box rear mounting bolt.

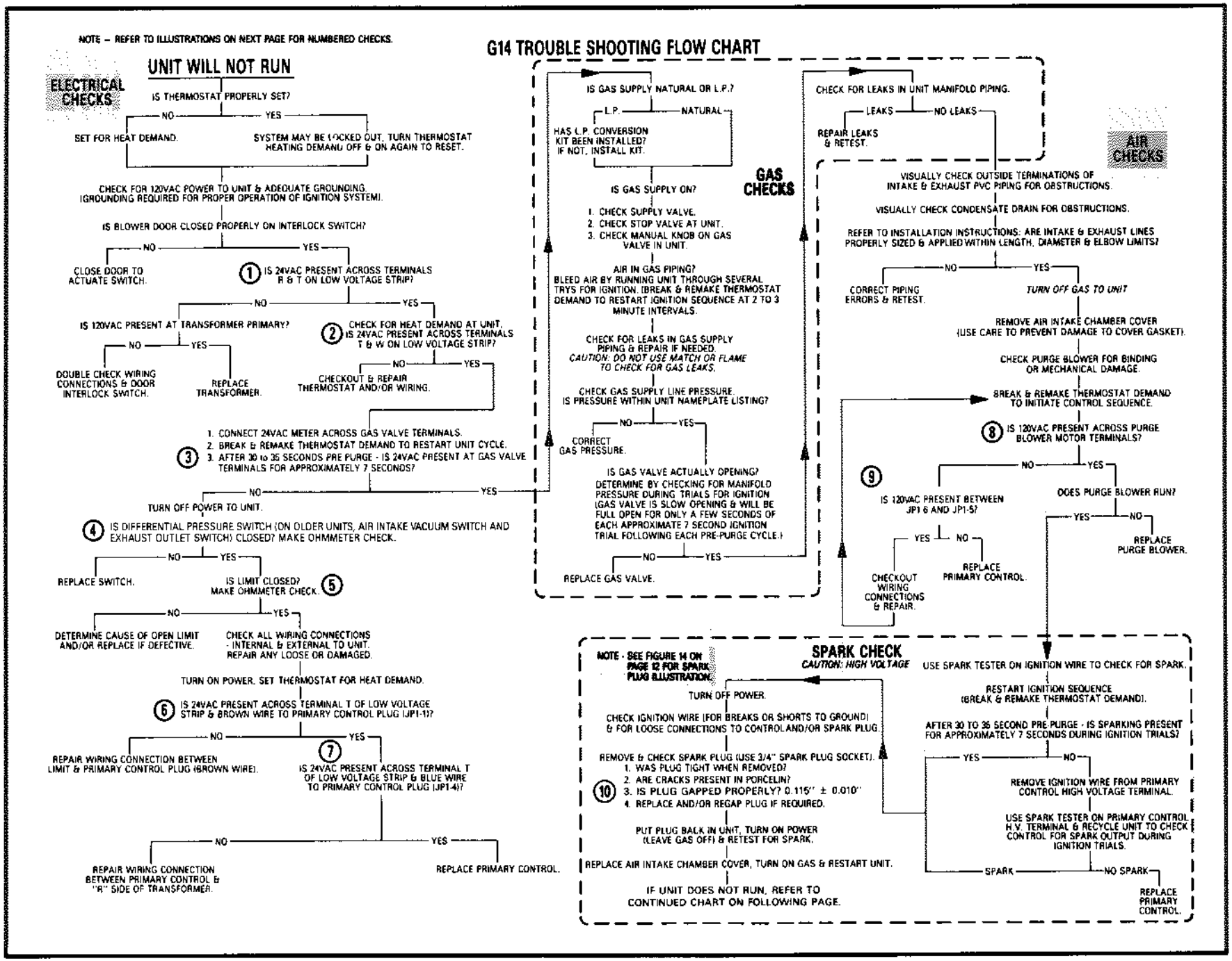
DANGER – EXTREMELY LOUD "PULSE" SOUNDS, WHICH CAN BE EASILY HEARD THROUGH THE SUPPLY OR RETURN AIR DUCTS, MAY INDICATE A COMBUSTION CHAMBER OR TAILPIPE LEAK. DO NOT ALLOW UNIT TO OPERATE WITH A COMBUSTION CHAMBER OR EXHAUST LEAK. BEFORE ALLOWING THE UNIT TO OPERATE, EXHAUST LEAKS MUST BE LOCATED AND CORRECTED.

