CONDENSING GAS FURNACES

Service Manual

NUGK	NULS
NULK	NDGK
NUGS	NDLK

This manual supports condensing gas furnaces manufactured after 1988.

Manufactured by:

Inter-City Products Corporation
Lavergne, TN USA 37086
Brantford, ONT. CANADA N3T 5P4

Part No. 2146635

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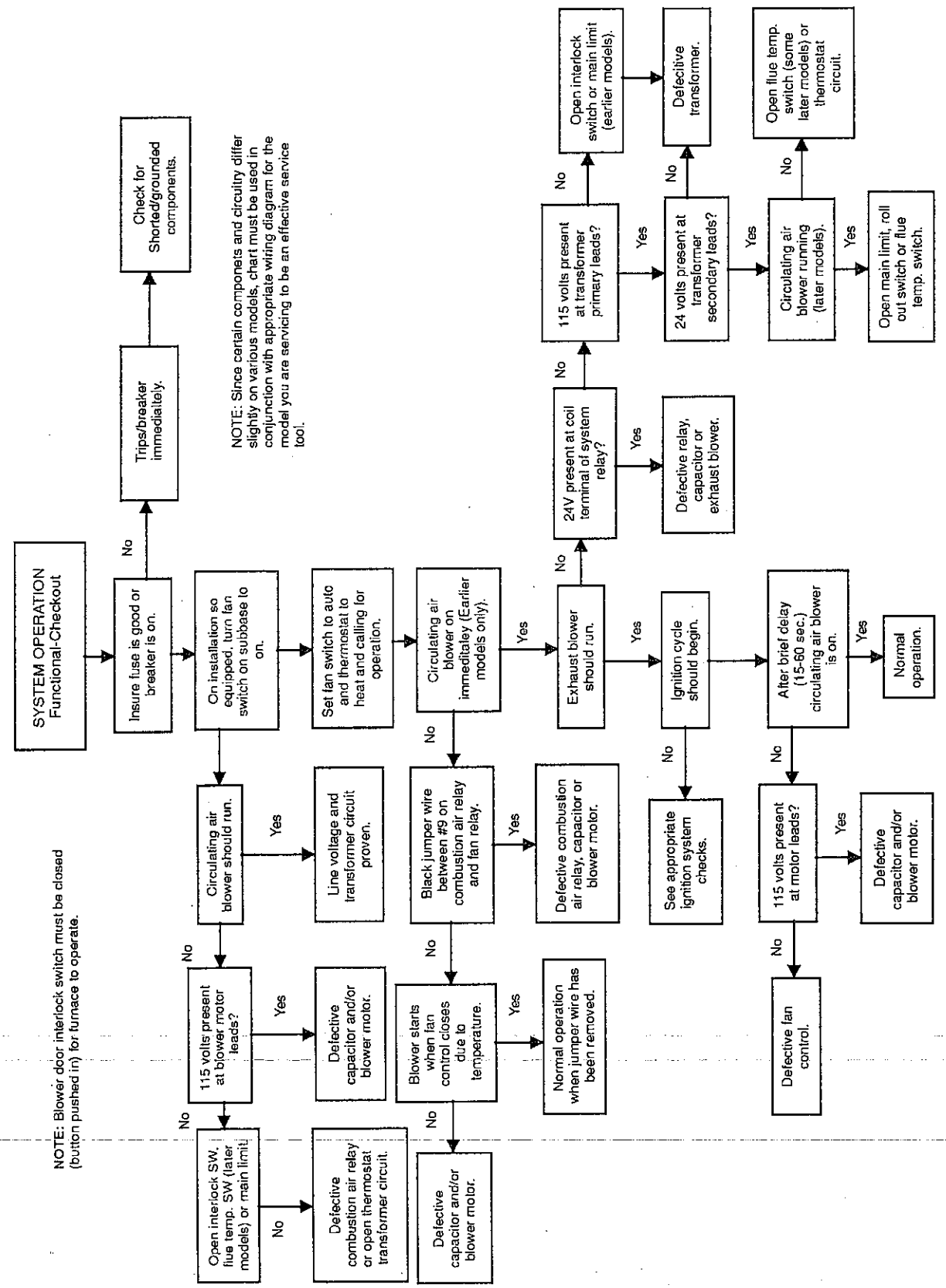
WARNING

The information contained in this manual is intended for use by a qualified service technician who is familiar with the safety procedures required in installation and repair and who is equipped with proper tools and testing instruments.

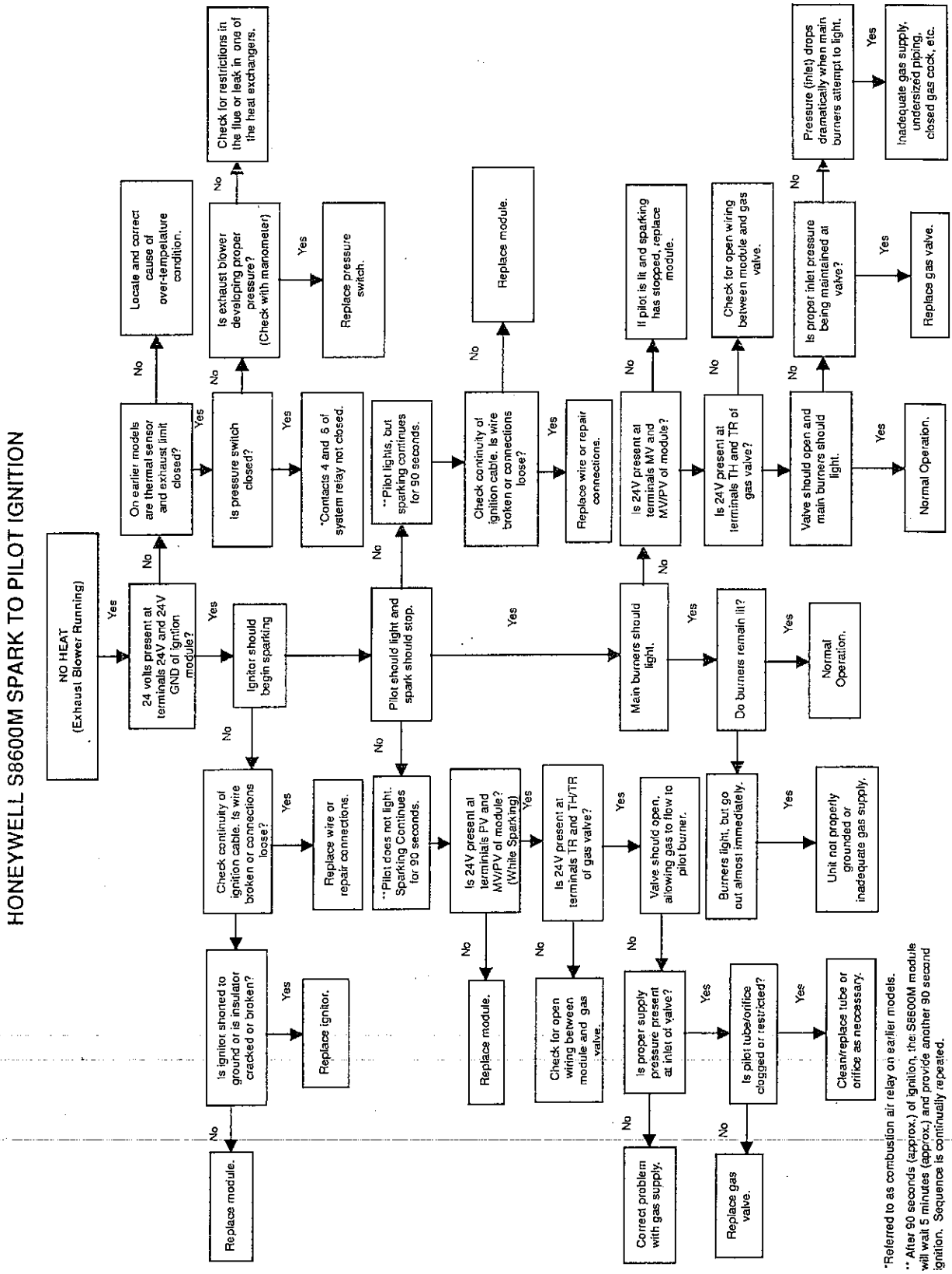
Installations and repairs made by unqualified persons can result in hazards subjecting the unqualified person making such repairs to the risk of injury or electrical shock which can be serious or even fatal not only to them, but also persons being served by the equipment.

If you install or perform service on equipment, you must assume responsibility for any bodily injury or property damage which may result to you or others. We will not be responsible for any injury or property damage arising from improper installation, service, and/or service procedures.

Furnace Troubleshooting Chart



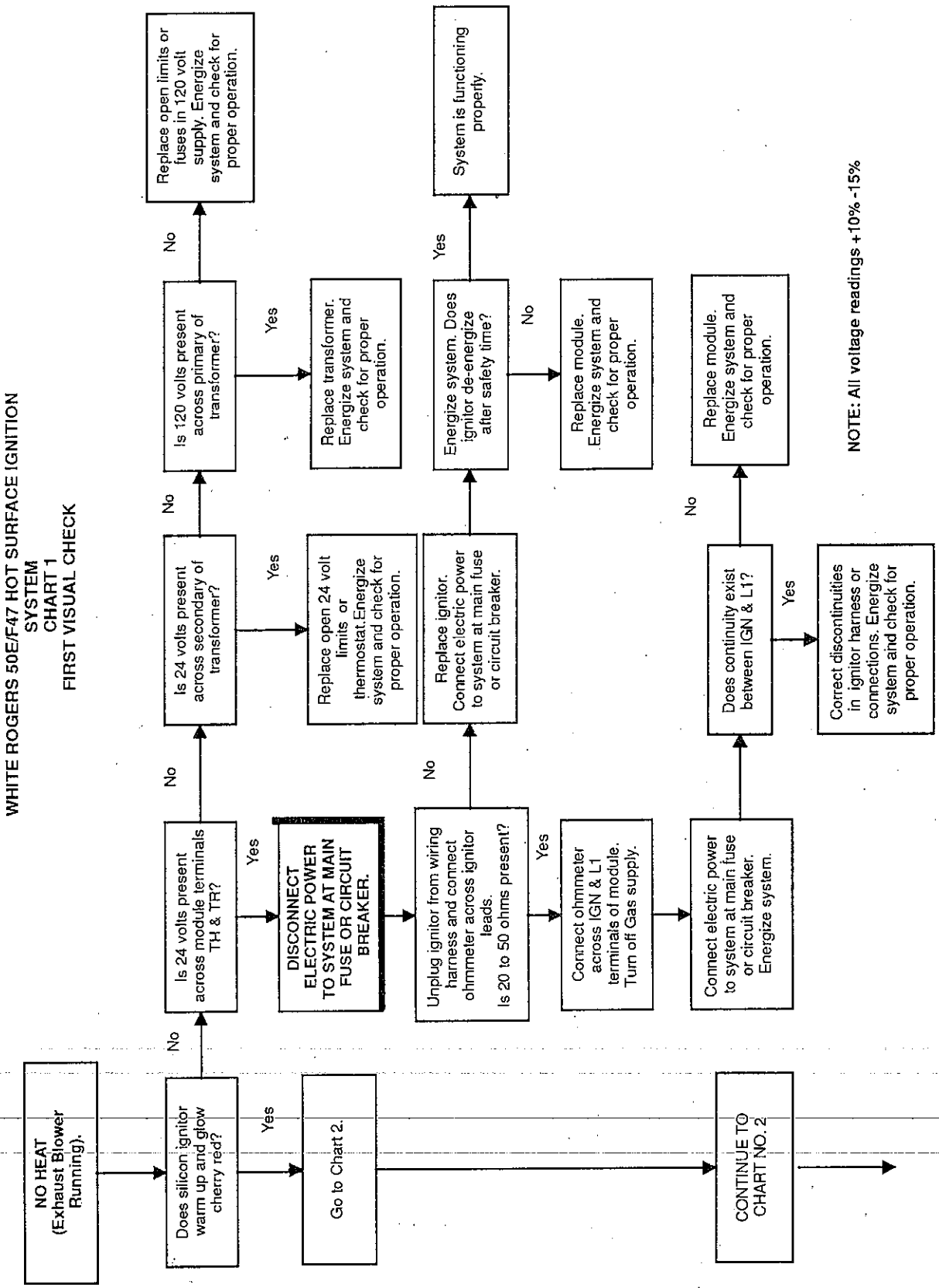
Honeywell S8600M Module Troubleshooting Chart



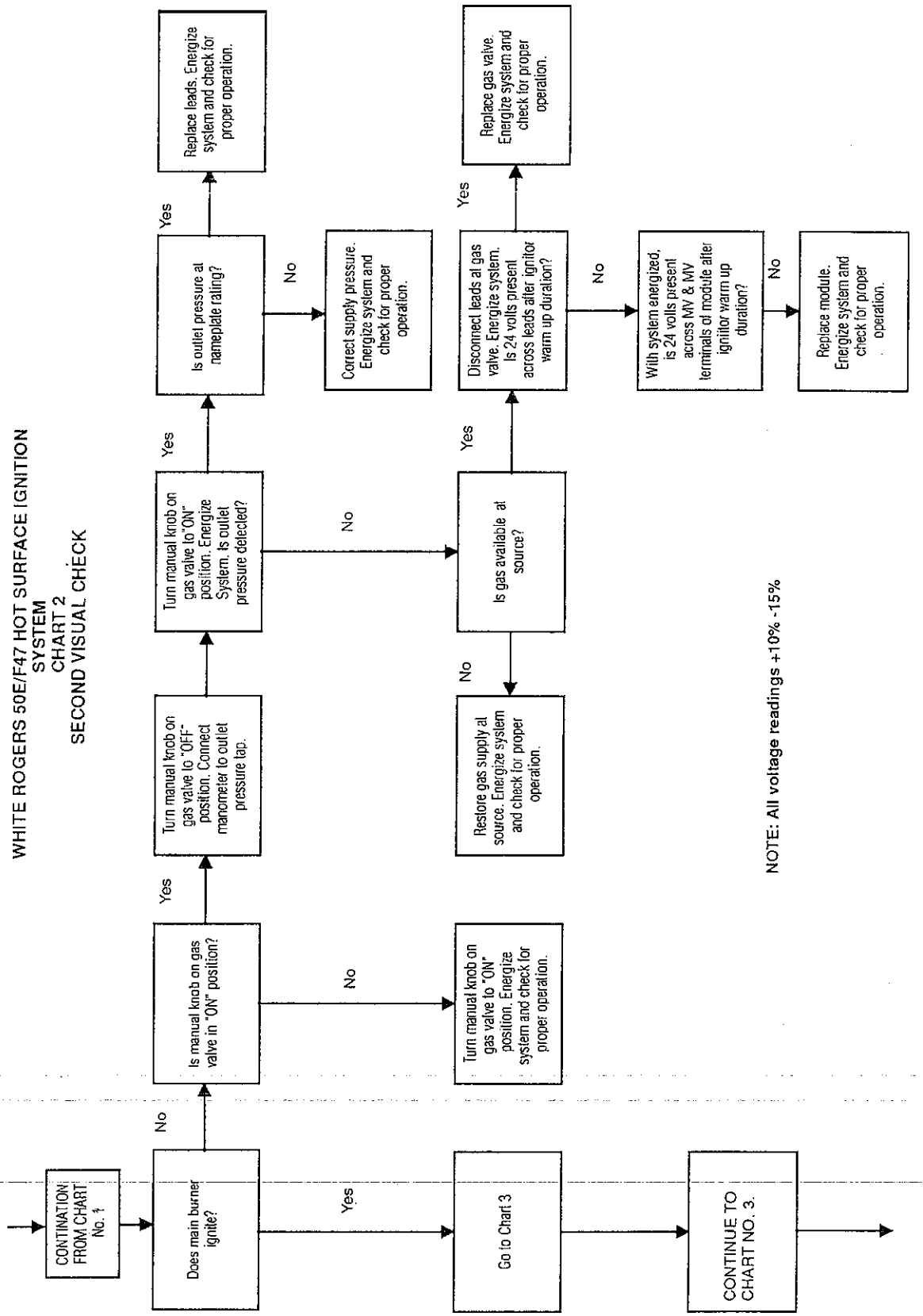
*Referred to as combustion air relay on earlier models.

** After 90 seconds (approx.) of ignition, the S8600M module will wait 5 minutes (approx.) and provide another 90 second ignition. Sequence is continually repeated.

