

GSR14 SERIES UNITS

I - INTRODUCTION

The GSR14 unit is a condensing furnace utilizing the pulse combustion process. It is unique in that it may be mounted in either a down-flow or horizontal flow position. The combustion process used is identical to that in the G14 series Pulse furnaces. 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.

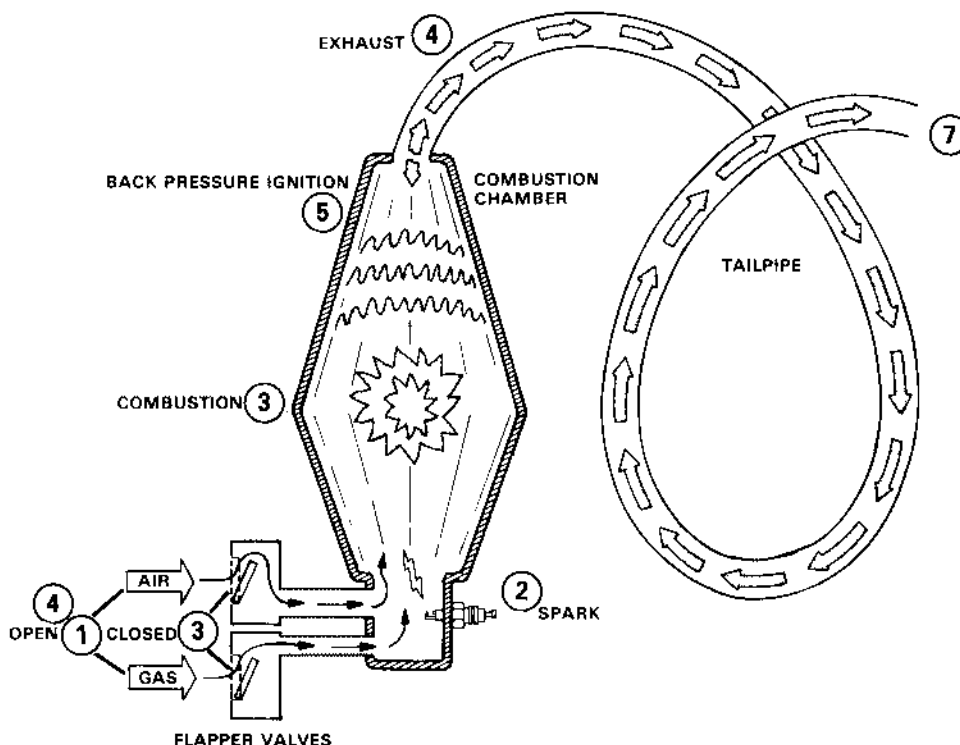
The unit uses a redundant gas valve to assure safety shut-off as required by A.G.A.

Electronic Direct Spark Ignition is used to initiate combustion. A flame rectification sensor 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 air intake or 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. This blower is not powered during unit operation.

The units are manufactured for natural gas application, L.P. kits are available for field modification.

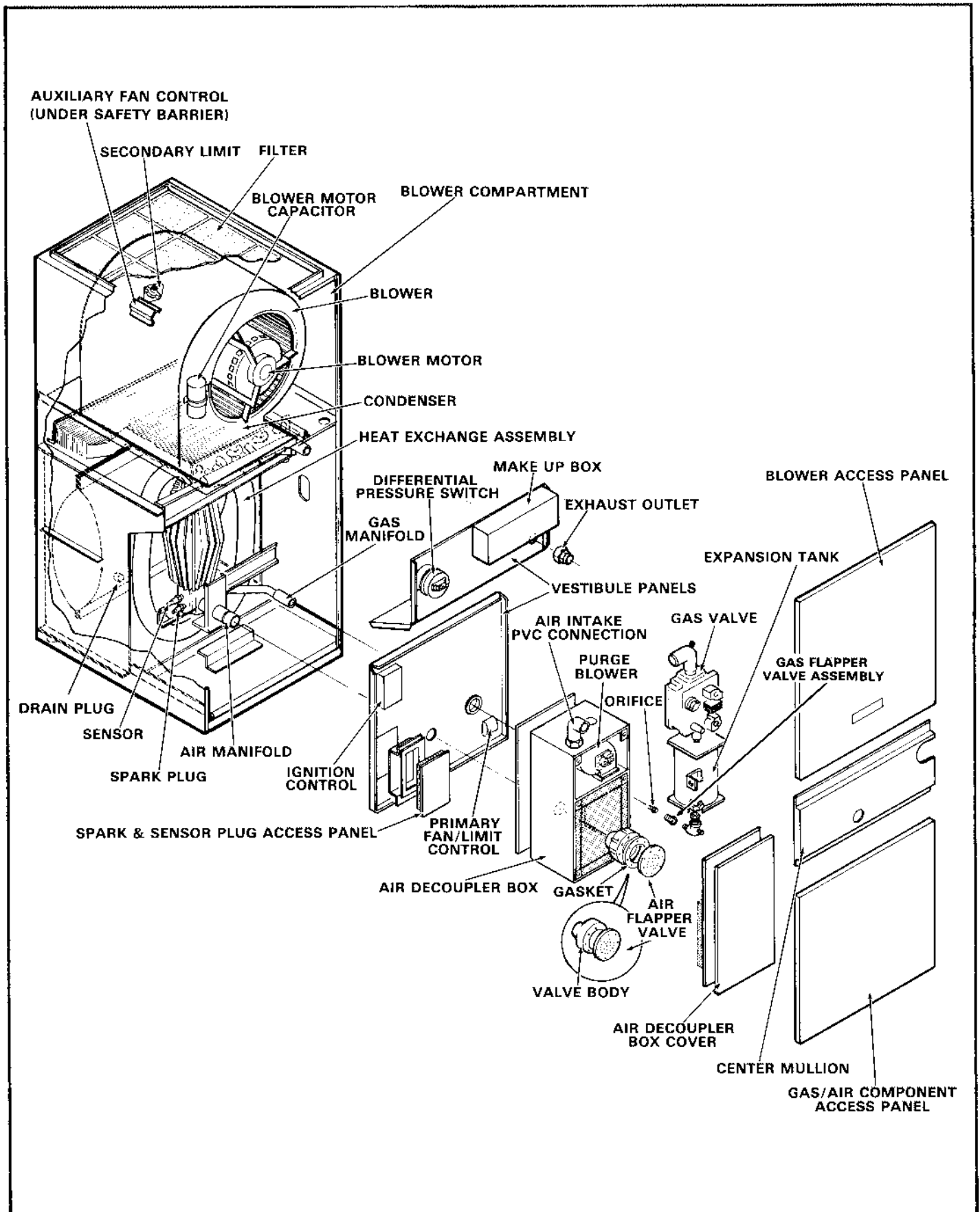
PULSE COMBUSTION PROCESS

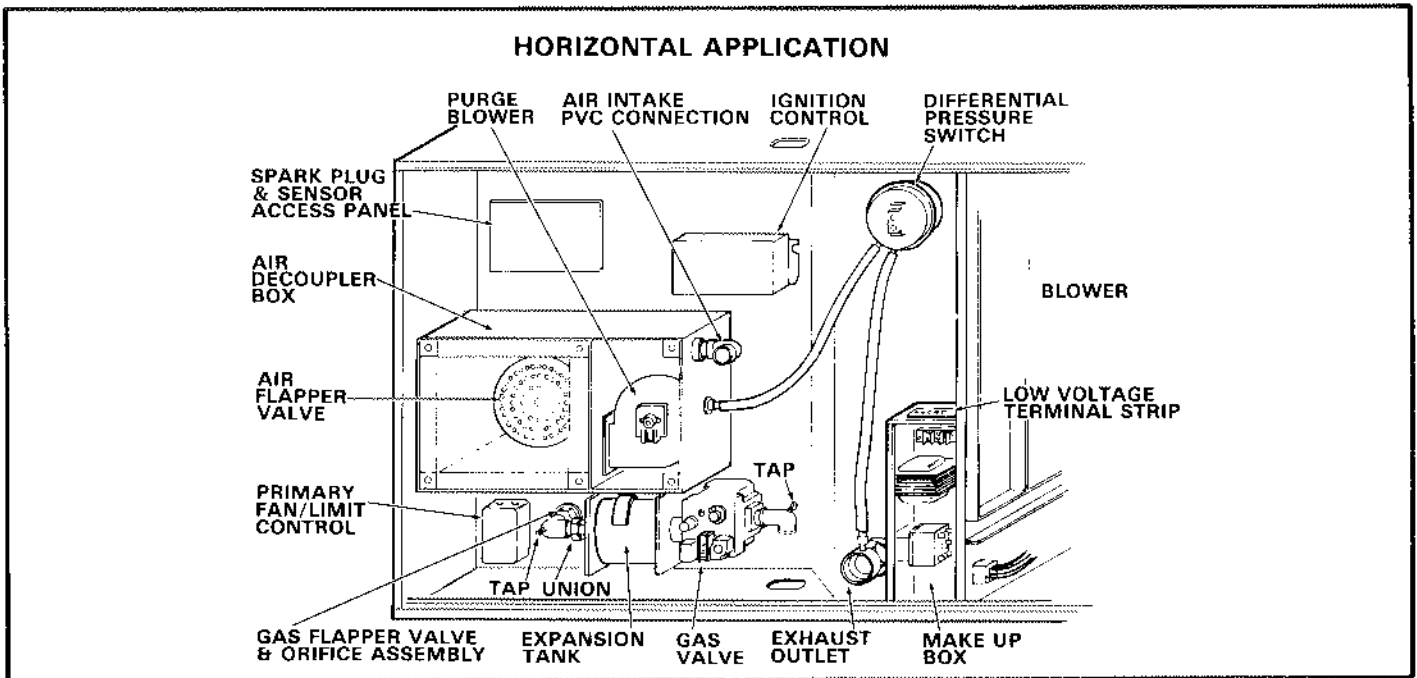


- 1- Gas and air enter and mix in combustion chamber.
- 2- To start the cycle a spark is used to ignite the gas and air mixture (This is one 'pulse').
- 3- Positive pressure from combustion closes flapper valves and forces exhaust gases down a tail pipe.
- 4- Exhaust gases leaving the chamber create 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 Btu each.
- 7- Latent heat is removed from combustion products and condensate (water) is formed in the condenser coil.

II - PARTS ARRANGEMENT





III - SPECIFICATIONS

The GSR14 unit input range covers 50,000 through 100,000 Btuh. See specifications table.

All units in the GSR14 series use direct drive blowers and accept cooling coils in nominal tonnages up to 5 tons for the '100'. Slab filters are used for return air in all the unit sizes.

SPECIFICATIONS

MODEL NO.		GSR14Q3-50	GSR14Q4-50 AGA/CGA	GSR14Q3-80	GSR14Q4/5-80	GSR14Q4/5-100
Input Btuh (AGA)		50,000	50,000	80,000	80,000	100,000
Output Btuh (AGA)	Indoor	48,000	48,000	72,000	72,000	93,000
	Non-Weatherized	47,000	47,000	71,000	72,000	92,000
†A.F.U.E. (AGA)	Indoor	95.4%	95.5%	92.4%	93.4%	91.0%
	Non-Weatherized	94.8%	95.0%	91.7%	92.9%	90.2%
High Static Certified by AGA (in. wg.)		.50	.50	.50	.50	.50
California Seasonal Efficiency		89.5%	89.2%	87.6%	87.6%	86.0%
Sea Level Ratings (CGA)	Input — Btuh (kW)	50,000 (14.7)	---	80,000 (23.4)	80,000 (23.4)	100,000 (29.3)
	Output — Btuh (kW)	48,500 (14.2)	---	76,000 (22.3)	76,000 (22.3)	93,500 (27.4)
	Efficiency (CGA certified)	97.0%	---	95.0%	95.0%	93.5%
High Altitude Ratings (CGA)	Input — Btuh (kW)	50,000 (14.7)	---	80,000 (23.4)	80,000 (23.4)	100,000 (29.3)
	Output — Btuh (kW)	48,500 (14.2)	---	75,600 (22.2)	75,600 (22.2)	91,000 (26.7)
	Efficiency (CGA certified)	97.0%	---	94.5%	94.5%	91.0%
High Static Certified by CGA — in. wg. (Pa)		.50 (124)	---	.50 (124)	.50 (124)	.50 (124)
Temperature rise range — °F (°C)		30-60 (17-33)	25-55 (14-31)	40-70 (22-39)	30-60 (17-33)	45-75 (25-41)
Vent/Intake air pipe size — in. (mm)††		2 (51)	2 (51)	2 (51)	2 (51)	2 (51)
Gas piping size	Natural	1/2 (13)	1/2 (13)	1/2 (13)	1/2 (13)	1/2 (13)
	L.P.G.	1/2 (13)	1/2 (13)	1/2 (13)	1/2 (13)	1/2 (13)
Condensate Drain Connection (Schedule 40 PVC) — in. (mm)		1/2 (13)	1/2 (13)	1/2 (13)	1/2 (13)	1/2 (13)
Blower Wheel Nominal diameter x width — in. (mm)		10x8 (254x203)	10x10 (254x254)	10x10 (254x254)	12x12 (305x305)	12x12 (305x305)
Blower Motor (hp) W		1/3 (249)	1/2 (373)	1/3 (249)	3/4 (560)	3/4 (560)
Number and size of Filters	in.	(1) 20 x 25 x 1	(1) 20 x 25 x 1	(1) 20 x 25 x 1	(1) 20 x 25 x 1	(1) 20 x 25 x 1
	mm	(1) 508 x 635 x 25	(1) 508 x 635 x 25	(1) 508 x 635 x 25	(1) 508 x 635 x 25	(1) 508 x 635 x 25
Tons of cooling that can be added (kW)		1-1/2-3 (5.3-10.5)	3-1/2-4 (12.3-14.0)	2-3 (7.0-10.5)	3-1/2-5 (12.3-17.5)	3-1/2-5 (12.3-17.5)
Shipping Weight -- lbs. (kg)		311 (141)	316 (143)	317 (144)	329 (149)	335 (152)
Number of packages in shipment AGA (CGA)		1 (2**)	1 (2**)	1 (2**)	1 (2**)	2** (2**)
Electrical characteristics		120 volts — 60 Hertz — 1 phase (less than 12 amps)				
L.P.G. Kit (optional AGA ONLY)*		LB-51702CJ	LB-51702CJ	LB-51702CK	LB-51702CK	LB-51702CL
Optional Horizontal Support Frame Kit — Shipping Wt.		LB-56495CA (All Models) — 18 lbs.				
Optional Down-Flo Additive Base — Shipping Wt.		LB-80639BB (All Models) — 6 lbs.				

†AGA Annual Fuel Utilization Efficiency based on DOE test procedures.

*For AGA L.P.G. units 50/80/100-1, -2 a field changeover kit is required and must be ordered separately. AGA units 50/80-6, -7, -8 are shipped with components necessary for field changeover. All CGA units are not field convertible.

††For information on minimum diameter for GSR14 venting see table 3 on page 19.

**Packages consist of assembled unit and in-line mufflers.

IV - UNIT COMPONENTS

A - Make-Up Box (Figure 1)

The Make-up box is located behind the blower access panel (see parts arrangement).

1 - Low Voltage Terminal Strip

A low voltage terminal strip with thermostat markings is located outside the make-up box.

2 - Transformer

A transformer located inside the make-up 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. On C.G.A. models the transformer includes a 2.0A inline fuse on the 'load' side of the secondary.

3 - Indoor Blower Relay

An indoor blower double pole double throw relay is located inside the make-up box to provide power to the blower. The relay contacts also control the 120VAC 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 make-up box. Also, a 120VAC accessory terminal strip is located on the power supply terminal.

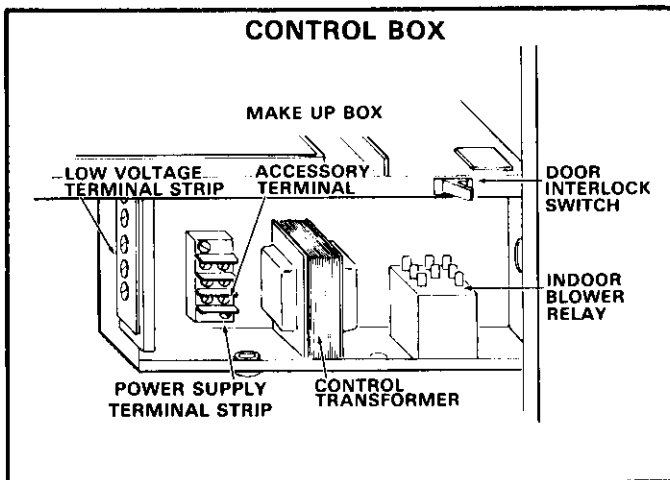


FIGURE 1

B - Fan/Limit Control (Figure 2)

A fan/limit control with a sure start heater is used to control blower operation. It is located in the lower end of the unit next to the air intake chamber. The fan control heater is energized with the gas valve and its contacts close after 30 to 45 seconds to bring on the blower. 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 the additional heat left over in the heat exchange assembly. Fan 'off' settings above 90°F may also cause nuisance trips of the secondary limit.

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.

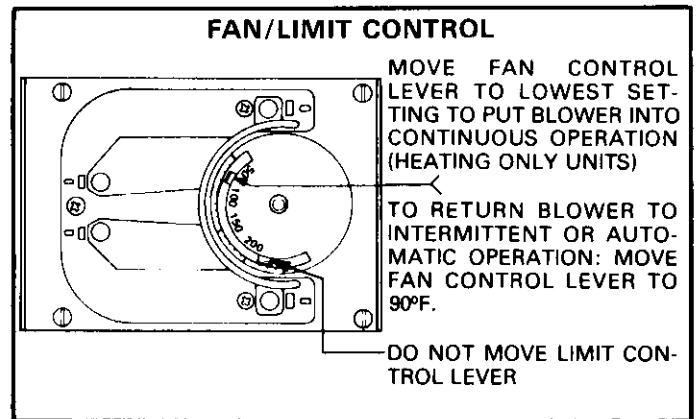


FIGURE 2

C - Auxiliary Fan Control (Figure 3)

A auxiliary fan control is located on the blower housing next to the secondary limit. Its purpose is to protect the secondary limit from 'tripping' by turning on the blower until blower compartment temperature is reduced. This is a safety cool down function of the unit and should serve to prevent service calls to reset the secondary limit.

WARNING - SHOCK HAZARD. THE AUXILIARY FAN CONTROL IS CONNECTED TO LINE VOLTAGE. IT IS HOUSED UNDER A BARRIER FOR SAFETY. BEFORE SERVICING THE CONTROL, BE SURE TO DISCONNECT POWER TO THE UNIT.

WARNING - THE BARRIER WHICH SHROUDS THE AUXILIARY FAN CONTROL MUST BE IN PLACE ANY TIME THE UNIT IS OPERATING. DO NOT OPERATE THE UNIT WITHOUT THE BARRIER IN PLACE.

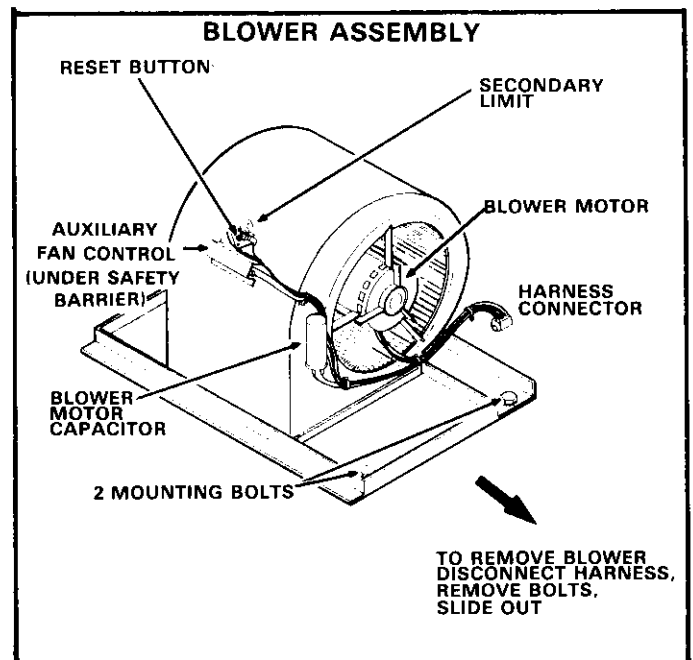


FIGURE 3

D - Secondary Limit (Figure 3)

A secondary limit is located on the blower housing to stop the unit in the event the blower does not operate properly. If the blower should fail to operate or either the return or supply airways become partially blocked, the blower housing would become too warm due to heat flow and cause the secondary limit to 'trip'. The secondary limit is preset to 160°F and cannot be adjusted. Should the secondary limit 'trip', it can be reset manually by pressing the button on the back of the limit. Allow adequate time for the limit to cool before attempting to reset. This is a safety shut down function of the unit.

The secondary limit and the auxiliary fan control work together to reduce excessive temperature in the upper (blower) end of the unit. First, as temperature rises in the blower compartment and nears 140°F, the auxiliary fan control actuates the blower in an attempt to reduce temperature. Should the blower be unable to reduce blower housing temperature and temperature continues to rise, the secondary limit will activate and 'shut down' the unit.