The unit should be examined visually for unusual amounts of condensate in any area other than the condensing coil outlet which might indicate a system leak.

Abnormal rattling and casing vibration other than obvious loose parts may indicate metal–to–metal contact of components which are normally separated during operation. The gas piping, condensing coil outlet and air intake pipe areas should be checked. The combustion chamber to exhaust decoupler area should also be checked.

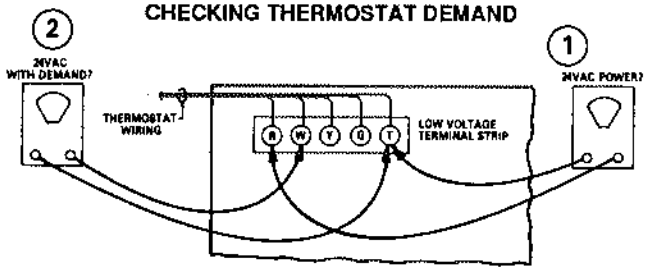
E–Basic Diagnostic Flow Chart



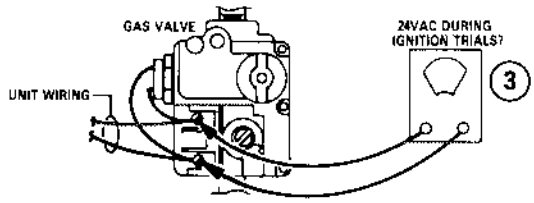

NOTE – REFER TO ILLUSTRATIONS ON NEXT PAGE FOR NUMBERED CHECKS.
G14 TROUBLE SHOOTING FLOW CHART
UNIT WILL NOT RUN
ELECTRICAL CHECKS
IS THERMOSTAT PROPERLY SET?
NO
YES
SET FOR HEAT DEMAND.
SYSTEM MAY BE LOCKED OUT. TURN THERMOSTAT HEATING DEMAND OFF & ON AGAIN TO RESET.
CHECK FOR 120VAC POWER TO UNIT & ADEQUATE GROUNDING. (GROUNDING REQUIRED FOR PROPER OPERATION OF IGNITION SYSTEM).
IS BLOWER DOOR CLOSED PROPERLY ON INTERLOCK SWITCH?
CLOSE DOOR TO ACTUATE SWITCH.
1 IS 24VAC PRESENT ACROSS TERMINALS R & T ON LOW VOLTAGE STRIP?
IS 120VAC PRESENT AT TRANSFORMER PRIMARY?
DOUBLE CHECK WIRING CONNECTIONS & DOOR INTERLOCK SWITCH.
REPLACE TRANSFORMER.
2 CHECK FOR HEAT DEMAND AT UNIT. IS 24VAC PRESENT ACROSS TERMINALS T & W ON LOW VOLTAGE STRIP?
CHECKOUT & REPAIR THERMOSTAT AND/OR WIRING.
3 1. CONNECT 24VAC METER ACROSS GAS VALVE TERMINALS.
2. BREAK & REMAKE THERMOSTAT DEMAND TO RESTART UNIT CYCLE.
3. AFTER 30 to 35 SECONDS PRE PURGE - IS 24VAC PRESENT AT GAS VALVE TERMINALS FOR APPROXIMATELY 7 SECONDS?
TURN OFF POWER TO UNIT.
4 IS DIFFERENTIAL PRESSURE SWITCH (ON OLDER UNITS, AIR INTAKE VACUUM SWITCH AND EXHAUST OUTLET SWITCH) CLOSED? MAKE OHMMETER CHECK.