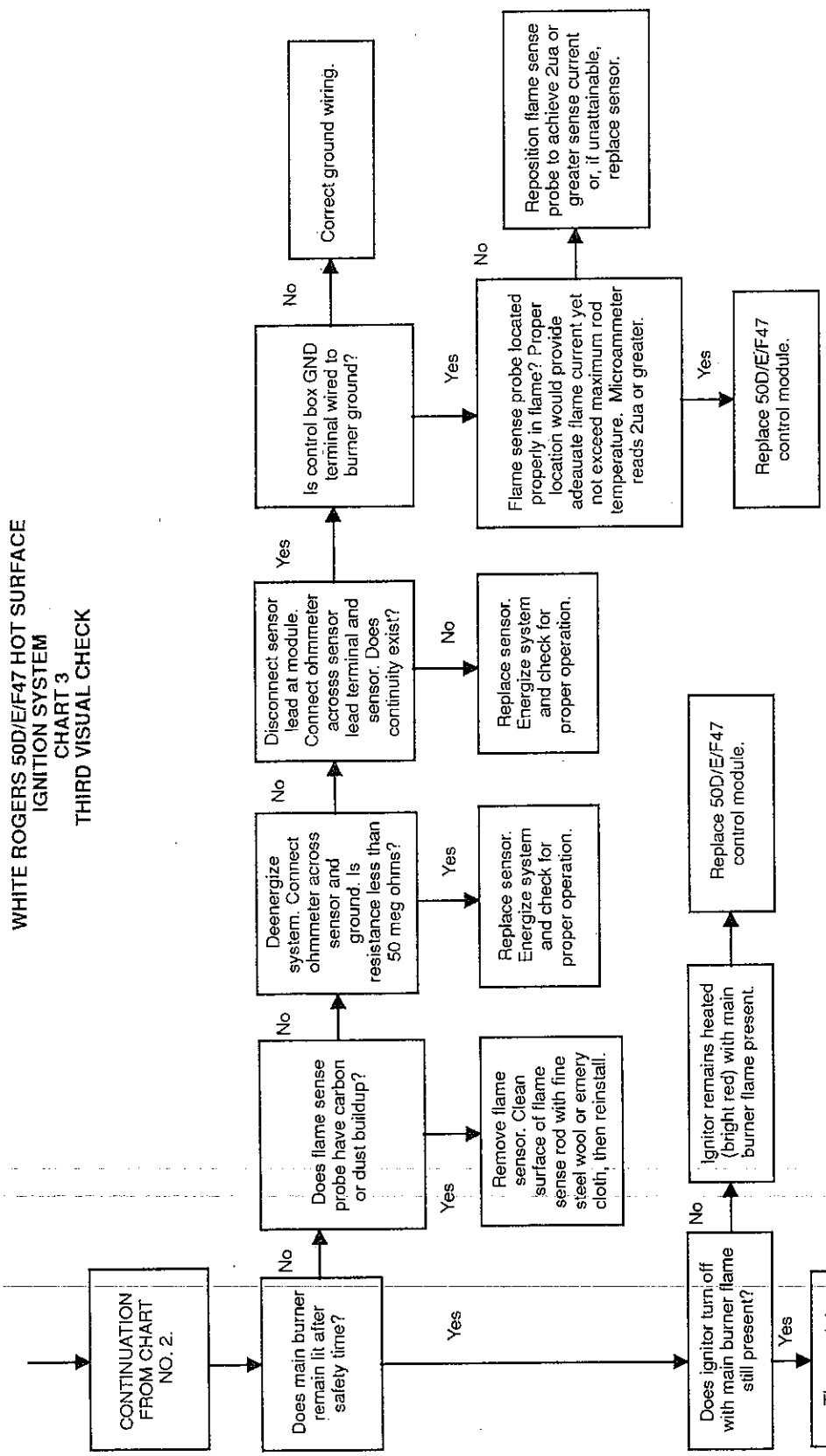
White Rodgers 50E/F47 Module Chart 1



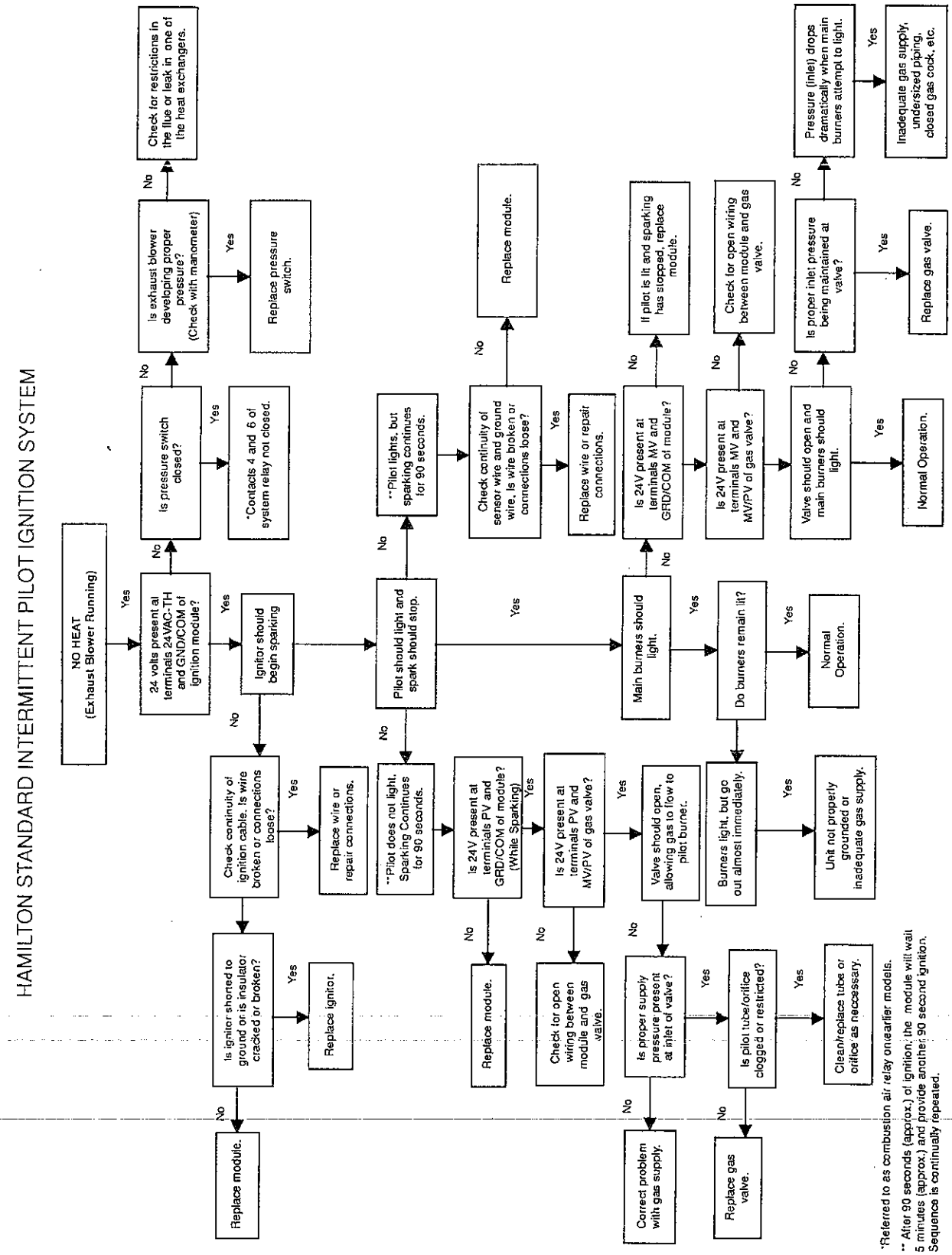
White Rodgers 50E/F47 Module Chart2



White Rodgers 50E/F47 Chart 3



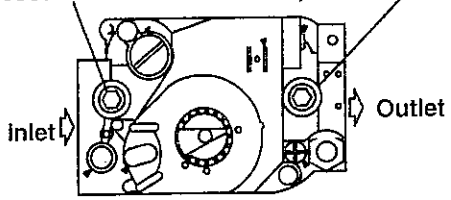
Hamilton Standard Intermittent Pilot Ignition System



D.C.
.15-.3 Minus Amps multiplication

Figure 1.

Typical Gas Valve



NOTE: Inlet pressure must be checked with all gas appliances fired.

80–10–01

Gas and Electrical Supply

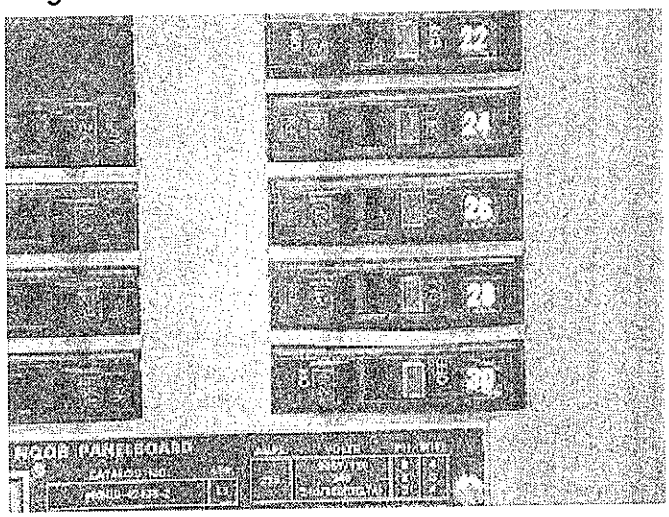
Natural Gas

Check the gas inlet pressure to the gas valve. Inlet pressure to the valve must be a minimum 4.5 in W.C. with all other appliances fired.

L.P. Gas

Check the gas inlet pressure to the gas valve. Inlet pressure to the valve must be a minimum of 11.0 in. W.C. with all other gas appliances fired.

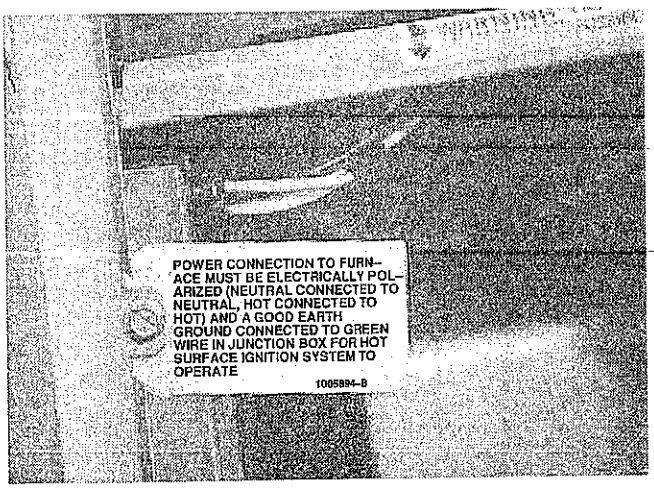
Figure 2.



Electrical Power to Furnace

Check the fuse or circuit breakers to make sure they are not blown or tripped. Supply voltage to the unit should be within plus or minus 10% of the voltage shown on the rating plate with the unit operating normally.

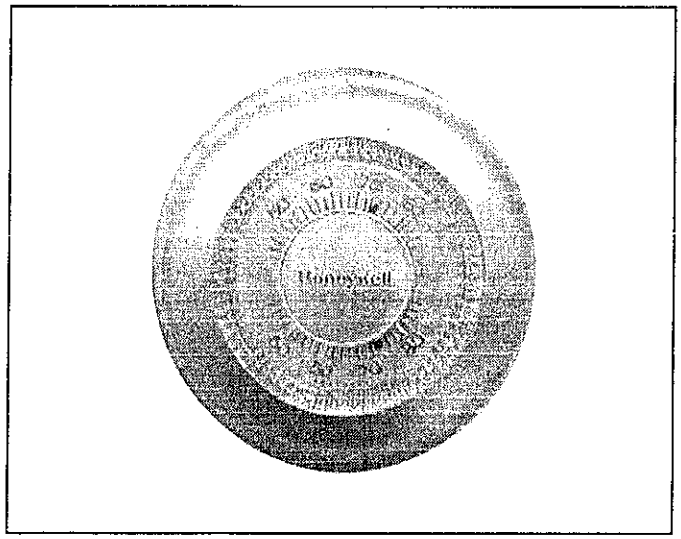
Figure 3.



Furnace Electrical Ground

The furnace may not operate at all or may operate intermittently if the furnace is not properly grounded.

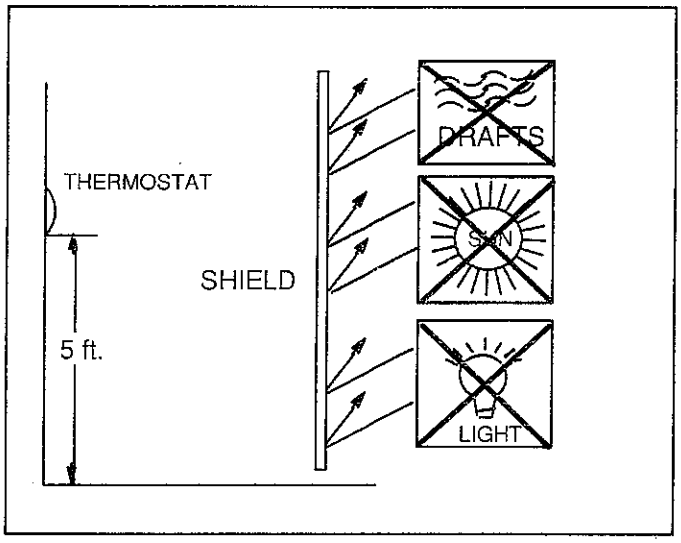
Figure 4.



Thermostats

A careful check of the thermostat and wiring must be made to insure that the thermostat is operating properly and that no wires are broken. The heat anticipator is checked and set to specifications.

Figure 5.

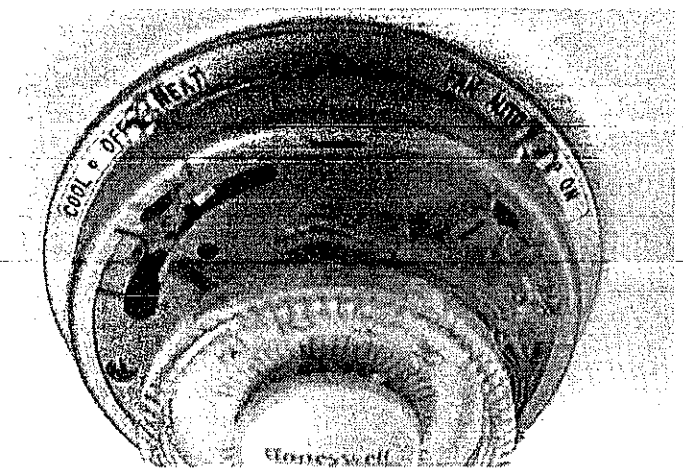


LOCATION

Locate the thermostat about 5 ft. above the floor in an area with good air circulation at average temperature.

Do not mount the thermostat where it may be affected by drafts, hot or cold air from ducts, or radiant heat from the sun or appliances. Level the thermostat exactly using a spirit level or plumb line. If not properly leveled, the thermostat control point will deviate from set point. Electronic digital thermostats will operate properly if not level, however they should be level for appearance.

Figure 6.

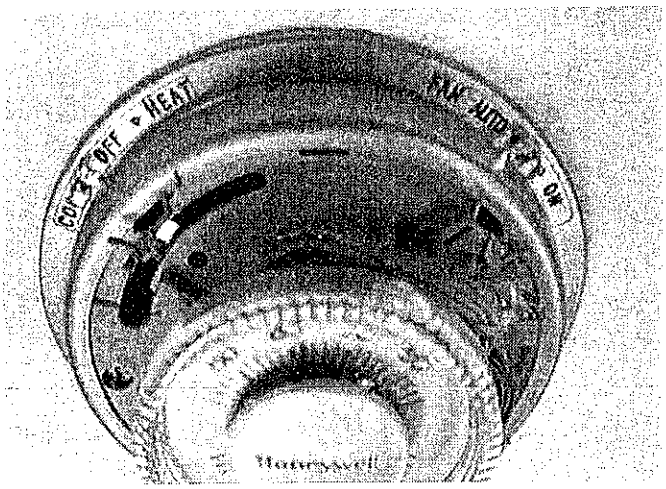


CHECKOUT

Turn on power supply and check the operation of the complete system as follows:

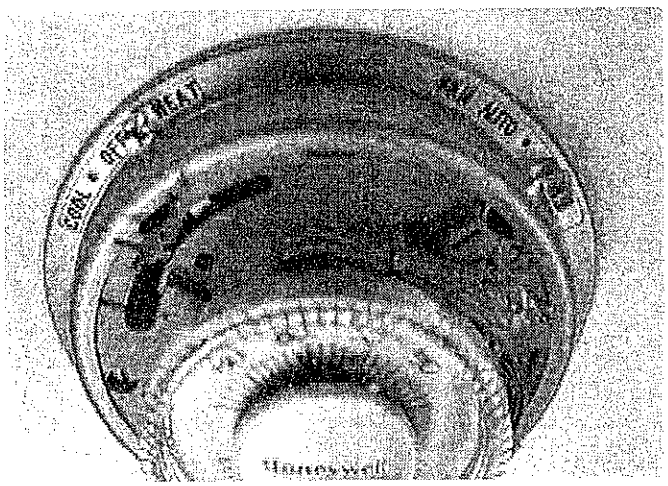
With system switch set at HEAT, and fan switch set at AUTO, set the thermostat at least 5 degrees above room temperature — heating equipment should start.

Figure 7.



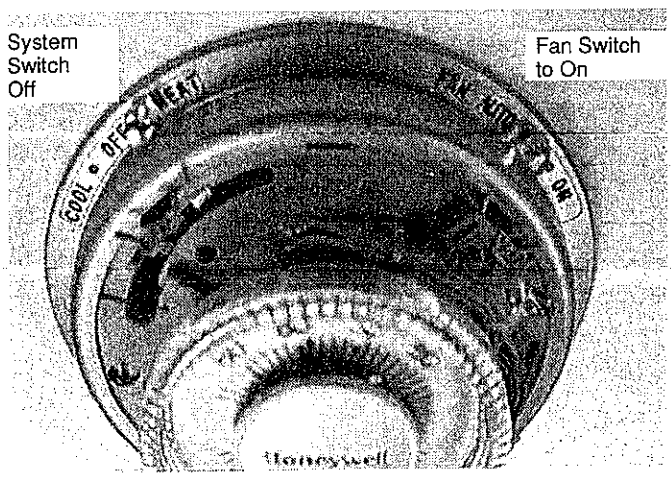
With system switch set at COOL, and fan switch set at AUTO, set the thermostat at least 5 degrees below room temperature — cooling equipment should start.

Figure 8.



Set fan switch at ON — fan should run continuously with system changeover switch in either HEAT or COOL position.

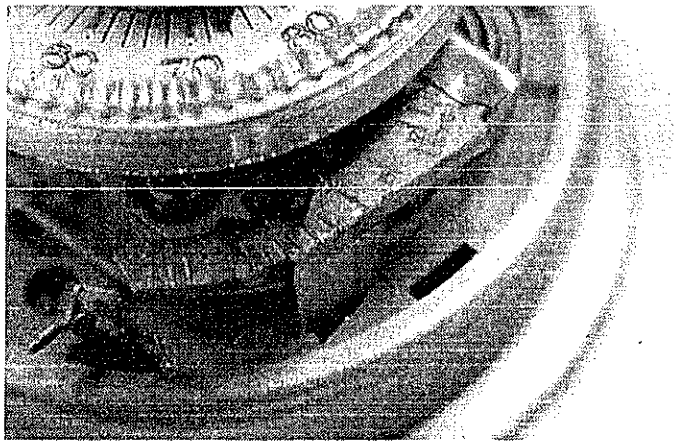
Figure 9.



Set system changeover switch to OFF and fan switch to ON — fan should run continuously and neither heating or cooling equipment can be actuated by the thermostat.

Operate the entire system at least one complete cycle with switches in each position. Set thermostat at the desired setting and system and fan switches in proper positions.

Figure 10.



Heat Anticipators

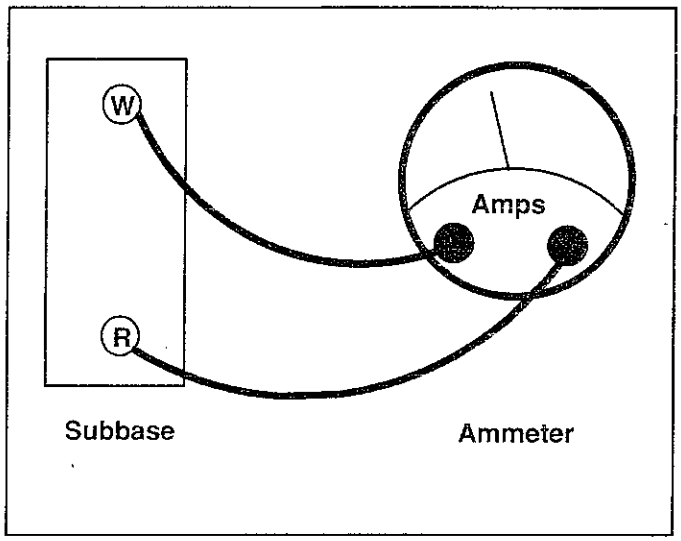
The adjustable heat anticipator must be set to match the current draw from the heating control through the thermostat.