E - Ignition Control

An electronic direct spark ignition with flame rectification sensing is used on all GSR14 units. Units may have ignition controls manufactured by Lennox, Gas Energy or Watsco (formerly Prestolite).

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 Lennox, Watsco and Gas Energy ignition controls are interchangeable between units. Any control can connect to any unit using the harness plug (JP-1). The Gas Energy control uses an interconnecting harness to connect to JP-1. Spark and sensor wires for each control are separate and different from JP-1 (see NOTE on this page and Figures 4,5,6).

NOTE - Replacement ignition controls may be made by a different manufacturer than the control being removed. Spark and sensor connections MAY be different. Ignition control replacement kits come supplied with new spark and sensor wires which fit the replacement control. Replacement wires with connectors may also be ordered separately. DO NOT ATTEMPT TO CUT OR SPLICE CONNECTORS ON OLD WIRES. Refer to Lennox repair parts for detailed ordering information and part numbers.

1 - Lennox GC-1 Control

The Lennox GC-1 control is illustrated in Figure 4. 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 control as shown.

The Lennox built GC-1 gas ignition control was changed in November, 1988. The change included the addition of internal self-test 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 4). 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.

The LED may be lit for the following reasons: 1 - lock-out condition; 2 - post-purge operation; and 3 - failure of the control.

If the lock-out is caused by unsuccessful ignition (5 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

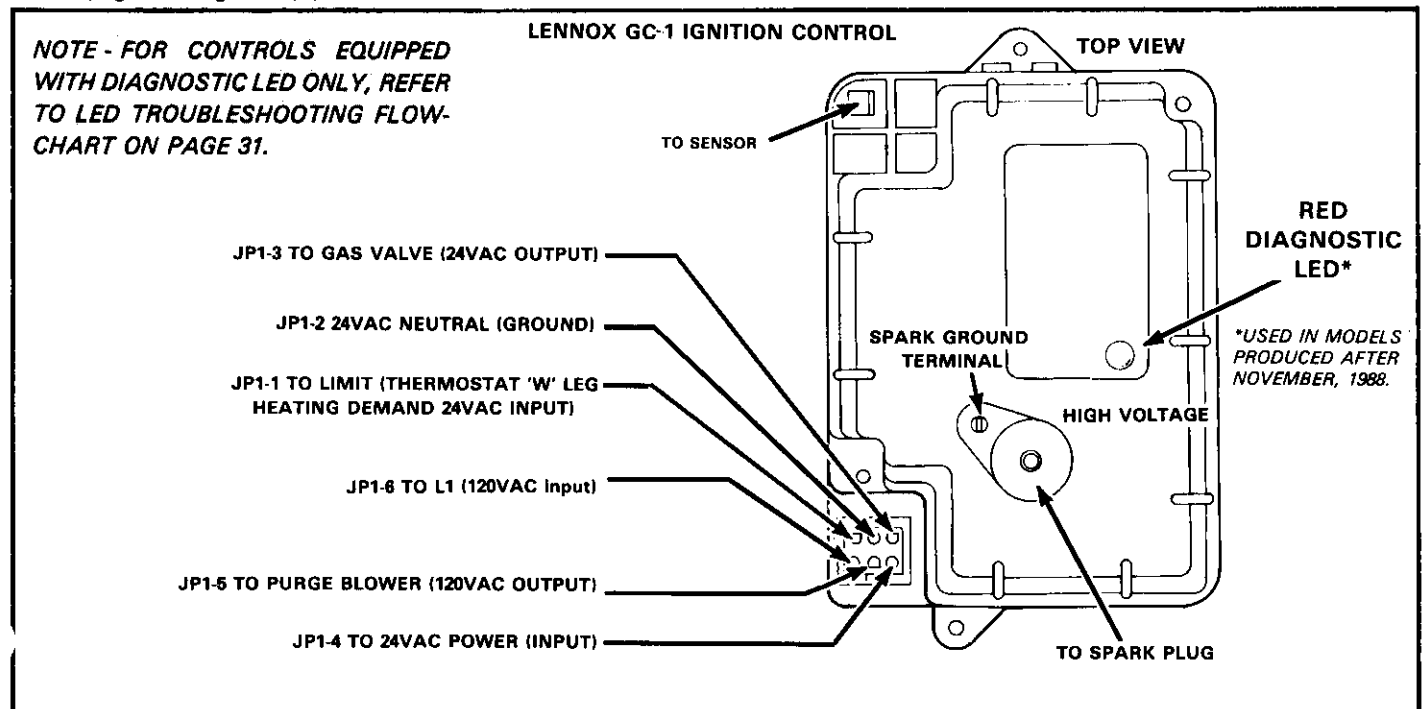


FIGURE 4

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 lightning strike near the unit.

The diagnostic light will be energized during normal post-purge operation. However, if the light remains energized for an extended time (several minutes) further service is required.

If the light comes back on after breaking and remaking power at the disconnect or immediately following a try for ignition, the control is damaged and must be replaced.

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

2 - Watsco Control

The Watsco control is illustrated in Figure 5. 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 use separate quick connect terminals on the control as shown.

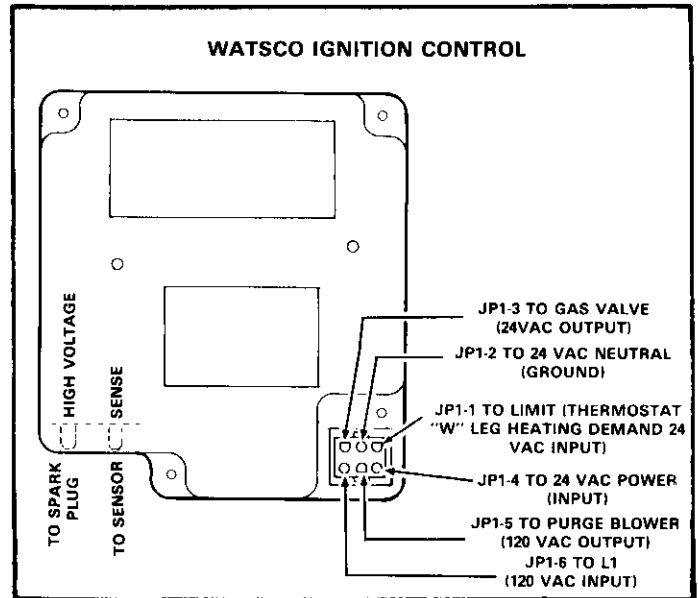


FIGURE 5

3 - Gas Energy Control

The Gas Energy control is illustrated in Figure 6. This control has an interconnecting harness used to connect it to the unit harness wiring plug. The terminals and connections are identified by func-

tion 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.

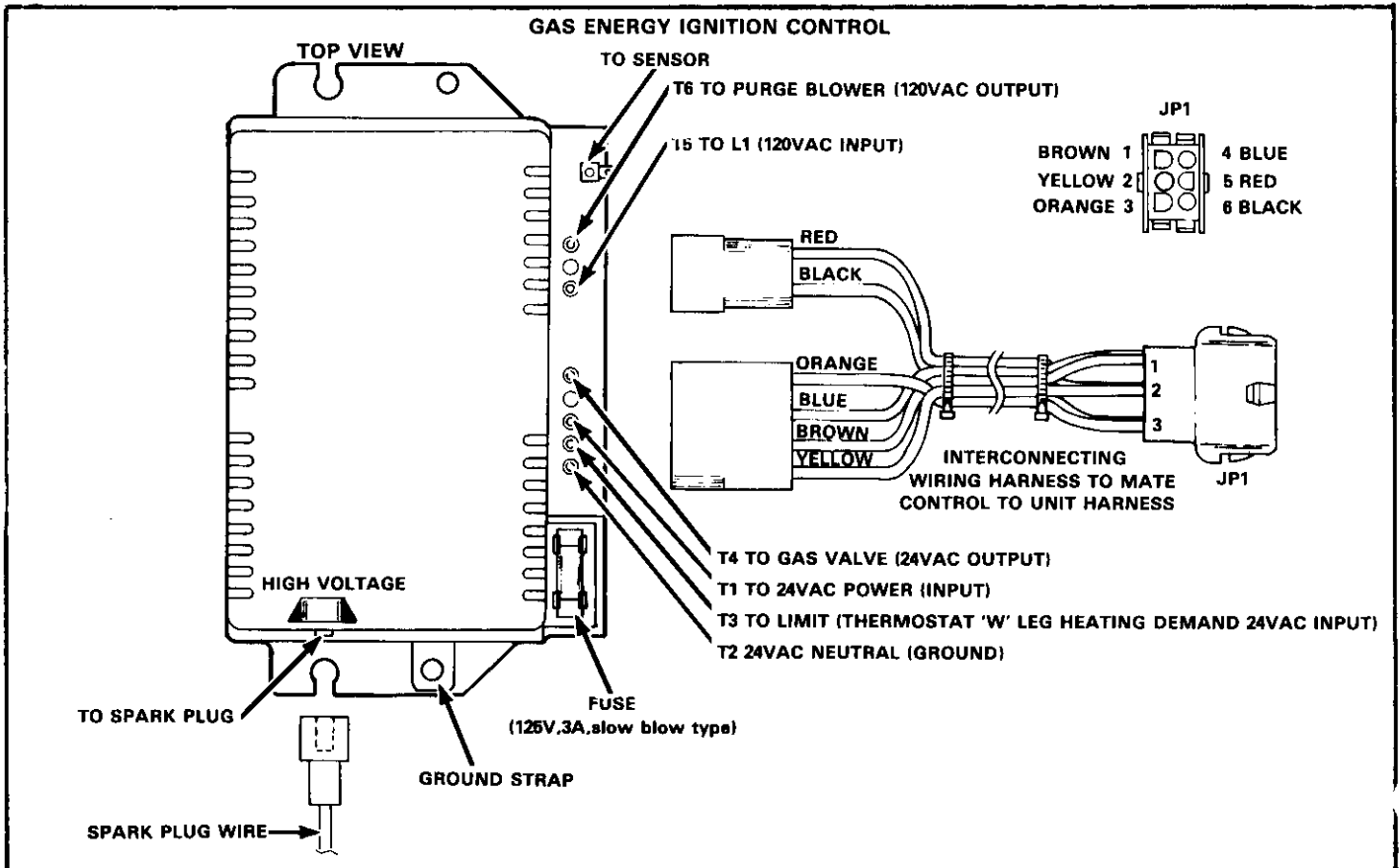


FIGURE 6

4 - Primary Control Functions

The primary control provides five main functions: pre-purge, control of the gas valve, ignition, flame sensing and post-purge. The ignition attempt sequence of the control provides 5 trials for igni-

tion before 'locking out'. The unit will usually ignite on the first attempt. See Figure 7 for a normal ignition sequence with nominal timings for simplicity.

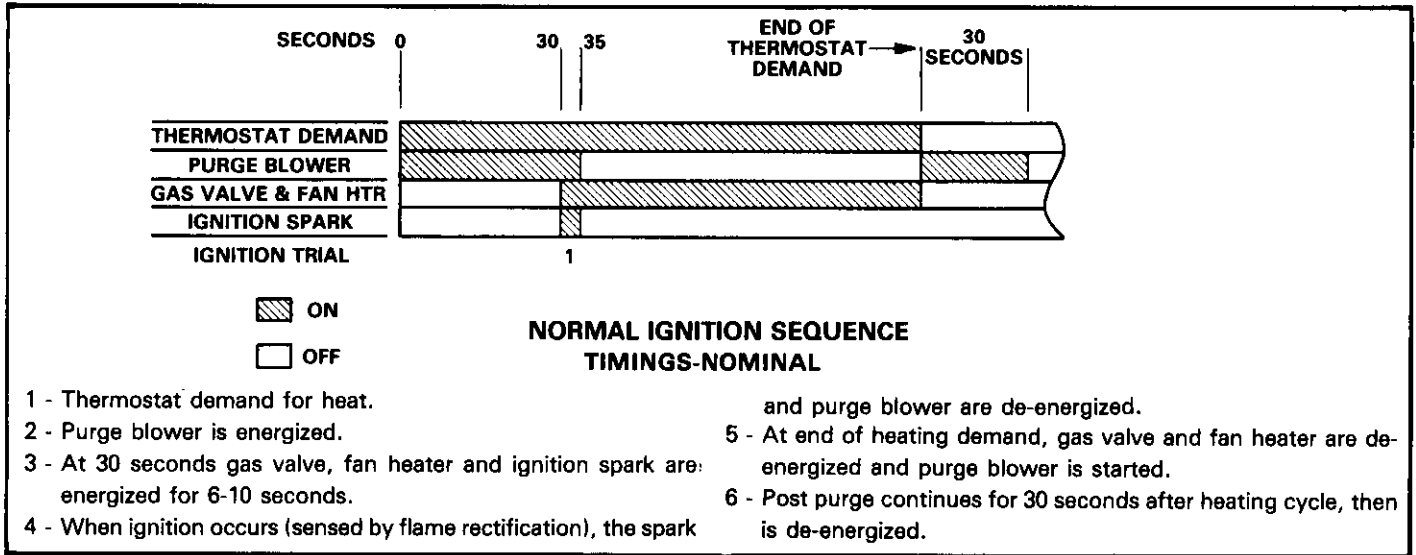


FIGURE 7

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 5 trials. Reset after 'lock out' requires only breaking and remaking the thermostat

demand. See Figure 8 for the ignition attempt sequence with retrials (nominal timings given for simplicity). Loss of combustion during a heating cycle is sensed through an absence of flame signal causing the control to lock out after five ignition trials.

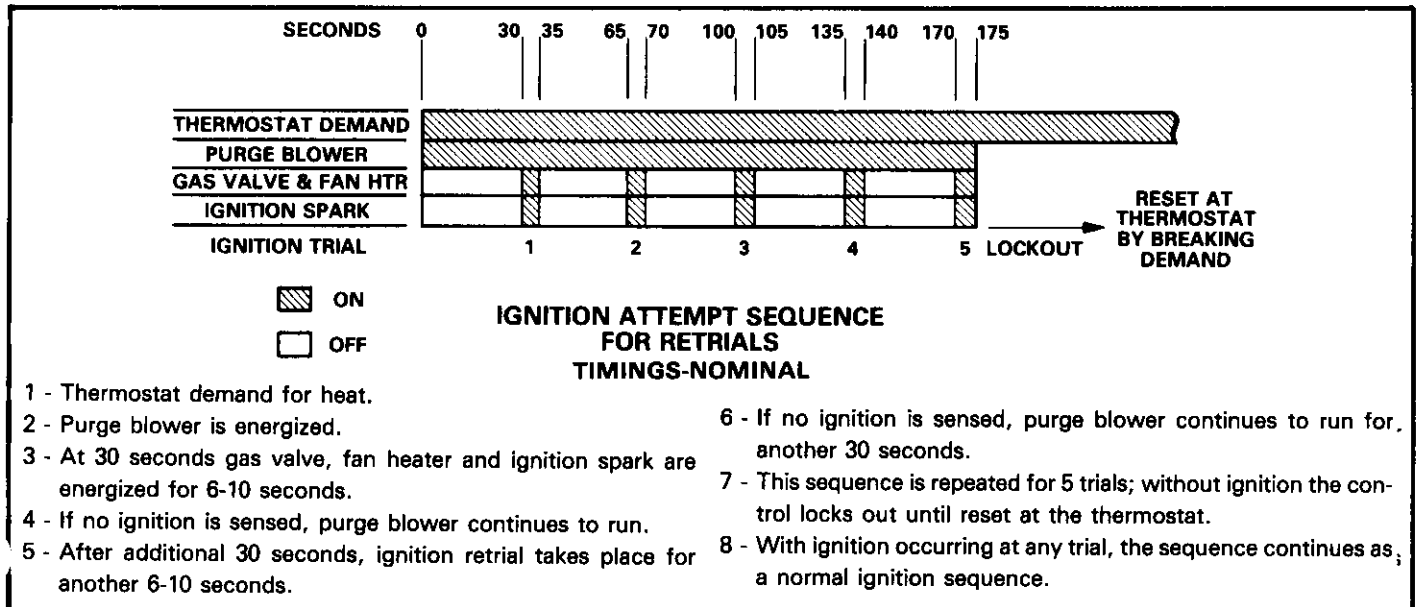


FIGURE 8

5 - Ignition Control Timing

The specific timings for the Lennox GC-1, Gas Energy and Watsco ignition controls vary, but do not affect operation. All will make five trials for ignition before 'lock out'. The specific timings for each are given in Figure 9.

The Watsco control runs through a post-purge cycle each time power is interrupted to the unit. Such interruptions include: if the main switch is turned off and on again or following intermittent

power failures or when replacing the blower door thus energizing 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.

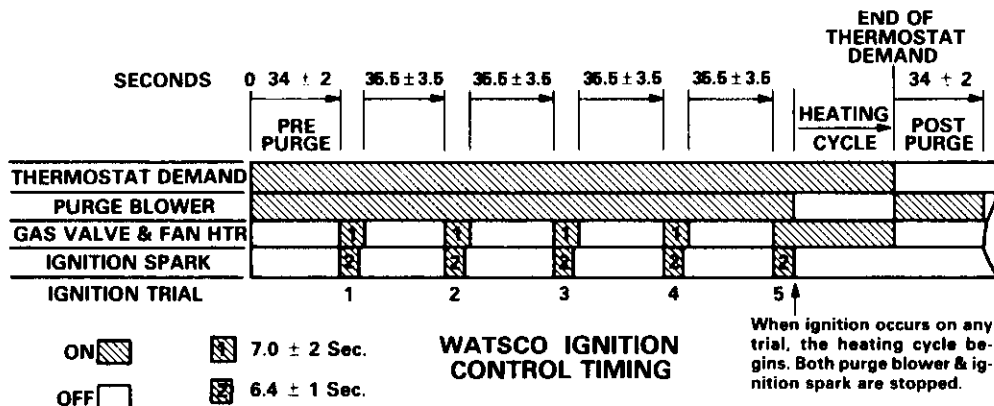
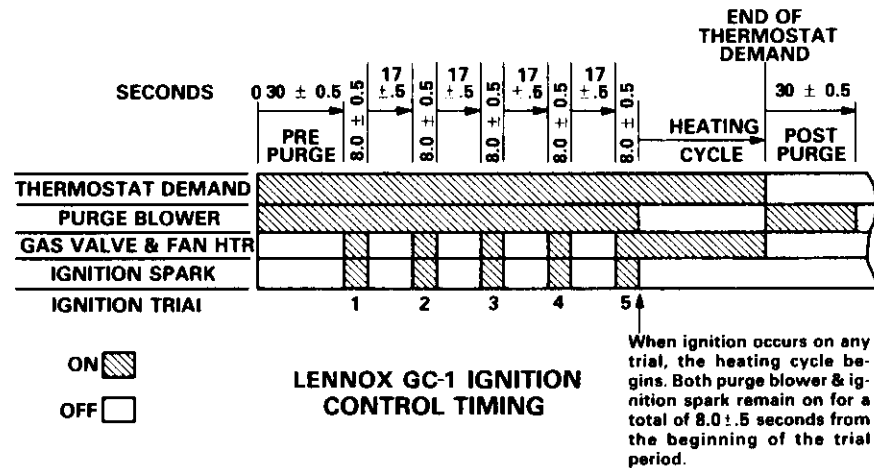
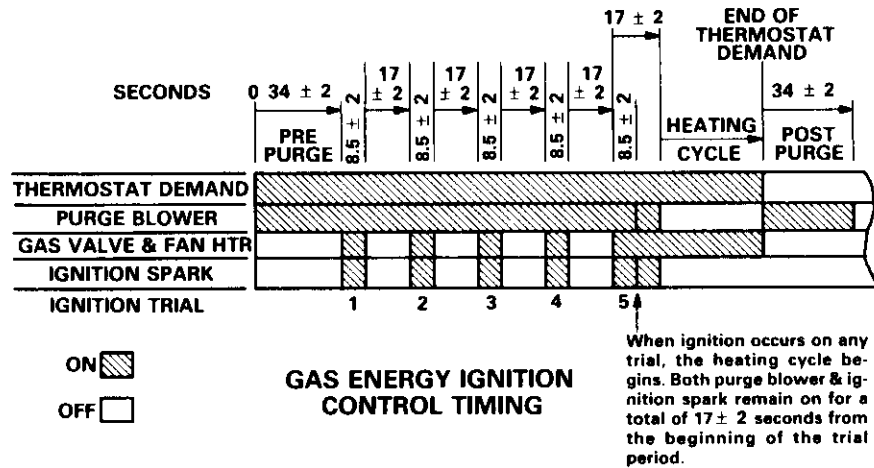


FIGURE 9

F - Gas Valves and Expansion Tank (Figure 10)

1 - Gas Valve

All units use a gas valve with a 1 second or less opening time from zero to maximum manifold pressure. The valve is internally redundant to assure safety shut-off. There are six adjacent terminals that are grouped in pairs on top of the valve. The terminals are used to energize the internal redundant solenoids. The solenoids are wired in parallel. A manual shut off knob is provided on the valve. Note that terminals 1 and 3 are 'Load' and are 'jumped' together. Terminal 2 is 'common'.