REPLACE SWITCH.
IS LIMIT CLOSED? MAKE OHMMETER CHECK. 5
DETERMINE CAUSE OF OPEN LIMIT AND/OR REPLACE IF DEFECTIVE.
CHECK ALL WIRING CONNECTIONS - INTERNAL & EXTERNAL TO UNIT. REPAIR ANY LOOSE OR DAMAGED.
TURN ON POWER. SET THERMOSTAT FOR HEAT DEMAND.
6 IS 24VAC PRESENT ACROSS TERMINAL T OF LOW VOLTAGE STRIP & BROWN WIRE TO PRIMARY CONTROL PLUG (JP1-1)?
REPAIR WIRING CONNECTION BETWEEN LIMIT & PRIMARY CONTROL PLUG (BROWN WIRE).
7 IS 24VAC PRESENT ACROSS TERMINAL T OF LOW VOLTAGE STRIP & BLUE WIRE TO PRIMARY CONTROL PLUG (JP1-4)?
REPAIR WIRING CONNECTION BETWEEN PRIMARY CONTROL & "R" SIDE OF TRANSFORMER.
REPLACE PRIMARY CONTROL.
GAS CHECKS
IS GAS SUPPLY NATURAL OR L.P.?
L.P.
NATURAL
HAS L.P. CONVERSION KIT BEEN INSTALLED? IF NOT, INSTALL KIT.
IS GAS SUPPLY ON?
1. CHECK SUPPLY VALVE.
2. CHECK STOP VALVE AT UNIT.
3. CHECK MANUAL KNOB ON GAS VALVE IN UNIT.
AIR IN GAS PIPING? BLEED AIR BY RUNNING UNIT THROUGH SEVERAL TRYS FOR IGNITION. (BREAK & REMAKE THERMOSTAT DEMAND TO RESTART IGNITION SEQUENCE AT 2 TO 3 MINUTE INTERVALS.
CHECK FOR LEAKS IN GAS SUPPLY PIPING & REPAIR IF NEEDED. CAUTION: DO NOT USE MATCH OR FLAME TO CHECK FOR GAS LEAKS.
CHECK GAS SUPPLY LINE PRESSURE. IS PRESSURE WITHIN UNIT NAMEPLATE LISTING?
CORRECT GAS PRESSURE.
IS GAS VALVE ACTUALLY OPENING? DETERMINE BY CHECKING FOR MANIFOLD PRESSURE DURING TRIALS FOR IGNITION (GAS VALVE IS SLOW OPENING & WILL BE FULL OPEN FOR ONLY A FEW SECONDS OF EACH APPROXIMATE 7 SECOND IGNITION TRIAL FOLLOWING EACH PRE-PURGE CYCLE.)
REPLACE GAS VALVE.
CHECK FOR LEAKS IN UNIT MANIFOLD PIPING.
LEAKS
NO LEAKS
REPAIR LEAKS & RETEST.
AIR CHECKS
VISUALLY CHECK OUTSIDE TERMINATIONS OF INTAKE & EXHAUST PVC PIPING FOR OBSTRUCTIONS.