Check the tech service data section for the suggested heat anticipator setting for the furnace you are servicing. If setting is not available, connect an AC ammeter (about 0 to 2.0 amp. range) between the "W" and "R" terminals on the back of the room thermostat.

NOTE:

If a wallplate or subbase is used, connect ammeter between appropriate terminals on front of the wall plate or subbase.

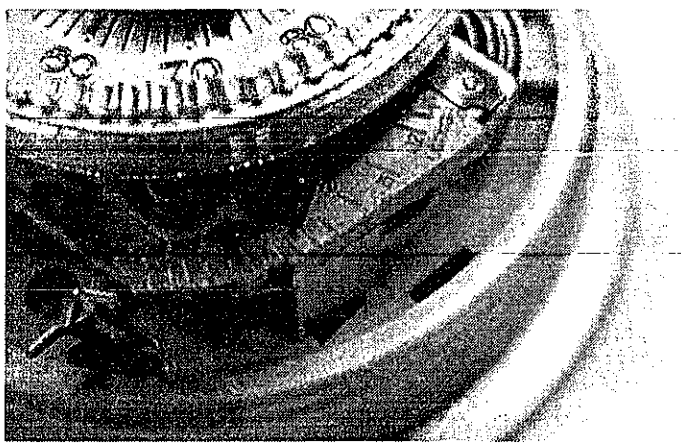
Figure 11.



HEAT ANTICIPATORS

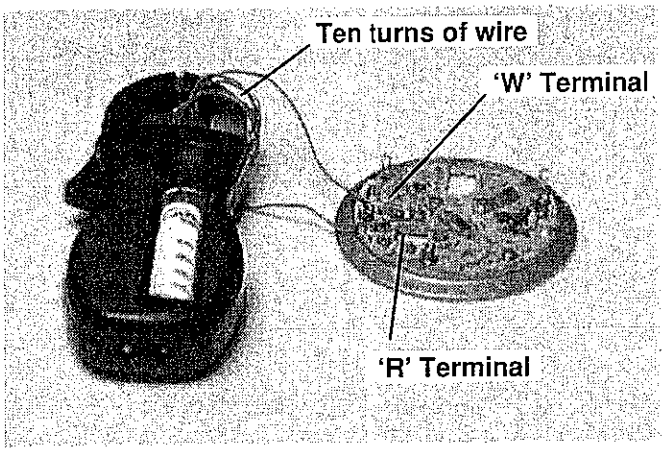
Move the thermostat or subbase system switch to OFF so no current passes through thermostat switch contacts. With the system operating through the ammeter, wait one minute and then read the ammeter. Use this reading to adjust the heat anticipator.

Figure 12.



The heat anticipator may require further adjustment for best performance. To lengthen burner–on–time, move the indicator in the direction of the "LONGER" arrows — not more than half a scale marking at a time. To shorten operation, move the indicator in the opposite direction.

Figure 13.



If a low range ammeter (0 – 2.0 amps) is not available, a clamp on type ammeter may be used as follows:

Turn the power off to the system and remove the thermostat from the subbase or wallplate.

Wrap exactly 10 turns of wire around the jaw of a split jaw induction type current meter as illustrated.

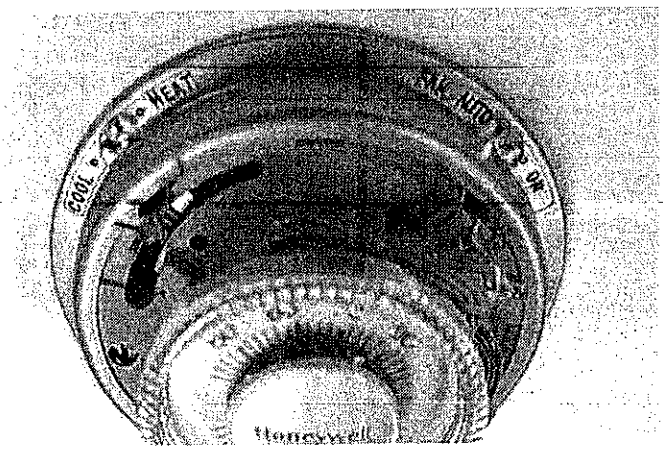
Connect one end of wire to the R terminal and the other to the W terminal.

Figure 14.

EXAMPLE:
2 amps : 10 = .2 amp draw.

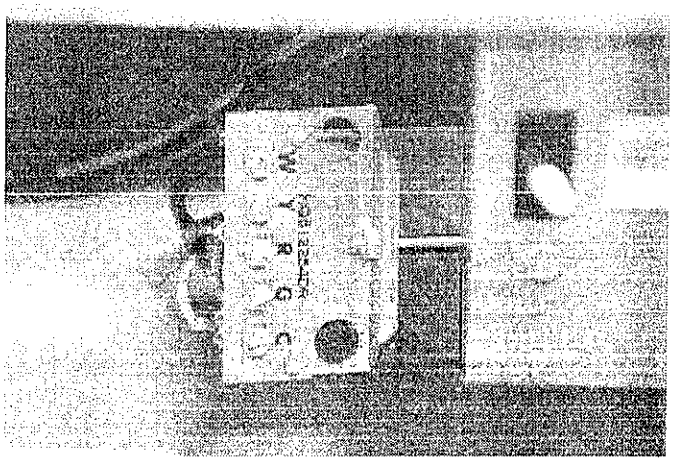
Turn on power to the system, furnace should fire. Wait approximately 1 minute and read amp scale. Divide reading by 10 to obtain current draw.

Figure 15.



Turn off power to the system and remove the amp meter and wire coil. Set the anticipator to match the amp draw, and mount thermostat.

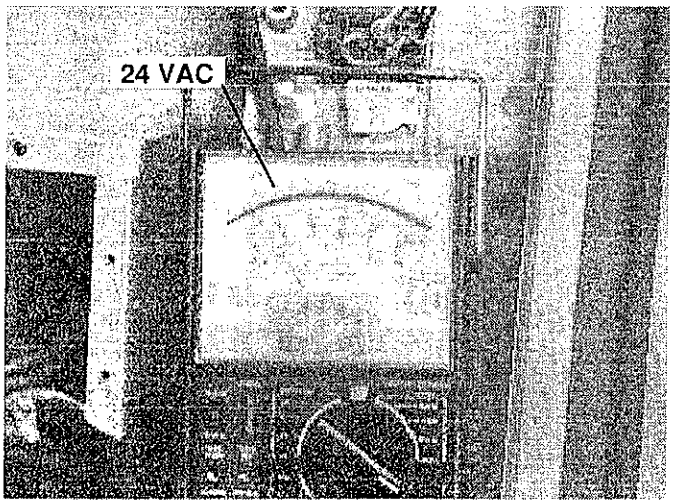
Figure 16.



Transformer

With power on to the furnace and the thermostat calling for heat, check the transformer low voltage side for minimum voltage of 25 volts A.C.

Figure 17.



Voltage to Control Module (With Exhaust Blower Operating)

Using a volt meter, check for minimum voltage (24 volts) across the terminals of the control module as specified below.
Honeywell S8600M = 24V and 24V GND
White Rogers HSI = TH and TR
Hamilton Standard = 24VAC--TH and GND/COM

If you do not have voltage to the module, follow the wiring diagram for the unit you are servicing and check all relays, switches and wiring. If any parts prove to be defective they must be replaced. Electrical leads must be clean, tight and defective wiring replaced.

Figure 18.

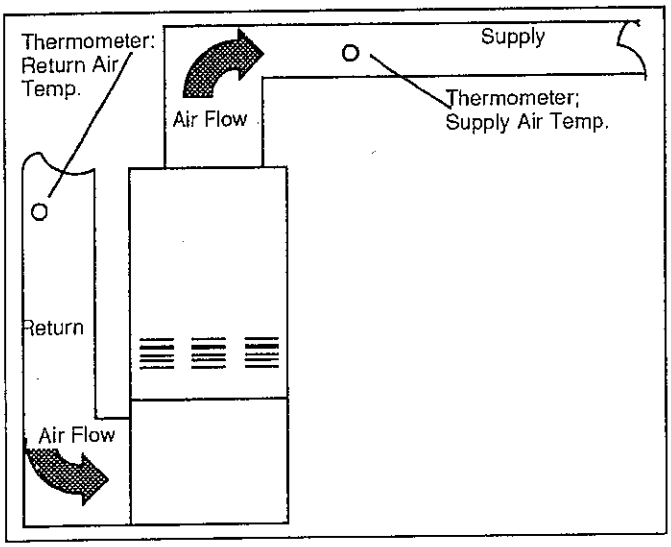


Figure 19.

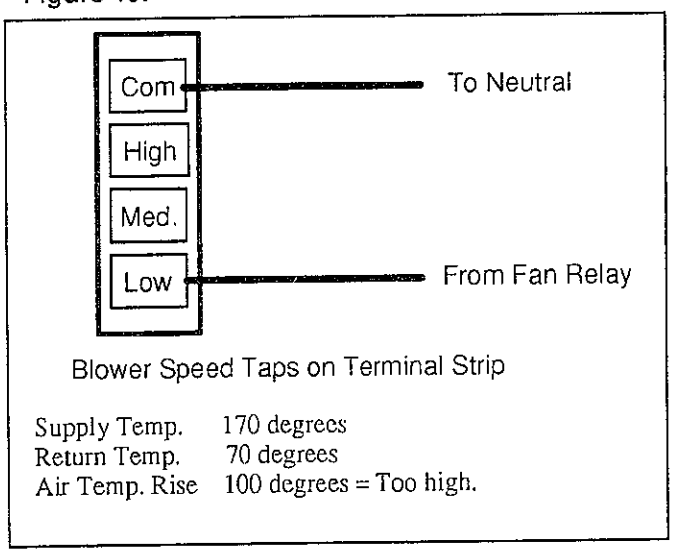
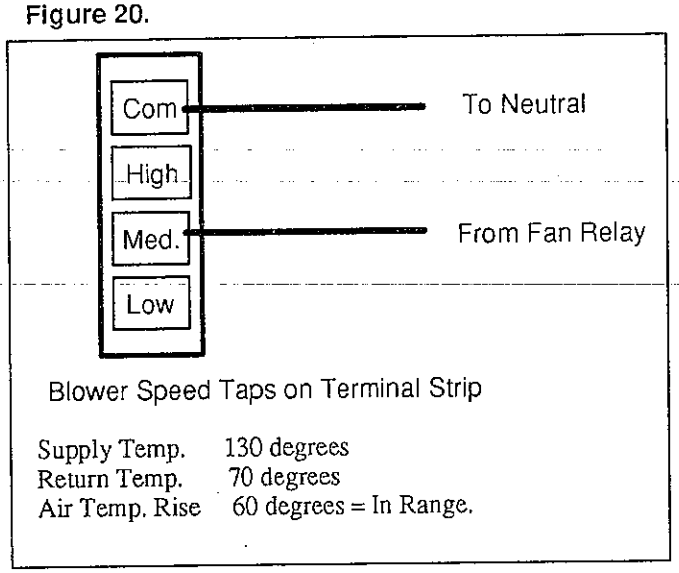


Figure 20.



Temperature Rise

CHECK TEMPERATURE RISE

Check temperature rise through the unit by placing a thermometer in the return air duct as close to the unit as possible. Place a second thermometer in the supply duct at least two (2) feet away from the furnace to prevent any false readings due to radiation from the furnace heat exchanger. All registers and duct dampers must be open and the unit should be operated at rated input for 15 minutes before taking readings. Temperature rise must be within the range specified on the rating plate.

With a properly designed system, the proper amount of temperature rise will normally be obtained when the unit is operating at rated input with the recommended blower speed.

NOTE:

Air temperature rise is the temperature difference between supply and return air.

If the correct amount of temperature rise is not obtained, when operating on the recommended blower speed, it may be necessary to change the blower speed. A higher blower speed will lower the temperature rise. A slower blower speed will increase the temperature rise. See blower speed taps on page 16.

Example:

Supply Temp. 170 degrees
Return Temp. 70 degrees
Air Temp Rise 100 degrees = Too High

Solution:

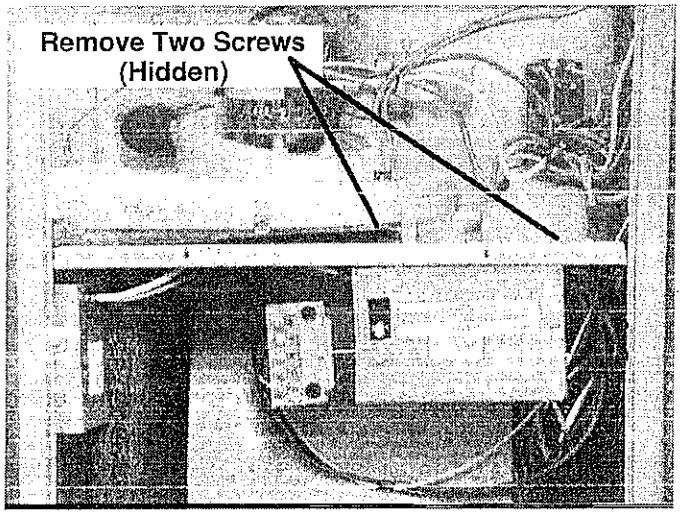
Increase blower speed.

Re–check and readjust until proper temperature rise is obtained.

Example:

Supply Temp. 130 degrees
Return Temp. 70 degrees
Air Temp Rise 60 degrees = In Range

Figure 21.



Blower Removal

Upflow Models Blower Assembly Removal

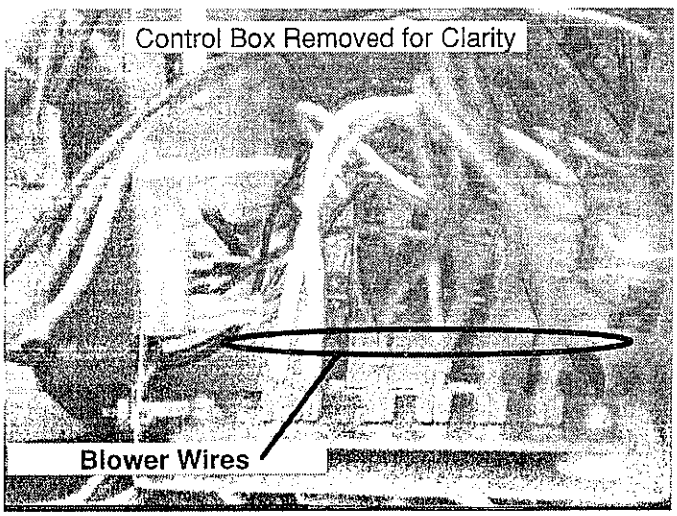
Disconnect all electrical power to the furnace before performing any service to the blower.

Remove the blower compartment door and remove the control box cover.

Remove the two screws from the top of the blower deck that hold the control box to the blower deck. In most cases the electrical leads will be long enough to move the control box out of the way.

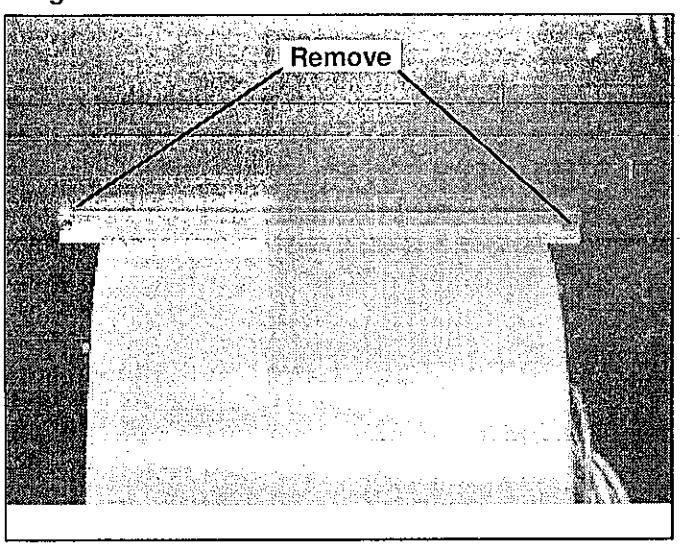
Remove the right rear screw that secures the exhaust blower to the blower deck. Do not remove the exhaust blower.

Figure 22.



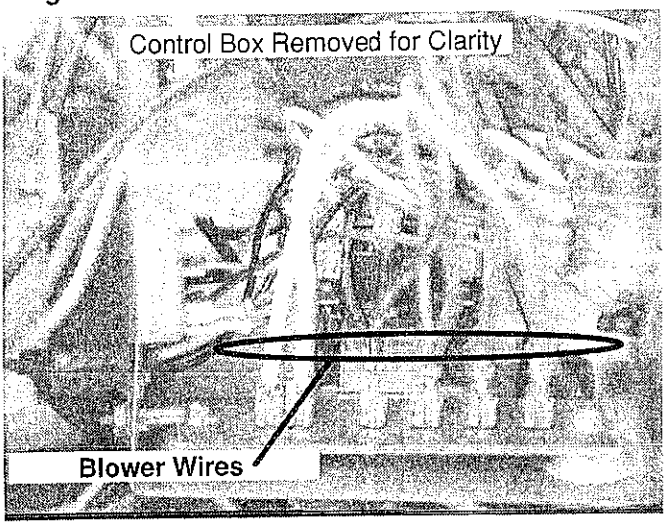
Remove the five (5) electrical leads from the speed tap strip in the control box to blower assembly, remove the "heyco connector" and pull the motor leads out of the control box.

Figure 23.



Remove the two retaining screws holding the blower in place in the slide rails. Blower can now be removed by pulling assembly from furnace.

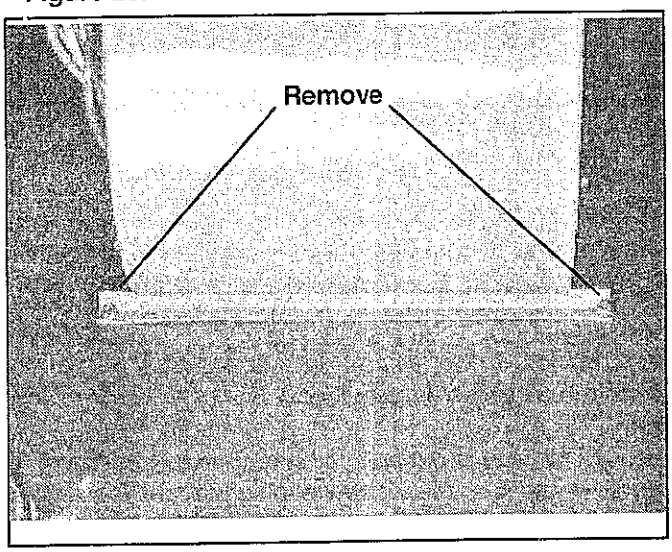
Figure 24.