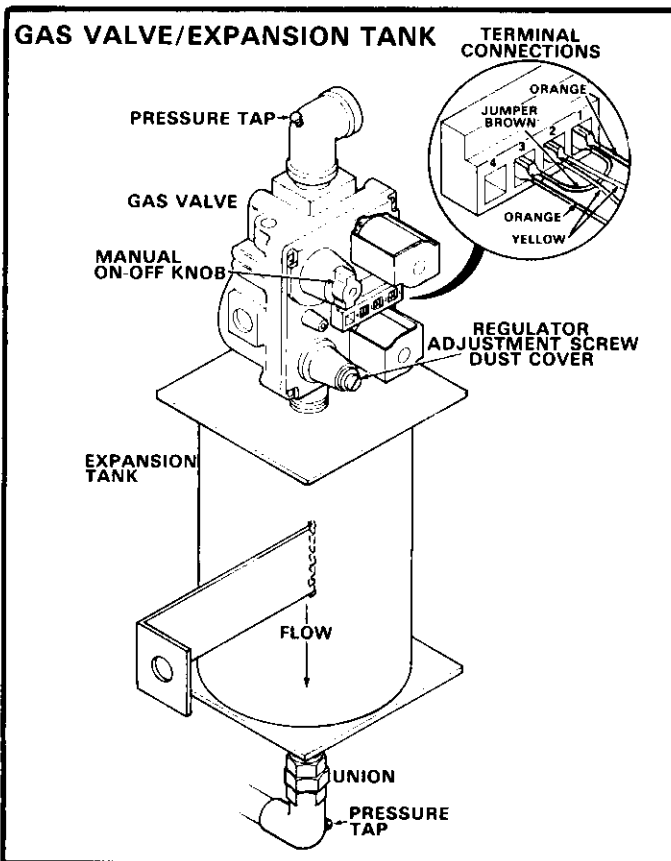


FIGURE 10

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.

3 - Gas Valve Conversion

All A.G.A. (GSR14-50/80/100-1,-2,-6,-7,-8) units can be converted from natural gas to liquid propane gas. C.G.A. (GSR14-50/80/100-3,-4,-5) units are not field convertible.

A gas changeover kit is available to convert natural gas units (GSR14-50/80/100 -1,-2) to L.P. gas. The kit includes one orifice, one gas valve conversion kit with heavy spring, one air diaphragm assembly (for GSR14-100 only) and changeover nameplate.

Using the kit to change unit form 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 11.

A spring behind the adjusting and regulator cover screw must be replaced by a heavier screw also included in the kit. In GSR14-100 units, the air diaphragm must be replaced. For GSR14-50/80 units, use existing air diaphragm assembly in L.P. conversion.

After the kit is applied, gas manifold pressure must be checked and properly adjusted.

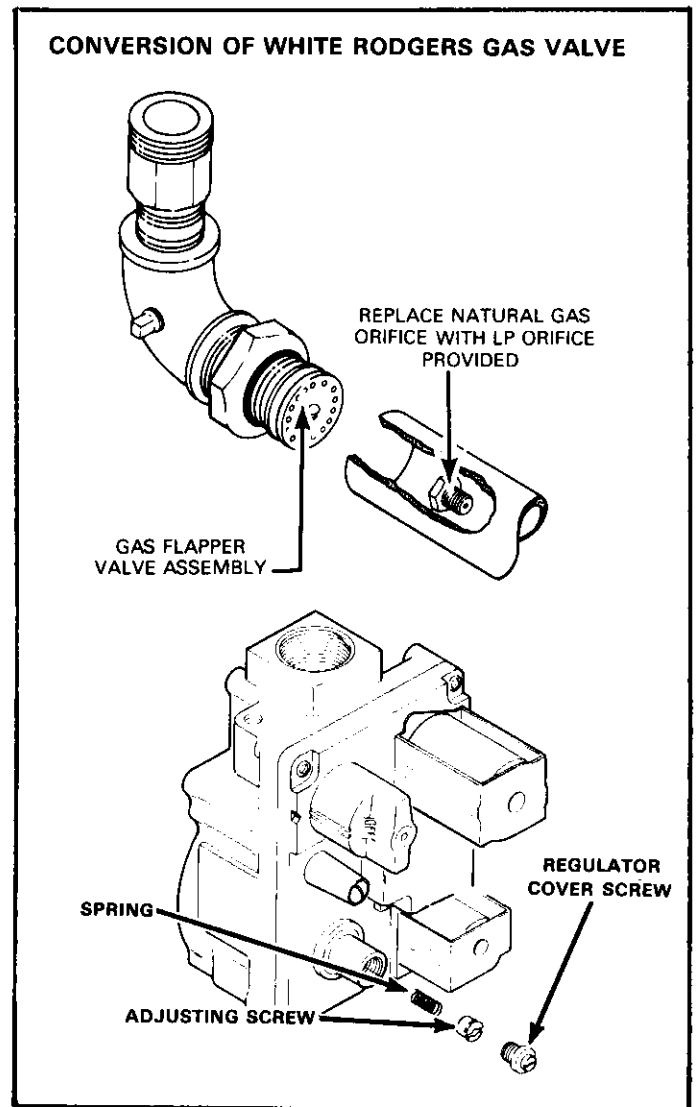


FIGURE 11

No kit is needed for conversion on GSR14-50/80 -6, -7, -8 units. These units are shipped with components required for field conversion to L.P. gas.

To make a field conversion, the existing gas orifice must be replaced by the L.P. gas orifice supplied with the furnace. Also, the regulator screw, located under plastic cap, must be rotated so that end labeled 'L.P.' points toward regulator. See Figure 12. For specific changeover instructions, refer to GSR14 series units installation and operation manual.

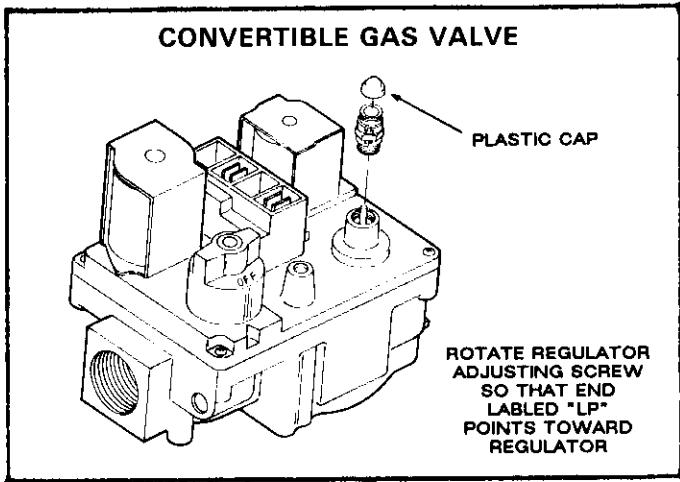


FIGURE 12

G - Differential Pressure Switch (Figure 13)

A 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 a barbed adaptor at the differential pressure switch (Figure 13). Each adaptor has a built in orifice of 0.018" I.D.

CAUTION - Each orificed adaptor 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 ADAPTORS. Replacement adaptors are available through Lennox repair parts.

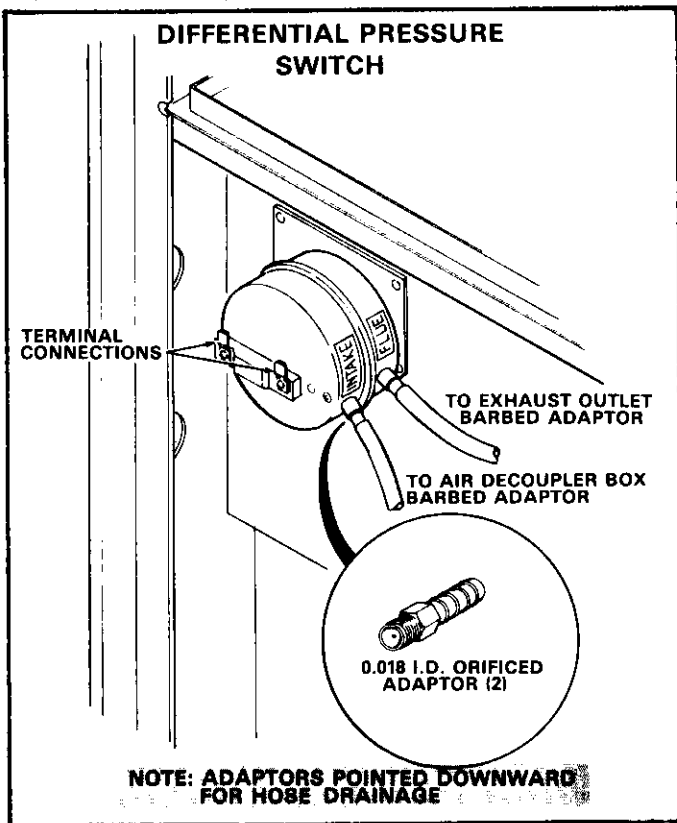


FIGURE 13

The switch is normally closed and remains closed under normal operating conditions. Any obstruction or close-off of the air intake or exhaust outlet (a differential pressure condition) causes the switch to open. When the 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 or exhaust.

The switch is factory preset to open at 3.0 in. \pm 0.25 in. W.C. total differential pressure (the difference in pressure between the intake side and the exhaust side) and cannot be adjusted. Some GSR14-100's may be equipped with switches preset to open at 4.5 in. \pm 0.25 in. W.C. Note that the switch is positioned with the orificed adaptors pointing downward so condensate can drain from the switch.

H - Gas Intake Flapper Valve (Figure 14)

1 - A union at the bottom of the expansion tank (to the left of the expansion tank if mounted horizontally) provides for removal of the gas flapper valve assembly and access to the orifice.

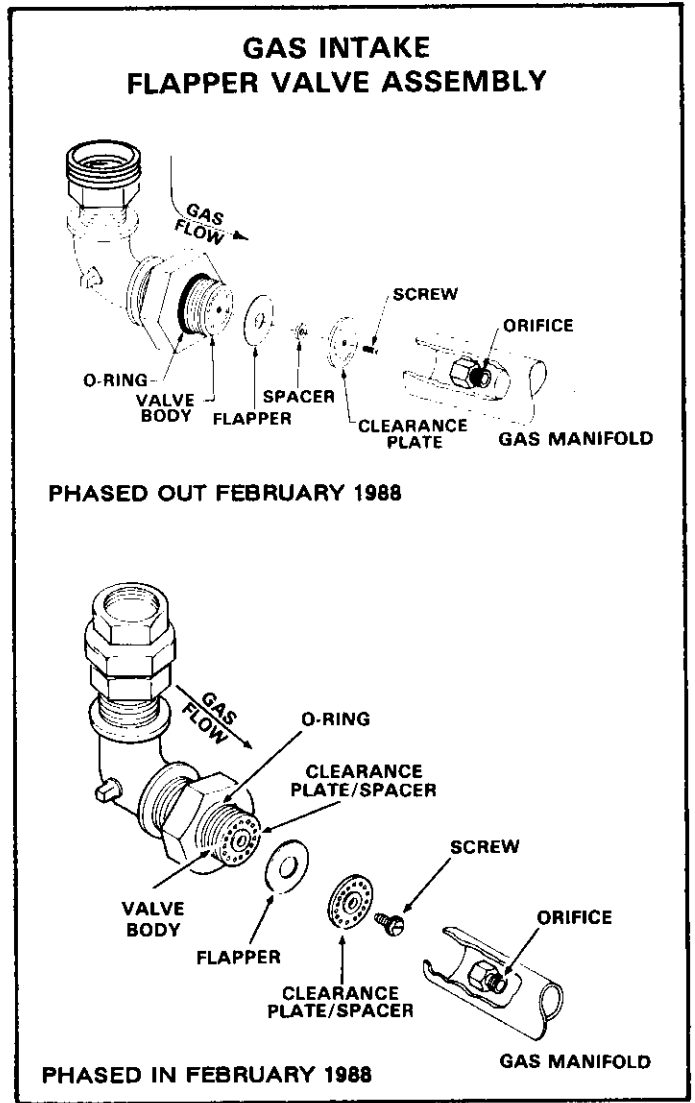


FIGURE 14

The flapper floats freely over the spacer and is opened against the back 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.

- Each GSR14 unit uses only one orifice located downstream of the flapper valve. The orifice is sized specifically for each unit. High altitude derating is not normally required. If special conditions exist where derating is required, contact the Lennox Division Headquarters in your area.

NOTE - Standard atmospheric burner orifices or orifice blanks cannot be used as replacements in GSR14 units.

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

NOTE - Proper orifice sizing is dependent on many variables. Non-convertible units are shipped with either an L.P. or natural gas orifice. Those units which are convertible are shipped with both types of orifices. For proper orifice sizing please refer to Lennox Repair Parts.

I - Air Intake and Purge Blower (see Parts Arrangement)

- The air intake chamber houses the purge blower and air intake flapper valve assemblies. 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 purge blower has a 120 volt motor and is permanently lubricated. It is powered only during pre- and post-purge. During the Pulse combustion process the purge blower is not powered, but air is drawn through the purge blower by negative pressure.

J - Air Intake Flapper Valve (see Parts Arrangement)

The air intake flapper valve is similar to the gas flapper valve in operation. A flapper floats freely over a spacer between two plates. In actual operation, initially, the flapper is forced against the back 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 back plate and air enters. The back pressure and negative pressures control the flapper valve with each pulse once ignition has occurred.

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

K - Combustion Chamber and Heat Exchange Assembly (Figure 15)

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 air

intake is above the gas intake on horizontally mounted units). The exhaust gas leaves through the tailpipe at the top (blower end) 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.

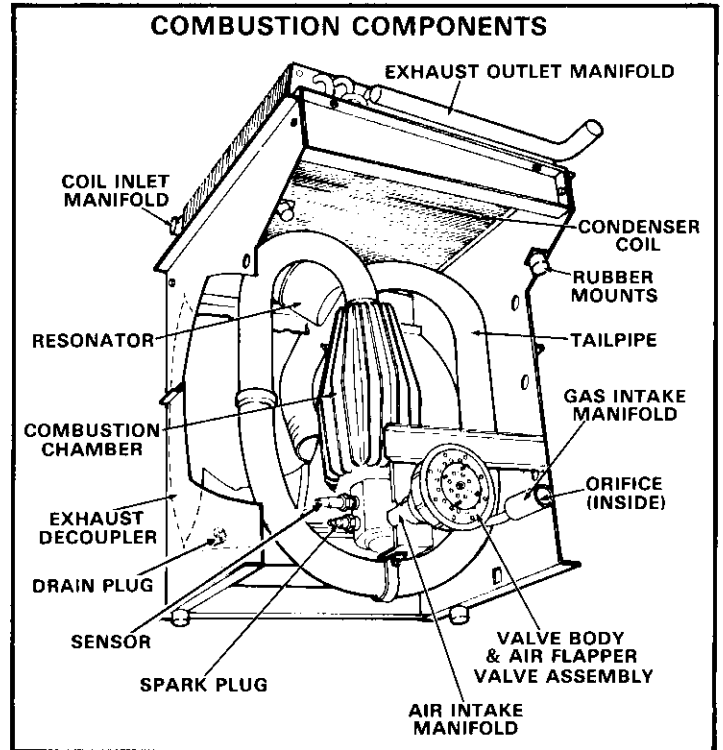


FIGURE 15

3 - Exhaust Decoupler

The exhaust decoupler is manifolded to the condenser coil. The condenser coil is where the latent heat of combustion is extracted from the exhaust gas. 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. For this reason, it is critical that the unit be mounted exactly as described in the proper installation techniques section when mounted horizontally. The exhaust outlet is located near the edge of the center (small) panel.

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. Refer to the heat exchanger replacement kit installation instructions for replacement procedures.

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 new heat exchangers.

L - Spark Plug and Sensor

- 1 - The spark plug and sensor are located on the lower left side of the combustion chamber opposite the gas intake (see Figure 15). The sensor is the top plug (nearest to the blower) as is longer than the spark plug. The spark plug is in the lower position (farthest from the blower). The plugs cannot be interchanged due to different thread diameters.
- 2 - Spark plug socket wrench size = 3/4 inch. Sensor plug socket wrench size = 11/16 inch.
- 3 - The spark plug is used in conjunction with the primary control for igniting the initial gas/air mixture.

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.

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

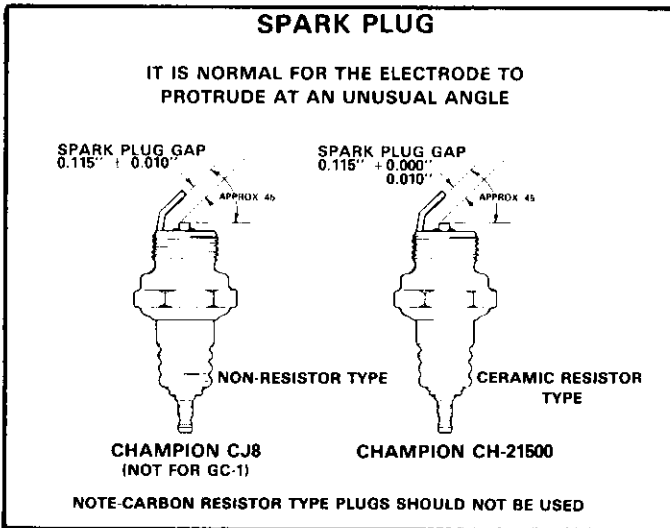


FIGURE 16

- 4 - Figure 16 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.
- 5 - The sensor is a spark plug type with 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 and Air Components Applied to Heat Exchanger (Figure 17)

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

- 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.

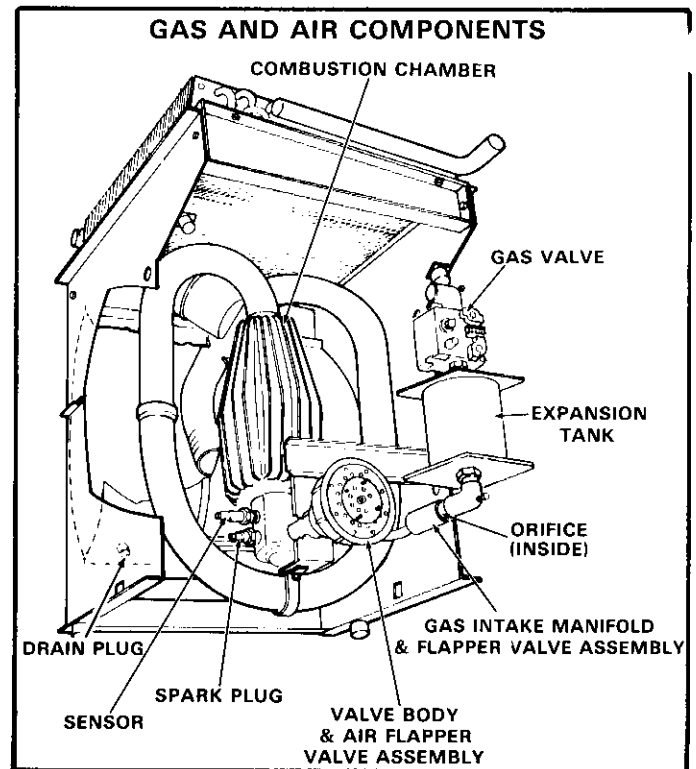


FIGURE 17

N - Blower Motors and Capacitors

All models use 120V PSC single phase 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

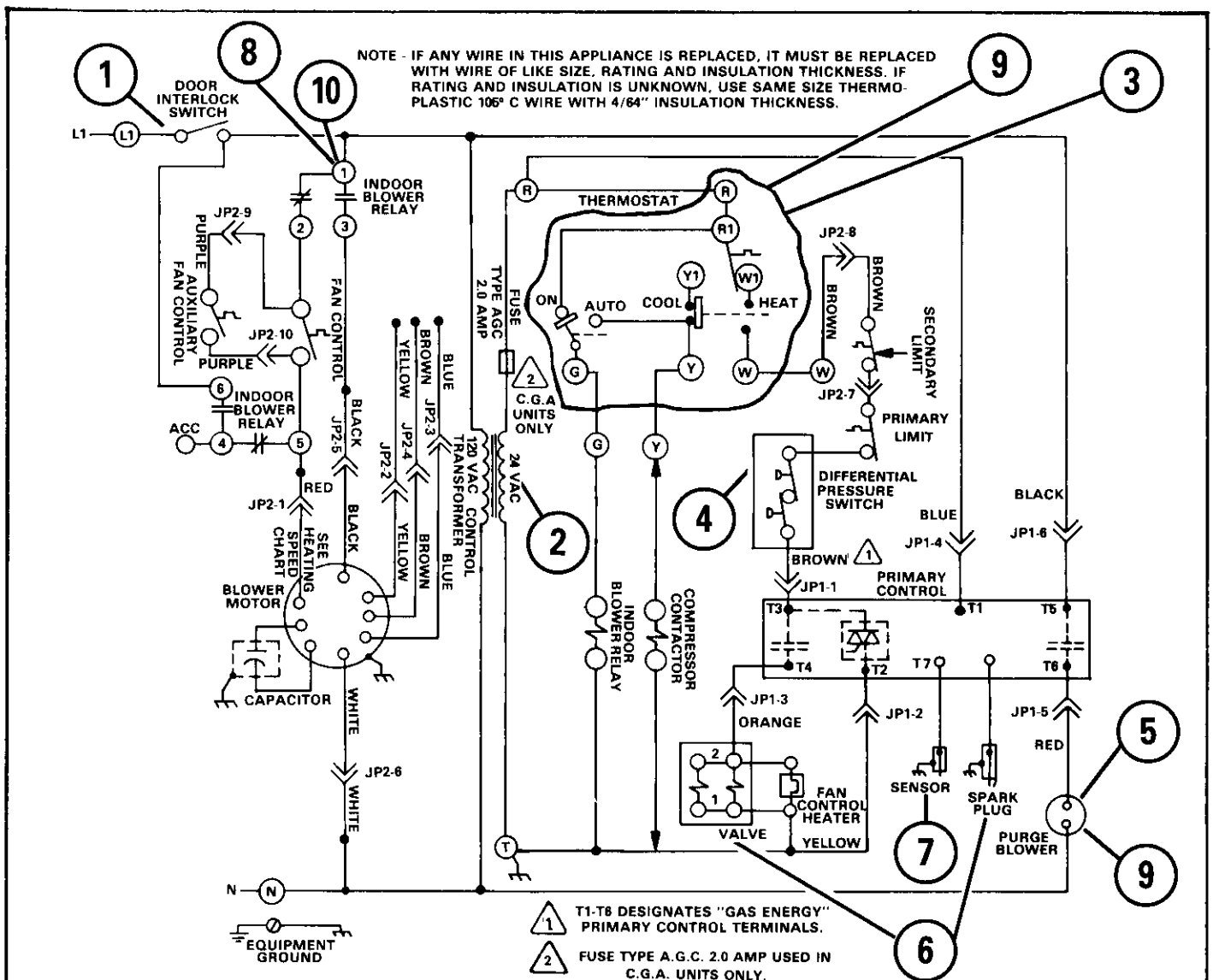
GSR14's use multi-tap blower motors (see blower speed table; table 2). Each motor is factory wired using black high speed tap for cooling and the red low speed tap for heating (GSR14Q3-80 uses the yellow medium-low speed tap for heating).

