GE APPLIANCES
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Service Manual

NF80UV

80% Upflow/Horizontal Two Stage
Variable Speed Gas Furnace

READ CAREFULLY.
KEEP THESE INSTRUCTIONS.

31-5000731 Rev. 0 11-22 GEA

SERVICE MANUAL

NF80UV Gas Furnace

This is a safety alert symbol and should never be ignored. When you see this symbol on labels or in manuals, be alert to the potential for personal injury or death.

WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a licensed professional HVAC installer (or equivalent), service agency or the gas supplier.

CAUTION

As with any mechanical equipment, contact with sharp sheet metal edges can result in personal injury. Take care while handling this equipment and wear gloves and protective clothing.

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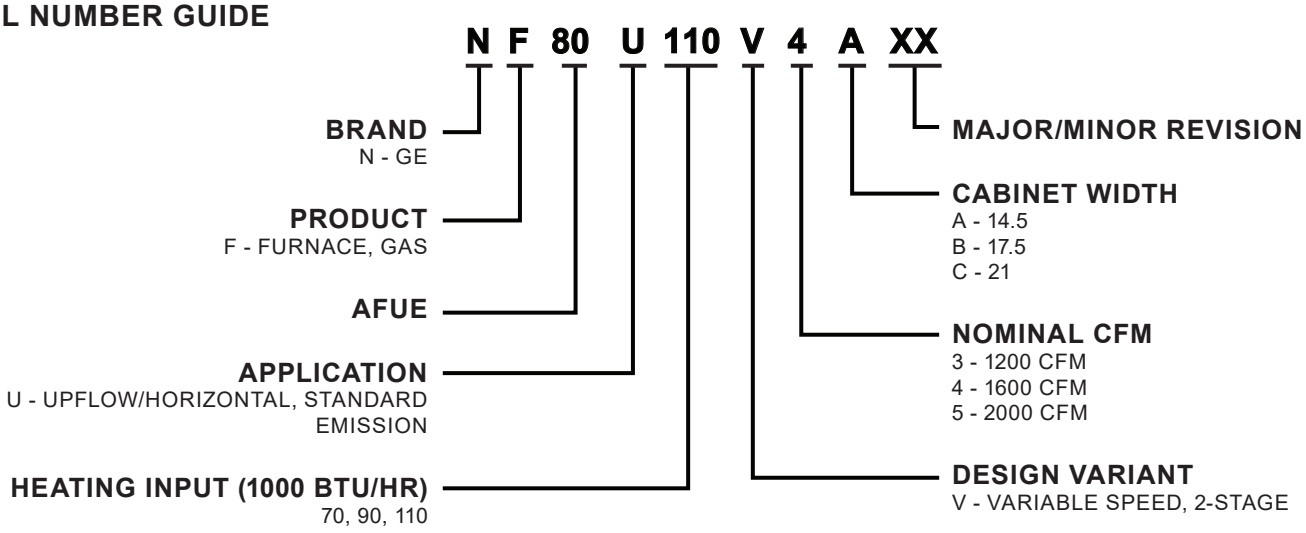
WARNING

Electric shock hazard.

Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch(es). Unit may have multiple power supplies.

Technical Specifications

MODEL NUMBER GUIDE



PHYSICAL AND ELECTRICAL DATA

	Model	Input (Btuh)	Output* (Btuh)	AFUE (ICS)	Nominal Cooling Capacity	Gas Inlet (in.)	Volts/ Hz/ Phase	Max. Time Delay Breaker or Fuse	Nominal F.L.A.	Trans. (V.A.)	Approx. Shipping Weight (lbs.)
Upflow / Horizontal	NF80U070V3A	66,000	52,000	80.0%	3 tons	1/2	120-60-1	15	7.7	40	128
	NF80U090V4B	88,000	70,000	80.0%	4 tons	1/2	120-60-1	20	12.8	40	154
	NF80U110V5C	110,000	87,000	80.0%	5 tons	1/2	120-60-1	20	12.8	40	181

Note: For vent length and clearances to combustibles, please reference installation instructions.
** Outputs shown are High Fire, 100% rate, Low Fire is 67% of shown output.*

BLOWER PERFORMANCE DATA

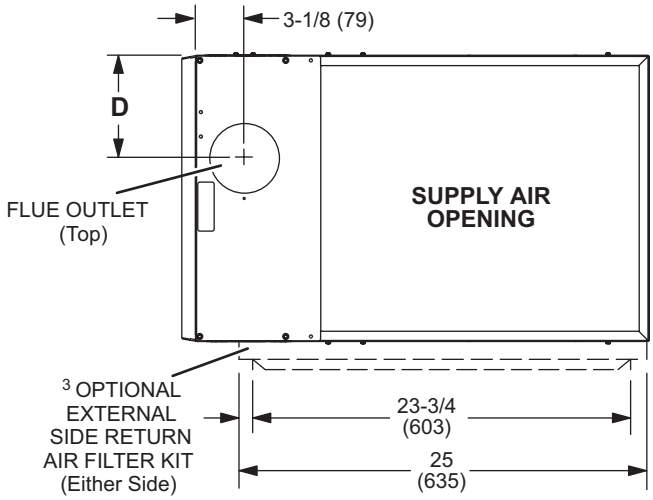
	Model	Motor Size (hp)	Blower Size	Heating						Cooling					
				Temp Rise F°	Speed Adjustment	CFM @ 0" - 0.5" w.c.				Cooling Stage	Speed Adjustment	CFM @ 0" - 0.8" w.c.			
						Setting "A"	Setting "B"	Setting "C"	Setting "D"			Setting "A"	Setting "B"	Setting "C"	Setting "D"
Upflow / Horizonatl	**Bottom Inlet**														
	NF80U070V3A	1/2 HP	10 x 8	High Fire 40 - 70	+	1129	1027	990	787	2nd Stage	+	1335	1215	1080	995
					Norm	1026	934	900	715		Norm	1225	1105	985	920
					-	923	841	810	644		-	1100	995	905	820
				Low Fire 25 - 55	+	1031	926	829	747	1st Stage	+	965	865	785	735
					Norm	937	842	754	679		Norm	885	795	735	690
					-	843	758	679	611		-	790	755	685	650
	NF80U090V4B	1 HP	11 x 9	High Fire 40 - 70	+	1646	1529	1518	1187	2nd Stage	+	1755	1545	1335	1030
					Norm	1496	1390	1380	1079		Norm	1600	1405	1200	940
					-	1346	1251	1242	971		-	1435	1260	1060	790
				Low Fire 25 - 55	+	1539	1398	1136	1096	1st Stage	+	1210	1035	890	665
					Norm	1399	1271	1033	996		Norm	1090	960	810	600
					-	1259	1144	930	896		-	985	850	690	525
	NF80U110V5C	1 HP	11 x 10	High Fire 35 - 65	+	2175	1950	1935	1546	2nd Stage	+	2205	1905	1705	1535
					Norm	1977	1773	1759	1405		Norm	2015	1710	1560	1400
					-	1779	1596	1583	1265		-	1810	1555	1395	1260
				Low Fire 25 - 55	+	1977	1783	1497	1431	1st Stage	+	1560	1355	1230	1065
					Norm	1797	1621	1361	1301		Norm	1425	1205	1085	955
					-	1617	1459	1225	1171		-	1265	1075	960	845
	Side Inlet														
	NF80U070V3A	1/2 HP	10 x 8	High Fire 40 - 70	+	1114	1018	979	778	2nd Stage	+	1345	1218	1097	1010
					Norm	1013	925	890	707		Norm	1213	1104	1003	926
					-	912	833	801	636		-	1106	1013	893	820
				Low Fire 25 - 55	+	1044	950	825	740	1st Stage	+	916	848	767	735
					Norm	949	864	750	673		Norm	859	795	726	689
					-	854	778	675	606		-	781	727	677	635
	NF80U090V4B	1 HP	11 x 9	High Fire 40 - 70	+	1667	1533	1522	1183	2nd Stage	+	1672	1498	1296	1006
					Norm	1515	1394	1384	1075		Norm	1499	1346	1158	897
					-	1364	1255	1246	968		-	1406	1210	1049	795
				Low Fire 25 - 55	+	1539	1398	1136	1096	1st Stage	+	1174	1013	901	638
					Norm	1399	1271	1033	996		Norm	1040	930	778	571
					-	1259	1144	930	896		-	956	809	698	529
	NF80U110V5C	1 HP	11 x 10	High Fire 35 - 65	+	2094	1925	1880	1505	2nd Stage	+	2011	1857	1688	1506
					Norm	1904	1750	1709	1368		Norm	1843	1687	1526	1375
					-	1714	1575	1538	1231		-	1640	1503	1382	1235
				Low Fire 25 - 55	+	1903	1730	1455	1375	1st Stage	+	1420	1286	1160	1019
					Norm	1730	1573	1323	1250		Norm	1277	1154	1048	942
					-	1557	1416	1191	1125		-	1116	1020	944	836

ACCESSORY LIST

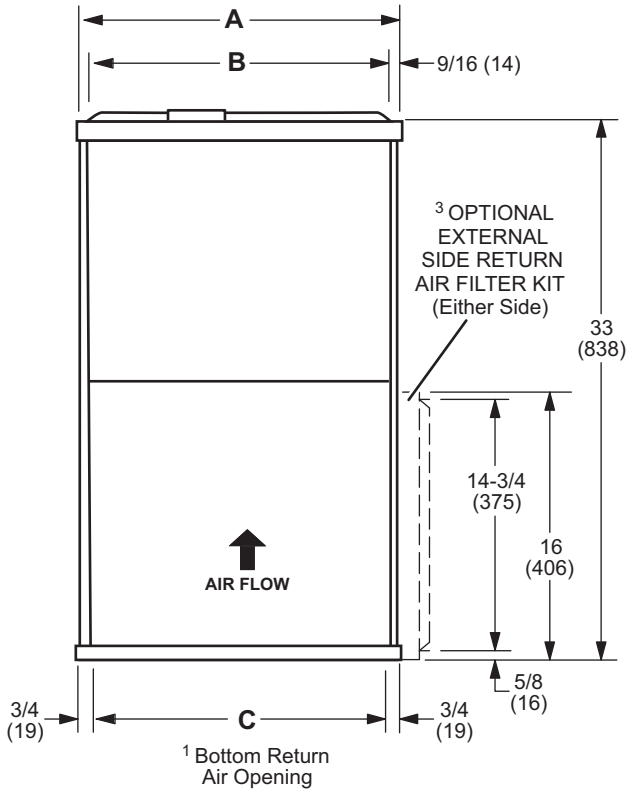
Catalog Number	Description
Natural to LP Kits	
11K48	Two-Stage (0 - 7500 ft.)
11K47	Two-Stage (>7500 ft.)
Return Air Base	
68W61	14.5 Inch, A Width
68W62	17.5 Inch, B Width
68W63	21.0 Inch, C Width

Note: For vent length and clearances to combustibles, please reference installation instructions.