VISUALLY CHECK CONDENSATE DRAIN FOR OBSTRUCTIONS.
REFER TO INSTALLATION INSTRUCTIONS: ARE INTAKE & EXHAUST LINES PROPERLY SIZED & APPLIED WITHIN LENGTH, DIAMETER & ELBOW LIMITS?
CORRECT PIPING ERRORS & RETEST.
TURN OFF GAS TO UNIT
REMOVE AIR INTAKE CHAMBER COVER (USE CARE TO PREVENT DAMAGE TO COVER GASKET).
CHECK PURGE BLOWER FOR BINDING OR MECHANICAL DAMAGE.
BREAK & REMAKE THERMOSTAT DEMAND TO INITIATE CONTROL SEQUENCE.
8 IS 120VAC PRESENT ACROSS PURGE BLOWER MOTOR TERMINALS?
9
IS 120VAC PRESENT BETWEEN JP1 6 AND JP1-5?
CHECKOUT WIRING CONNECTIONS & REPAIR.
REPLACE PRIMARY CONTROL.
DOES PURGE BLOWER RUN?
REPLACE PURGE BLOWER.
SPARK CHECK
CAUTION: HIGH VOLTAGE
NOTE - SEE FIGURE 14 ON PAGE 12 FOR SPARK PLUG ILLUSTRATION.
TURN OFF POWER.
CHECK IGNITION WIRE (FOR BREAKS OR SHORTS TO GROUND) & FOR LOOSE CONNECTIONS TO CONTROL AND/OR SPARK PLUG.
REMOVE & CHECK SPARK PLUG (USE 3/4" SPARK PLUG SOCKET).
10
1. WAS PLUG TIGHT WHEN REMOVED?
2. ARE CRACKS PRESENT IN PORCELIN?
3. IS PLUG GAPPED PROPERLY? 0.115" ± 0.010"
4. REPLACE AND/OR REGAP PLUG IF REQUIRED.
PUT PLUG BACK IN UNIT, TURN ON POWER (LEAVE GAS OFF) & RETEST FOR SPARK.
REPLACE AIR INTAKE CHAMBER COVER, TURN ON GAS & RESTART UNIT.
IF UNIT DOES NOT RUN, REFER TO CONTINUED CHART ON FOLLOWING PAGE.
USE SPARK TESTER ON IGNITION WIRE TO CHECK FOR SPARK.
RESTART IGNITION SEQUENCE (BREAK & REMAKE THERMOSTAT DEMAND).
AFTER 30 TO 35 SECOND PRE PURGE - IS SPARKING PRESENT FOR APPROXIMATELY 7 SECONDS DURING IGNITION TRIALS?
REMOVE IGNITION WIRE FROM PRIMARY CONTROL HIGH VOLTAGE TERMINAL.
USE SPARK TESTER ON PRIMARY CONTROL H.V. TERMINAL & RECYCLE UNIT TO CHECK CONTROL FOR SPARK OUTPUT DURING IGNITION TRIALS.
SPARK
NO SPARK
REPLACE PRIMARY CONTROL.