TABLE 2

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

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

V - SEQUENCE OF OPERATION



- 1 - Line voltage feeds through the door interlock switch. The 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 secondary limit, the primary limit and the differential pressure switch to energize the primary control.
- 5 - Through the primary control the purge blower is energized for prepurge (see Figure 8 for length of prepurge).
- 6 - At the end of prepurge the purge blower continues to run and the gas valve, fan control heater and spark plug are energized (see Figure 8 for start attempt timings).
- 7 - The sensor determines ignition by flame rectification and de-energizes the spark plug and purge blower. Combustion continues.
- 8 - After approximately 30 to 45 seconds the fan control has warmed enough to close the contacts. The closed contacts energize the indoor blower motor on heating speed. If, at any time during a heating cycle, combustion is lost and heating demand is still present, the ignition control immediately returns to step 5 above.
- 9 - When heating demand is satisfied the thermostat contacts open. The primary control is then de-energized removing power from the gas valve and fan control heater. At this time the purge blower is energized for postpurge. The indoor blower motor remains on.
- 10 - When the air temperature lowers to 90°F the fan control contacts open - shutting the indoor blower off.

VI - PROPER INSTALLATION

*Please refer to Lennox GSR14 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 unit should always be transported in the downflow position with the wooden shipping base installed. The blower may be removed to reduce the units weight while moving.

2 - Support Frame and Suspension Rods (Figure 18)

THE UNIT *MUST NOT* BE SUSPENDED BY ITSELF. A SUPPORT FRAME *MUST* BE USED TO PREVENT DAMAGE (SAGGING) TO THE UNIT. A support frame kit is available from Lennox.

3 - Raised Platform

When mounting in a crawlspace or on attic beams it is important that the unit be supported by a flat base to prevent damage (sagging) to the unit.

4 - Isolation Mounting Pads

Vibration isolating pads should be used especially when the unit is installed on wood flooring. 'Isomode' pads or equivalent should be used.

5 - Horizontal Mounting (Figure 18)

When Mounting the unit horizontally **IT *MUST* BE PLACED SO THAT WHEN FACING THE UNIT THE AIRFLOW IS FROM RIGHT TO LEFT.** This placement is necessary so moisture can drain from the condensing coil **AND *MUST NOT* BE CHANGED.** If mounted in any other position (such as inverted or on its back - see Figure 18), the condensing coil will fill with condensate and make the unit inoperable.

6 - Drain Pan

The pan should be used in ALL applications where surrounding structures, such as walls or ceilings, might be damaged by potential condensate leakage. If an evaporator coil is used, the drain pan should be extended under the coil to catch potential condensate leakage. In any installation where the unit is mounted horizontally a drain pan can be used to catch potential condensate leakage.

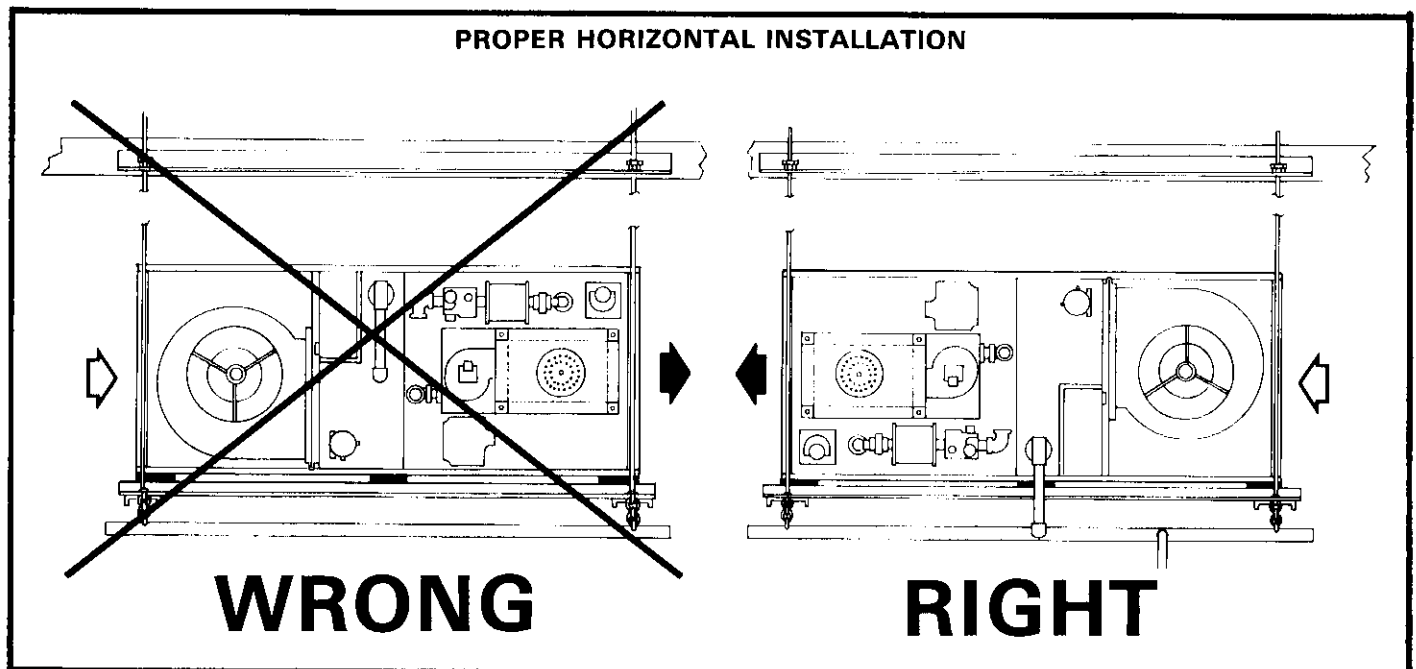
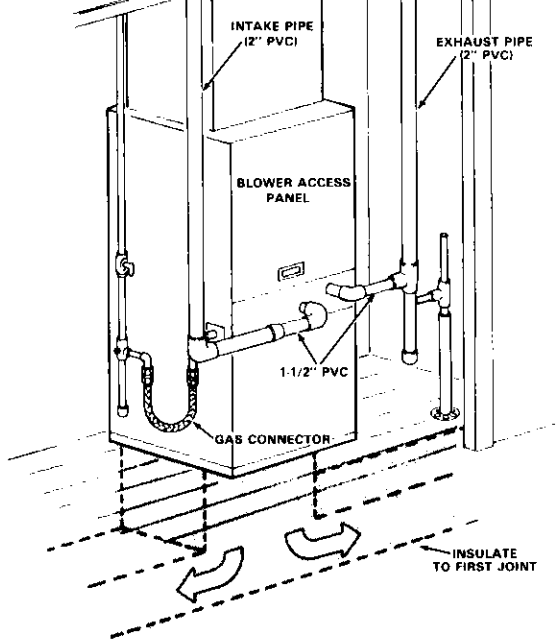


FIGURE 18

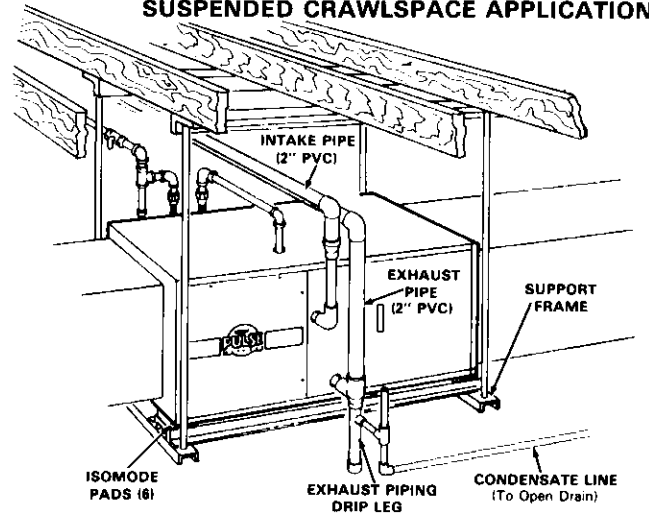
TYPICAL INSTALLATIONS

DRIP LEG
CONDENSATE TRAP

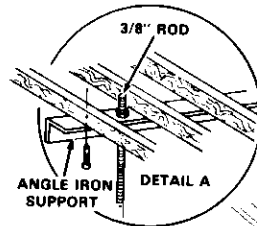
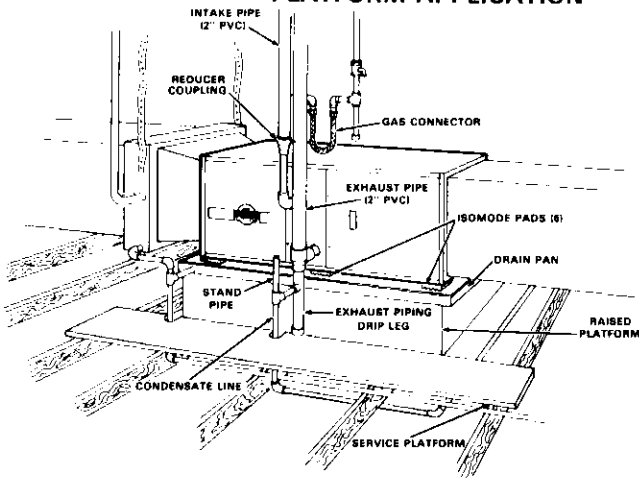
DOWN FLOW APPLICATION



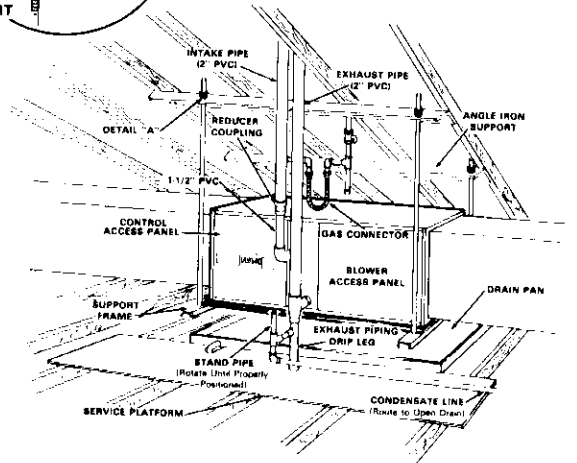
SUSPENDED CRAWLSPACE APPLICATION



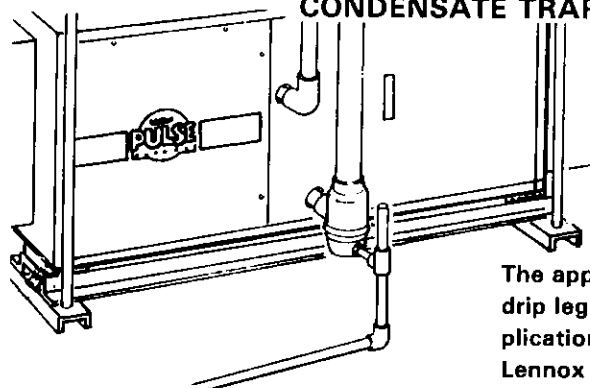
ALTERNATE ATTIC
PLATFORM APPLICATION



PREFERRED ATTIC
SUSPENDED APPLICATION



BALL FLOAT
CONDENSATE TRAP



The applications above are shown with a drip leg condensate trap installed. All applications may also be installed with a Lennox ball float condensate trap.

7 - Condensate Line (Figure 19)

When installing the unit in areas subjected to freezing temperature, the drip leg or ball float 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. Refer to GSR14 heat cable kit installation instructions for proper application.

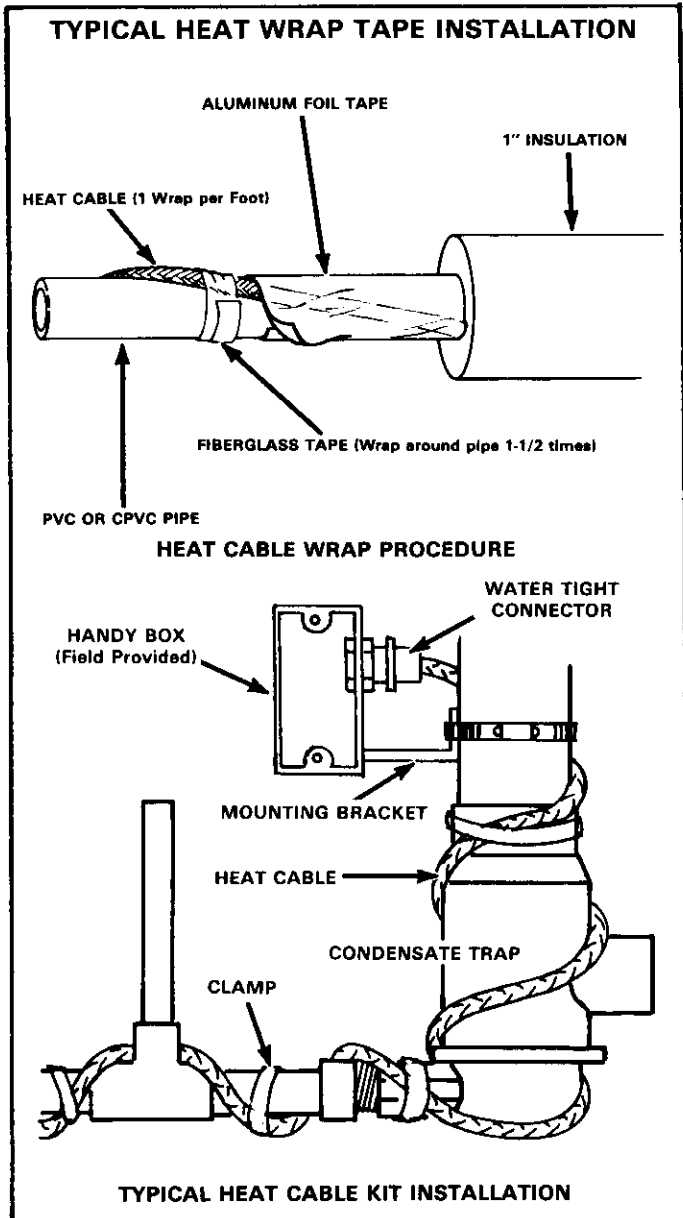


FIGURE 19

8 - Condensate Trap Installation (Figure 20)

Condensate may be removed two ways. The drip leg installation is detailed in figure 20. The ball float installation is detailed in the following section. Some installations may require a remotely mounted drip leg and condensate line. The condensate line must be sloped away from the unit to allow proper drainage. A sagging line can hinder drainage.

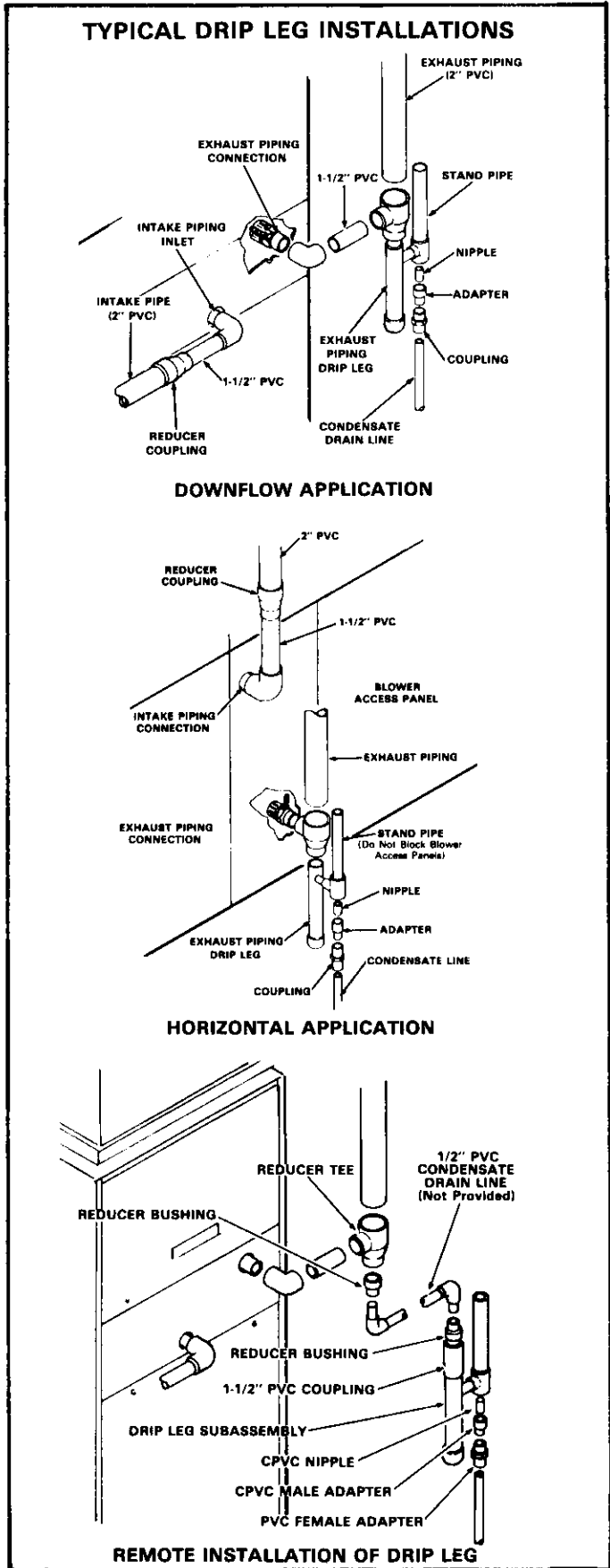


FIGURE 20

- 13 - Return Air Plenum Insulated Past First Elbow**
 A 1.5 to 3.0 lb. density, matte face, 1 inch thick insulation is recommended but not required. All exposed edges should be protected from air flow.

- 14 - Gas Supply Piping Centered in Inlet Hole (Figure 23)**
 The gas supply should not rest on the unit cabinet.