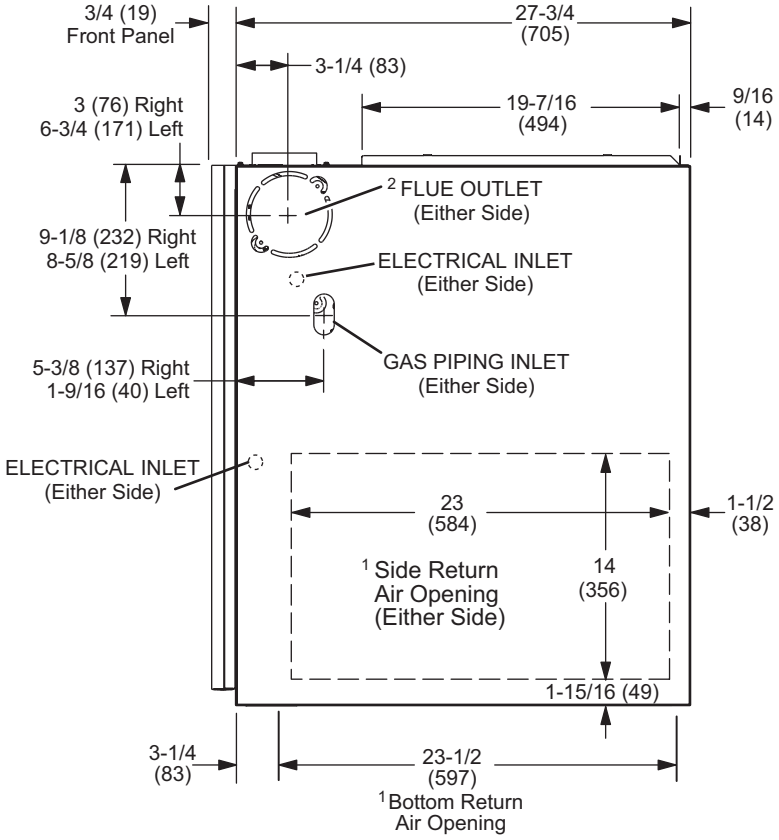
Unit Dimensions



TOP VIEW



FRONT VIEW



SIDE VIEW

Capacity	A		B		C		D	
	in.	mm	in.	mm	in.	mm	in.	mm
070-3A	14-1/2	368	13-3/8	340	13	330	4-3/4	121
090-4B	17-1/2	446	16-3/8	416	16	406	6-1/4	159
110-5C	21	533	19-7/8	504	19-1/2	495	8	203

Parts Arrangement

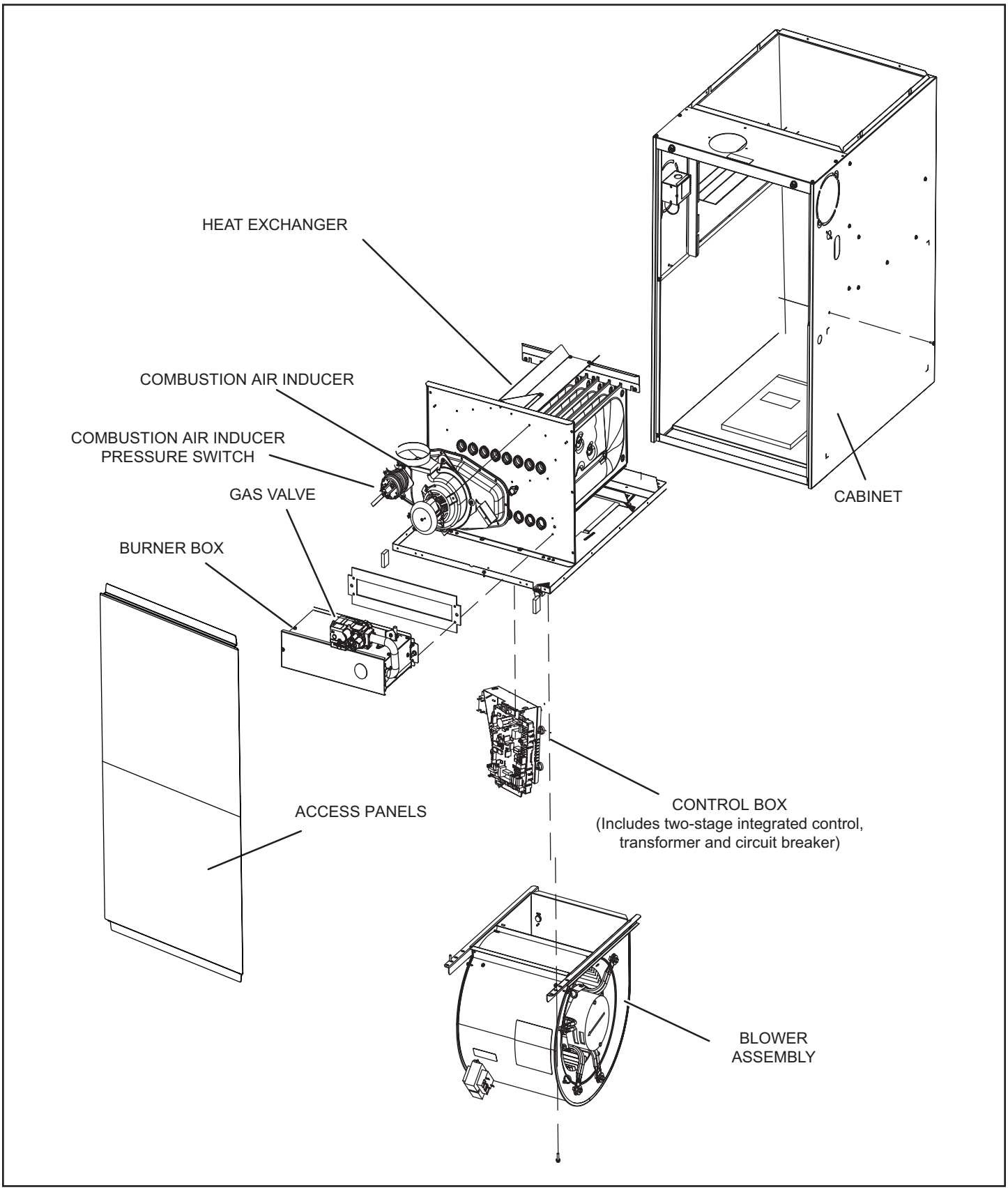


Figure 1. Expanded View

Unit Components

NF80UV unit components are shown in Figure 1. The gas valve, combustion air inducer and burners can be accessed by removing the access panel. Electrical components are in the control box (Figure 2) found in the blower section.

⚠ CAUTION

Electrostatic discharge can affect electronic components. Take precautions to neutralize electrostatic charge by touching your hand and tools to metal prior to handling the control.

Control Box

Control Transformer (T1)

A transformer located in the control box provides power to the low voltage section of the unit. Transformers on all models are rated 40VA with a 120V primary and a 24V secondary.

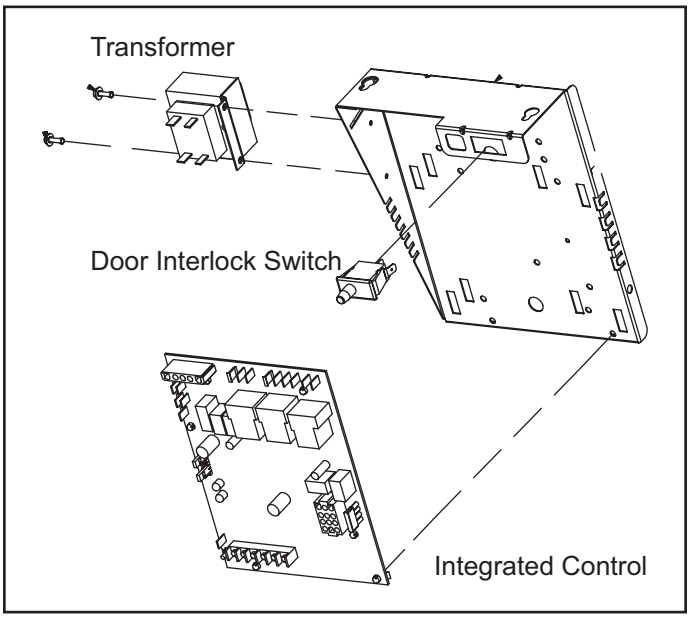


Figure 2. Control Box

Door Interlock Switch (S51)

A door interlock switch rated 14A at 125VAC is wired in series with line voltage. When the inner blower access panel is removed the unit will shut down.

⚠ WARNING

Shock hazard.