Counterflow Models: Blower Assembly Removal

Remove the electrical leads from the speed tap strip in the control box to blower assembly.

Figure 25.

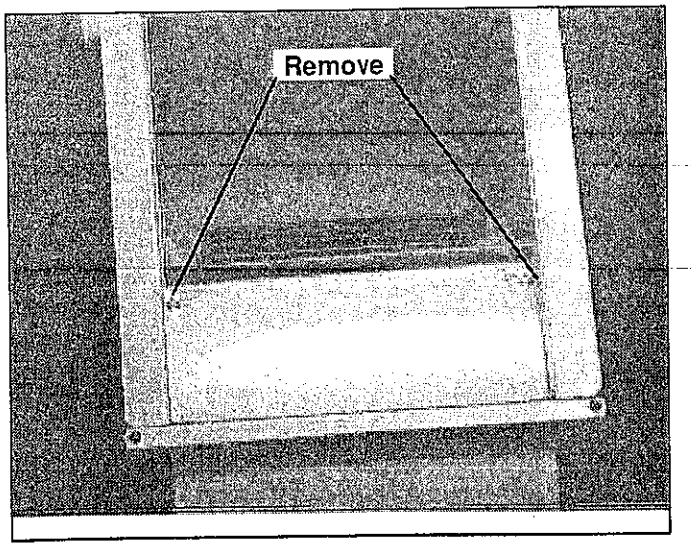


Remove the two retaining screws that hold the blower in position in the slide rails.

Note:

It is not necessary to remove the electrical control box before removing the blower. The blower can be removed by lifting up on the blower while pulling out and turning the blower to the right. Control box and junction box have been removed for clarity.

Figure 26.



Blower Wheel Removal (All)

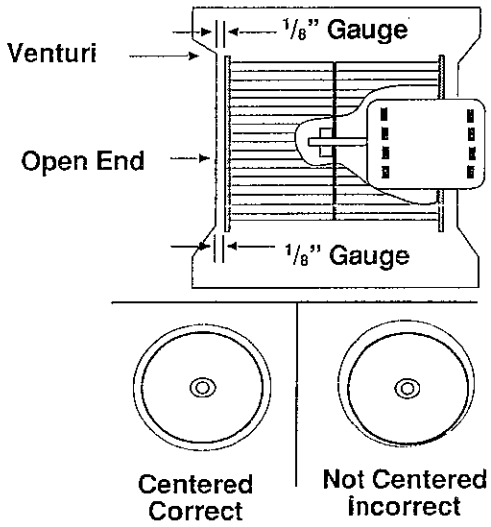
Remove the two screws securing the cut–off plate to the blower housing. Remove the blower cut–off plate from the throat of the blower scroll.

Loosen the set screw securing the blower wheel to the motor shaft.

Remove the three bolts securing the motor to blower housing and remove motor and bracket as an assembly. No further disassembly is necessary unless the motor is being replaced.

The blower wheel can now be removed from the scroll.

Figure 27.



Blower Wheel Installation

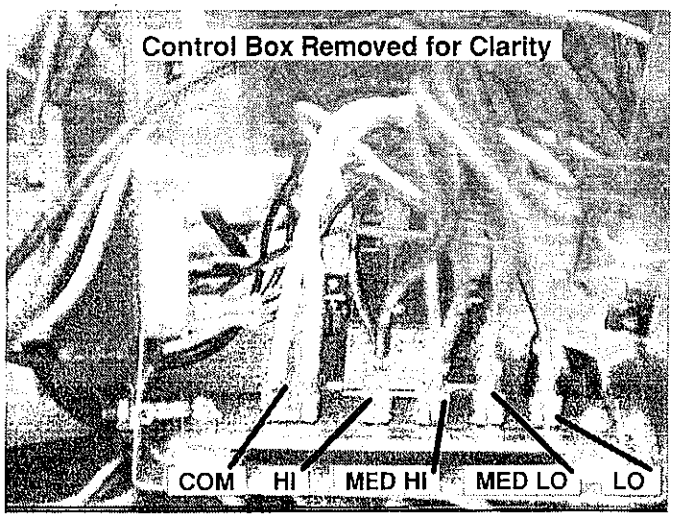
Installation of the new blower wheel is the reverse of the removal. The following steps must be observed when installing the new wheel.

The blower wheel must be centered in the venturi opening and 1/8 in. from the shaft (open) end of the housing.

Place a piece of 1/8 in. gauge stock between venturi and wheel.

Pull the wheel against the gauge and lock the wheel into position with the set screw.
Remove the gauge and re–install the blower assembly in reverse order.

Figure 28.

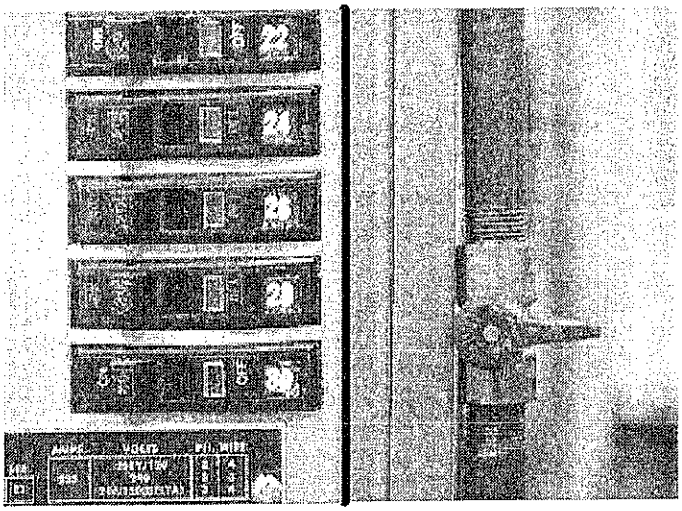


Blower Speed Taps

Air flow can be increased (this will decrease the outlet air temperature) by changing the blower speed tap to a higher setting. The terminal block in the electrical control box makes this a simple operation.

The violet wire is plugged into the desired speed tap for cooling and the yellow wire is plugged into the desired speed tap for heating.

Figure 29.



Burners

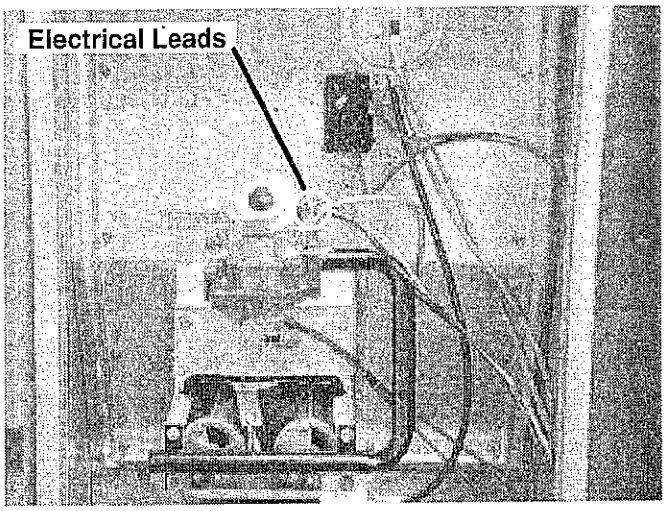
NUGK Series

Gas Valve and Manifold Removal

1. Turn off electrical power to the furnace at the disconnect, the circuit breakers, or remove the fuses.

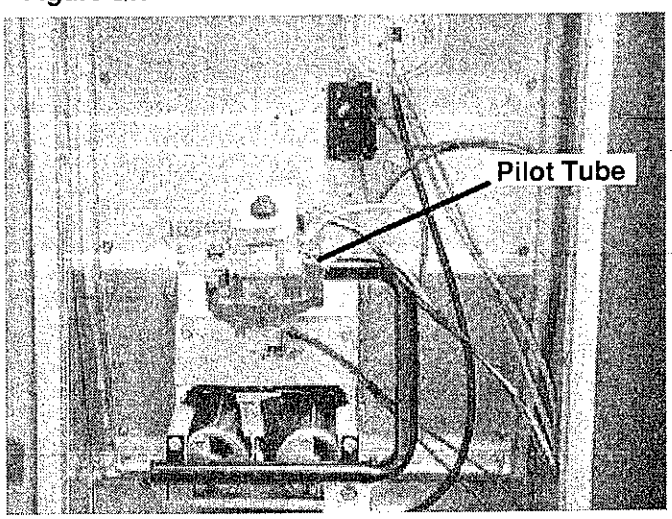
2. Shut off the gas supply at the manual shut off valve. Disconnect the gas supply line to the gas valve at the union. After removing the gas valve, it is recommended that the gas line be capped if the line is to be open for an extended period of time.

Figure 30.



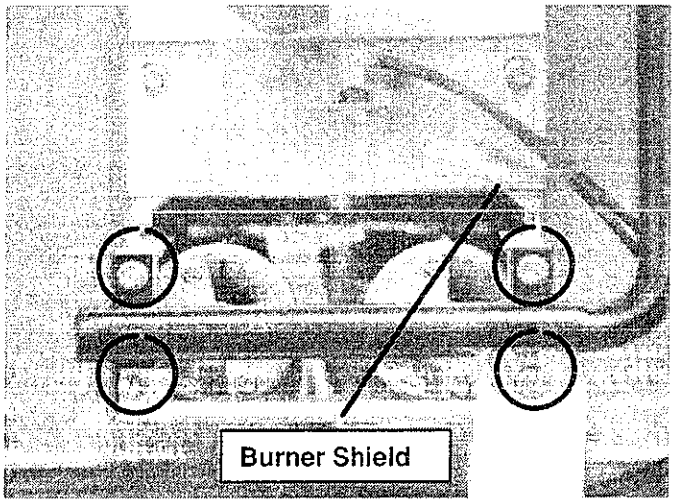
3. Disconnect the electrical leads to the gas valve.

Figure 31.



4. Disconnect the pilot tube from the gas valve, on those models equipped with spark to pilot ignition .

Figure 32.

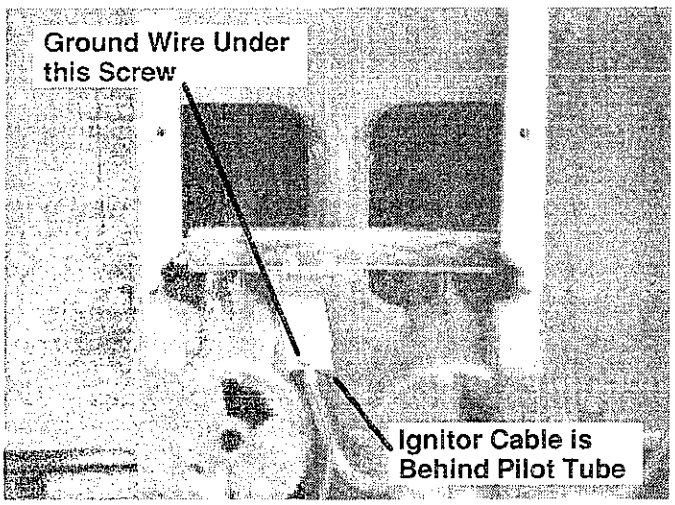


Remove Gas Valve and Manifold Assembly

Remove the four screws, circled, and remove the manifold and gas valve as an assembly.

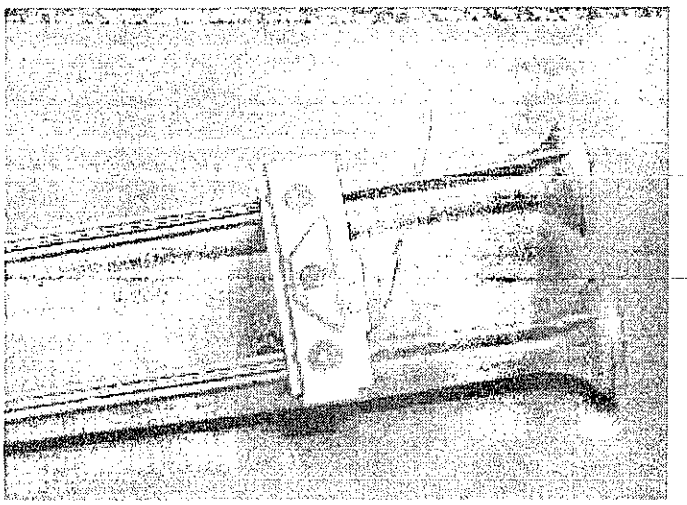
Carefully inspect the manifold and orifices to be sure that the manifold and orifices are clear.

Figure 33.



Raise the burner shield and disconnect the ignitor cable and ground wire. Burners and crosslighter, with pilot, can now be removed as an assembly.
NOTE: For Hot Surface Ignition (HSI) models, disconnect the ignitor wire at the molex plug. Disconnect the flame sensor wire from the module. Remove the ground wire from the ignitor bracket or burner face.

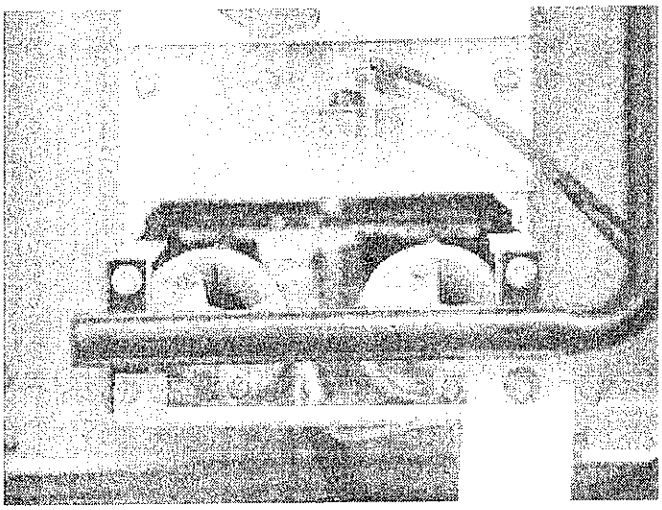
Figure 34.



Inspection

Inspect the burners and crosslighter and clean if necessary. Be sure burners are seated in the slot in the rear of the heat exchanger before installing the manifold.

Figure 35.



Reassembly

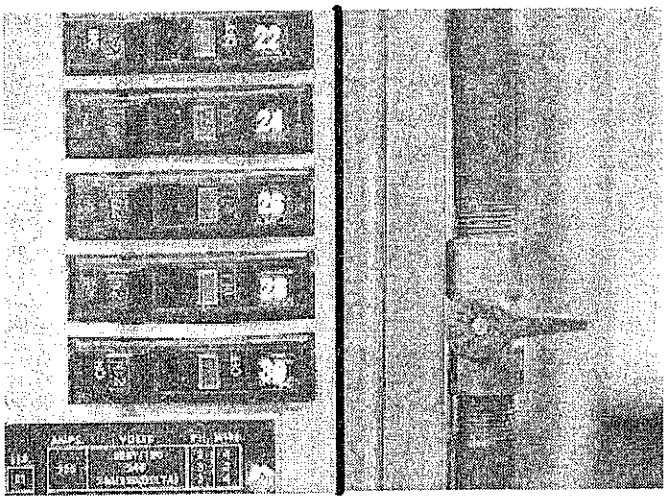
Reassemble all parts in reverse order of removal.

Insert burners into the heat exchanger. **Burners must be inserted into the slots at the back of the heat exchanger and leveled before installing the manifold.**

After reassembly and the gas has been turned on. All joints must be checked for gas leaks using a soapy solution. All leaks must be repaired immediately.

Burner shield MUST be replaced before returning furnace to normal operation.

Figure 36.



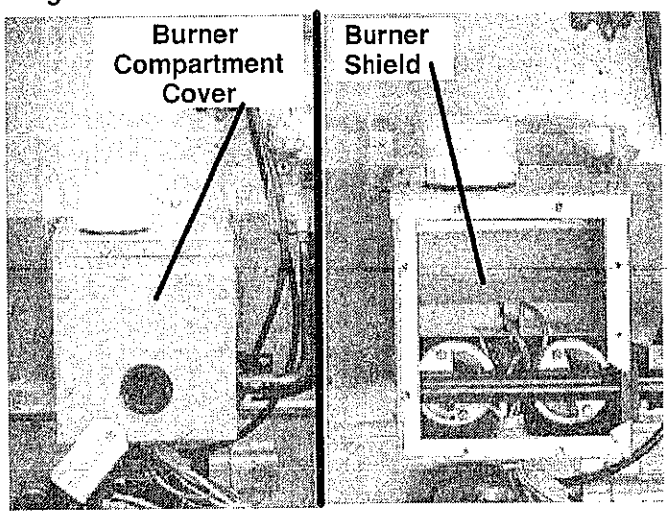
NUGS/NULS Series

Gas Valve and Manifold Removal

1. Turn off electrical power to the furnace at the disconnect, circuit breakers, or by removing fuses.

2. Shut off the gas supply at the manual shut off valve. Disconnect the gas supply line to the gas valve at the union. (After removing the gas valve, it is recommended that the gas line be capped if the line is to be open for an extended period of time.)

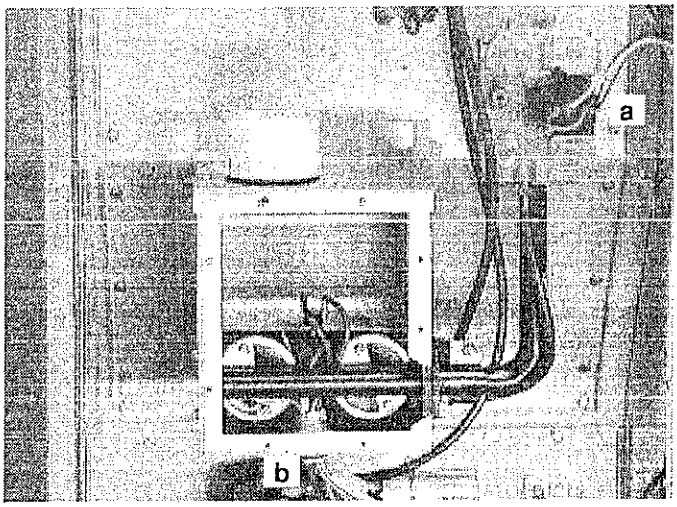
Figure 37.



3. Remove the burner compartment cover.

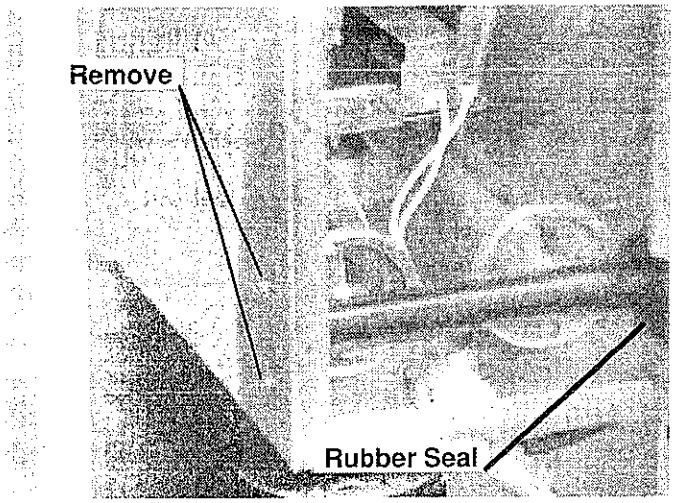
4. Remove the wires from the rollout switch on the burner shield and remove the burner shield.