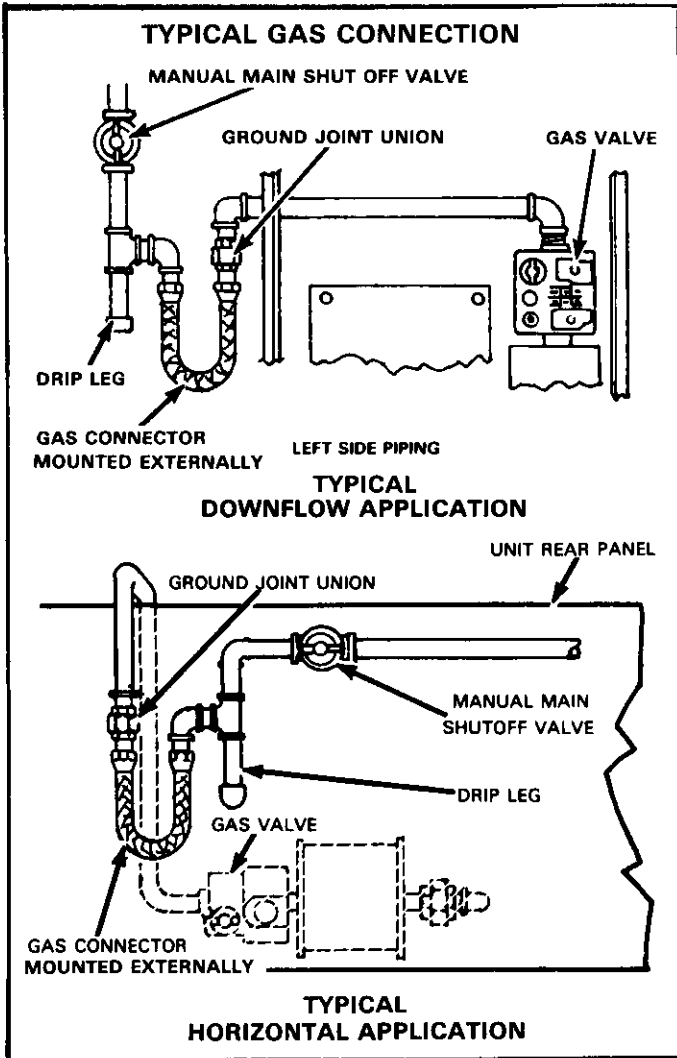


FIGURE 23

- 15 - Gas Connector (used on AGA units only) (Figure 24)**

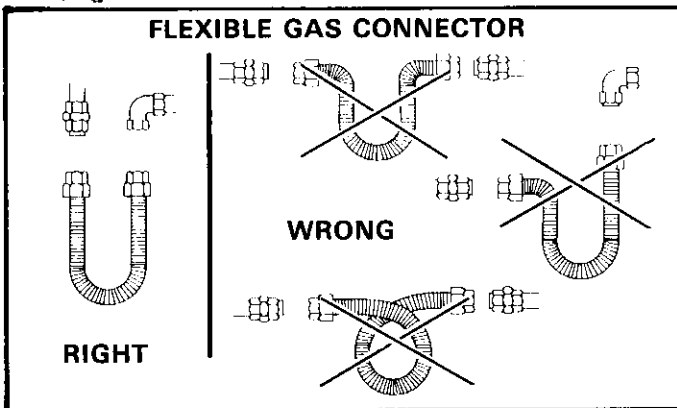


FIGURE 24

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. DO NOT RUN FLEXIBLE CONNECTOR INTO UNIT CABINET.

- 16 - Electrical Conduit Isolated from Ductwork and Joists**

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

- 17 - Field Wiring (Figure 25)**

Field wiring is connected to terminal strips. Multi-speed blower motors are factory wired with low speed (Red) taps for heating and high speed (black) taps for cooling (GSR14Q3-80 uses the yellow medium-low speed tap for heating).

The units include an accessory 120VAC terminal for wiring accessories such as humidifiers or electronic air cleaners. This terminal is energized only when the blower motor is operating (either through the fan control circuit or when the indoor blower relay is energized).

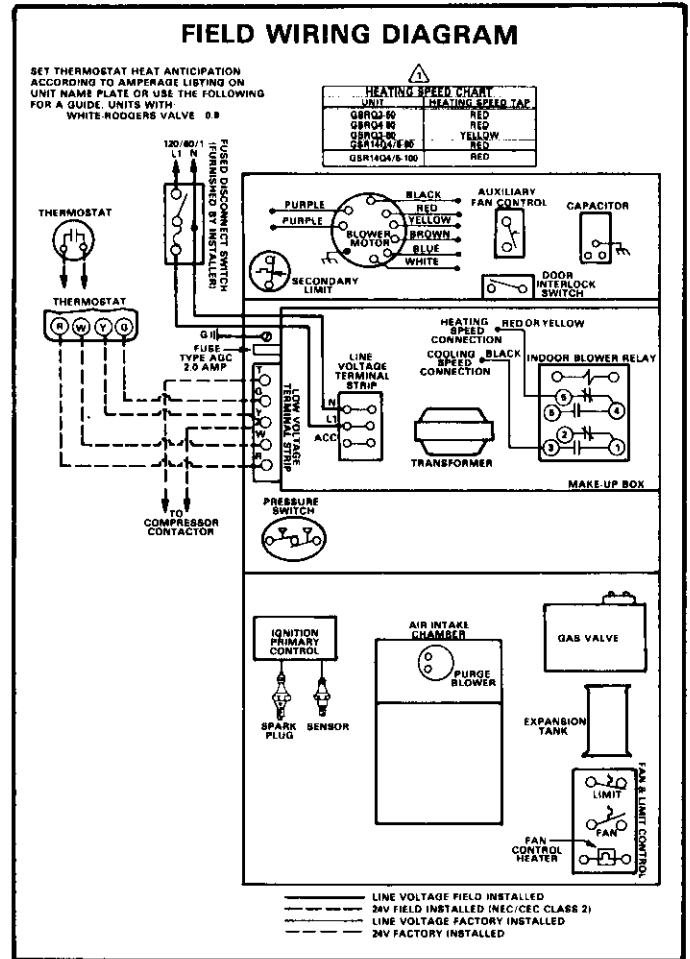


FIGURE 25

- 18 - Isolation Hangers**

PVC piping for intake and exhaust lines should be suspended from hangers. A suitable hanger can be fabricated from a 1 inch wide strip of 26 ga. covered with 'Armaflex' or equivalent.

19 - Muffler

All C.G.A. units and the A.G.A. GSR14-100 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. GSR14-50,-80 series units. *ANY TIME AN EXHAUST MUFFLER IS USED IN AREAS SUBJECTED TO FREEZING TEMPERATURE AND ESPECIALLY IF THE MUFFLER IS MOUNTED HORIZONTALLY, A HEAT CABLE KIT MUST BE USED ON THE MUFFLER TO PREVENT CONDENSATE FROM FREEZING INSIDE.* Use only Lennox heat cable kits which are approved for use with PVC pipe.

20 - Exhaust Insulation

In areas subject to freezing temperature, the exhaust pipe must be insulated with 1/2" Armaflex or equivalent when run through unheated space.

21 - Concentric Termination (Figure 26)

In concentric termination, intake and exhaust piping are centrally located. See Figure 26.

Exhaust piping must terminate straight out or up at a level 12 in. above normal snow accumulation. Termination must not be within 6 feet of other vents or 3 feet of structure openings.

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

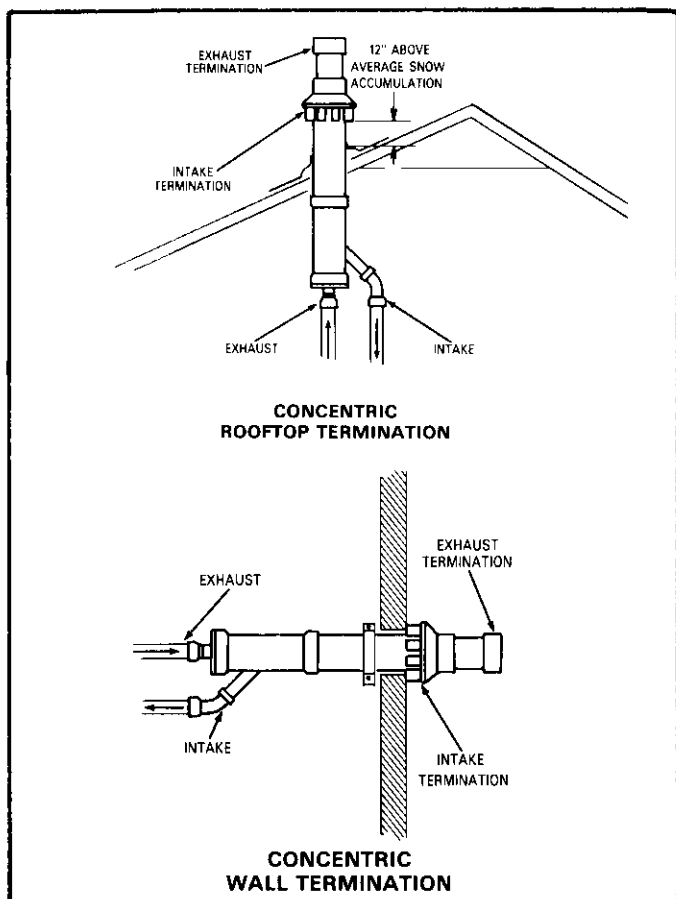


FIGURE 26

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 ON 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.

TABLE 3

MINIMUM DIAMETER FOR GSR14 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

22 - Standard Intake/Exhaust Termination (Figures 27,28,29)

Intake and exhaust pipes should be placed as close together as possible at termination end. See Figures 27, 28 and 29. MAXIMUM SEPARATION IS 3 IN. ON ROOF TERMINATIONS 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 re-circulation does not occur.

Exhaust piping must terminate straight out or up and termination must not be within 6 feet of other vents or 3 feet of structure openings.

Refer to the GSR14 Operation and Installation Instructions for detailed instructions 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.

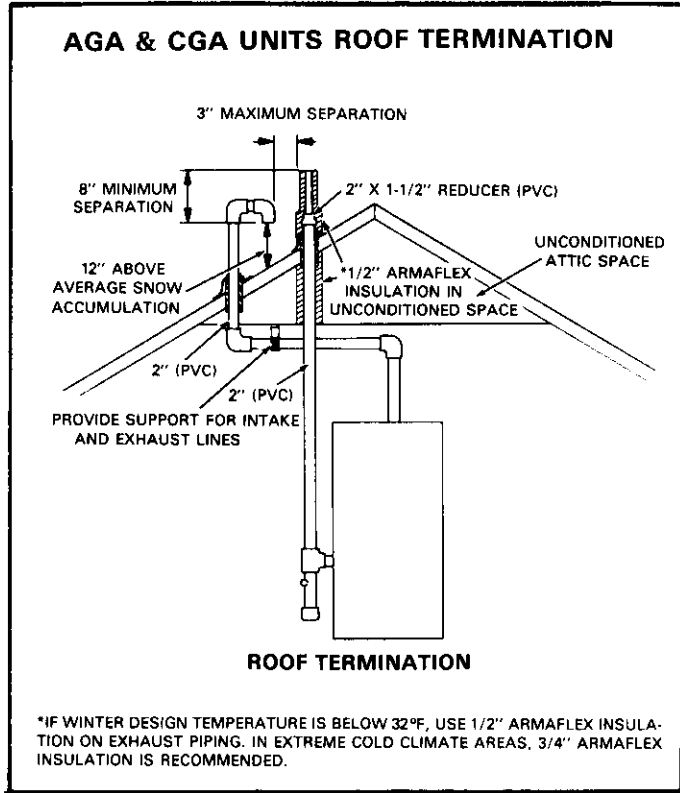


FIGURE 27

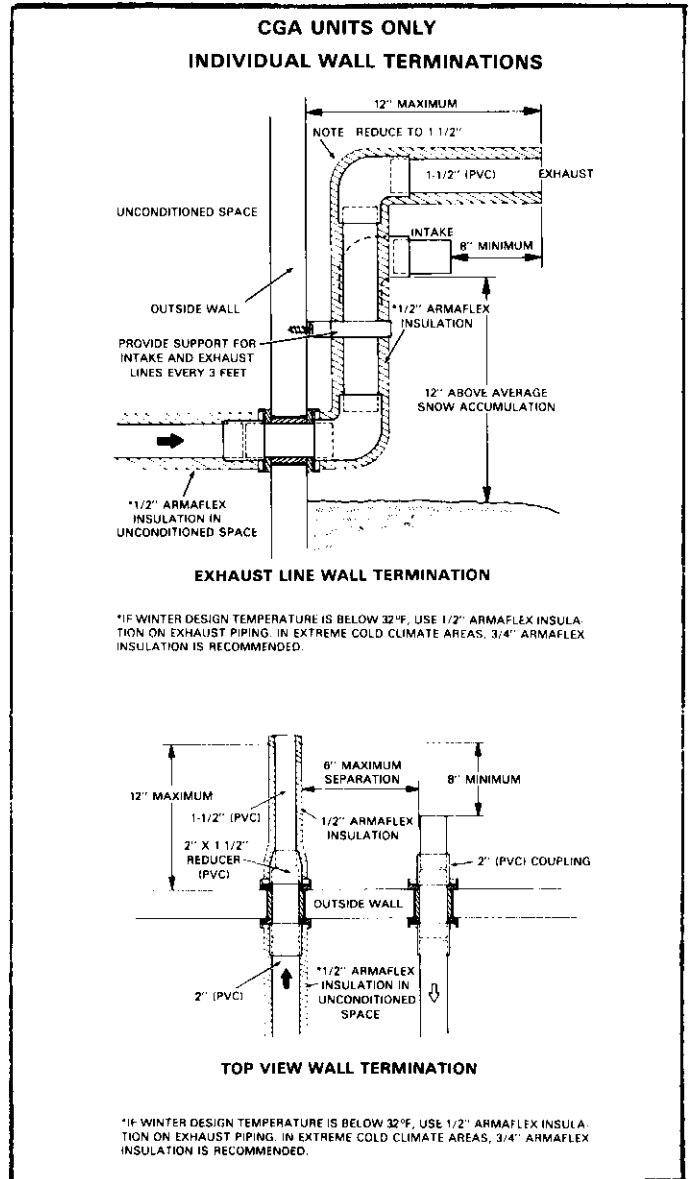


FIGURE 28

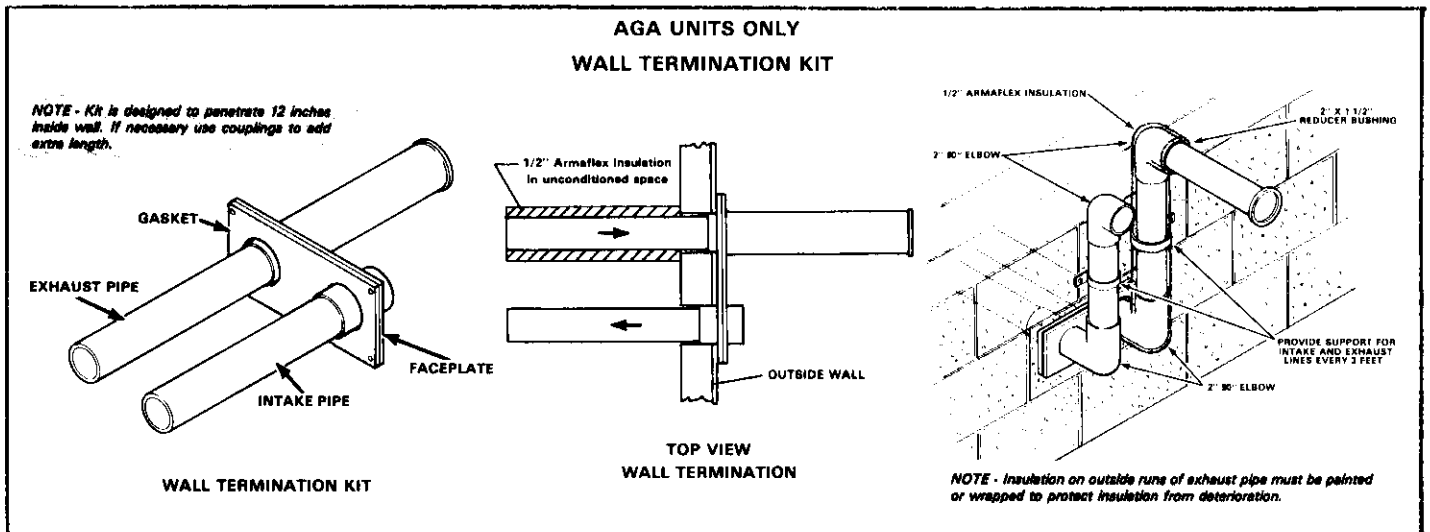


FIGURE 29

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* - Prelubricated and sealed. No further lubrication required.
 - b. *Direct Drive Motors with oiling ports* - Prelubricated 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. 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 in. filters.
- 2 - The filters supplied with the GSR14 can be washed with water and mild detergent. They should be sprayed with Filter Handicoater when dry prior to reinstalling in the unit. The Filter Handicoater is RP products coating No. 418 and is available as Lennox part No. P-8-5069.

C - Fan and Limit Controls

Check fan and limit controls for proper operation and (where possible) setting. For settings, refer to the 'Fan and Limit' section of 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

- 1 - Check intake and exhaust PVC lines and all connections for tightness and make sure there is no blockage. Also check condensate line for free flowing operation and complete drainage.
- 2 - If unit is equipped with condensate trap, disassemble and clean condensate trap using instructions outlined in section VI, step 9.

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 GSR14 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 warm air and return plenums. Locate the thermometer in the warm air plenum where it will not 'see' the the heat exchanger, thus picking up radiant heat.
- 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 low, decrease blower speed; if high, increase blower speed. To change blower motor speed taps see table 2.
- 4 - Be sure to check that the discharge static pressure is within the range of values listed on the unit rating plate before adjusting the blower speed taps.

To Measure Discharge Static Pressure:

- 1 - Measure tap locations as shown in Figure 30.
- 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 the motor speed to deliver the air desired according to the unit rating plate.
- 4 - Seal around the hole when the check is complete.

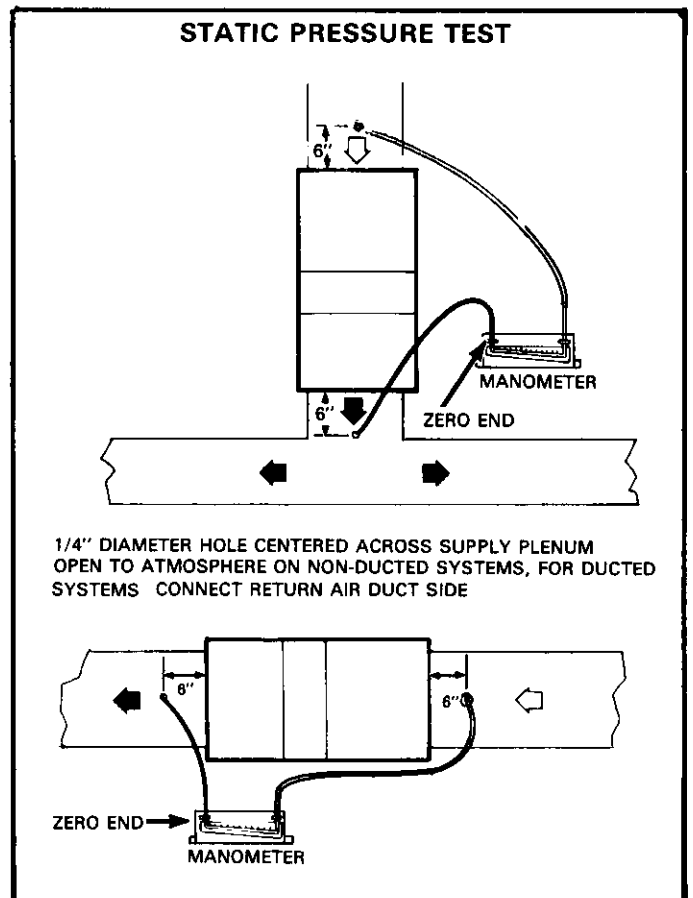


FIGURE 30

B - Manifold Pressure

GSR14 series units without a convertible gas valve can take an L.P. changeover kit. After kit is applied, manifold pressure must be adjusted. Those GSR14 series units equipped with a convertible gas valve need no kit. On these models, manifold pressure is preset and needs no adjustment.

Checks of manifold pressure are made as verification of proper regulator adjustment. Manifold pressure for the GSR14 can be measured 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:

1 - Remove the 1/8 inch pipe plug from the pressure tap on the elbow below the expansion tank, see parts arrangement for location of tap.

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

2 - Insert hose adaptor in tap and connect gauge.

3 - Set thermostat for heating demand (the demand can be started at the unit by jumping 'R' to '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. See step 5 for units that will not ignite.

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 next to the electrical terminals and manual on/off knob. Refer to Figure 10.

7 - Always recheck the manifold pressure after adjusting the regulator. Turn the adjustment screw clockwise to increase manifold pressure and counterclockwise to decrease manifold pressure.

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 supply pressure should only be checked with the unit running. A 1/8 inch pipe plug and tap are supplied in the elbow on the inlet side of the gas valve for checking line pressure. Line pressure ratings are also listed on the unit rating plate.

D - Flame Signal

A 50 microamp DC meter range is needed to check the flame signal on the ignition primary controls. ('Simpson' models 250, 255 and 260 have a DC microamp range of 0-50 and are suggested for use).

Flame signal 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 (spark electrode) 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. To measure flame signal, follow the procedure below.

To Measure:

1 - Place the meter in series between the ignition control and sensor wire; positive(+) lead of the meter to the ignition control sensor connection and negative(-) lead of the meter to the sensor wire.

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

3 - The flame signals are as follows:

Lennox GC1 primary control - 1 to 25 microamps DC

Watsco primary control - 2 to 5 microamps DC

Gas Energy 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 135°F for any of the GSR14's. If exhaust temperature exceeds 135°F, the auxiliary fan control may activate and either the primary limit or secondary limit may 'trip'. High exhaust temperature may indicate a problem in the unit or restrictions in ducts or PVC pipes.

Most units run with a maximum exhaust temperature of 110°F to 125°F from lower to higher unit inputs. Exhaust temperatures lower than these are normal.

F - Exhaust CO₂ (Carbon Dioxide) Content

Carbon Dioxide is a colorless -odorless gas produced in small amounts by all furnaces, including the GSR14, during the combustion process. When the unit is properly installed and operating normally, the CO₂ content of the exhaust gas is within 8.0 to 10.0% for natural gas and within 9 to 11.5% for L.P. gases. If the unit appears to be operating normally at or beyond the upper limit of the CO₂ 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 CO₂ content is to use the Bacharach CO₂ test with a Fyrite CO₂ indicator. Other methods of testing CO₂ are available. Closely follow the instructions included with the test kit you choose. A method for connecting the CO₂ test kit to the GSR14 is outlined in the next section.