Disconnect power before servicing. Integrated control is not field repairable. If control is inoperable, simply replace entire control.

Can cause injury or death. Unsafe operation will result if repair is attempted.

Integrated Control (A92)

Units are equipped with a variable capacity integrated control. The system consists of an ignition / blower control (Figure 3) with control pin designations (Table 3 and Table 4) and an ignitor. The control and ignitor work in combination to ensure furnace ignition and ignitor durability. The control provides gas ignition, safety checks and indoor blower control with two-stage gas heating. The furnace combustion air inducer, gas valve and indoor blower are controlled in response to various system inputs such as thermostat signal, pressure and limit switch signal and flame signal.

The furnace has a built-in, self-diagnostic capability. If a system problem occurs, a fault code is shown by a red LED on the control. The control continuously monitors its own operation and the operation of the system. If a failure occurs, the LED will indicate the failure code. The flash codes are presented in Table 2.

Fault Code History Button

The control stores the last five fault codes in memory. A pushbutton switch is located on the control. When the pushbutton switch is pressed and released, the control flashes the stored fault codes. The most recent fault code is flashed first; the oldest fault code is flashed last. To clear the fault code history, press and hold the pushbutton switch in for more than 5 seconds before releasing.

Single Stage Thermostat Operation

The automatic heat staging option allows a single stage thermostat to be used with two stage furnace models. To activate this option, move the jumper pin (see Figure 3) to desired setting (5 minutes or 10 minutes). The furnace will start on 1st stage heat and stay at 1st stage heat for the duration of the selected time before switching to 2nd stage heat.

W1 on the integrated control must be connected to W1 on the thermostat.

High Heat State LED

A green LED is provided on the control board to indicate high heat state (see Table 1).

CFM LED

An amber LED is provided on the control board to display CFM. To determine what CFM the motor is delivering at any time, count the number of times the amber LED flashes. Each flash signifies 100 CFM; count the flashes and multiply by 100 to determine the actual CFM delivered (for example: 5 flashes x 100 = 500 CFM).

LED Status	Description
LED Off	No demand for high heat
LED On	HIgh heat demand, operating normally
LED Flashing	High heat demand, high pressure switch not closed

Table 1. High Heat State Green LED

LED Status	Description
LED Off	No power to control or control hardware fault detected
LED On	Normal operation
1 Flash	Flame present with gas valve de-energized
2 Flashes	Pressure switch closed with combustion air inducer de-energized
3 Flashes	Low-fire pressure, rollout or limit switch open
4 Flashes	Primary limit switch open
5 Flashes	Not used
6 Flashes	Pressure switch cycle lockout
7 Flashes	Lockout, burners fail to light
8 Flashes	Lockout, burners lost flame too many times
9 Flashes	Line voltage polarity incorrect

Table 2. Diagnostic Codes Red LED

Pin #	Function
1	Ignitor (Hot)
2	Combustion Air Inducer High Speed
3	Combustion Air Inducer Low Speed
4	Combustion Air Inducer Neutral
5	Ignitor Neutral

Table 3. Control 5-Pin Terminal Designation

Airflow Adjustments

Cooling Mode

The units are factory set for the highest airflow for each model. Adjustments can be made to the cooling airflow by repositioning the jumper plug marked COOL – A, B, C, D (see Figure 3). To determine what CFM the motor is delivering at any time, count the number of times the amber LED on the control board flashes. Each flash signifies 100 CFM; count the flashes and multiply by 100 to determine the actual CFM delivered (for example: 5 flashes x 100 = 500 CFM).

Pin #	Function
1	Gas Valve Second Stage
2	Second Stage Prove Switch
3	Rollout Switch In
4	Ground
5	24V Hot
6	Primary Limit In
7	Gas Valve First Stage
8	Gas Valve Common
9	24V Neutral
10	Ground
11	Rollout Switch Out
12	First Stage Prove Switch

Table 4. 12-Pin Terminal Designation

Heating Mode

These units are factory set to run at the middle of the heating rise range as shown on the unit rating plate. If higher or lower rise is desired, reposition the jumper plug marked HEAT - A, B, C, D (see Figure 3). To determine what CFM the motor is delivering at any time, count the number of times the amber LED on the control board flashes. Each flash signifies 100 CFM; count the flashes and multiply by 100 to determine the actual CFM delivered (for example: 5 flashes x 100= 500.

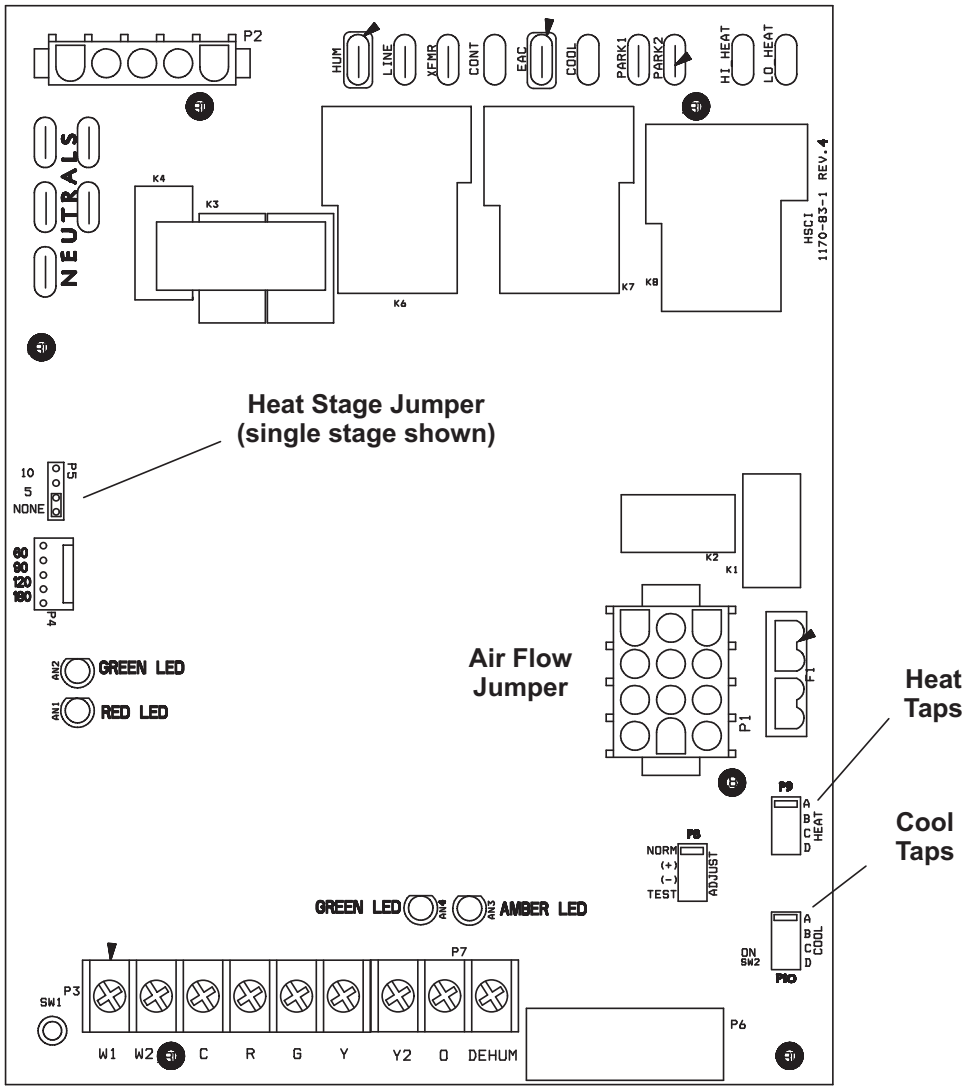
Adjust Tap

Airflow amounts may be increased or decreased by 10% by moving the ADJUST jumper plug (see Figure 3) from the NORM position to the (+) or (-) position. Changes to the ADJUST tap will affect both cooling and heating airflows. The TEST position on the ADJUST tap is not used.

Continuous Blower Operation

The comfort level of the living space can be enhanced when using this feature by allowing continuous circulation of air between calls for cooling or heating. The circulation of air occurs at half the full cooling airflow rate.

To engage the continuous blower operation, place the fan switch on the thermostat into the ON position. A call for fan from the thermostat closes R to G on the ignition control board. The control waits for a 1 second thermostat delay before responding to the call for fan by ramping the circulating blower up to 50% of the cooling speed. When the call for continuous fan is satisfied, the control immediately ramps down the circulating blower.



TERMINAL DESIGNATIONS
HUM -Humidifier (120VAC)
Line - Input (120VAC)
XFMR - Transformer (120VAC)
EAC - Indoor Air Accessory (120VAC)
Cool - Cool Speed (120VAC)
Park 1 - Dead terminal for alternate speed tap
Park 2 - Dead terminal for alternate speed tap

Figure 3. Integrated Control

Indoor Blower Motor

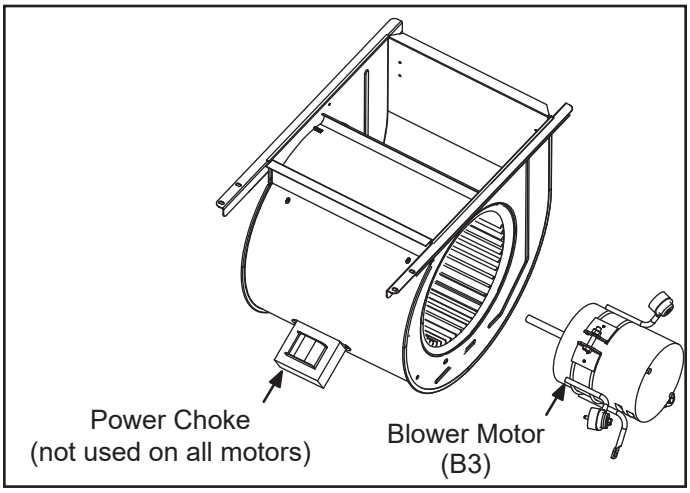


Figure 4.