G14 TROUBLESHOOTING FLOW CHART—UNIT WILL NOT RUN

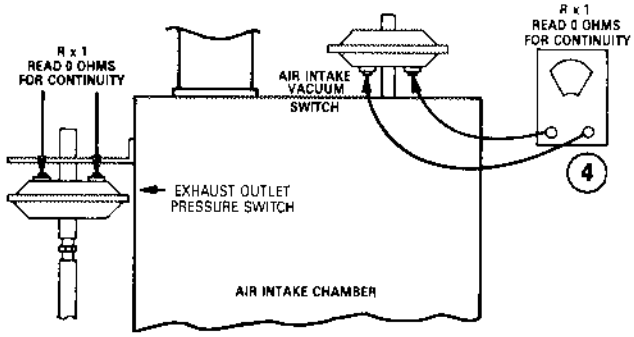
CHECKING VOLTAGE AT TERMINAL AND CHECKING THERMOSTAT DEMAND



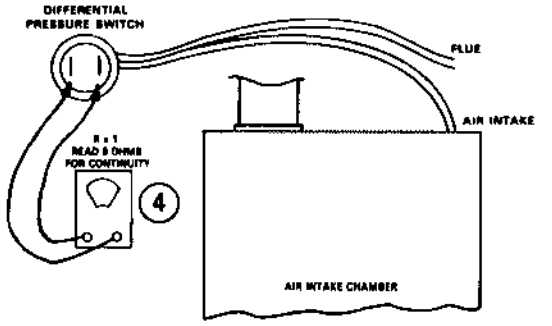
CHECKING VOLTAGE AT GAS VALVE



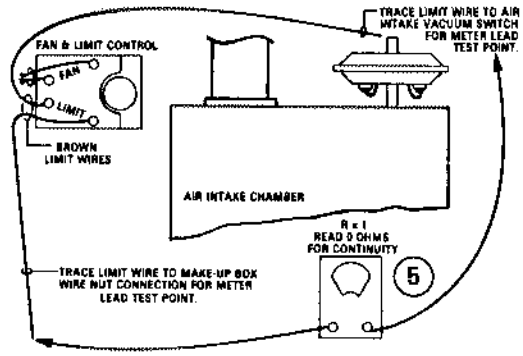
CHECKING FOR OPEN SWITCH
A–AIR INTAKE VACUUM SWITCH AND EXHAUST OUTLET SWITCH



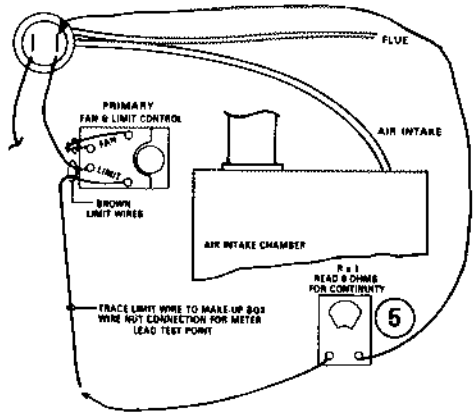
B–DIFFERENTIAL PRESSURE SWITCH



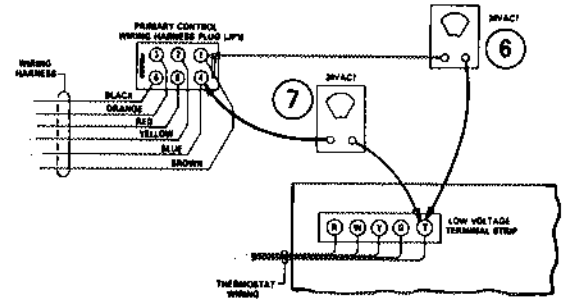
CHECKING FOR OPEN SWITCH IN LIMIT CONTROL
A–AIR INTAKE VACUUM SWITCH AND EXHAUST OUTLET SWITCH



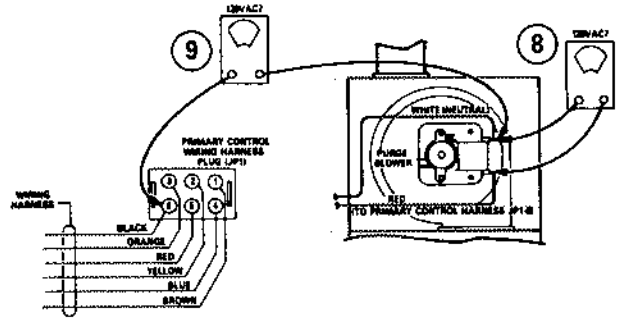
B–DIFFERENTIAL PRESSURE SWITCH



CHECKING VOLTAGE AT PRIMARY CONTROL



CHECKING VOLTAGE AT PURGE BLOWER



UNIT STARTS CLEAN BUT RUNS LESS THAN 10 SECONDS

RESET UNIT IF LOCKED OUT, LISTEN FOR CHANGE IN SOUND OF UNIT BEFORE IT STOPS.

- UNIT "LUGS" DOWN BEFORE STOPPING.
- UNIT STOPS WITHOUT ANY CHANGE IN SOUND BEFORE STOPPING.

RECIRCULATION CHECKS

CHECK FOR RECIRCULATION OF EXHAUST GASES TO AIR INTAKE AT THE OUTSIDE TERMINATIONS OF PVC PIPING

ARE INTAKE & EXHAUST PVC LINES SEPARATED AS REQUIRED IN KIT INSTALLATION INSTRUCTIONS?