Figure 38.



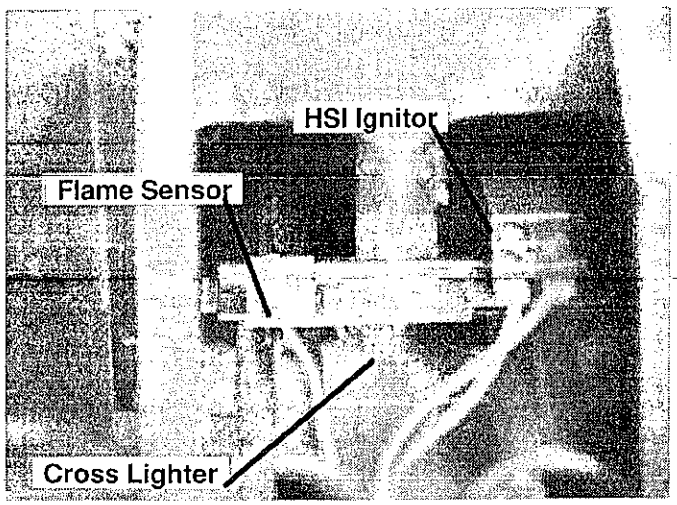
5. Disconnect the electrical leads to the gas valve and the ground wire from the burner face.

Figure 39.



Remove the screws securing the manifold to the burner box, the two screws shown and one screw from the opposite side of burner box. The manifold can now be removed. Be careful not to damage the rubber seal where the manifold enters burner compartment on the right side.

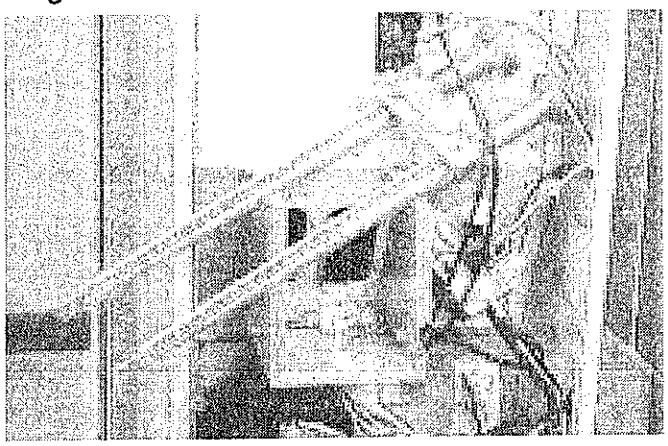
Figure 40.



Remove the wing nut securing the ignitor to the crosslighter. Remove the shield and carefully remove the ignitor from the crosslighter laying in the bottom of the burner compartment. **EXTREME CAUTION MUST BE USED IN HANDLING THE HSI IGNITOR TO KEEP FROM DAMAGING THE IGNITOR.**

Remove the screw securing the flame sensor to the crosslighter and lay the flame sensor in the bottom of the burner compartment.

Figure 41.

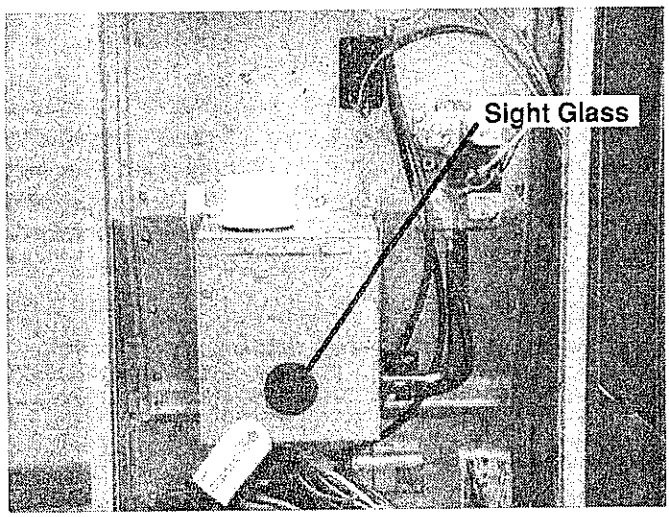


This allows you to remove burners and crosslighter without disturbing the seal around the wiring.

The crosslighter and burners can now be inspected and cleaned if necessary.

Reassemble in reverse order, making sure the burners are seated in the rear of the heat exchanger and the seal around the manifold is tight.

Figure 42.



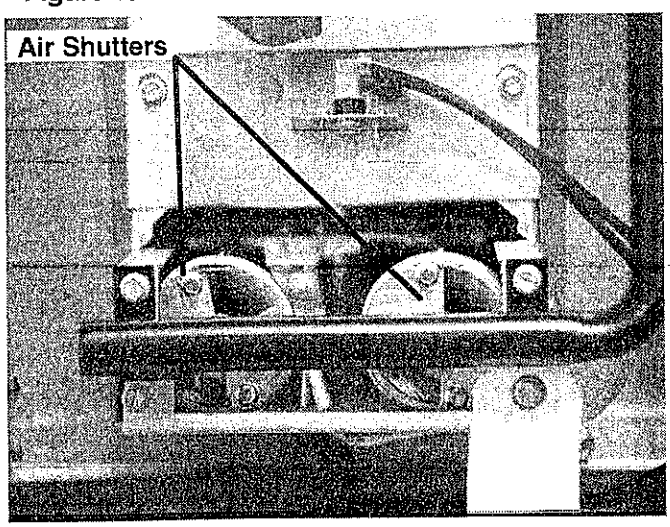
Primary Air Adjustment (ALL)

If the burners are not equipped with Air Shutters (natural gas models), **NO** Adjustment is necessary. On L.P. models, adjustment of the air shutter may be necessary to obtain the correct flame characteristics and/or to minimize the resonance heat exchanger noise generated by the burner flame.

Resonance noise can be caused by:
Incorrect or misaligned orifices—Verify size and alignment
Improper gas pressure — check and adjust
Air shutters out of adjustment — adjust the air shutter (L.P. applications must have air shutters installed.)

Observe flame by looking through the inspection glass in cover. If adjustment is necessary, remove burner compartment cover and adjust air shutters as described below. Replace burner compartment cover and observe the flame through the inspection glass.

Figure 43.



Adjustment Procedures (NUGK Shown)

Adjustment procedure is the same for **DIRECT VENT MODELS**, except the burner compartment cover **must** be in place when checking flame characteristics.

Check air shutter position – should be full open.

1. Start the furnace; see lighting instructions on furnace or in the Owners Information Manual.
2. Allow furnace to run for 10 minutes then check flame characteristics.

Figure 44.

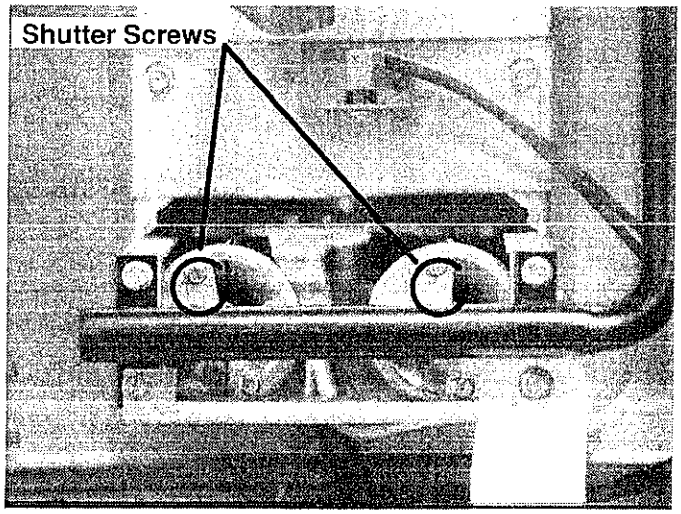
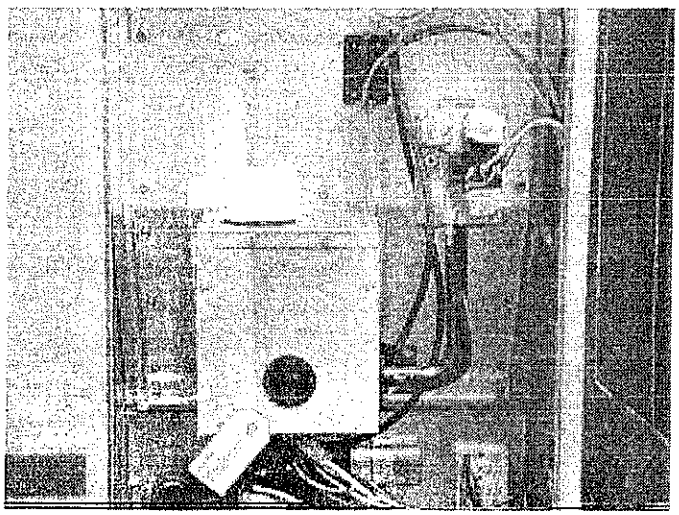


Figure 45.



Adjustment (Continued)

3. Loosen shutter screw(s) and close shutter until flame is yellow.
4. Open shutters just enough to eliminate yellow.
5. Tighten locking screws. (Flame will normally have slight yellow tip when adjusted properly).

The **DIRECT VENT** burner compartment cover **MUST** be in place when observing the flame.

Burners should fit loosely in the furnace and not bind against the manifold or heat exchanger.

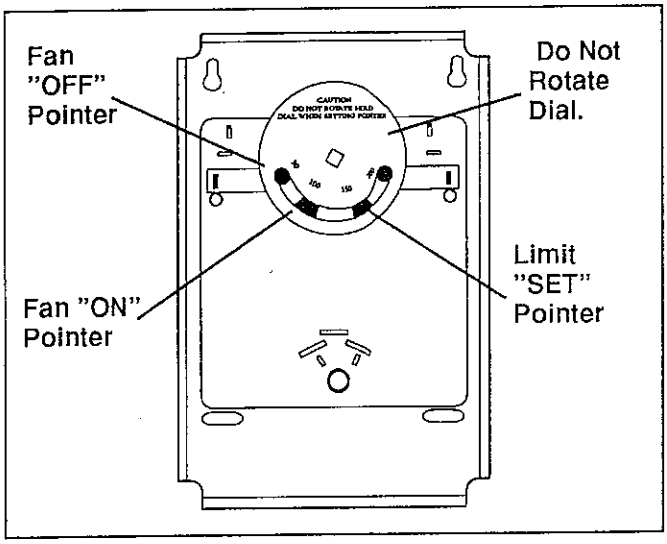
Burner compartment cover MUST be in place before returning furnace to normal operation.

NOTE:

It is imperative that L.P. furnaces be properly adjusted. Condensing furnaces are more critical to adjustments and more susceptible to sooting than gravity vented furnaces due to the design characteristics in the secondary heat exchanger. For this reason, proper burner adjustment is extremely important.

Example: Air shutters must be adjusted to eliminate resonance and/or obtain correct burner operation.

Figure 46.



Fan and Limit Controls

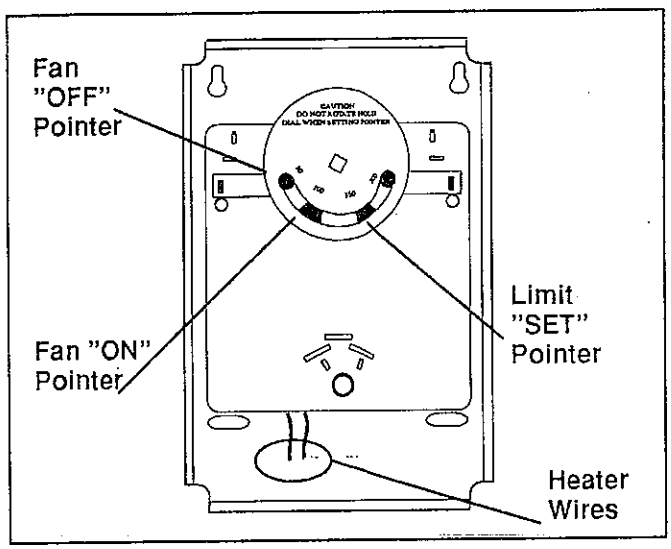
ADJUSTMENT (The adjustment covers the Honeywell models discussed in this manual.)

NOTE:

The 'limit set pointer' on the limit control is factory preset and must not be adjusted.

1. Adjustment — **DO NOT** rotate the dial when setting pointers.
2. If necessary, adjust fan **ON–OFF** settings to obtain a satisfactory comfort level.
3. If the fan runs too long after furnace shutdown and blows cold air; adjust the fan **'OFF'** pointer up a few degrees.
4. If the fan goes off and then comes back on and off, adjust fan **'OFF'** pointer a few degrees lower.

Figure 47.



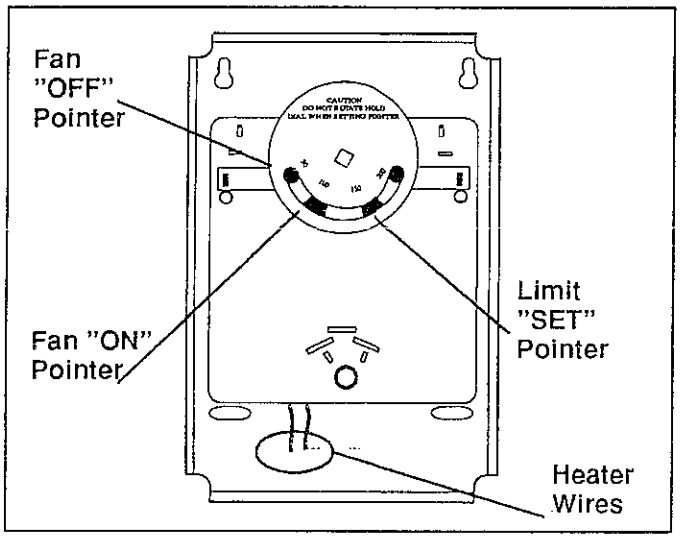
Fan and Limit Control (Honeywell–Timed On, Temperature Terminated)

The control is a timed on, temperature terminated switch. A 24 volt heater causes a 'warp switch' in the fan and limit control to turn on the fan after the furnace has fired.

How the Control Works

1. Start cycle.
2. Thermostat calls for heat.
3. Gas valve comes on; furnace fires.
4. Power goes to the fan limit control.
5. A 24 volt heater starts to heat a 'warp switch' and approximately 40 seconds later the blower starts.

Figure 48.



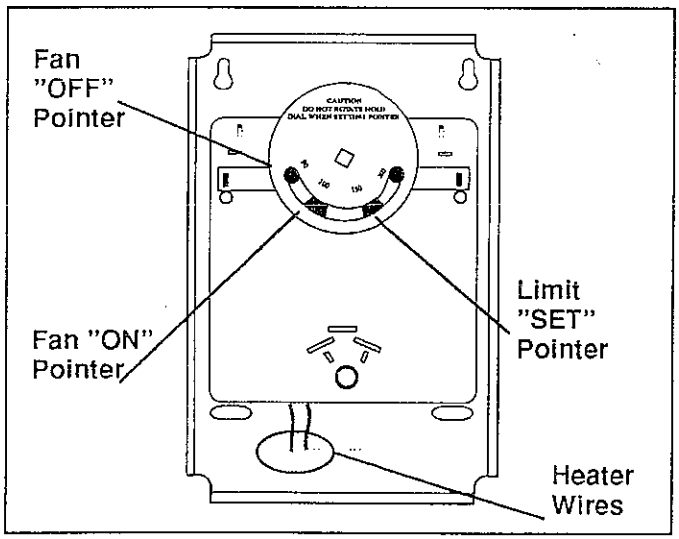
6. Cycle Terminates.

7. Thermostat shuts off power to gas valve.

8. Furnace no longer fired, no power to heater.

9. Blower continues to run until "helix" of fan and limit control cools to preset temperature for fan cycle to end thermally for lack of heat.

Figure 49.



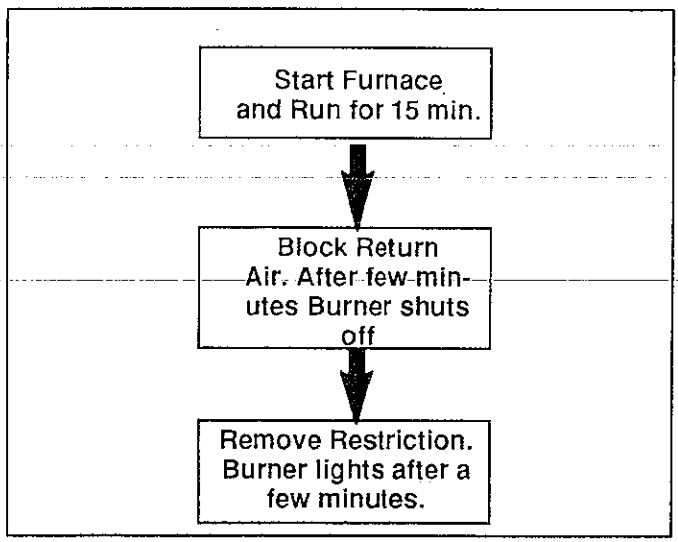
BURNED OUT HEATER ELEMENT

1. Use an Ohmmeter to check the heater element using 1 x 10,000 scale.

2. Disconnect the heater wires and connect ohmmeter across wires going to heater in control.

3. Infinity reading — bad heater element, replace fan and limit control.

Figure 50.



LIMIT CONTROL CHECK

NOTE: **The 'limit set pointer' on the limit control is factory preset and must not be adjusted.**

1. Check limit control function after 15 minutes of operation by blocking the return grille(s)..

2. After several minutes the main burners should go OFF. Blower will continue to run.

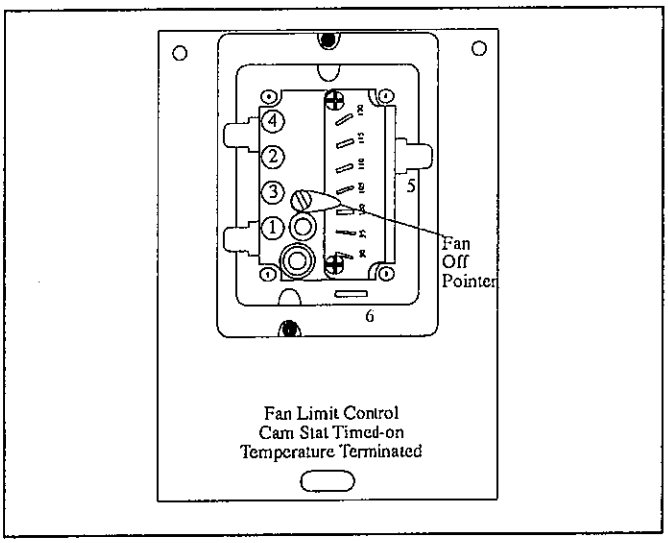
3. Remove air restrictions and main burner will relight after a cool down period of a few minutes.