> **⚠ WARNING**
>
> During blower operation, the ECM motor emits energy that may interfere with pacemaker operation. Interference is reduced by both the sheet metal cabinet and distance.

The motor communicates with the integrated control via a 2-way serial connection. The motor receives all necessary functional parameters from the integrated control and does not rely on a factory program like traditional variable speed motors. NF80UV units use a three-phase, electronically controlled D.C. brushless motor (controller converts single phase a.c. to three phase D.C.), with a permanent-magnet type rotor (Figure 6). Because this motor has a permanent magnet rotor it does not need brushes like conventional D.C. motors.

The stator windings are split into three poles which are electrically connected to the controller. This arrangement allows motor windings to turn on and off in sequence by the controller.

A solid-state controller is permanently attached to the motor. The controller is primarily an A.C. to D.C. converter. Converted D.C. power is used to drive the motor. The controller contains a microprocessor which monitors varying conditions inside the motor (such as motor workload).

The controller uses sensing devices to sense what position the rotor is in at any given time. By sensing the position of the rotor and then switching the motor windings on and off in sequence, the rotor shaft turns the blower.

All NF80UV blower motors use single phase power. An external run capacitor is not used. The motor uses permanently lubricated ball-type bearings.

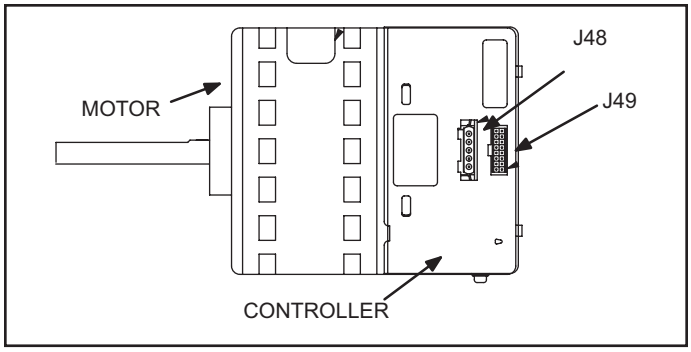


Figure 5. GenTeq Blower Motor B3

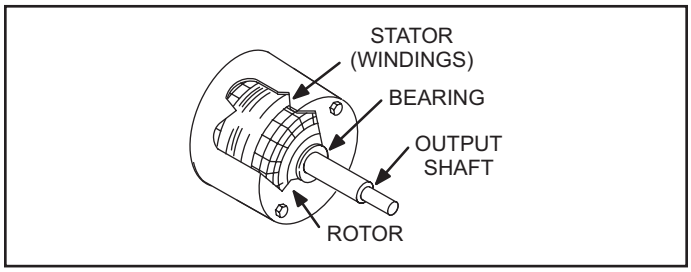


Figure 6. Blower Motor Components

Internal Operation

Each time the controller switches a stator winding (Figure 6) on and off, it is called a “pulse.” The length of time each pulse stays on is called the “pulse width.” By varying the pulse width (Figure 8), the controller varies motor speed (called “pulse-width modulation”). This allows for precise control of motor speed and allows the motor to compensate for varying load conditions as sensed by the controller. In this case, the controller monitors the static workload on the motor and varies motor rpm in order to maintain constant airflow (cfm).

The motor controller is driven by the Two-stage Variable Speed Integrated control board.

Motor rpm is continually adjusted internally to maintain constant static pressure against the blower wheel. The controller monitors the static work load on the motor and motor amp-draw to determine the amount of rpm adjustment. Blower rpm may be adjusted any amount in order to maintain a constant cfm as shown in blower tables. The cfm remains relatively stable over a broad range of static pressure. Since the blower constantly adjusts rpm to maintain a specified cfm, motor rpm is not rated. Hence, the terms “cool speed”, “heat speed” or “speed tap” in this manual, on the unit wiring diagram and on blower B3, refer to blower cfm regardless of motor rpm.

The unit control indicates the desired cfm. The blower will maintain the desired cfm as long as external static pressure does not exceed 0.8”. If the system exceeds this amount, the blower may enter a “cut back”, mode wherein it then slows down to protect itself from electrical damage. During this “cut back” mode the unit control will still indicate the same desired cfm regardless of actual motor rpm.

Initial Power Up

When line voltage is applied to B3, there will be a large inrush of power lasting less than 1/4 second. This inrush charges a bank of DC filter capacitors inside the controller. If the disconnect switch is bounced when the disconnect is closed, the disconnect contacts may become welded. Try not to bounce the disconnect switch when applying power to the unit.

Motor Start-Up

When B3 begins start-up, the motor gently vibrates back and forth for a moment. This is normal. During this time the electronic controller is determining the exact position of the rotor. Once the motor begins turning, the controller slowly eases the motor up to speed (this is called “soft-start”). The motor may take as long as 10-15 seconds to reach full speed. If the motor does not reach 200 rpm within 13 seconds, the motor shuts down. Then the motor will immediately attempt a restart. The shutdown feature provides protection in case of a frozen bearing or blocked blower wheel. The motor may attempt to start eight times. If the motor does not start after the eighth try, the controller locks out. Reset controller by momentarily turning off power to unit.

The DC filter capacitors inside the controller are connected electrically to the motor supply wires. The capacitors take approximately 5 minutes to discharge when the disconnect is opened. For this reason it is necessary to wait at least 5 minutes after turning off power to the unit before attempting to change speed taps.

⚠ DANGER

Disconnect power from unit and wait at least five minutes to allow capacitors to discharge before attempting to service motor. Failure to wait may cause personal injury or death.

Figure 7 shows the two quick-connect jacks (J48 and J49) which connect the motor to the NF80UV. Jack J48 is the power plug and jack J49 connects the unit controls to the motor.

Jack J48 is the power plug. Line voltage must be applied to J48 pins 4 and 5 in order for the motor to operate. When using 120VAC pins 1 and 2 must be jumpered.

Jack J49 connects the unit controls to the motor. The motor assigns priority to J49 pin 2 so that if a call for cooling and a call for heating are concurrent, heating call overrides and the blower operates on high speed heating tap.

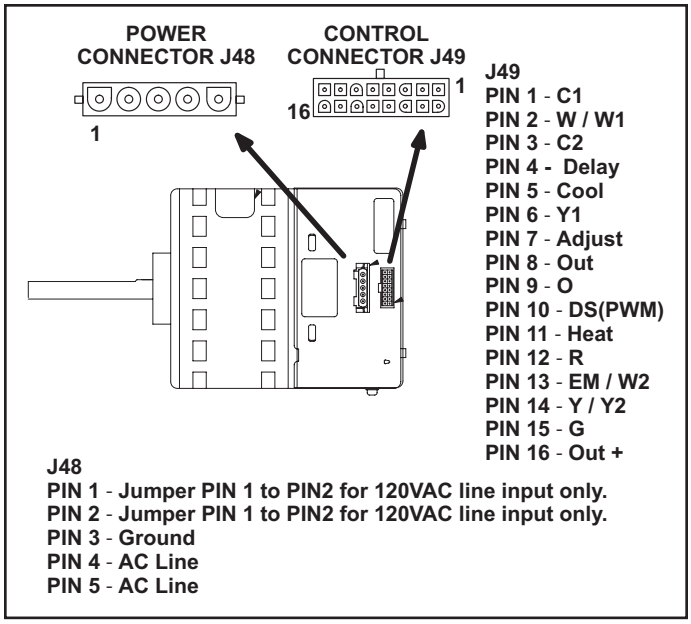


Figure 7. GenTeq Harness Connectors

Power Choke (L13)

A choke coil may be used on some models. The choke is located on the blower housing and is used to suppress transient current spikes.

Remove Blower from Unit

1. Remove unit access panels, control box, bolts and wiring jackplugs.
2. Slide blower out front of unit.

Precautions

If the furnace or its electronically controlled blower motor is improperly or inadequately grounded, it may cause television interference (commonly known as RFI or radio frequency interference).

This interference is caused by internal switching frequencies of the motor controller. TV interference may show up as small specks or lines which randomly appear on the TV screen accompanied by pops or clicks in the sound. Before attempting any service, make sure the indoor unit is causing the interference. To check, disconnect power to indoor unit then check TV for continued signs of interference.

TV interference may be stopped by making sure the motor is solidly grounded to the cabinet (metal to metal) and by making sure the cabinet is solidly grounded. If TV interference persists, make sure the television (and all affected RF appliances) are moved away from the furnace. Also make sure affected appliances are connected to a separate electrical circuit.

Motor speed is determined by the size of the electrical pulse sent to the motor windings. The longer the pulse, the faster the motor.

OUTPUT FROM CONTROLLER TO MOTOR WINDINGS	
WINDINGS TURNED OFF	WINDINGS TURNED ON
	ON PULSE OFF PULSE

The frequency of the pulses to the windings is 20KHz.
DO NOT ATTEMPT TO MEASURE THESE VOLTAGES.