G - Exhaust CO (Carbon Monoxide) Content

If the unit appears to be operating normally with CO₂ output at or near the 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% regardless of the type of gas used.

Conditions Which Might Cause Abnormally High CO Include:

(Conditions are not limited to this list)

- 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 - The type of gas used.
- 4 - Atmospheric conditions present at a particular location.
- 5 - Dirty or worn air flapper. (Air flapper should be checked and replaced if needed.)

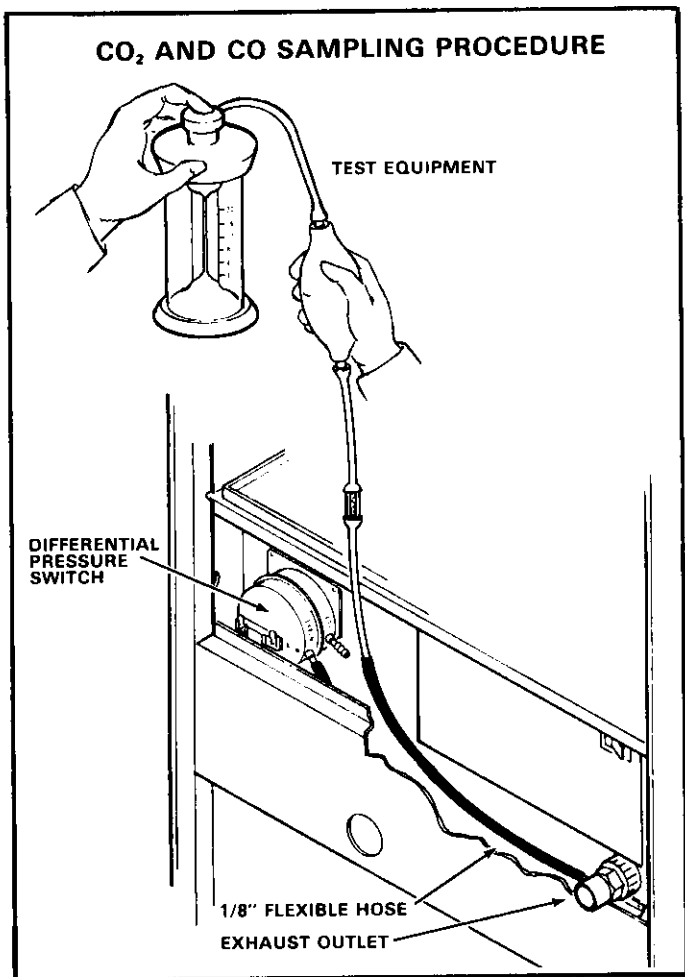


FIGURE 31

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

To Connect a Device for Taking CO₂ or CO Samples:

- 1 - Disconnect the differential pressure switch hose from the 1/8" differential pressure switch outlet adaptor and connect the sampling device to the hose (Figure 31).
- 2 - Set thermostat to highest setting and allow the unit to run for 15 minutes before taking a sample.
- 3 - Take the CO₂ or CO sample.
- 4 - When CO₂ 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 adaptor.

CAUTION - MAKE SURE THE DIFFERENTIAL PRESSURE SWITCH HOSE IS SECURELY RECONNECTED TO THE PRESSURE SWITCH ADAPTOR. 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 in the combustion chamber
 - h. Loose sensor wire
- 2 - Primary Limit Cutout
 - a. Blower failure
 - b. Temperature rise too high
 - c. Restricted filter or return air
 - d. Restricted discharge air
- 3 - Secondary Limit Cutout
 - a. Blower failure
 - b. Temperature rise too high
 - c. Restricted filter or return air opening
 - d. Restricted discharge air
 - e. Primary fan control shutting blower off too early
 - f. Auxiliary fan control by activating the blower is unable to compensate for temperature rise in blower housing.

I - Internal Component Temperatures

During operation, temperature at the top of the combustion chamber and tailpipe is 1000-1200°F. At the tailpipe entrance to the exhaust decoupler, temperature has dropped to approximately 600°F. From the exhaust decoupler outlet to the coil intake manifold the temperature has reached approximately 350°F. At the coil exhaust outlet manifold, temperature ranges from approximately 100°F to 110°F. These are average temperatures and 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 is a measurement of acidity and alkalinity.

The following scale shows the relative pH of some common liquids as compared with the condensate of GSR14 units.

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

pH RANGE	
	0
	1
Increasing Acidity ↑	2 - Vinegar
	3 - Wine
	4 - Orange Juice
	5 - Tomato Juice
	6
	7 - tap water
	8
	9
Increasing Alkalinity ↓	10
	11
	12
	13
	14

} GSR14 Condensate
pH Range

K - Acceptable Operating Input

Field Adjustments to the unit are not normally needed due to the specifically sized components for each unit 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 GSR14 above or below this acceptable operating range may cause continuity, startup and lockout 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 on appliances if used.
- 2 - Set the 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 or five-foot dial on the meter, time one full revolution (in seconds) with a watch. See Figure 32.

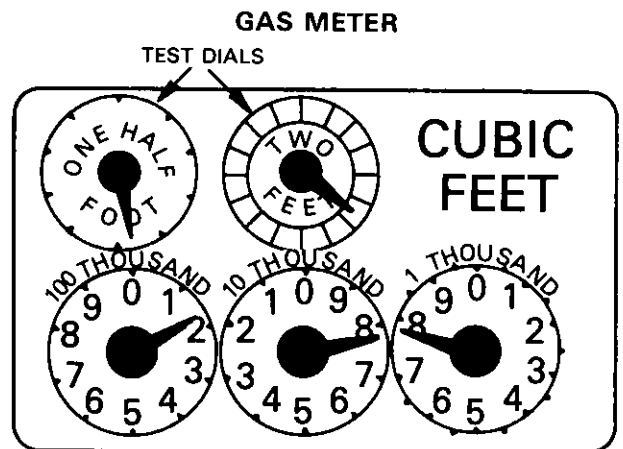


FIGURE 32

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

EXAMPLE:

- a. One revolution on the two-foot dial = 90 seconds.
- b. Using the gas rate chart, Table 4, note that 90 seconds = 80 cubic feet of gas per hour.

c. Nominally there are 1000 Btu in each cubic foot of gas. Make adjustment to this figure where the gas heating value is other than 1000 Btu per cubic foot (contact the local gas supplier for local Btu per cubic foot gas ratings).

d. 80 cu. ft./hr. x 1000 Btu/cu. ft. = 80000 Btuh input.

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

TABLE 4

METER FLOW RATE				
GAS RATE – CUBIC FEET PER HOUR				
Secs. for One Rev.	Size of Test Meter Dial			
	1/2 Cubic Feet	1 Cubic Feet	2 Cubic Feet	5 Cubic Feet
10	180	360	720	1,800
11	164	327	655	1,636
12	150	300	600	1,500
13	138	277	555	1,385
14	129	257	514	1,286
15	120	240	480	1,200
16	112	225	450	1,125
17	106	212	424	1,059
18	100	200	400	1,000
19	95	189	379	947
20	90	180	360	900
21	86	171	343	857
22	82	164	327	818
23	78	157	313	783
24	75	150	300	750
25	72	144	288	720
26	69	138	277	692
27	67	133	267	667
28	64	129	257	643
29	62	124	248	621
30	60	120	240	600
31	58	116	232	581
32	56	113	225	563
33	55	109	218	545
34	53	106	212	529
35	51	103	206	514
36	50	100	200	500
37	49	97	195	486
38	47	95	189	474
39	46	92	185	462
40	45	90	180	450
41	44	88	176	440
42	43	86	172	430
43	42	84	167	420
44	41	82	164	410
45	40	80	160	400
46	39	78	157	391
47	38	77	153	383
48	37	75	150	375
49	37	73	147	367

METER FLOW RATE				
GAS RATE – CUBIC FEET PER HOUR				
Secs. for One Rev.	Size of Test Meter Dial			
	1/2 Cubic Feet	1 Cubic Feet	2 Cubic Feet	5 Cubic Feet
50	36	72	144	360
51	35	71	141	353
52	35	69	138	346
53	34	68	136	340
54	33	67	133	333
55	33	65	131	327
56	32	64	129	321
57	32	63	126	316
58	31	62	124	310
59	30	61	122	305
60	30	60	120	300
62	29	58	116	290
64	29	56	112	281
66	29	54	109	273
68	28	53	106	265
70	26	51	103	257
72	25	50	100	250
74	24	48	97	243
76	24	47	95	237
78	23	46	92	231
80	22	45	90	225
82	22	44	88	220
84	21	43	86	214
86	21	42	84	209
88	20	41	82	205
90	20	40	80	200
94	19	38	76	192
98	18	37	74	184
100	18	36	72	180
104	17	35	69	173
108	17	33	67	167
112	16	32	64	161
116	15	31	62	155
120	15	30	60	150
130	14	28	55	138
140	13	26	51	129
150	12	24	48	120
160	11	22	45	112
170	11	21	42	106
180	10	20	40	100
190	9.5	19	38	95
200	9	18	36	90
210	8.5	17	34	86
220	8	16	33	82

IX - NEW UNIT STARTUP

Normal setup conditions of a new unit installation may 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 and residues of oil and water are purged from the heat exchange assembly. Break and remake the thermostat demand to restart the ignition sequence at 2 to 3 minute intervals until continuous operation is obtained.

X - TROUBLESHOOTING

Troubleshooting of the GSR14 depends on a complete understanding of how all the components work as described in this manual. Common problems are broken down 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 SPATTER STARTS AND DIES

EACH OF THE FOUR PROBLEM CATEGORIES ABOVE ARE BROKEN DOWN INTO TROUBLESHOOTING FLOWCHARTS on the following pages with additional information provided to explain certain checks. Steps in the flowcharts for measuring manifold pressure, flame signal, exhaust CO₂ content, exhaust CO content and operating input are explained in previous sections.

CHOOSE THE FLOWCHART THAT BEST DESCRIBES THE UNIT'S PROBLEM. FOLLOW THE FLOWCHART 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 up 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 be 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 ft-lbs. The sensor is torqued to 14 ± 1 ft-lbs. Allow metal to cool before measuring torque.**

AIR FLAPPER VALVE ASSEMBLY (50's,80's ONLY)

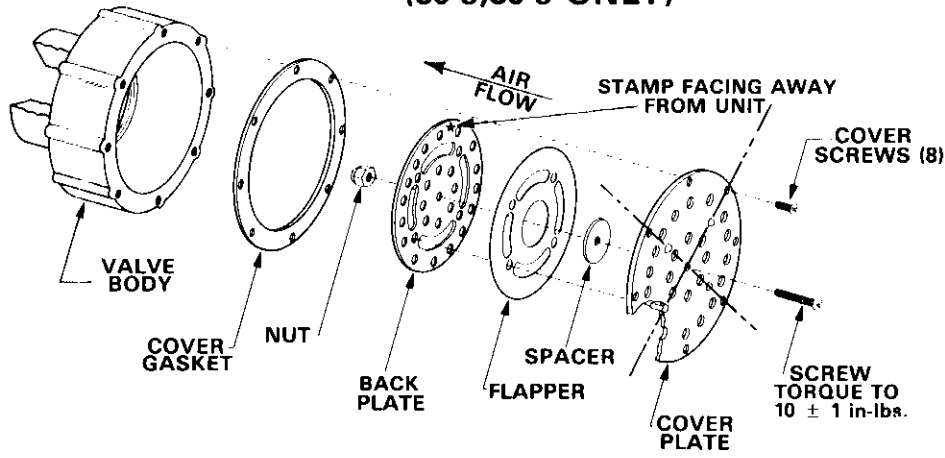


FIGURE 33

A - Checking Air Intake Flapper Valve

- a. Remove air intake chamber cover and check for foreign materials that may have accumulated, clean purge blower and upper and lower chamber compartments if necessary.
- b. 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 re-secure 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 NEW REPLACEMENT AIR FLAPPER VALVES. If replacing the old air flapper valve in the unit, NEW REPLACEMENT SCREWS ARE AVAILABLE IN KIT FORM FROM LENNOX REPAIR PARTS. DO NOT USE Loctite OR SIMILAR THREAD SEIZING COMPOUNDS TO SECURE OLD 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 e. and f. below). **CAUTION - DO NOT DROP.**

- c. DO NOT DISASSEMBLE THE INTERNAL COMPONENTS OF THE VALVE. If taken apart, the plates can be rotated out of phase or reversed and the spacer thickness has an extremely low tolerance. Note that each plate has a stamp of the spacer thickness, a star or the words 'THIS SIDE OUT' stamped on each plate. These stamps should all lie in the same quadrant (Figure 33) and face the outside of the unit.
- d. 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.
- e. For models Q3,4-50,80 ONLY: AIR FLAPPER VALVES FOR THESE UNITS REQUIRE A GASKET BETWEEN THE VALVE AND VALVE BODY for proper operation (see Figure 33). 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. 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 6 or 8 places around the valve. If the valve is out of the clearance dimension given in Figure 34 at any point around the valve, simply replace the assembly.

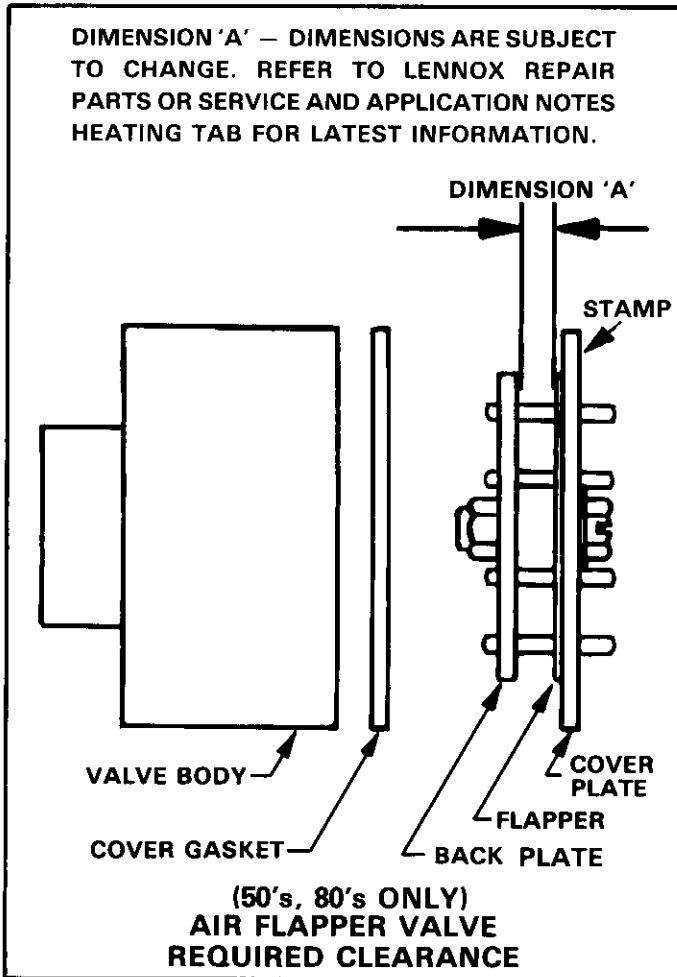


FIGURE 34

f. For models Q4/5-100 ONLY: THE FLAPPER ASSEMBLY FOR THIS UNIT DOES NOT REQUIRE A GASKET BETWEEN THE VALVE AND VALVE BODY (see Figure 35). The air flapper assembly is designed as a one-piece unit. Clearances between the flapper and back plate cannot be readily checked. If suspected of being faulty after a visual inspection, simply replace the assembly.

g. 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.

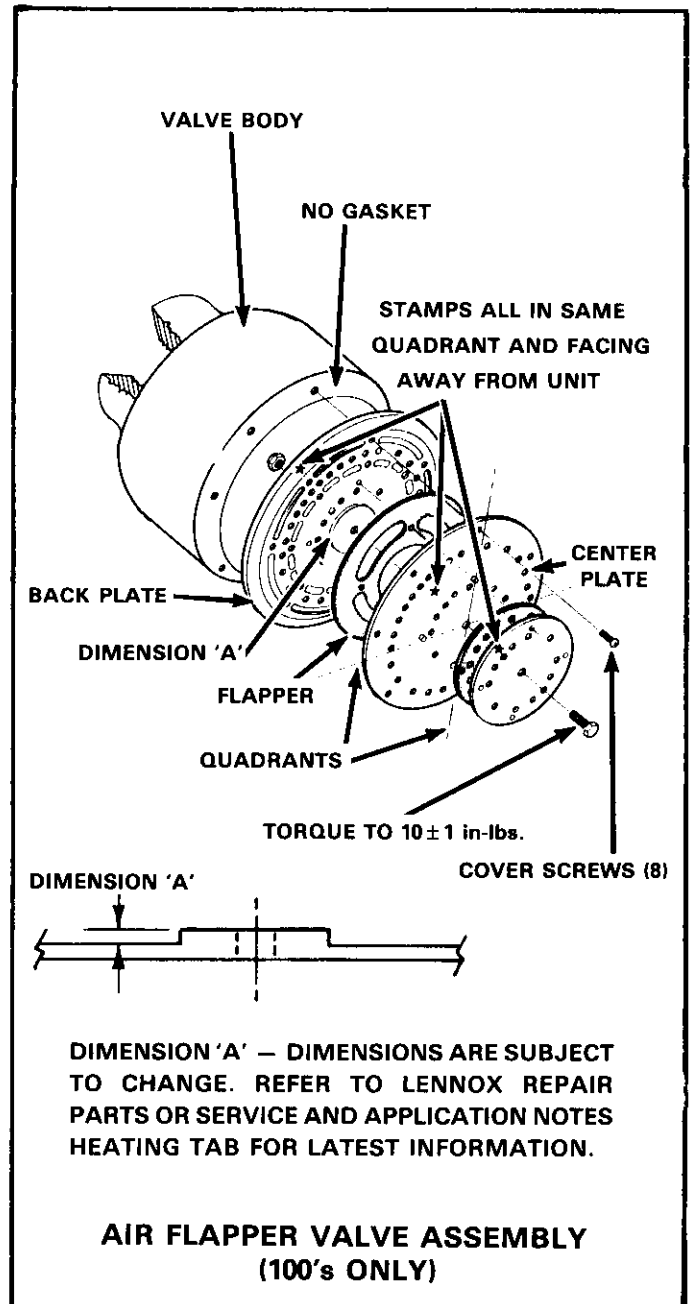


FIGURE 35

MAKE SURE THE STAR STAMPED ON THE COVER PLATE OR THE WORDS 'THIS SIDE OUT' ARE PLACED TO THE OUTSIDE OF THE UNIT. Then tighten the screws evenly to a maximum of 23 oz. in. ± 1 oz. in. for 50 and 80 series units and 10 oz. in. ± 2 oz. in. for 100 series units. Do not overtighten the screws, if the 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

- Disconnect the union at the bottom of the expansion tank and remove the entire gas flapper valve, nipple and elbow assembly as one piece. It is not recommended to remove the elbow and nipple from the flapper valve unless the valve is being replaced. Use care not to damage the O-Ring when handling the valve out of the unit. **DO NOT DROP.**
- Do not turn or remove the center screw of the valve assembly. Visually inspect the flapper. If the flapper is torn, creased or has uneven (frayed) edges, the valve assembly must be replaced.
- 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 back plate. If the flapper does not move freely or is trapped under the spacer, the valve assembly must be replaced.
- Check for the required clearance between flapper and valve body. Refer to Figure 36. 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 dimension given in Figure 36 at any point around the valve, it must be replaced.
- 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.**

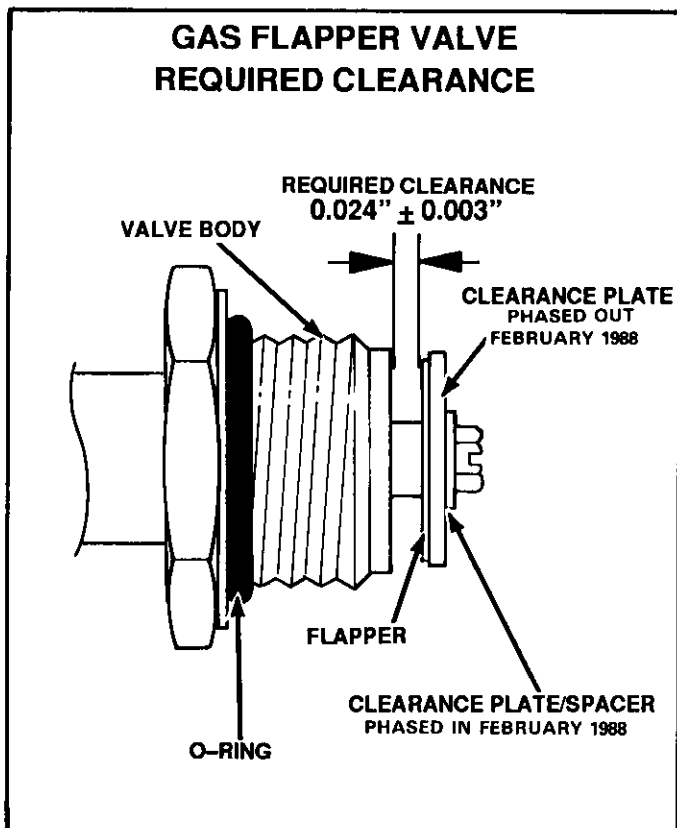


FIGURE 36

C - Checking the Gas Orifice

- With the gas flapper valve assembly removed, use a flashlight to check for blockage of the orifice in the manifold. Use a 1/2 inch shallow socket with extension to remove the orifice.
- Check the orifice drill size for the unit as given by Lennox Repair Parts listings. If the orifice is incorrect it must be replaced.
- Refer to Figure 37 for physical characteristics of the orifice. The orifice opening must not be chamfered. The orifice taper **MUST** be centered and not recessed. **THE TAPER MUST BE ON BOTH SIDES OF THE ORIFICE.** If any defects are found (including nicks and scars) the orifice must be replaced.