4. Fan and limit controls are preset at the factory.

5. Adjust the thermostat setting below room temperature.

6. Main burners should go off.

Figure 51.

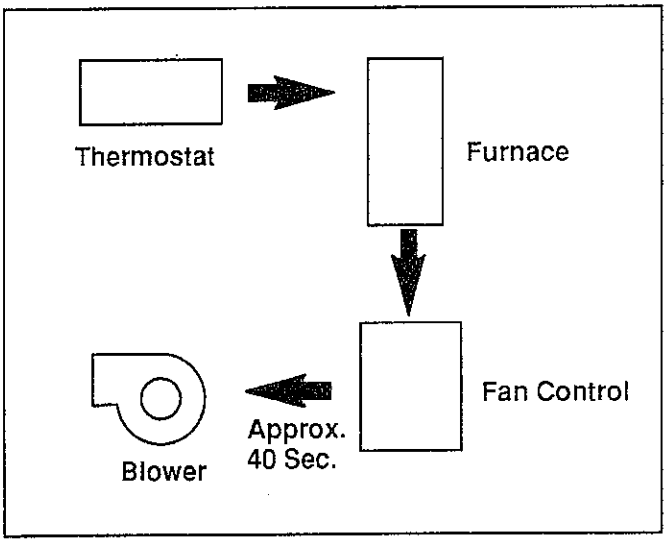


Fan and Limit Control (Cam–Stat Timed–on Temperature Terminated

The control is a timed–on temperature terminated switch. A 24VAC heater causes a 'warp switch' in the fan and limit control to turn on the fan after the furnace has fired.

The fan 'ON' timing is not adjustable. The fan 'OFF' setting may be adjusted with a small screwdriver. Rotating the pointer to a lower number will cause the fan to run longer.

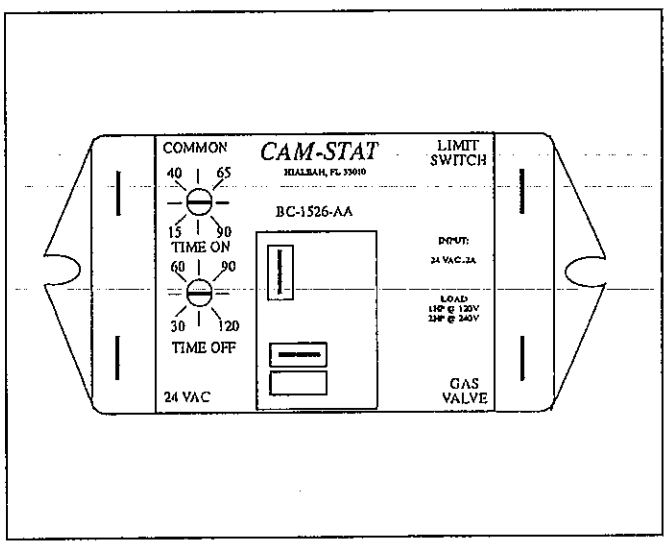
Figure 52.



HOW CONTROL WORKS

1. Start cycle.
2. Thermostat calls for heat.
3. Furnace fires.
4. Power goes to fan and limit control.
5. 24 volt heater starts to heat 'warp switch' and approximately 40 (nominal) seconds later blower starts.
6. Thermostat shuts off power to gas valve.
7. Furnace no longer fired — no power to heater.
8. Blower continues to run until fan/limit control cools to preset temperature for fan cycle to end thermally for lack of heat.

Figure 53.

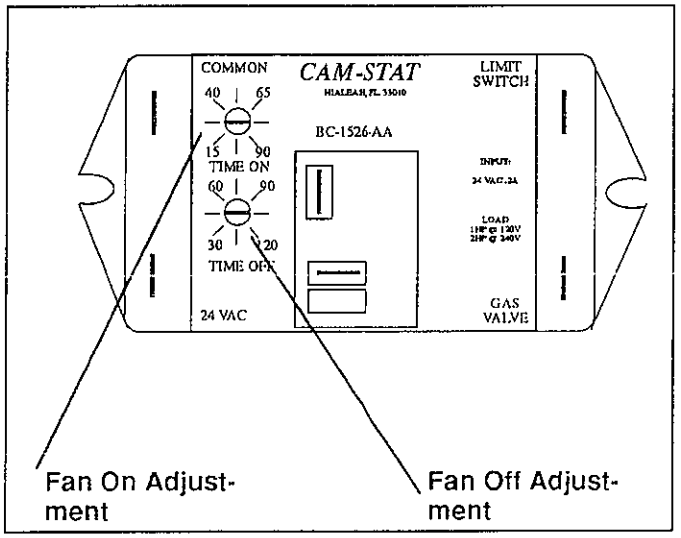


Electronic Fan Control (Timed–on, Timed Off)

How Control Works

1. Start cycle.
2. Thermostat calls for heat.
3. Timing on begins when gas valve is energized.
4. Fan comes on at end of timing on setting.
5. Fan runs until gas valve is deenergized at which time off timing begins. Fan continues to run until end of time off setting.

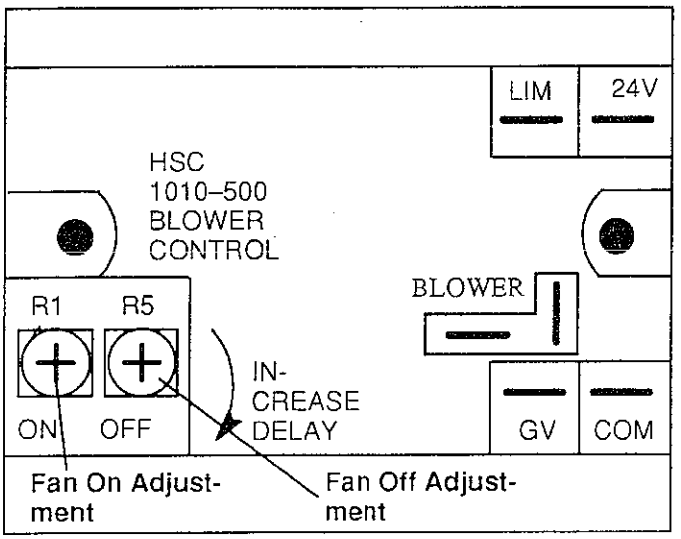
Figure 54.



ADJUST BLOWER ON/OFF

Rotate time on adjustment until screw slot lines up with the desired time on. Rotate time off adjustment until screw slot lines up with the desired time off.

Figure 55.



NOTE: On recent production models, the unit may have a Cam–Stat, Heatcraft, or Hamilton Standard fan timer. The timers are pictured in Figures 55, 56, and 57. The adjustment is the same as discussed above, however times may not be indicated on some models. There may only be an indicator (arrow) showing the direction to turn to increase the delay.

Figure 56.

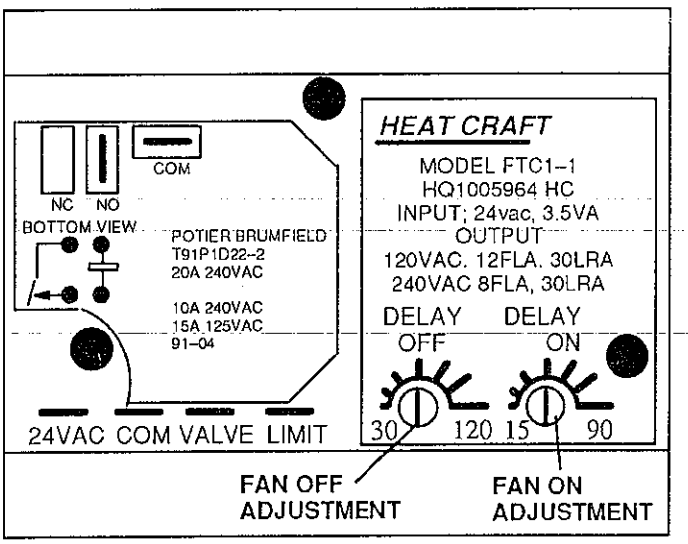


Figure 57.

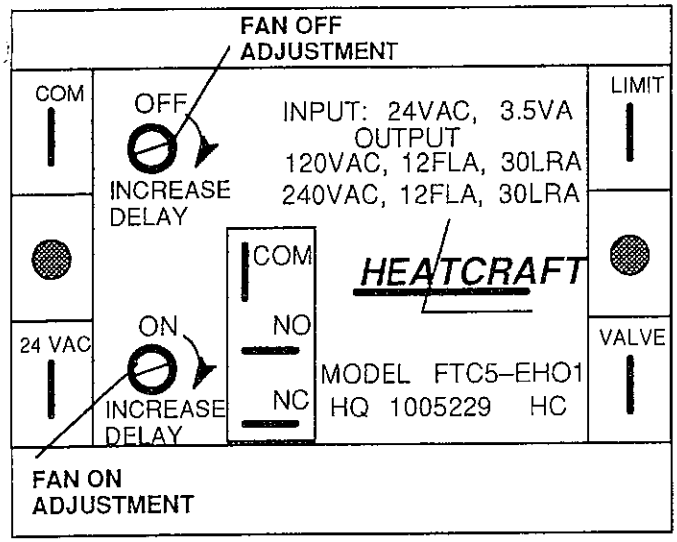


Figure 58.

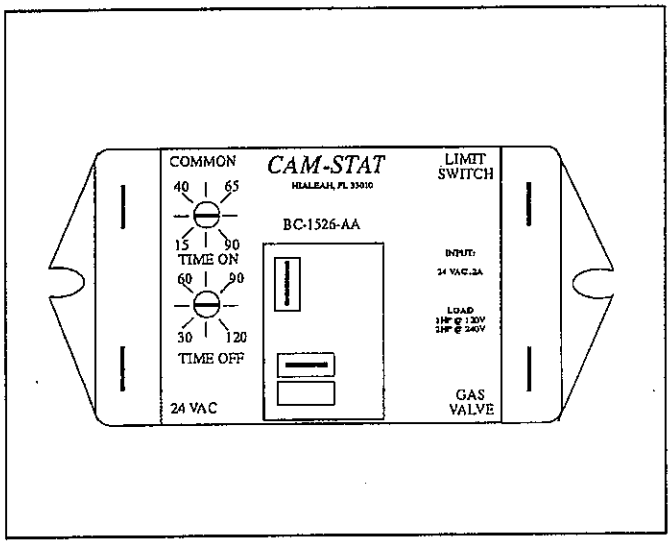
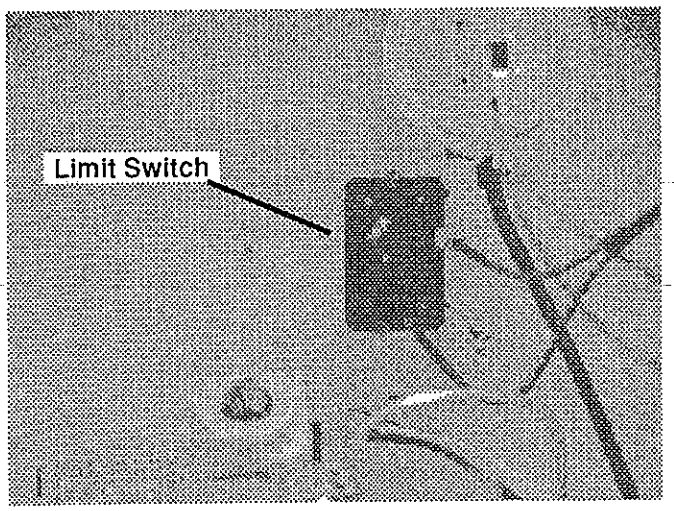


Figure 59.



Checking for Defective Control

Any time there is power to the furnace, 24VAC should be present across 'COM' and 24VAC terminals and 'COM' and 'LIMIT' terminals. Once the control module has energized the gas valve, 24VAC should be present across the 'COM' and 'gas valve'. A quick check can be made as follows:

1. Connect a jumper across '24VAC' and the gas valve terminals. Blower should start after the selected time delay has expired.

2. Remove the jumper and the blower will turn off after the selected time delay has expired.

3. Disconnecting the wire at the limit terminal at any time should cause the blower to start immediately.

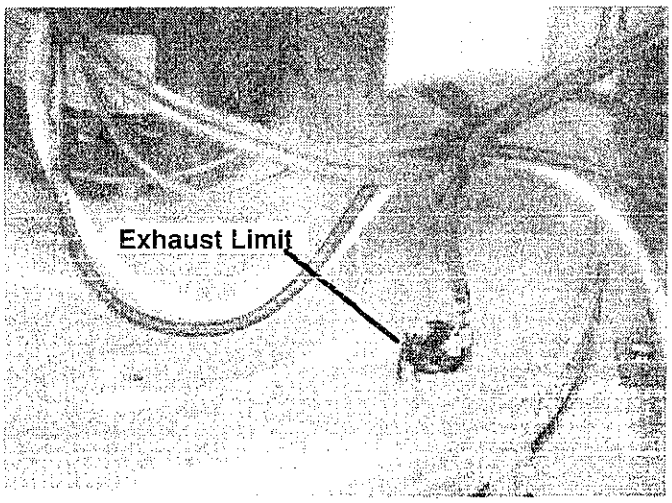
Limit Switch

A separate limit switch is used with the above control and is not field adjustable.

Checking Limit Control

Same as other controls.

Figure 60.

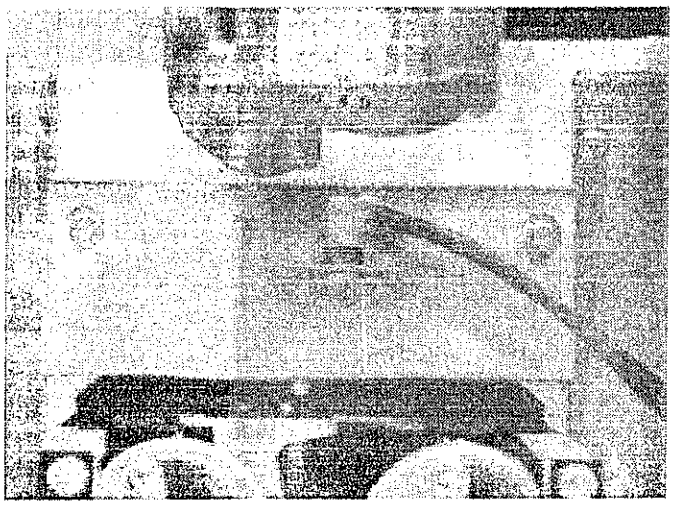


Exhaust Limit Switch

The exhaust limit switch is located on the exhaust blower housing and is used to sense high exhaust temperature. The limit switch is a normally closed snap disc type switch. When high temperatures are sensed the switch will open breaking the electrical circuit. When the temperature falls the switch will reset.

A possible cause for the limit switch to open may be caused by soot build up inside the primary or secondary heat exchangers, or lint build up outside the secondary, preventing heat transfer from the exchangers. The primary heat exchanger and/or secondary heat exchanger must be cleaned.

Figure 61.



Rollout Limit Switch

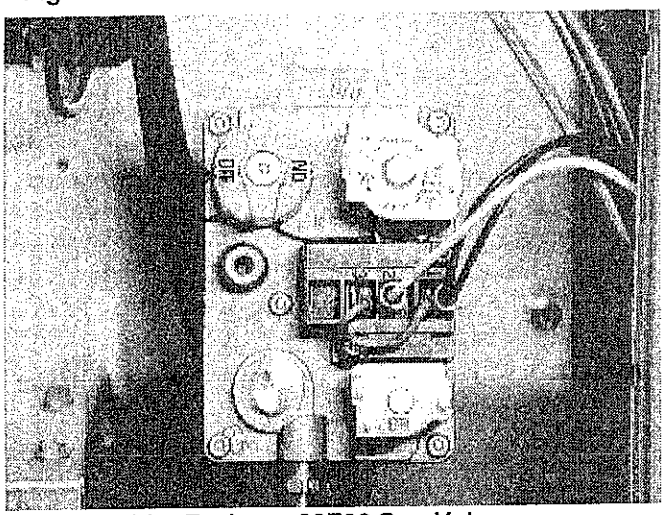
The rollout limit switch is located on the burner shield. The switch is used to sense high temperatures caused by blockage in the heat exchangers and flue, causing flame rollout.

The limit switch is a normally closed snap disc type switch.

When high temperatures are sensed the switch will open breaking the electrical circuit to the burner control system. Whenever the temperature drops below a specified temperature, the switch will reset* and ignition sequence will resume.

*** Beginning with Date Code L8944 all units (Except Direct Vent Models) were built with a manual reset rollout switch. These must be reset manually when tripped.**

Figure 62.



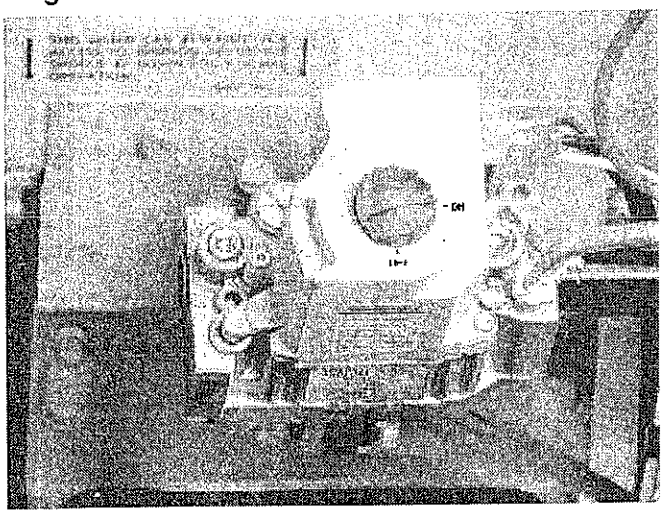
White Rodgers 36E36 Gas Valve

Gas Valves

White–Rodgers 36E36

The manual gas knob of this valve differs from those of most other valves in that it does not have to be pushed in to be turned. The knob can also be turned a full 360 degrees in either direction. There are detents at the 'ON' and 'OFF' positions allowing it to remain at either position.

Figure 63.