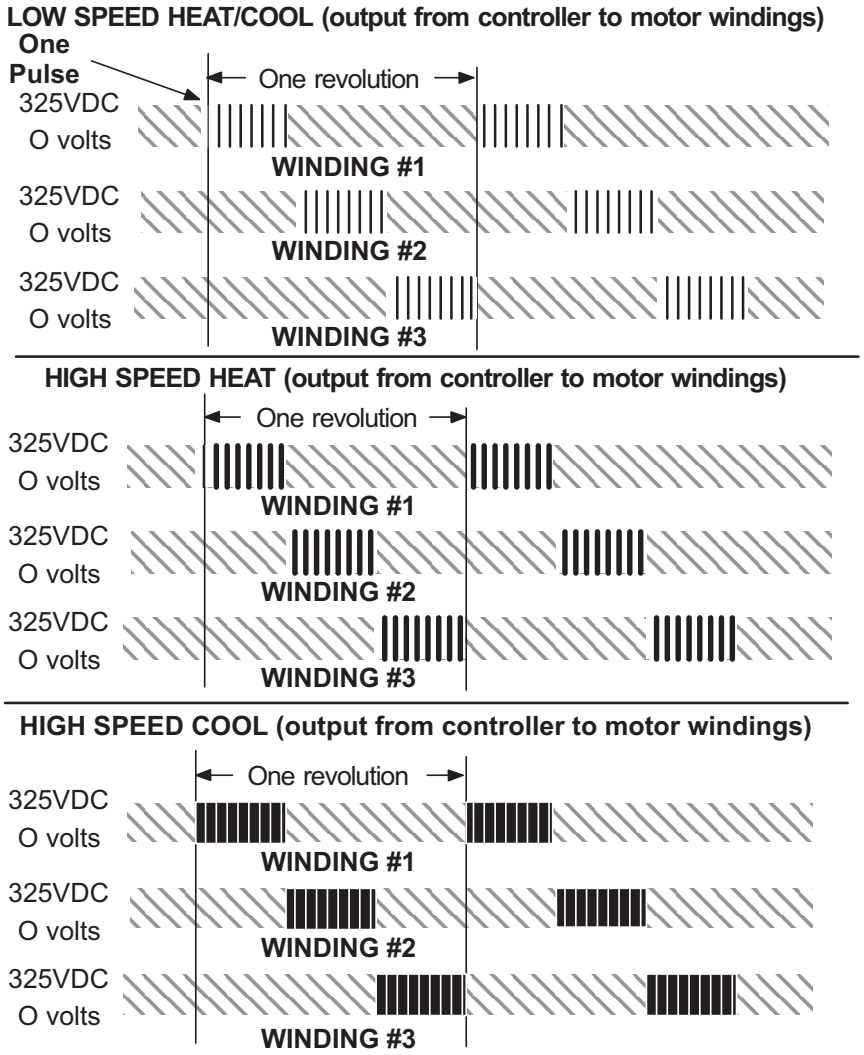


Figure 8. Motor Speed Control with D.C. Pulse-Width Modulation

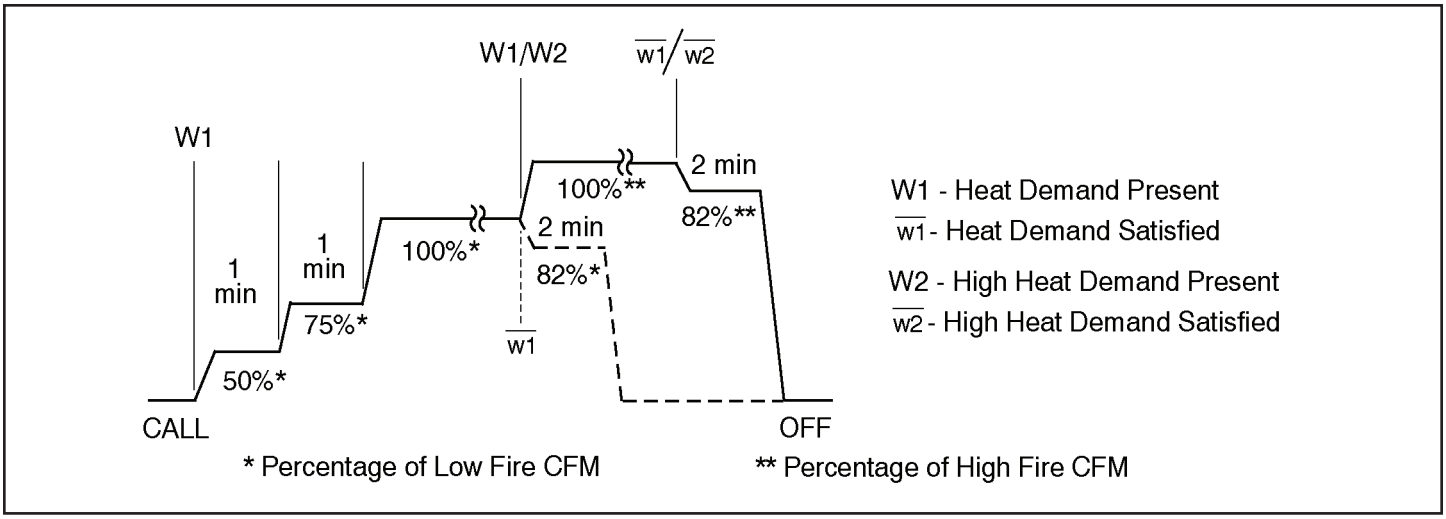


Figure 9. Indoor Blower Operation - 1st Stage-2nd Stage (W1/W2) Heat Call

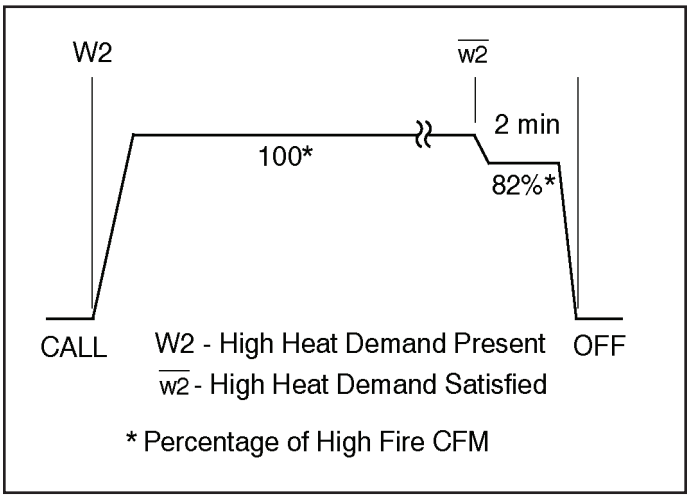


Figure 10. Indoor Blower Operation - High Heat (W2) Call

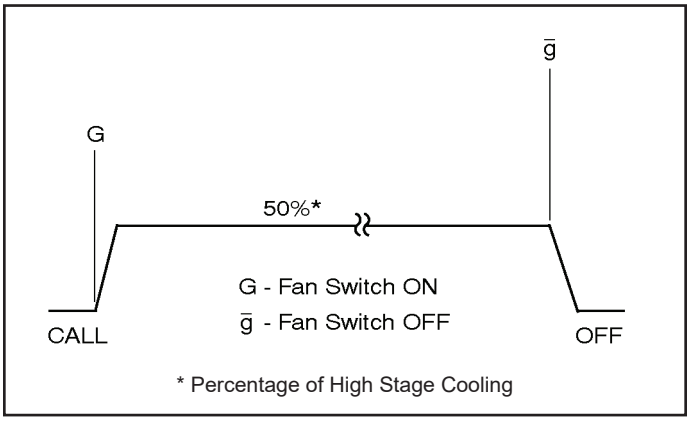


Figure 11. Indoor Blower Operation - Call for Fan

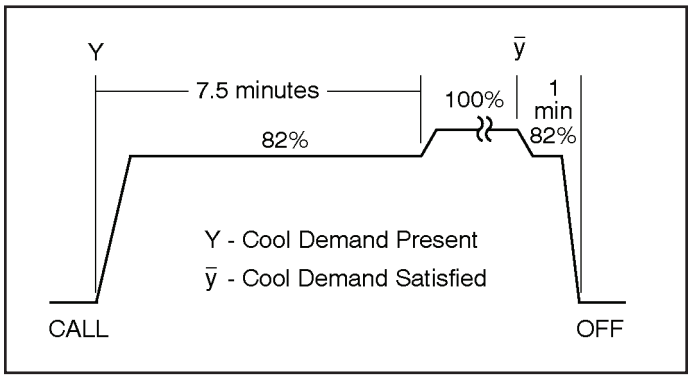


Figure 12. Indoor Blower Operation - Single Stage Cooling

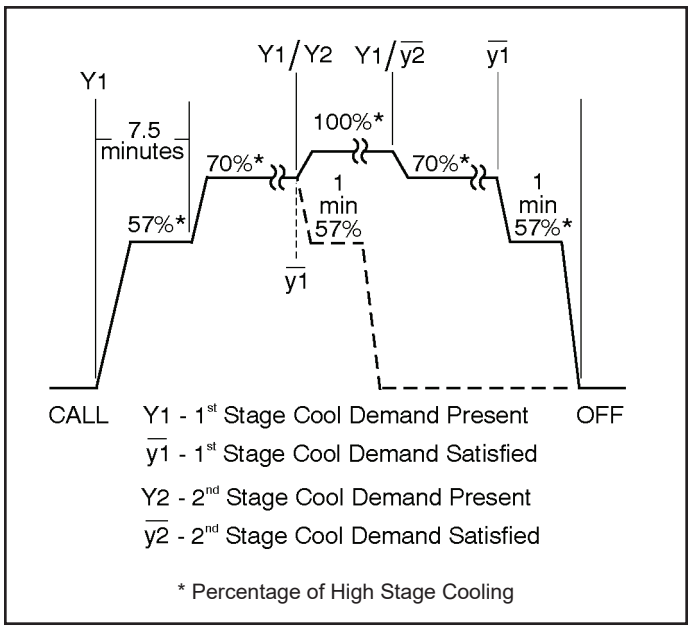


Figure 13. Indoor Blower Operation - Two Stage Cooling

Heating Components

Ignitor

The ignitor is made of durable silicon nitride. Ignitor longevity is enhanced by controlling voltage to the ignitor. The integrated control provides a regulated 120 volts to the ignitor for a consistent ignition and long ignitor life. Ohm value should be 39 to 70. See Figure 14 for ignitor location and Figure 16 for ignitor check out.