- NO → MODIFY OR CORRECT AS REQUIRED.
- YES → ARE INTAKE & EXHAUST PVC LINES TERMINATED INTO A WINDOW WELL, ALCOVE OR CORNER WHERE VARYING CONDITIONS CAUSE RECIRCULATION?
  - NO → IF OUTSIDE TEMPERATURE IS LOW ENOUGH, OBSERVE EXHAUST OUTLET VAPOR WHEN UNIT IS RUNNING. RECIRCULATION WILL BE SEEN EASILY.
    - MODIFY OR CORRECT TERMINATIONS TO ELIMINATE RECIRCULATION.
  - YES → MODIFY OR CORRECT TERMINATIONS TO ELIMINATE RECIRCULATION.

NOTE - RECIRCULATION IS ALSO POSSIBLE WHEN EXHAUST CO_2 CONTENT IS ABOVE 10%. THIS IS DIFFICULT TO MEASURE AS AN INDICATION IN THIS CASE IF THE UNIT WILL ONLY RUN FOR 10 SECONDS OR LESS.

(5) IS LIMIT CUTTING OUT UNIT? CHECK FOR OPEN LIMIT IMMEDIATELY FOLLOWING UNIT CUTOUT. SHUT OFF POWER AND MAKE OHMMETER CHECK.

- NO
- YES → DETERMINE CAUSE OF LIMIT CUTOUT AND CORRECT PROBLEM.

IS DIFFERENTIAL PRESSURE SWITCH or AIR INTAKE PRESSURE SWITCH CUTTING OUT UNIT?

IS DIFFERENTIAL PRESSURE SWITCH (ON OLDER UNITS, AIR INTAKE VACUUM SWITCH AND EXHAUST OUTLET SWITCH) CLOSED? MAKE OHMMETER CHECK.

(4) CONNECT 24 VAC METER ACROSS SWITCH TERMINALS & RECYCLE UNIT. METER READS 0 VOLTS WHEN UNIT RUNS. IF SWITCH OPENS METER READS APPROXIMATELY 24 VAC.

- NO
- YES → CHECK FOR PARTIAL BLOCKAGE OF AIR INTAKE PVC PIPING & CONDENSATE LINE
  - IF NO BLOCKAGE EXISTS - REPLACE VACUUM SWITCH.

- NO
- YES → CHECK FOR BLOCKAGE OF EXHAUST OUTLET PVC PIPING AND CONDENSATE LINE.
  - IF NO BLOCKAGE EXISTS - REPLACE PRESSURE SWITCH.