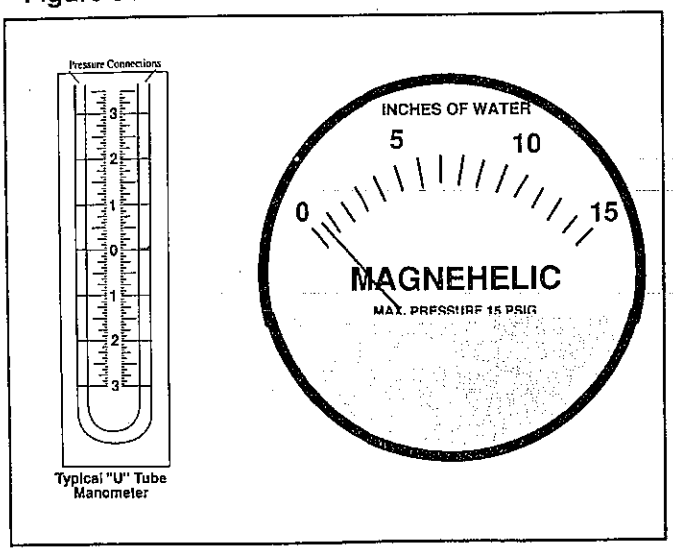


Honeywell VR8204A Gas Valve

Honeywell VR8204A Gas Valves

The VR8204A is a snap opening gas valve.

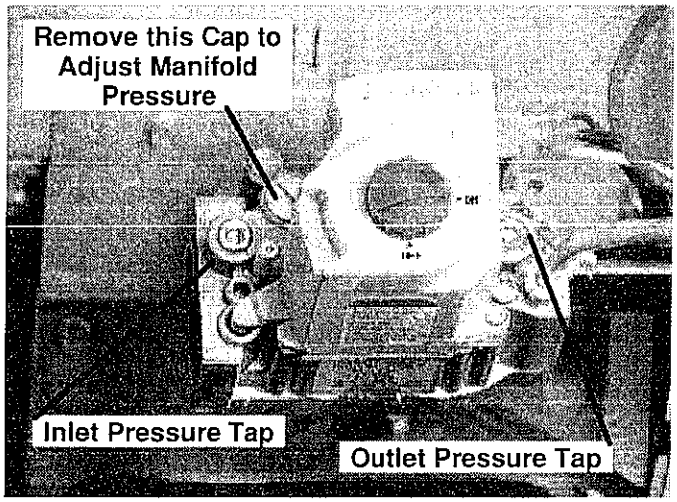
Figure 64.



Checking Gas Pressure (Natural Gas)

Gas pressure is checked using a 'U' tube manometer or a magnehelic gauge. The instrument is connected to the inlet pressure tap on the gas valve to check gas line pressure and the outlet pressure tap to set manifold pressure. Incoming gas pressure to the gas valve, with all other gas appliances fired, is a minimum of 4.5 in. w.c. and a maximum of 11.0 in. w.c. The ideal input pressure to the gas valve should be 7.0 in. w.c. Outlet, or manifold, pressure should be adjusted to 3.5" w.c..

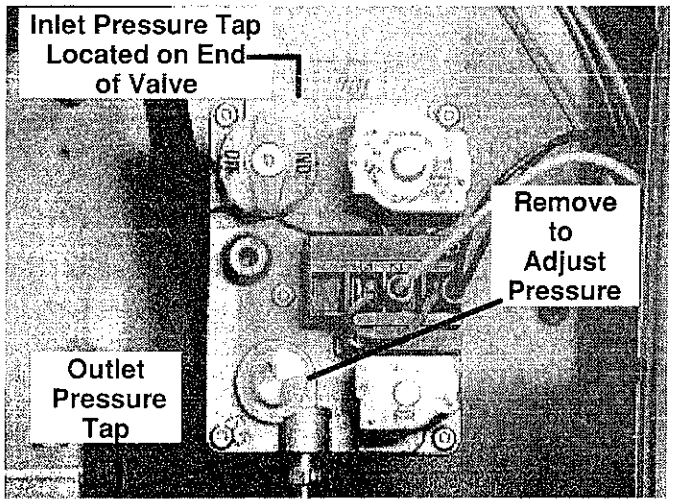
Figure 65.



Checking Gas Pressure To Valve (LP Gas)

Gas pressure is checked using a 'U' tube manometer or a magnehelic gauge. The instrument is connected to the inlet pressure tap on the gas valve to check gas line pressure and the outlet pressure tap to set manifold pressure. Incoming gas pressure to the gas valve, with all other gas appliances fired, is a minimum of 11.0" in. w.c. and a maximum of 14.0 in. w.c. The ideal input pressure to gas valve should be 12.0 in. w.c. Outlet, or manifold, pressure should be adjusted to 10.0" w.c..

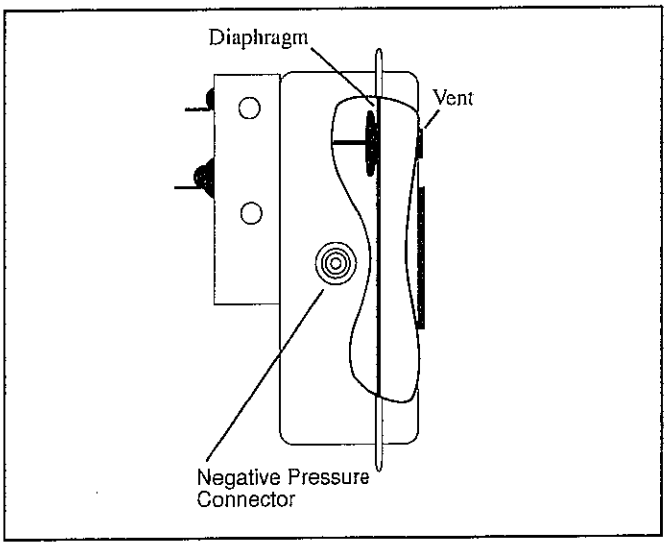
Figure 66.



Checking Gas Pressure (Direct Vent)

Checking gas pressure on the DIRECT VENT furnace is the same as described above **EXCEPT that the burner cover MUST BE REMOVED** when adjusting manifold pressure. Failure to have the burner cover removed can result in false readings and the furnace may be overfired or underfired.

Figure 67.



Pressure Switches

Exhaust Blower Pressure Switch

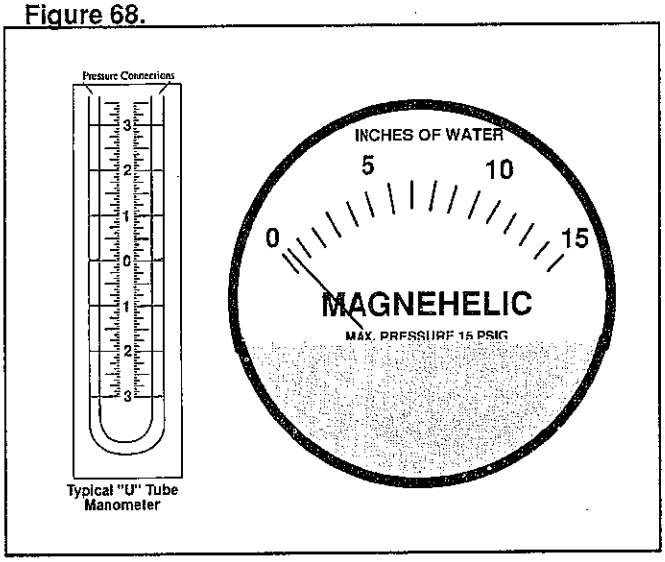
"NUGK" Normal Operation

The exhaust blower pressure switch is in the negative side of the exhaust blower system. The switch is used to sense a blockage in the exhaust system. On a call for heat from the thermostat, the exhaust blower starts to operate. (On one side of the blower, a negative (–) pressure is created and on the other side a positive (+) pressure is created. Combustion (– pressure) air is drawn through the primary heat exchanger, through the tube to the secondary heat exchanger, through the second heat exchanger, through he exhaust blower (+ pressure) and out the flue.

If the exhaust system is clear, the negative (–) pressure is felt by the diaphragm in the pressure switch. The normally open contact of the switch closes, completing the electrical circuit though the switch and the ignition cycle will begin. If the ignition cycle begins at the same time as the exhaust blower begins to run the switch is stuck closed.

Trouble Shooting

Figure 68.



Manually turn off the gas supply to the furnace. Check for negative pressure using a "U" Tube manometer or a magnehelic gauge, by disconnecting the tube from the switch and connecting to the test instrument.

Figure 69.

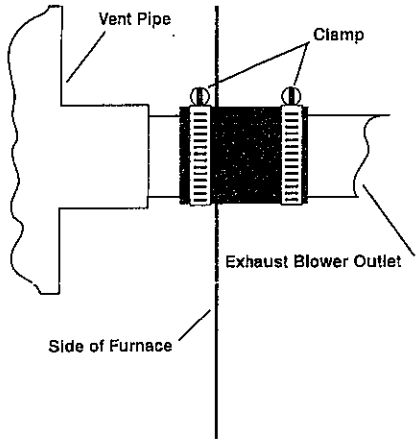
Chart #1: Exhaust Blower Pressure Switch

Switch Part #	Set in In. "WC"	Color	Units
			Units w/ date code H540 & earlier
611921	–2.5 ± .25	———	
1000743	–4.12 ± .175	Yellow	NDG/LK050
1000744	–3.25 ± .20	Orange	NDG/LK075
1000745	–2.36 ± .20	Red	NDG/LK100
1000746	–1.91 ± .15	Blue	NDG/LK125
1000747	–4.175 ± .175	Green	NUG/LK050
1000748	–3.2 ± .20	Gray	NUD/LK075
1000749	–1.95 ± .15	Purple	NUG/LK125
1001181	–2.3 ± .20	White	NUG/LK100

Turn the furnace on. The exhaust blower should start to operate. Read the pressure just as the blower reaches operating speed and compare it to the pressures listed in Chart #1.

If the pressure comes up to specifications. reconnect the tube to the pressure switch.

Figure 70.

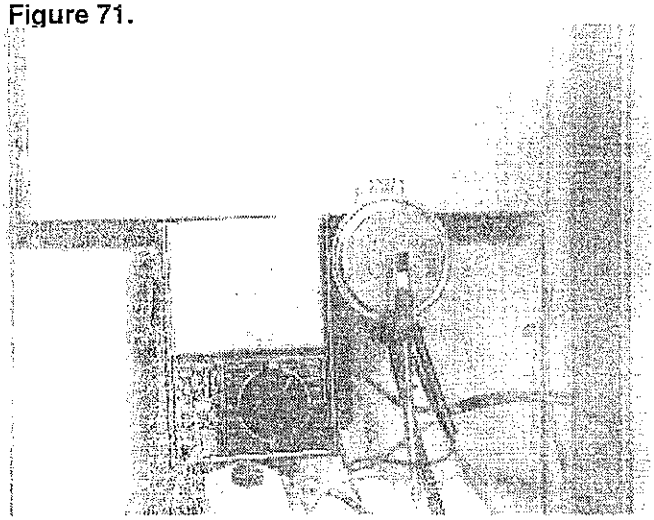


Typical Vent Connection

If pressure does not come up to specifications, remove the vent pipe assembly from the exhaust blower. If pressure now comes up to specifications you have problems in the vent system and it must be repaired or corrected.

If the blower is operating properly and pressure does not come up to specifications, you most likely have air leakage in the heat exchangers, transfer tube, or collector box.

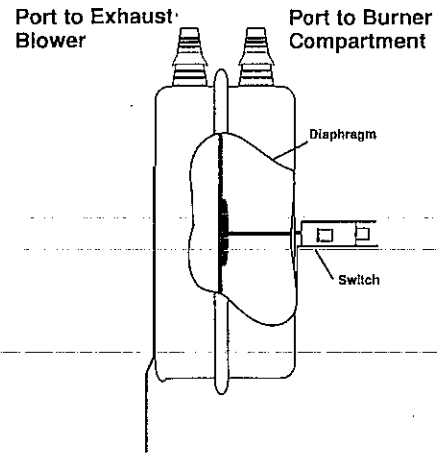
Figure 71.



Turn off furnace and remove electrical leads from the switch. Connect an ohmmeter across the switch. If you have continuity across the switch without the blower operating, the switch is defective and must be replaced.

Turn the furnace on and watch the meter, the switch should close just as the blower reaches operating speed.

Figure 72.

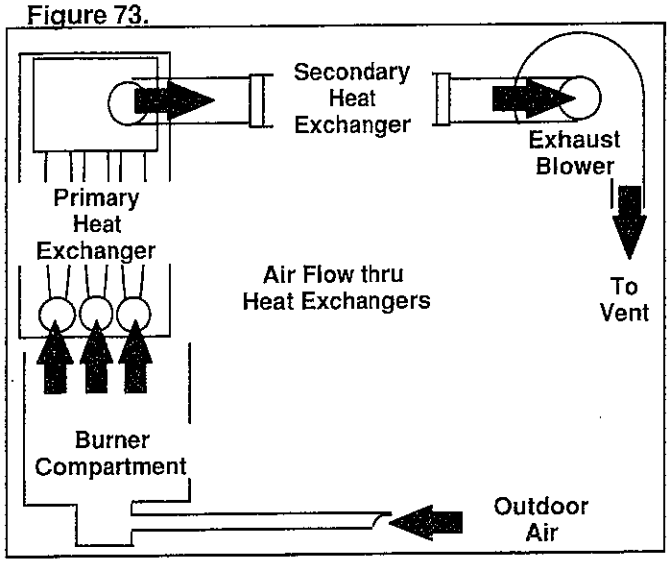


NUGS Exhaust Blower Pressure Switch
(Cut-a-Way)

"NUGS" Normal Operation

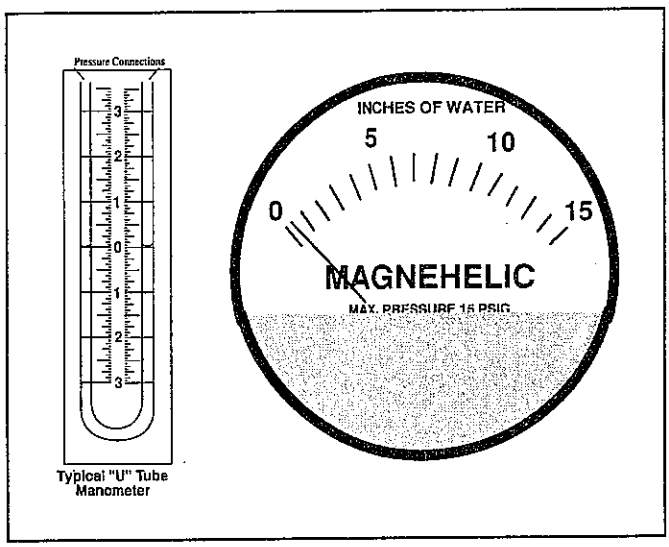
The exhaust blower pressure switch has two pressure taps. The switch senses the pressure differential between the negative side of the exhaust blower system and a lower negative pressure in the sealed burner compartment. The function of the exhaust blower pressure switch is to sense pressure differentials by means of a flexible diaphragm inside the pressure switch. As this diaphragm flexes in response to pressure, the movement is transmitted mechanically to a set of electrical contacts. If the switch fails to sense the proper pressure differential, it will shut down the system, preventing sooting of the primary and secondary heat exchangers.

Figure 73.



On a call for heat from the thermostat, the exhaust blower starts to operate. A negative pressure is created at the inlet side of the blower and this negative pressure is sensed by one side of the pressure switch. At the same time outside air is drawn through the combustion air inlet into the sealed burner compartment, creating a negative pressure of a lower value in the burner compartment. The pressure switch senses the difference between these two negative pressures. If the differential is within the range of the switch, the contacts on the pressure switch will close and complete the circuit through the switch.

Figure 74.



Trouble Shooting

To troubleshoot the exhaust blower pressure switch, it must be determined that the pressure sensing part of the switch is seeing the proper pressures and that the electrical part of the switch is opening and closing. The tools needed to test the operation of the switch are the following:

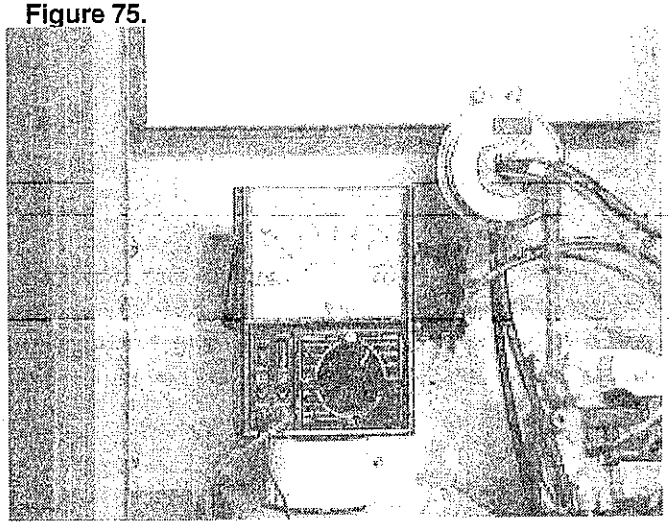
To read pressures, either a "U" Tube or a magnehelic gauge.

An ohmmeter can be used to check continuity through the electrical part of the switch.

Turn off the gas supply at the shutoff valve in the gas supply line to the furnace.

Remove the hoses from the pressure switch and connect both sides of a "U" Tube manometer or magnehelic gauge manometer to the tubes.

Figure 75.



Disconnect the wires to the pressure switch and connect an Ohmmeter across the terminals.

With the furnace off there should be no continuity across the terminals. If there is, the switch is defective and must be replaced. Turn the furnace on and read the pressure differential with the 'U' Tube or the magnehelic gauge.

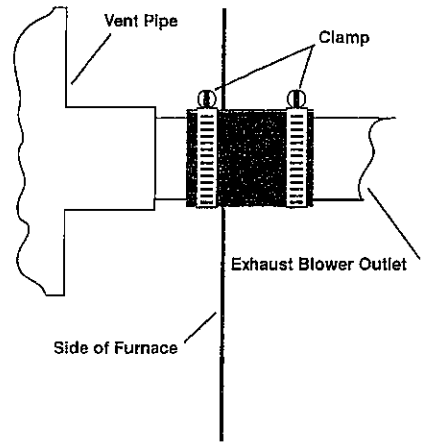
Figure 76.

Chart #2: Exhaust Blower Pressure Switch				
Switch Part #	Set in In. "WC"	Color	Units	Vent Size
1006406	2.90 ± .10	Blue	NUGS100	3"
1006405	3.40 ± .10	Green	NUGS075	3"
1005605	2.60 ± .10	Yellow	NUGS125	3"
1005604	2.90 ± .10	Blue	NUGS100	2"
1005603	3.40 ± .10	Green	NUGS075	2"
1005602	3.60 ± .10	Red	NUGS050	2"
*1006410	2.35 ± .10	Yellow	NUGS125	3"
*1006409	2.60 ± .10	Yellow	NUGS100	2"or 3"
*1006408	3.05 ± .10	Yellow	NUGS075	2"or 3"
*1006407	3.20 ± .10	Yellow	NUGS050	2"

*High Altitude Switch, Available from Service Parts Only

If the pressure is within the range shown in Chart #2, reconnect the hoses to the pressure switch and turn the furnace on. If the switch fails to close, the pressure switch is defective and must be replaced.