NOTE: *The NF80UV furnace contains electronic components that are polarity sensitive. Make sure that the furnace is wired correctly and is properly grounded.*

Flame Sensor

A flame sensor is located on the left side of the burner support. See Figure 14. The sensor tip protrudes into the flame envelope of the left-most burner. The sensor can be removed for service without removing any part of the burners. During operation, flame is sensed by current passed through the flame and sensing electrode. The control allows the gas valve to remain open as long as flame signal is sensed. See Table 5 for flame signal.

Normal	Low	Drop Out
1.5 or greater	1.0 or less	0.5

Table 5. Flame Signal in Microamps

Gas Valve

The valve (Figure 14) is internally redundant to assure safety shut-off. If the gas valve must be replaced, the same type valve must be used.

24VAC terminals and gas control knob are located on the valve. A wire harness connects the terminals from the gas valve to the electronic ignition control. 24V applied to the terminals energizes the valve.

Inlet and outlet pressure taps are located on the valve. A regulator adjustment screw is located on the valve.

LPG change over kits are available from GE Appliances. Kits include burner orifices and a gas valve conversion.

Flame Rollout Switches (S47)

Flame rollout switch is a high temperature limit located on top of the burner box, one on each side.- See Figure 14. The limit is a N.C. SPST manual-reset limit. When S47 senses rollout, the circuit breaks and the ignition control immediately stops ignition and closes the gas valve. Rollout can be caused by a blocked heat exchanger, flue or lack of combustion air. The switch is factory set to trip (open) at 210°F and cannot be adjusted. The switch can be manually reset. To manually reset a tripped switch, push the reset button located on the control.

Burners

All units use inshot burners. Burners are factory set and require no adjustment. Always operate the unit with the burner box front panel in place. Each burner uses an orifice that is precisely matched to the burner input. Burners can be removed as a one piece assembly for service. If burner assembly has been removed, it is critical to align center of each burner to the center of the clamshell when re-installing. See more detail in Maintenance section.

Primary Limit Control (S10)

The primary limit (S10) is located in the heating vestibule panel. When excess heat is sensed in the heat exchanger, the limit will open. If the limit is open, the furnace control energizes the supply air blower and closes the gas valve. The limit automatically resets when unit temperature returns to normal. The switch must reset within three minutes or the control will go into soft lockout for one hour. The switch is factory set and cannot be adjusted. The switch may have a different set point for each unit model number.

Combustion Air Inducer (B6)

All NF80UV units use a two-stage combustion air inducer to move air through the burners and heat exchanger during heating operation. The blower uses a 120VAC motor. The motor operates during all heating operation and is controlled by integrated control control A92. The inducer also operates for 15 seconds before burner ignition (pre-purge) and for 5 seconds after the gas valve closes (post-purge). The inducer operates on low speed during firststage heat, then switches to high speed for second stage heat.

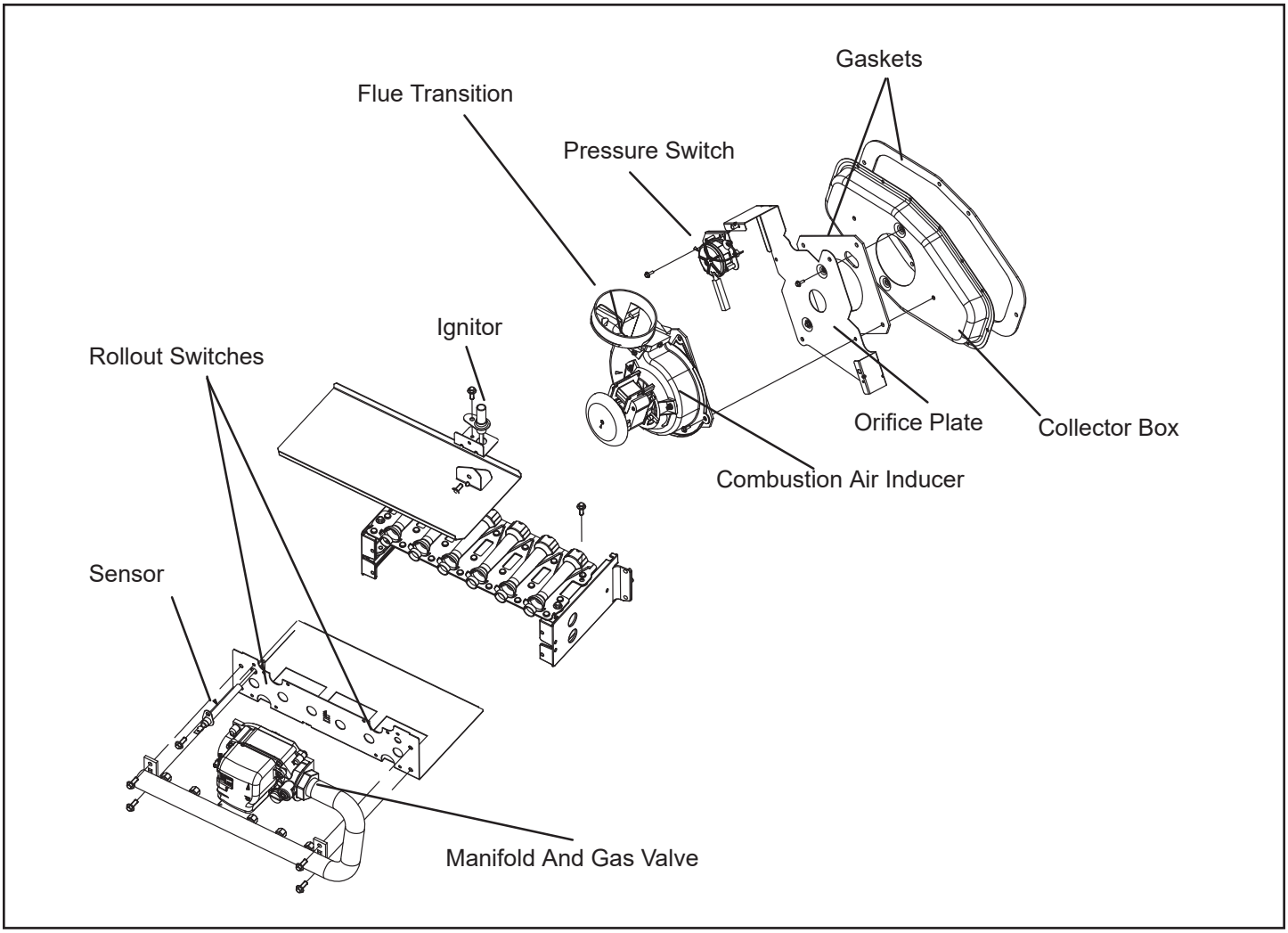


Figure 14. Heating Components

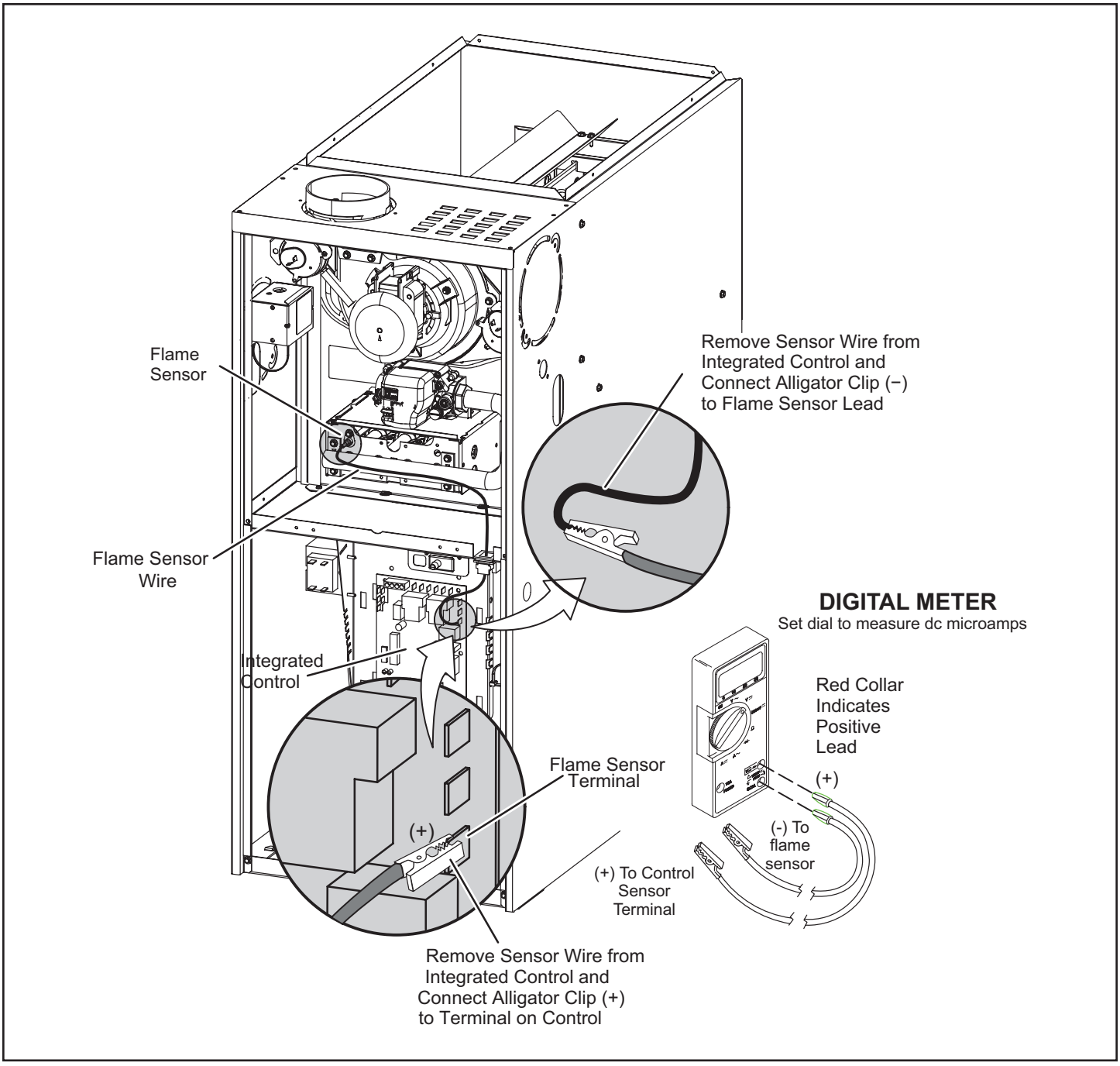
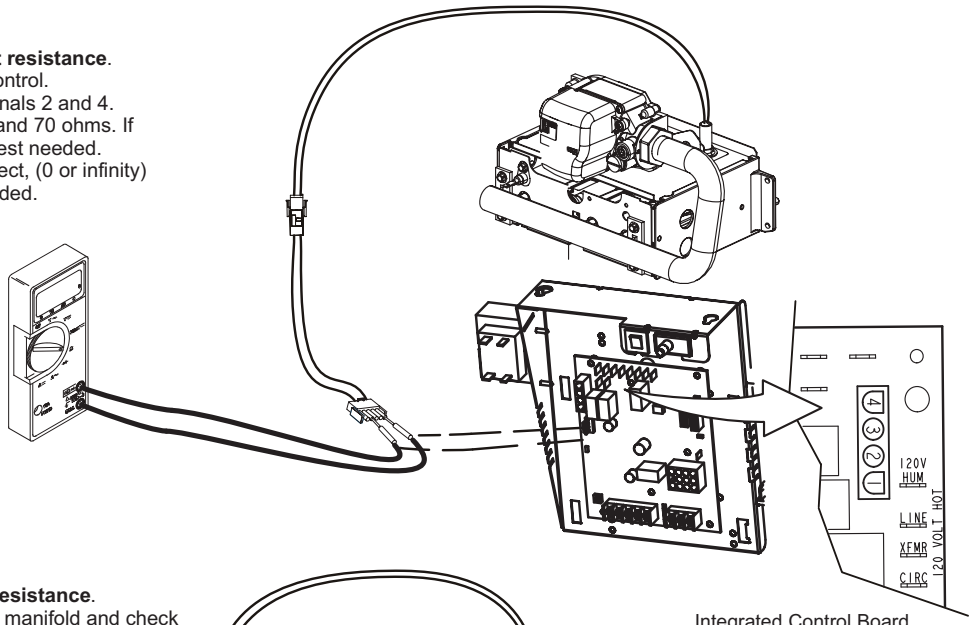