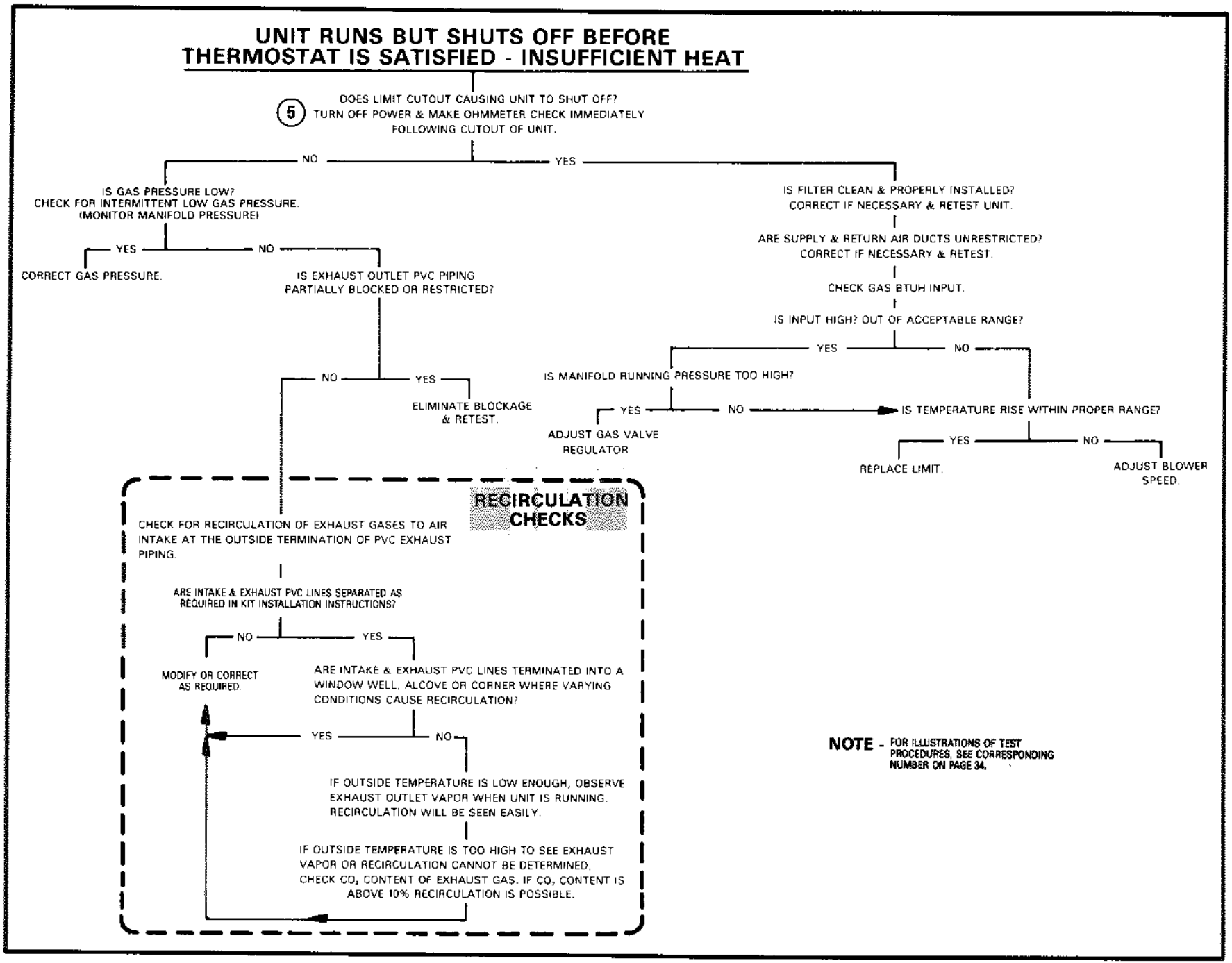
IS FLAME SIGNAL PRESENT & CORRECT? CHECK WITH MICROAMP METER

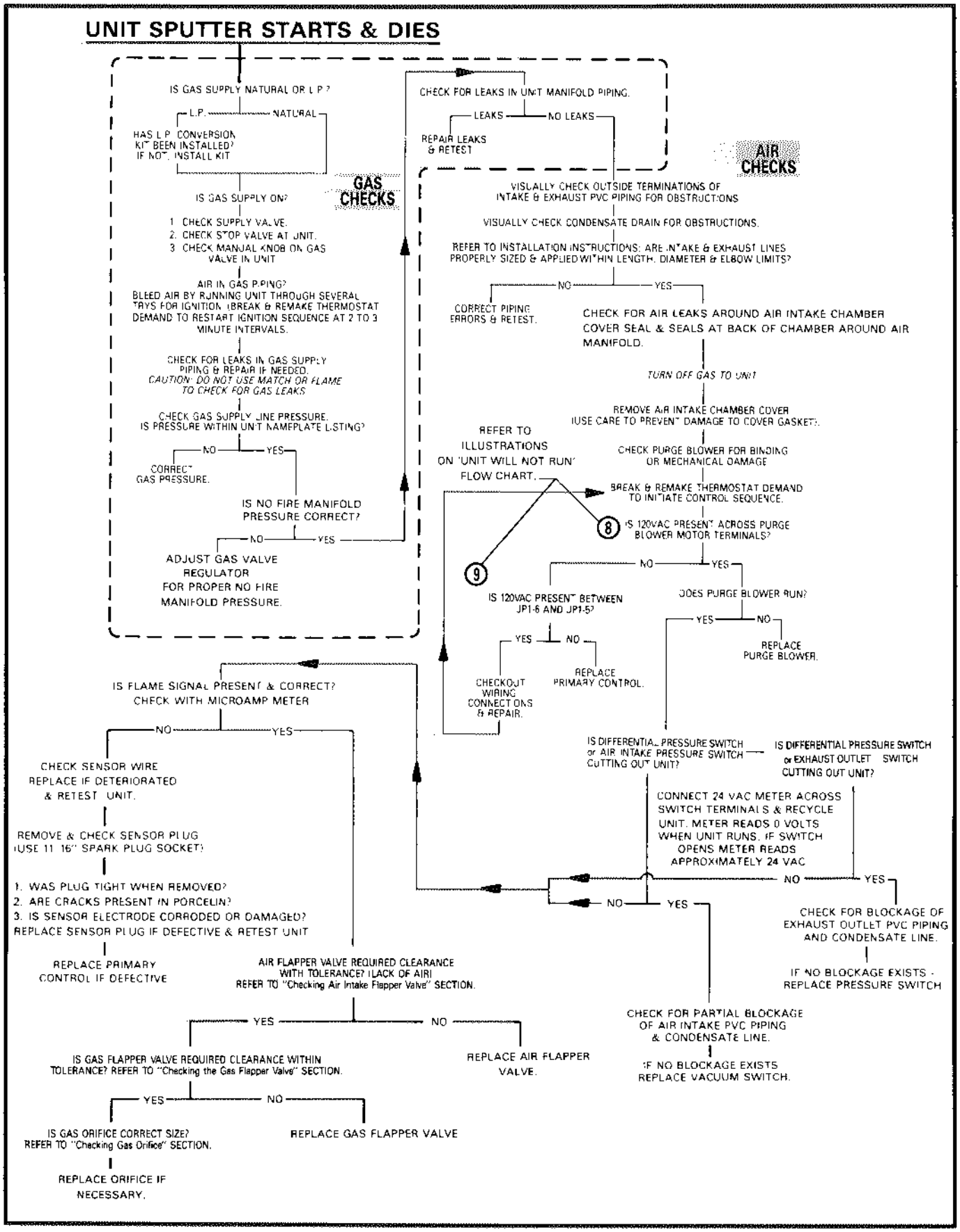
- NO → CHECK SENSOR WIRE REPLACE IF DETERIORATED & RETEST UNIT.
  - REMOVE & CHECK SENSOR PLUG (USE 11/16" SPARK PLUG SOCKET).
    1. WAS PLUG TIGHT WHEN REMOVED?
    2. ARE CRACKS PRESENT IN PORCELIN?
    3. IS SENSOR ELECTRODE CORRODED OR DAMAGED?

    REPLACE SENSOR PLUG IF DEFECTIVE & RETEST UNIT
- YES → GO TO LEFT SIDE OF CHART & MAKE RECIRCULATION CHECKS.
  - IF RECIRCULATION IS NOT PRESENT, CHECK FOR ADEQUATE GROUNDING OF UNIT & PRIMARY CONTROL. IF OKAY, CHECK PRIMARY CONTROL TIMING.
    - MONITOR MANIFOLD PRESSURE OR GAS VALVE COIL, PURGE BLOWER (120 VAC), SPARK PLUG WIRE WITH SPARK TESTER & FLAME SIGNAL. USE THE TIMING CHARTS IN FIGURE 7 OF THIS MANUAL TO DETERMINE IF PRIMARY CONTROL IS DEFECTIVE.
      - REPLACE PRIMARY CONTROL IF DEFECTIVE.

NOTE - FOR ILLUSTRATIONS OF TEST PROCEDURES, SEE CORRESPONDING NUMBER ON PAGE 34.

UNIT RUNS BUT SHUTS OFF BEFORE THERMOSTAT IS SATISFIED - INSUFFICIENT HEAT



NOTE - FOR ILLUSTRATIONS OF TEST PROCEDURES, SEE CORRESPONDING NUMBER ON PAGE 34.

UNIT SPUTTER STARTS & DIES