Figure 77.



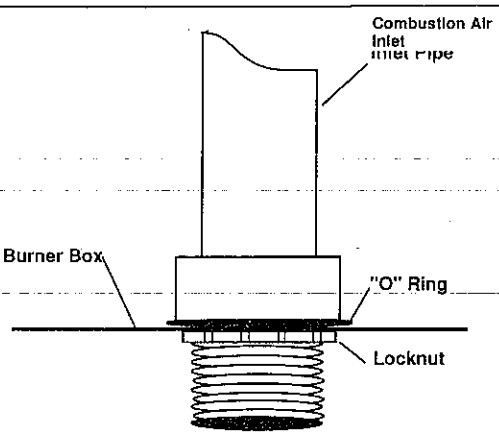
Typical Vent Connection

If the pressure differential is not within the range in Chart #2, check the following:

Disconnect the vent at the outlet of the exhaust blower and turn the furnace on.

If the contacts on the switch close, then inspect the vent for blockage and clear the blockage. If the contacts do not close with the vent disconnected, reconnect the vent.

Figure 78.



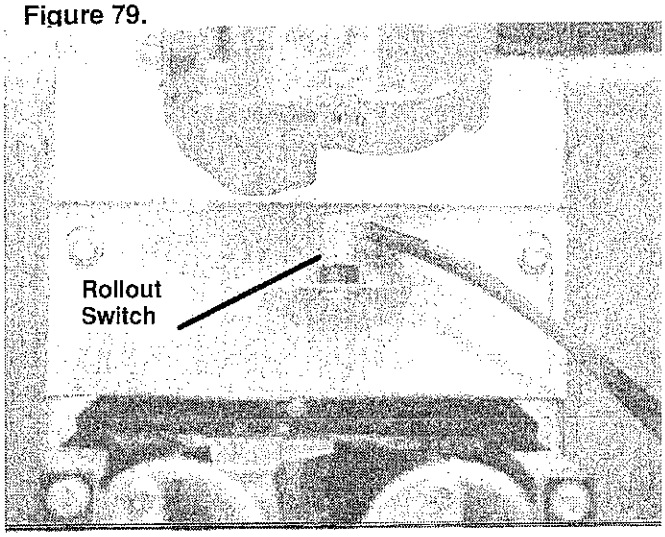
Detail: Inlet Air Pipe Connection

Remove the burner compartment cover and disconnect the inlet air pipe by removing the locknut securing it to the burner box

Replace the burner compartment cover and turn the furnace on. If the contacts close on the switch, inspect the inlet air system for blockage and clear the blockage. Reconnect all lines and replace the burner compartment cover.

Restore the gas supply to the furnace and place the furnace back in service.

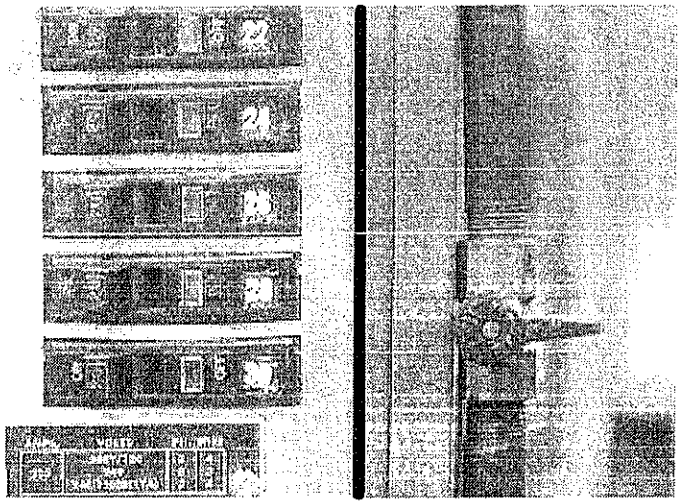
Figure 79.



NUGK & NUGS

Since the exhaust blower switch can only read a differential between the suction side of the exhaust blower and the burner compartment it may not detect an internal blockage in the heat exchanger. The roll–out switch provides this safety function. See limit switch section for operation and check out.

Figure 80.

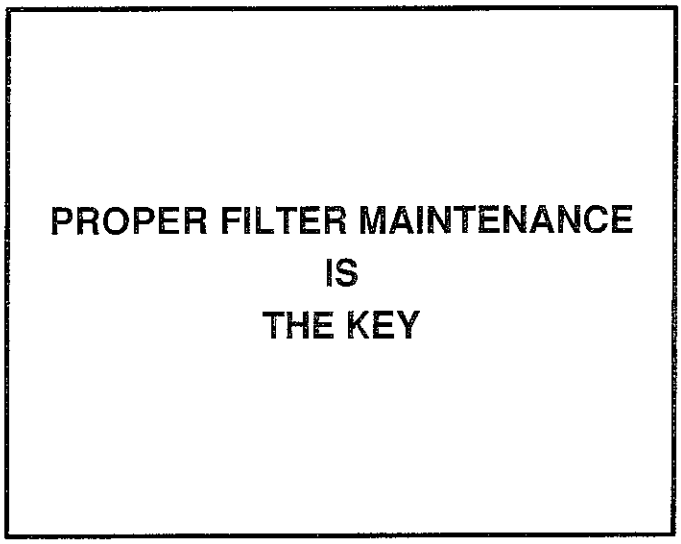


Heat Exchangers

Cleaning and/or Replacing Heat Exchangers.

Shut off electrical and gas supply to furnace.

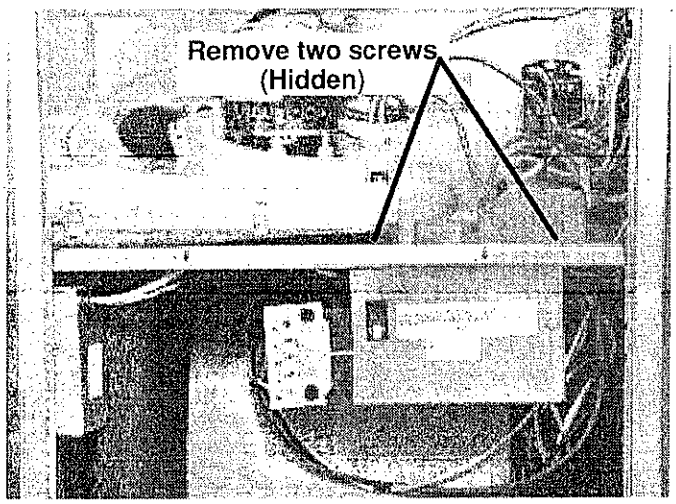
Figure 81.



Cleaning Secondary Heat Exchanger (Current Production) – Upflow Models

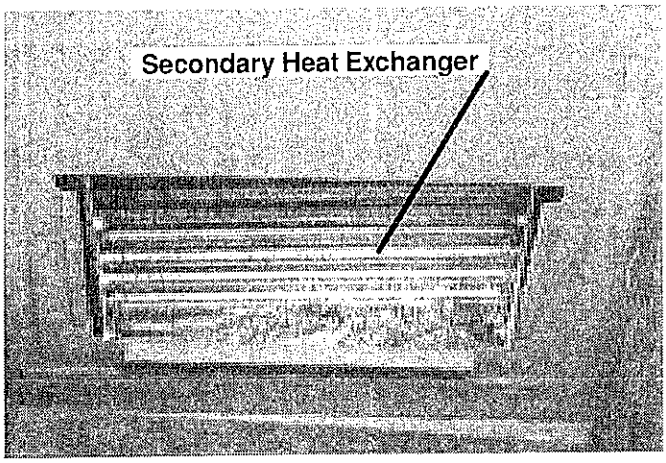
The exterior surface of the secondary heat exchanger may require cleaning if the furnace filters are not maintained properly. The inlet side surface of the secondary heat exchanger can be cleaned without removing it from the furnace.

Figure 82.



Remove two screws from the burner side of the blower deck that secure the control box and remove the control box from the blower compartment.

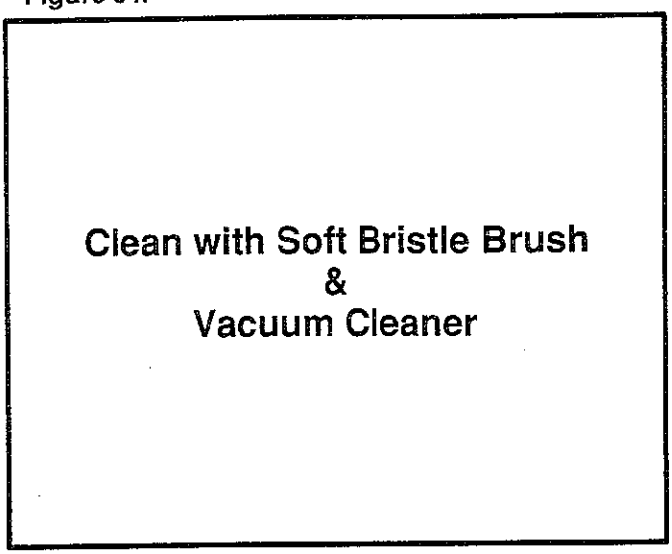
Figure 83.



Remove the two screws securing the blower and remove the blower from the furnace.

Once the blower has been removed the inlet side of the secondary heat exchanger can be accessed from the inside of the blower compartment for cleaning.

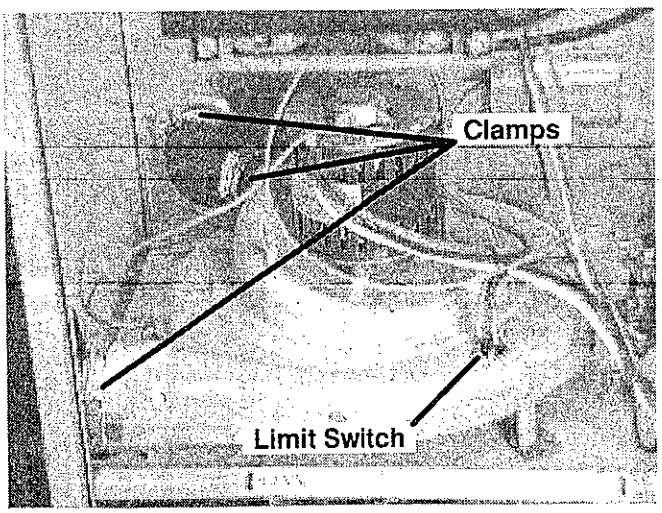
Figure 84.



Use a soft bristle brush and a vacuum cleaner to clean the surface. Do not use a wire brush or harsh chemicals to clean the surface as you may damage the fins. Inspect the blower wheel and, if necessary, clean before re–installing. Use caution when cleaning the blower wheel to keep from dislodging balance weights from the wheel.

If the secondary heat exchanger is being replaced, continue as follows:

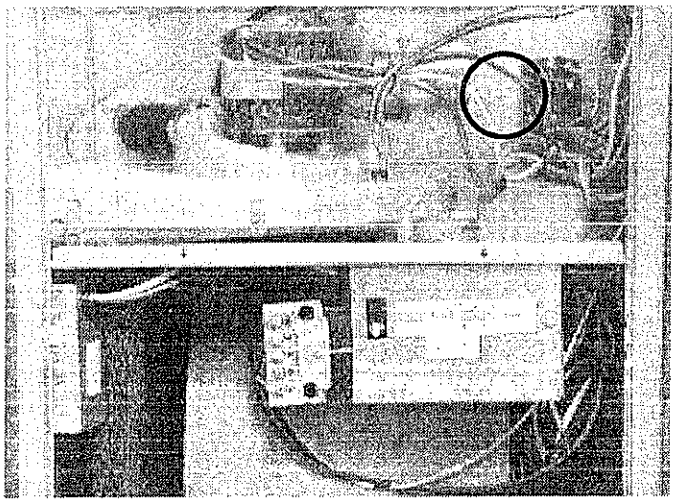
Figure 85.



Secondary Heat Exchanger Removal/Replacement – Upflow Models

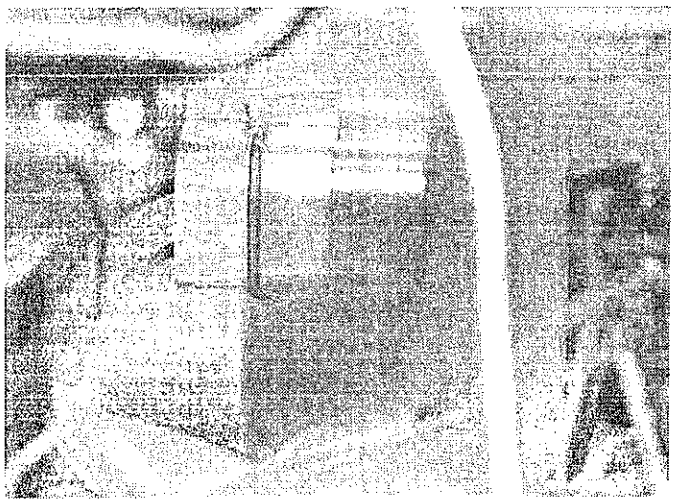
Loosen the clamps on the exhaust blower inlet and outlet. Disconnect the wires to the exhaust blower limit switch. Remove two screws securing exhaust blower to blower deck. **Do not remove exhaust blower at this time.**

Figure 86.



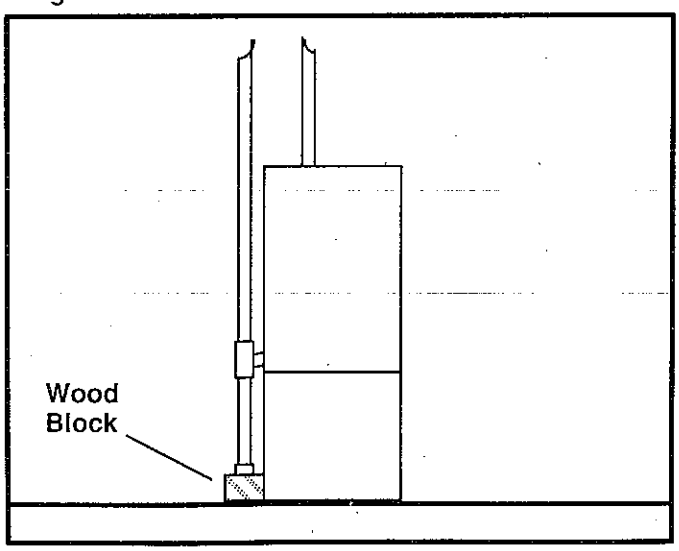
Locate where the black and white wires terminate in the control box and disconnect.

Figure 87.



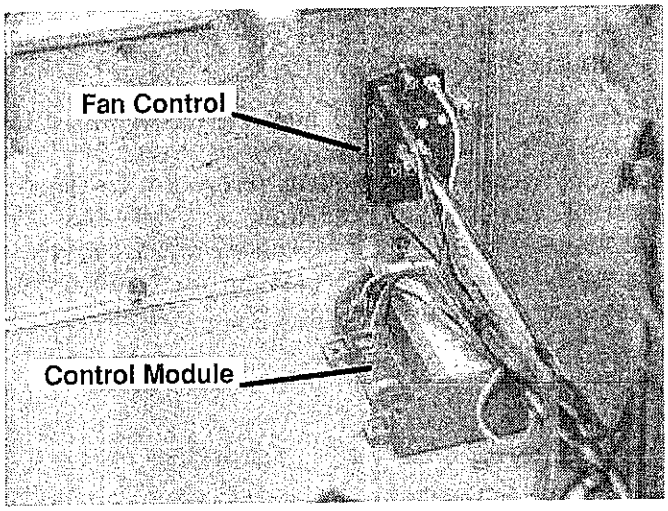
Remove the exhaust blower capacitor and strap from their mounting on the vestibule panel. (On earlier models the capacitor is mounted on the exhaust blower housing and do not have to be removed.)

Figure 88.



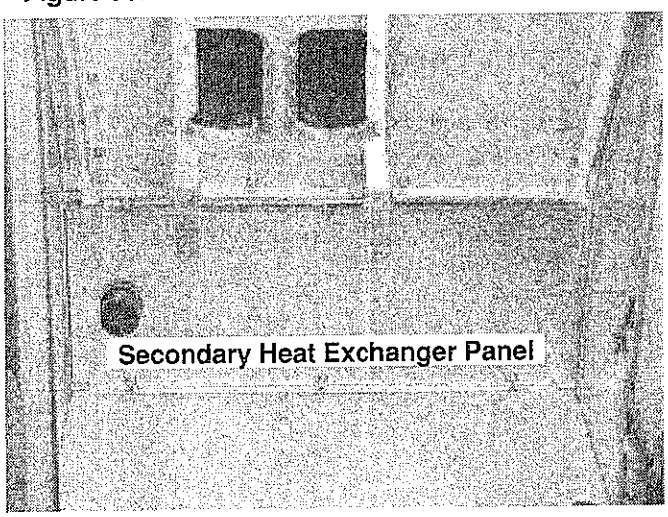
Support the vent pipe with a wooden block under the trap and remove the exhaust blower.

Figure 89.



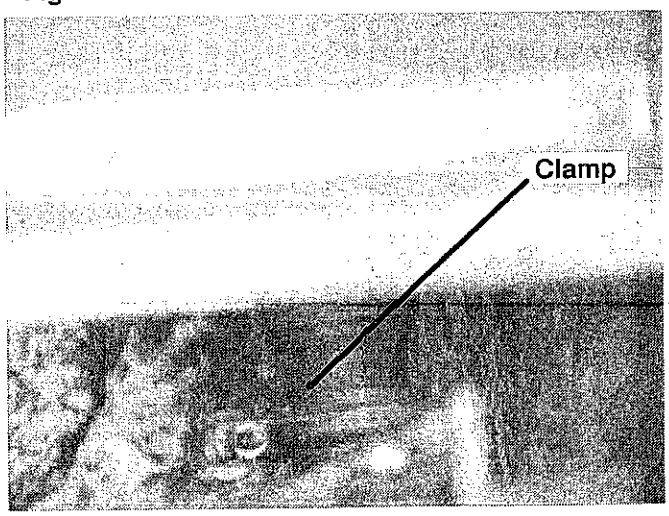
Remove the electronic fan control, if equipped, and the control module.

Figure 90.



Remove the secondary heat exchanger panel in the vestibule.

Figure 91.



Remove the muffler clamp securing the transfer tube to the secondary heat exchanger. Raise the transfer tube up and disengage from the secondary heat exchanger. The heat exchanger can now be removed from the furnace.

If the interior of the secondary heat exchanger is plugged with soot it should be considered defective and be replaced.