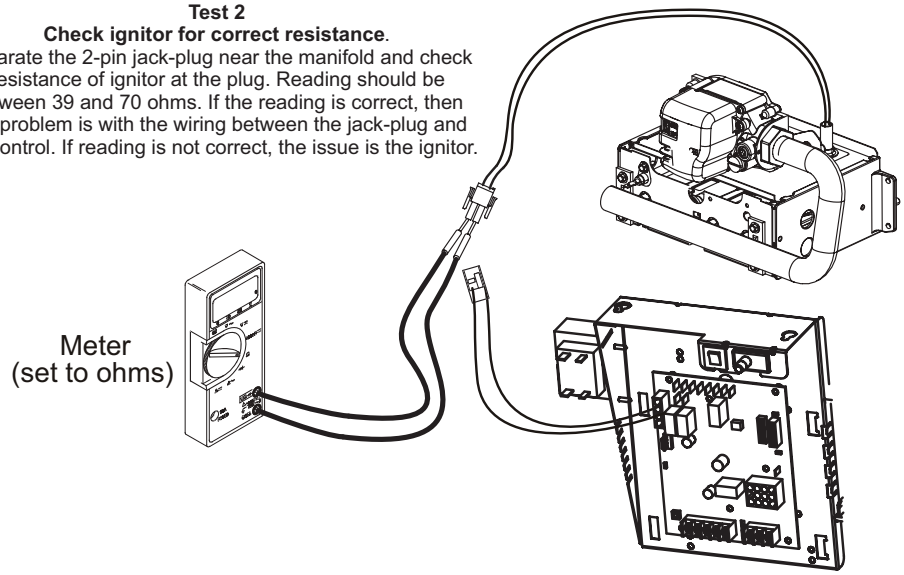
Figure 15. Measuring Flame Signal

Test 1
Check ignitor circuit for correct resistance.
Remove 4-pin plug from control.
Check ohms reading across terminals 2 and 4.
The reading should be between 39 and 70 ohms. If value is correct, this is the only test needed.
If the reading on the meter is not correct, (0 or infinity) then a second test is needed.

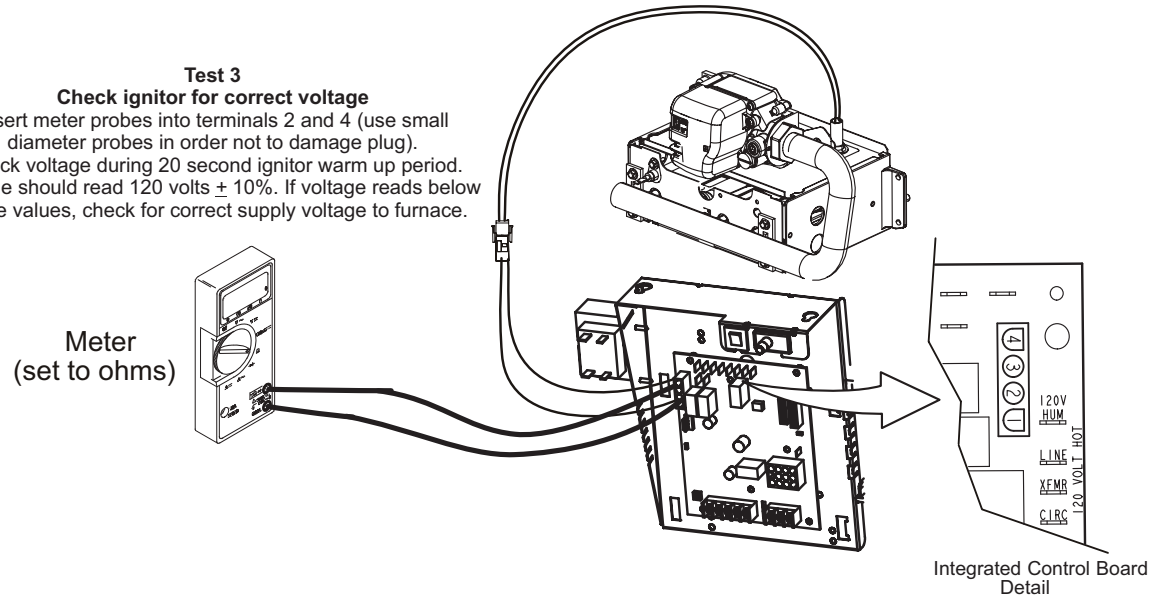


Integrated Control Board Detail

Test 2
Check ignitor for correct resistance.
Separate the 2-pin jack-plug near the manifold and check resistance of ignitor at the plug. Reading should be between 39 and 70 ohms. If the reading is correct, then the problem is with the wiring between the jack-plug and the control. If reading is not correct, the issue is the ignitor.



Test 3
Check ignitor for correct voltage
Insert meter probes into terminals 2 and 4 (use small diameter probes in order not to damage plug).
Check voltage during 20 second ignitor warm up period.
Voltage should read 120 volts ± 10%. If voltage reads below these values, check for correct supply voltage to furnace.



Integrated Control Board Detail

Figure 16. Ignitor Check

Combustion Air Inducer Pressure Switch (S18)

NF80UV series units are equipped with a dual combustion air pressure switch (first and second stage) located on the combustion air inducer orifice bracket. The switch is connected to the combustion air inducer housing by means of a flexible silicone hose. It monitors negative air pressure in the combustion air inducer housing.

The switches are a single-pole single-throw proving switch electrically connected to the integrated control. The purpose of the switch is to prevent burner operation if the combustion air inducer is not operating or if the flue becomes obstructed.

On heat demand (first or second stage) the switch senses that the combustion air inducer is operating. It closes a circuit to the integrated control when pressure inside the combustion air inducer decreases to a certain set point.

Set points vary depending on unit size. See Table 6. The pressure sensed by the switch is negative relative to atmospheric pressure. If the flue becomes obstructed during operation, the switch senses a loss of negative pressure (pressure becomes more equal with atmospheric pressure) and opens the circuit to the furnace control and gas valve.

Unit	Set Point Low Heat	Set Point High Heat
-070	0.25	0.60
-090	0.35	0.68
-110	0.30	0.68

Table 6. Pressure Switch Setting 0 - 4500'

Troubleshooting

See Figure 17 for measuring operating pressure and checking resistance in the pressure switch.