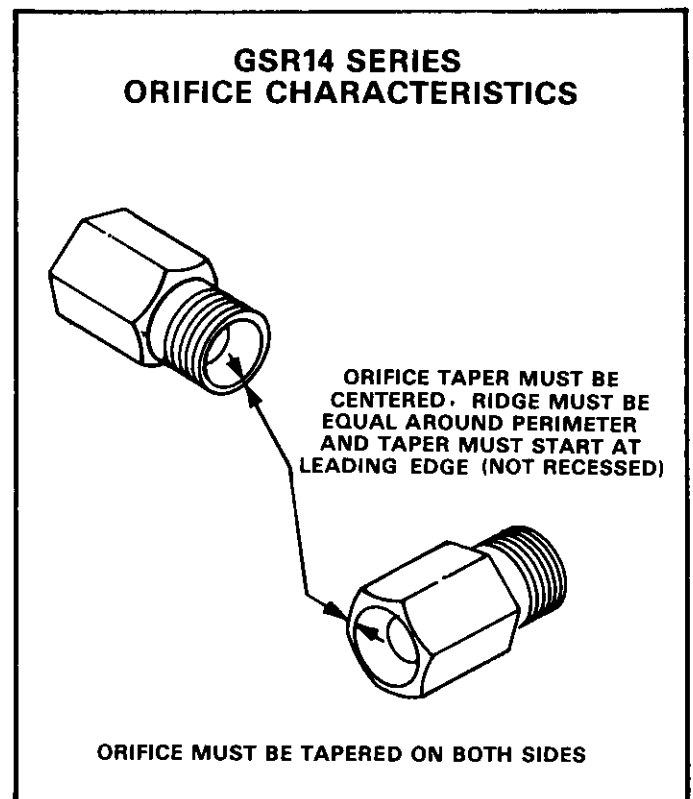


FIGURE 37

- Standard atmospheric burner orifices or orifice blanks cannot be used as replacements for the GSR14. Only replacement orifices supplied through Lennox should be used.
- When threading the orifice into the manifold use a rubber or foam insert in the socket to hold the threads past the end of the socket. **CAREFULLY ALIGN THREADS BY HAND TURNING THE SOCKET EXTENSION UNTIL THE 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
- 6 - Miscellaneous

Troubleshooting Other Problems:

1 - Blower Runs Continuously

- Step 1 - Is thermostat fan switch set to 'ON'? If so, switch to 'AUTO'
- Step 2 - Is fan Control 'OFF' setting below ambient air temperature? If so, readjust to 90°F
- Step 3 - Are primary and auxiliary fan controls 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 leftover heat retained in the unit when the airflow is stopped builds up causing a recycle problem.

3 - Supply Air Blower Does Not Run

Be sure to reset secondary limit if tripped

- Step 1 - Check voltage at the blower taps after about 45 seconds
- Step 1 - Check for loose wiring
- Step 2 - Blower Relay operating properly? Check for 120VAC between terminal 2 and neutral immediately after ignition. See electrical schematic.
- Step 3 - Fan Control operating normally? Check for 120VAC between terminal 5 and neutral after the unit has been operating 35 to 40 seconds. See electrical schematic.
- Step 4 - Blower and/or capacitor operating normally? Check for 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 does operate.

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

Abnormal hissing sounds around the air decoupler box may indicate one of the following. Corrective action is required if this sound is heard:

- 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 bolts.

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 relationship should also be checked.

6 - Miscellaneous

To check for a faulty auxiliary fan control, disconnect the control from the unit and test for continuity. Contacts 1 and 3 should be open at ambient temperature and contacts 1 and 2 should be closed at ambient temperature.

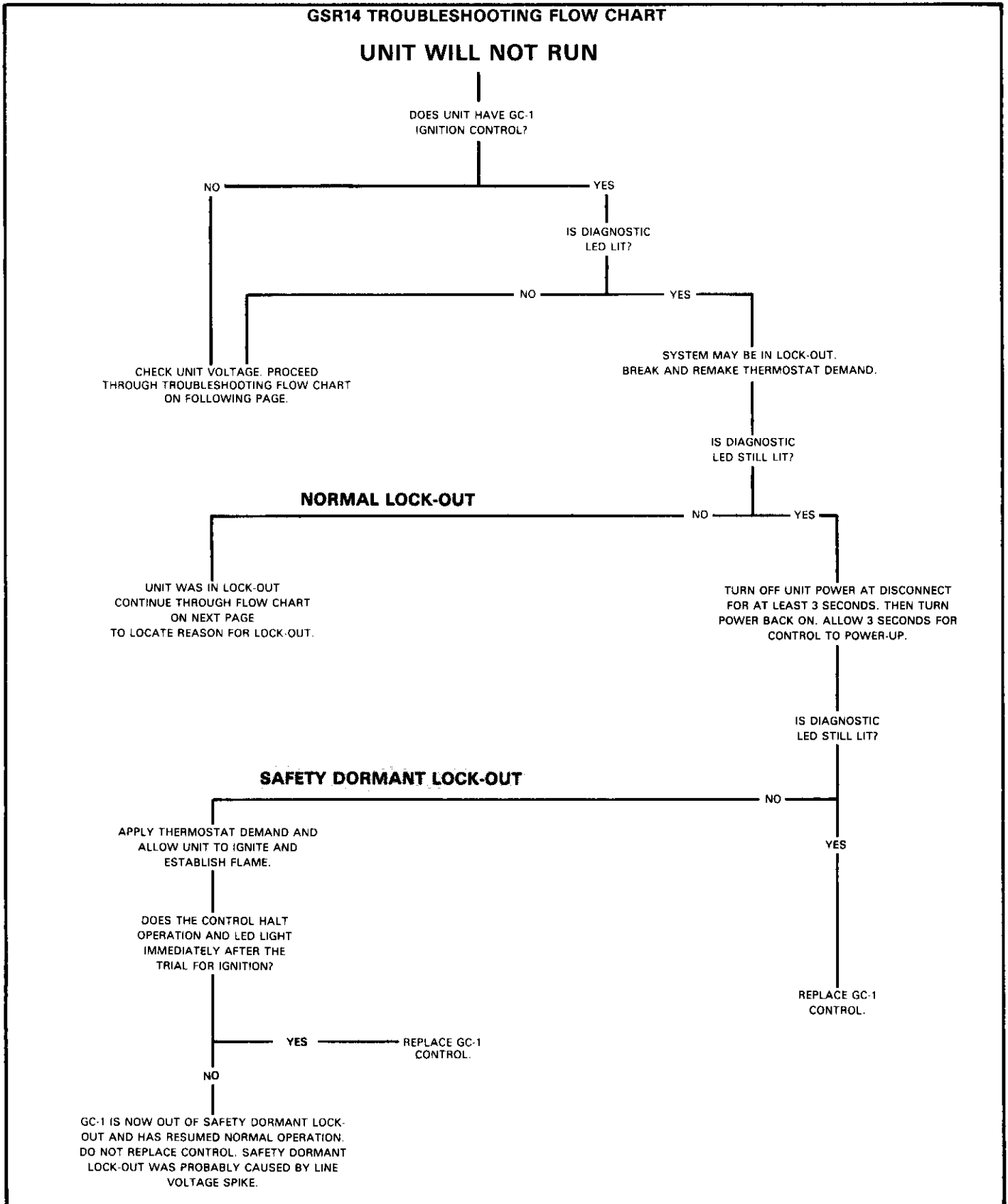
WARNING - SHOCK HAZARD. THE AUXILIARY FAN CONTROL IS CONNECTED TO LINE VOLTAGE. IT IS HOUSED UNDER A BARRIER FOR SAFETY. BEFORE SERVICING THE CONTROL, BE SURE TO DISCONNECT POWER TO THE UNIT.

WARNING - THE BARRIER WHICH SHROUDS THE AUXILIARY FAN CONTROL MUST BE IN PLACE ANY TIME THE UNIT IS OPERATING. DO NOT OPERATE THE UNIT WITHOUT THE BARRIER IN PLACE.

To check for a faulty secondary limit, disconnect the limit from the unit and test for continuity. Contacts should be closed at ambient temperature.

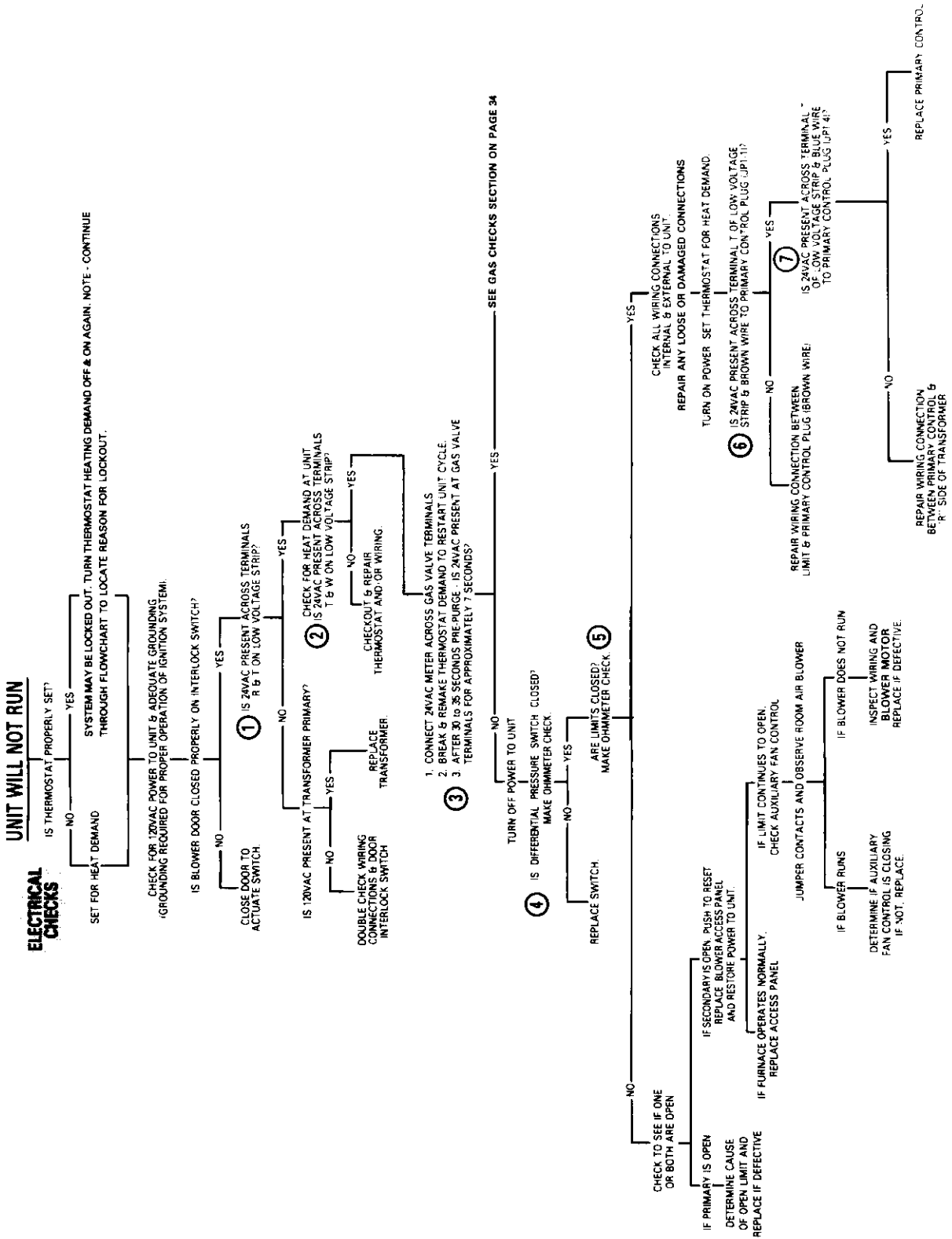
Note - If the secondary limit will not reset after cooling several minutes it is faulty and should be replaced.

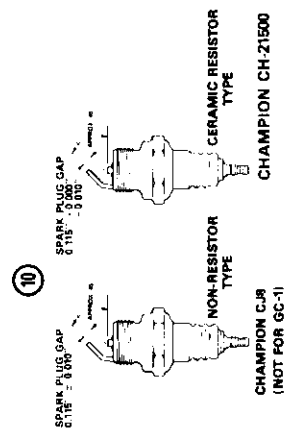
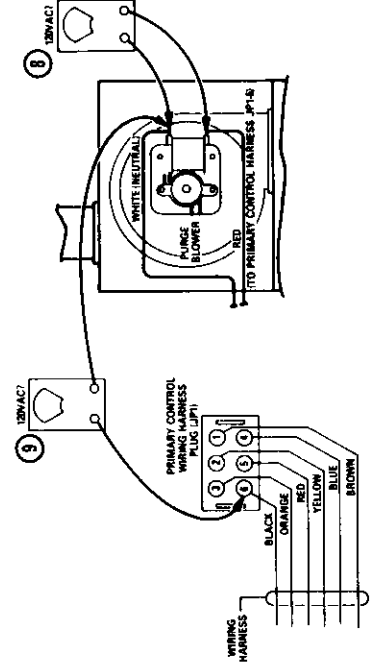
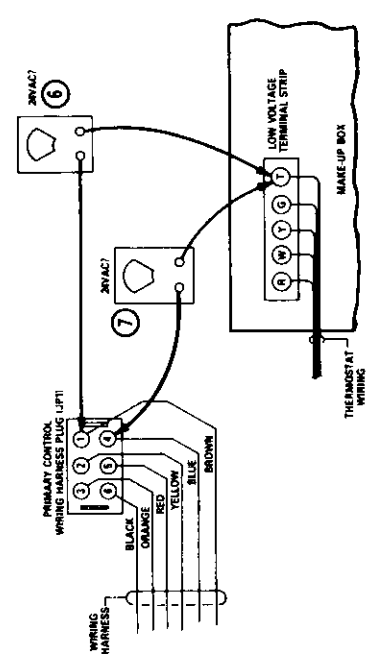
E - Basic Diagnostic Flow Chart



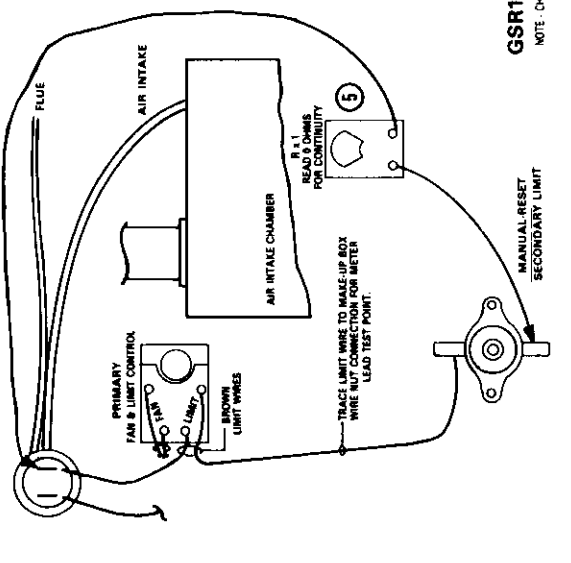
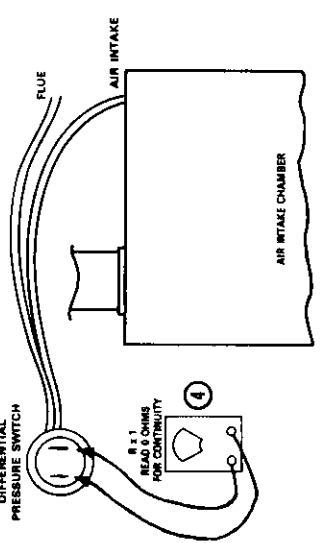
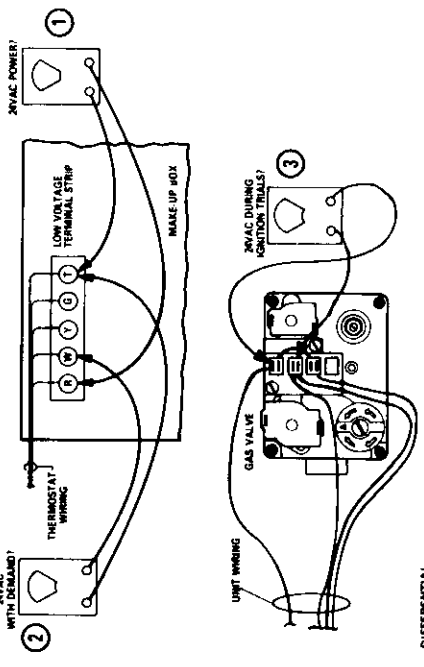
GSR14 TROUBLESHOOTING FLOW CHART

(continued from flow chart on previous page)
 NOTE: Numbered steps refer to illustrations on adjacent page.





IT IS NORMAL FOR THE ELECTRODE TO PROTRUDE AT AN UNUSUAL ANGLE



GSR14 TROUBLESHOOTING -- UNIT WILL NOT RUN

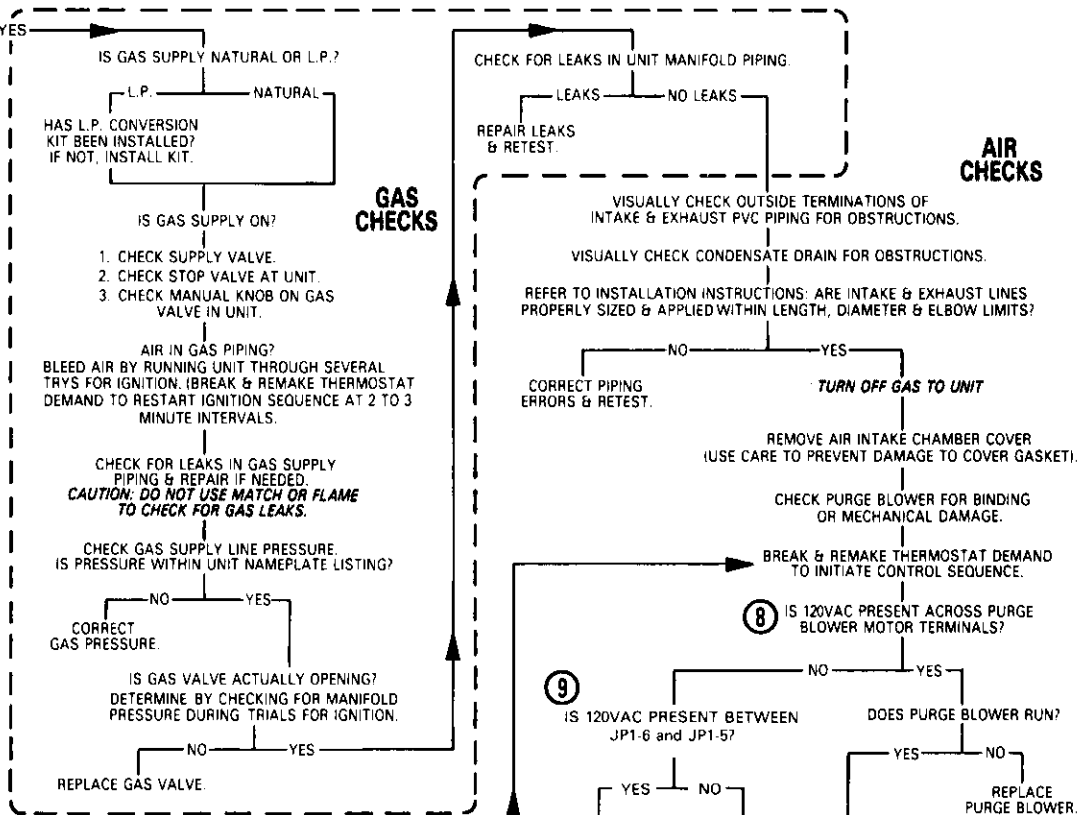
NOTE - CHECKS ILLUSTRATED CORRESPOND TO GSR14 TROUBLESHOOTING FLOW CHART ON OPPOSITE PAGE

GSR14 TROUBLESHOOTING FLOW CHART

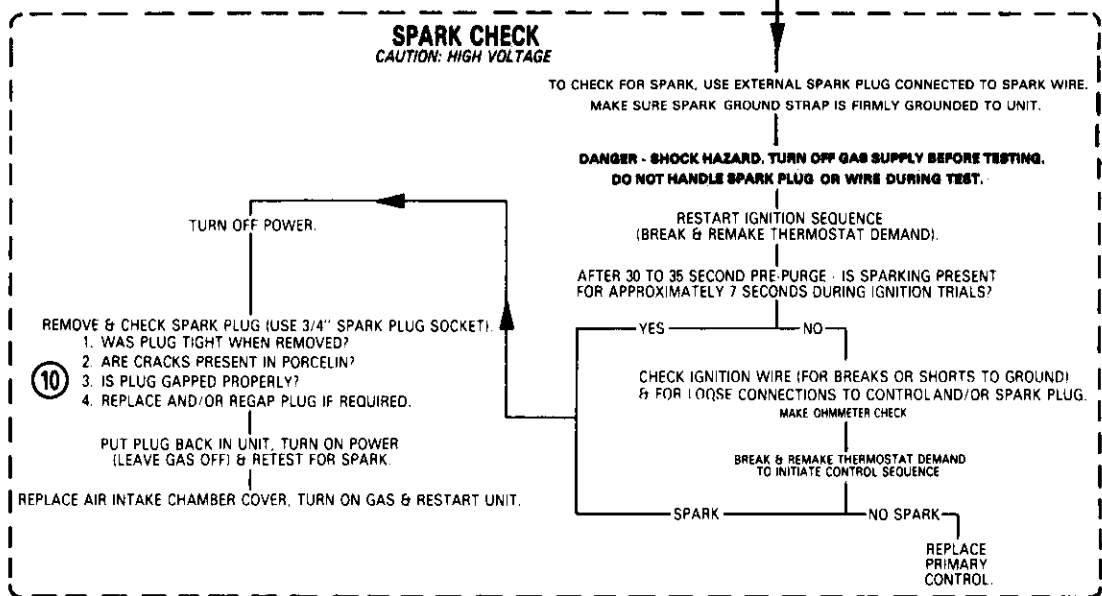
(continued from page 32)

NOTE - REFER TO ILLUSTRATIONS ON PREVIOUS PAGE FOR NUMBERED CHECKS.

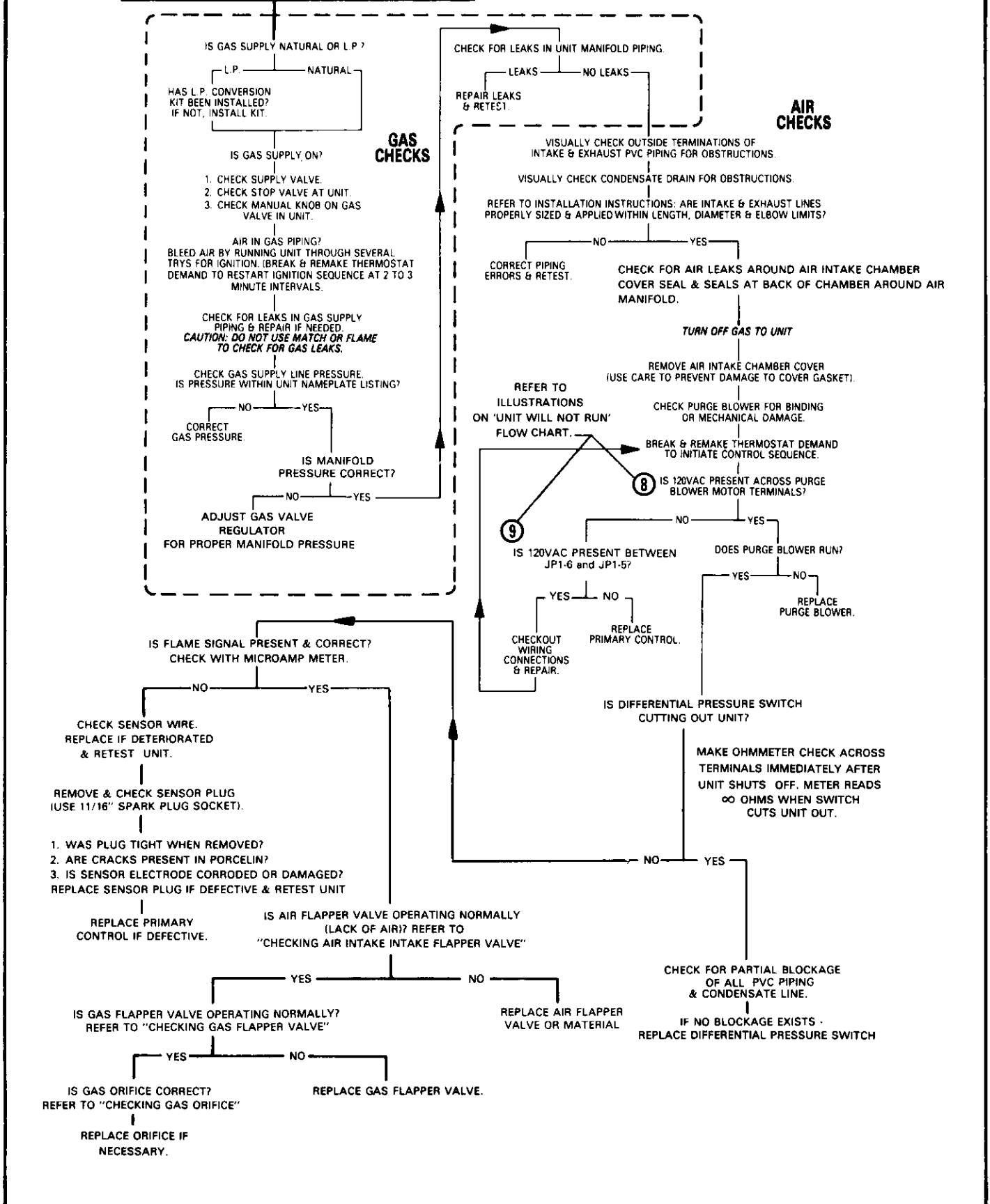
CONTINUED FROM UNIT WILL NOT RUN FLOW CHART ON PAGE 32.



AIR CHECKS



UNIT SPUTTER STARTS & DIES



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 AND EXHAUST PVC LINES SEPARATED NO MORE THAN 3" AT OUTSIDE TERMINATION? DOES EXHAUST TERMINATION EXTEND AT LEAST 8" PAST INTAKE TERMINATION?

NO
 YES
 MODIFY OR CORRECT SEPARATION TO A MAXIMUM OF 3"

ARE INTAKE & EXHAUST PVC LINES TERMINATED INTO A WINDOW WELL, ALCOVE OR CORNER WHERE VARYING CONDITIONS CAUSE RECIRCULATION?

NO
 YES
 MODIFY OR CORRECT EXHAUST OUTLET VAPOR WHEN UNIT IS RUNNING. RECIRCULATION WILL BE SEEN EASILY.

MODIFY OR CORRECT TERMINATIONS TO ELIMINATE RECIRCULATION.

NOTE - RECIRCULATION IS ALSO POSSIBLE WHEN EXHAUST CO₂ 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.

IS FLAME SIGNAL PRESENT & CORRECT? CHECK WITH MICROAMP METER.

NO
 YES

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 PORCELAIN?
 3. IS SENSOR ELECTRODE CORRODED OR DAMAGED?
- REPLACE SENSOR PLUG IF DEFECTIVE & RETEST UNIT.

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 9 OF THIS MANUAL TO DETERMINE IF PRIMARY CONTROL IS DEFECTIVE.

REPLACE PRIMARY CONTROL IF DEFECTIVE.

1
 ARE LIMITS CUTTING OUT UNIT? CHECK FOR OPEN LIMIT IMMEDIATELY FOLLOWING UNIT CUTOFF. SHUT OFF POWER AND MAKE OHMMETER CHECK.

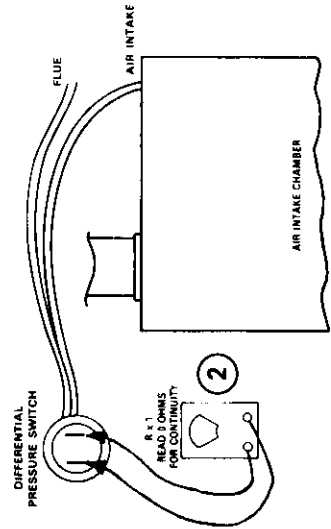
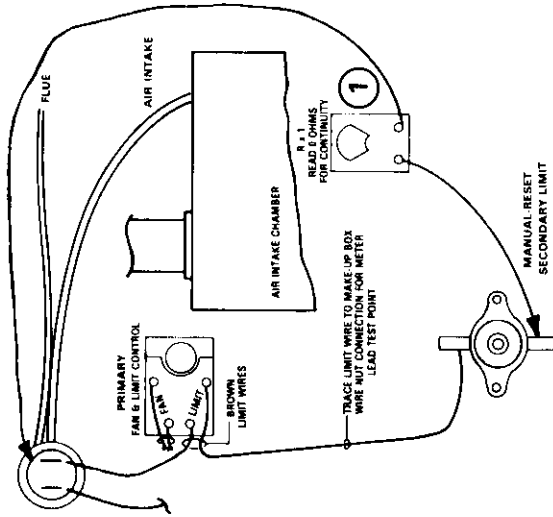
NO
 YES
 DETERMINE CAUSE OF LIMIT CUTOFF AND CORRECT PROBLEM.

IS DIFFERENTIAL PRESSURE SWITCH CUTTING OUT UNIT?

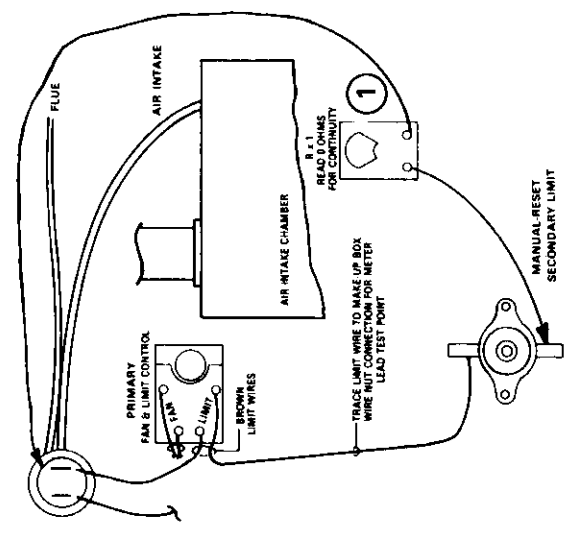
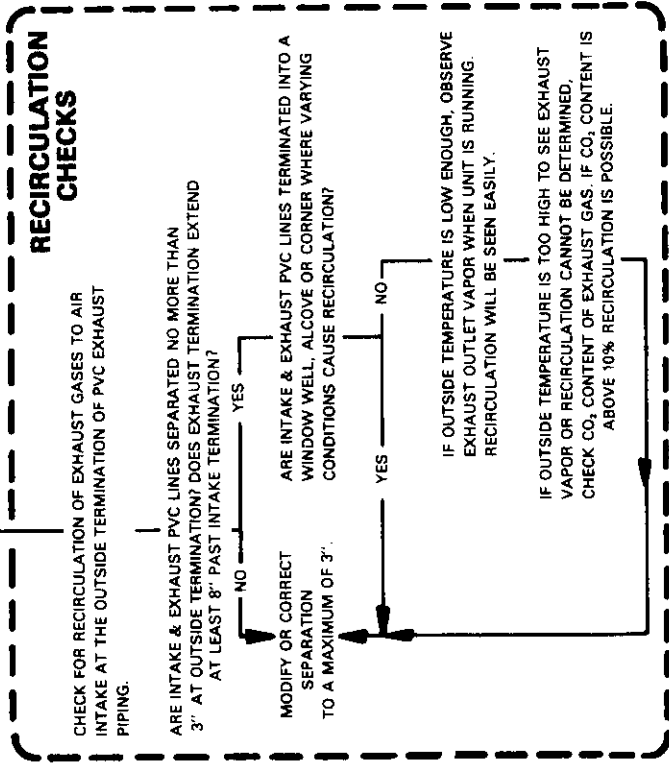
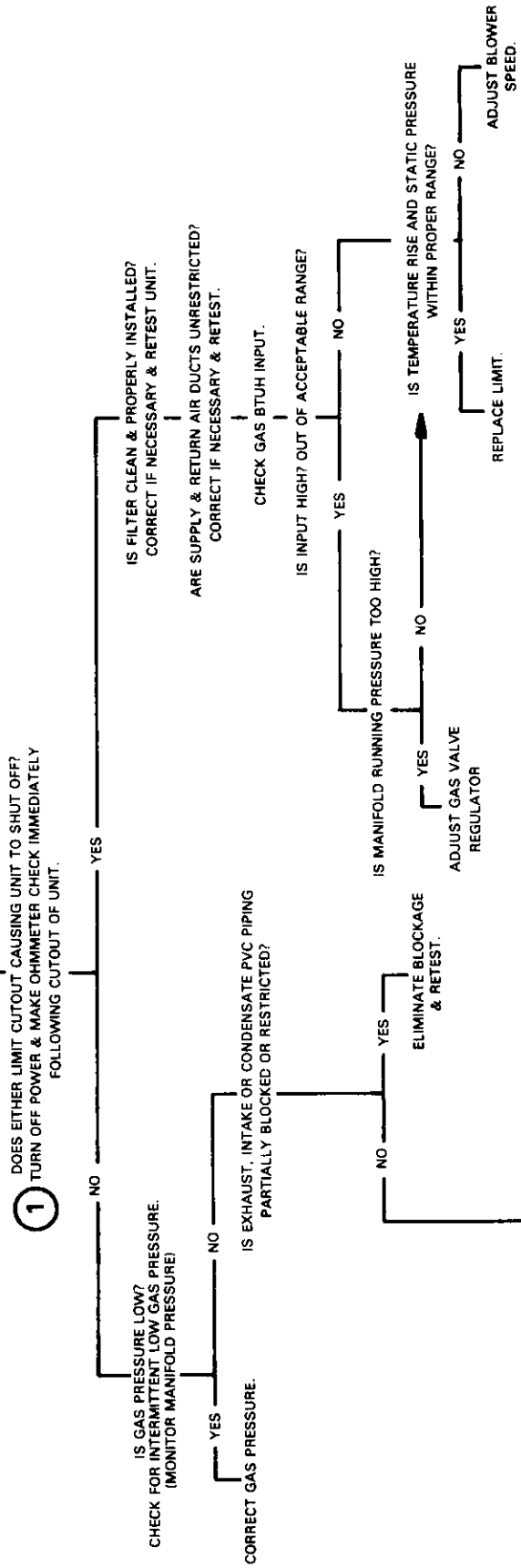
2
 MAKE OHMMETER CHECK ACROSS TERMINALS IMMEDIATELY AFTER UNIT SHUTS OFF. METER READS ∞ OHMS WHEN SWITCH CUTS UNIT OUT.

NO
 YES
 CHECK FOR PARTIAL BLOCKAGE OF ALL PVC PIPING & CONDENSATE LINE.

IF NO BLOCKAGE EXISTS - REPLACE VACUUM SWITCH.



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



XI - UNIT ACCESSORIES

1 - Low Ambient Thermostat Kit (Figure 38)

A low ambient thermostat kit is available for GSR14-50 units. The kit prevents a GSR14-50 unit from short-cycling when low ambient conditions exist. A low ambient condition can result from a low indoor thermostat setting (55°F or less return air). Short cycling conditions (run times of 4 to 5 minutes), may cause a buildup of water in the exhaust decoupler. The kit includes a return duct mounted field adjustable thermostat and a relay. See GSR14 low ambient thermostat kit installation instructions for proper installation and wiring. Low ambient kit operating sequence is shown in figure 39.

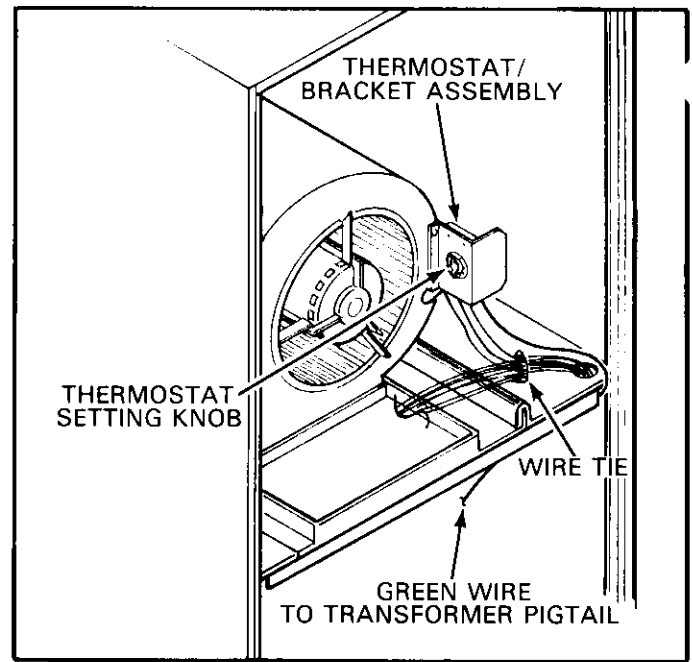
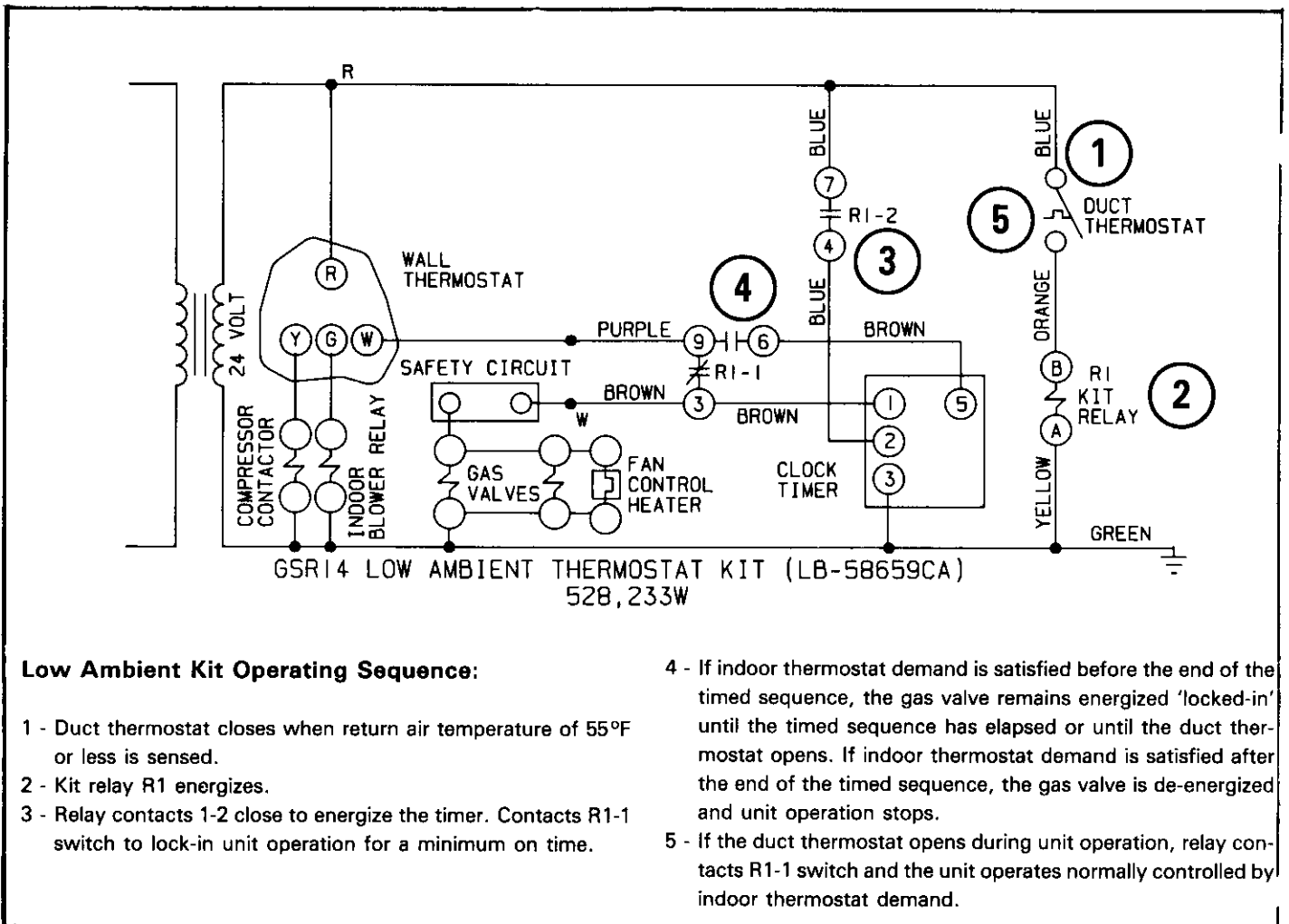


FIGURE 38



Low Ambient Kit Operating Sequence:

- 1 - Duct thermostat closes when return air temperature of 55°F or less is sensed.
- 2 - Kit relay R1 energizes.
- 3 - Relay contacts 1-2 close to energize the timer. Contacts R1-1 switch to lock-in unit operation for a minimum on time.
- 4 - If indoor thermostat demand is satisfied before the end of the timed sequence, the gas valve remains energized 'locked-in' until the timed sequence has elapsed or until the duct thermostat opens. If indoor thermostat demand is satisfied after the end of the timed sequence, the gas valve is de-energized and unit operation stops.
- 5 - If the duct thermostat opens during unit operation, relay contacts R1-1 switch and the unit operates normally controlled by indoor thermostat demand.

FIGURE 39