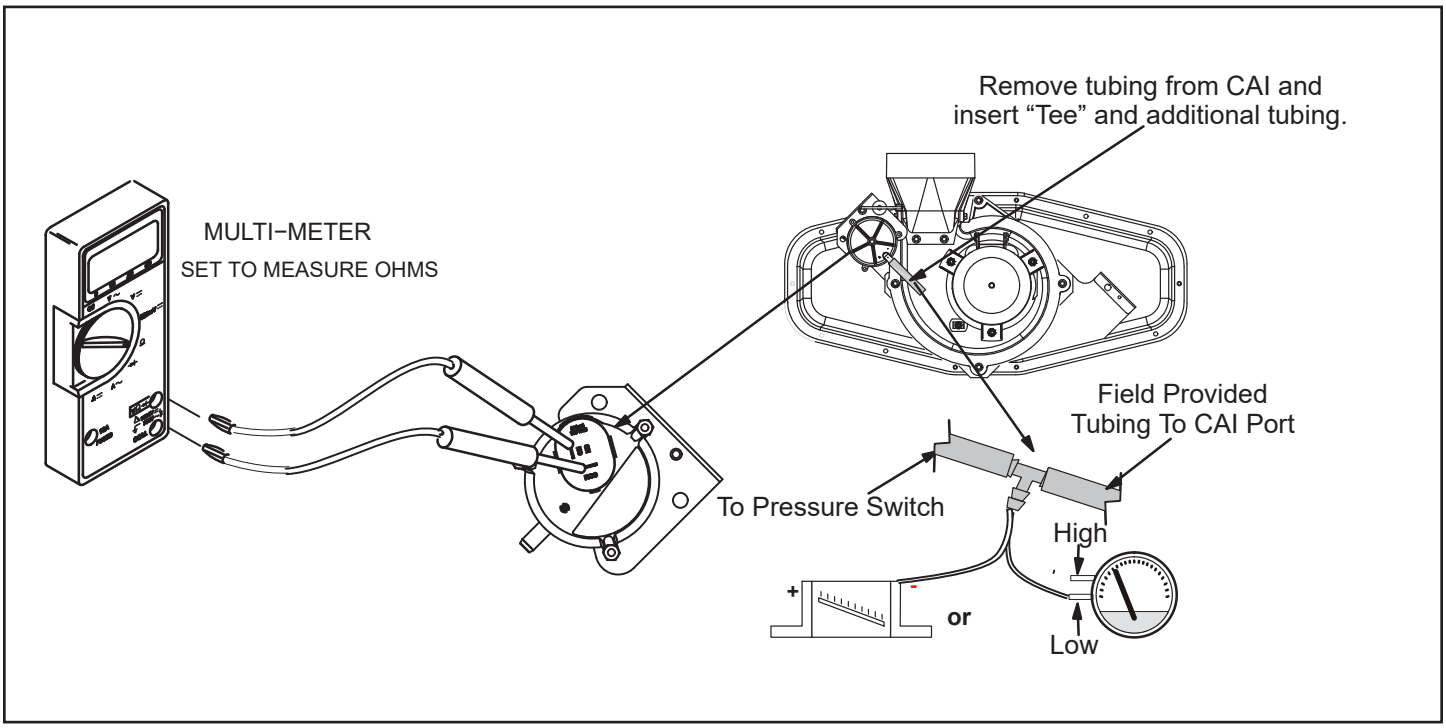


Figure 17.

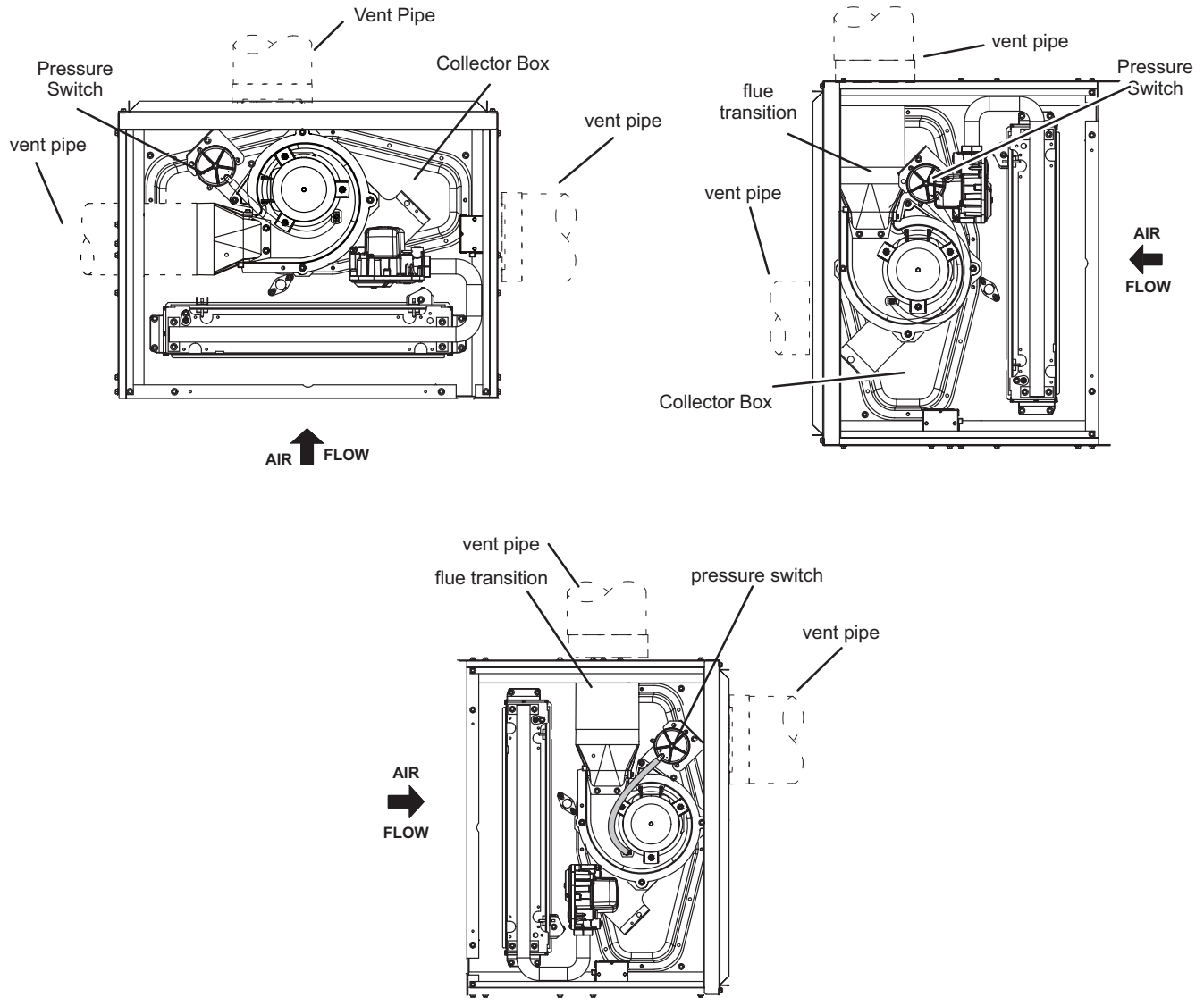
Multiple Venting

The NF80UV furnace can vent in multiple positions. See Figure 18.

The make up box may be removed and the combustion air inducer may be rotated clockwise or counterclockwise 90° to allow for vertical or horizontal vent discharge in a vertical or horizontal cabinet position. Remove the four mounting screws, rotate the assembly (assembly consists of orifice plate, proving switch, gasket and combustion air inducer), then reinstall the mounting screws. See unit Installation Instructions for more detail.

⚠ IMPORTANT

The combustion air pressure switch must be moved for horizontal discharge air left position.



In all positions route the wires away from moving parts and the heat of the inducer motor to prevent damage to the wires. The pressure switch must be installed above the CAI to prevent moisture from collecting in the hoses or switch.

Figure 18.

Placement and Installation

Make sure unit is installed in accordance with installation instructions and applicable codes.

Start-Up

For Your Safety, Read Before Operating

⚠ WARNING

Do not use this furnace if any part has been under water. Immediately call a licensed professional service technician (or equivalent) to inspect the furnace and to replace any part of the control system and any gas control which has been under water.

⚠ WARNING

If overheating occurs or if gas supply fails to shut off, shut off the manual gas valve to the appliance before shutting off electrical supply.

⚠ CAUTION

Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch.

⚠ WARNING

During blower operation, the ECM motor emits energy that may interfere with pacemaker operation. Interference is reduced by both the sheet metal cabinet and distance.

BEFORE LIGHTING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

The gas valve on this unit is equipped with a gas control switch. Use only your hand to move the switch. Never use tools. If the switch will not turn or if the control switch will not move by hand, do not try to repair it.

Placing the Furnace into Operation

These units are equipped with an automatic ignition system. Do not attempt to manually light burners on these furnaces. Each time the thermostat calls for heat, the burners will automatically light. The ignitor does not get hot when there is no call for heat on units with an automatic ignition system.

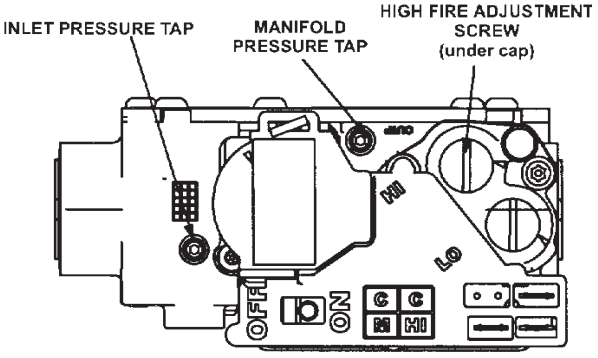
⚠ WARNING

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

Gas Valve Operation

See Figure 19 and Figure 20

1. **STOP**! Read the safety information at the beginning of this section.
2. Set the thermostat to the lowest setting.
3. Turn OFF all electrical power to the unit.
4. This furnace is equipped with an ignition device which automatically lights the burners. Do not try to light the burners by hand.
5. Remove the heating compartment access panel.
6. Move gas valve switch to OFF position. Do not force. See Figure 19 and Figure 20.
7. Wait five (5) minutes to clear out any gas. If you then smell gas, **STOP**! Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions. If you do not smell gas go to next step.



Shown in **ON** position.

Figure 19. White Rodgers Gas Valve

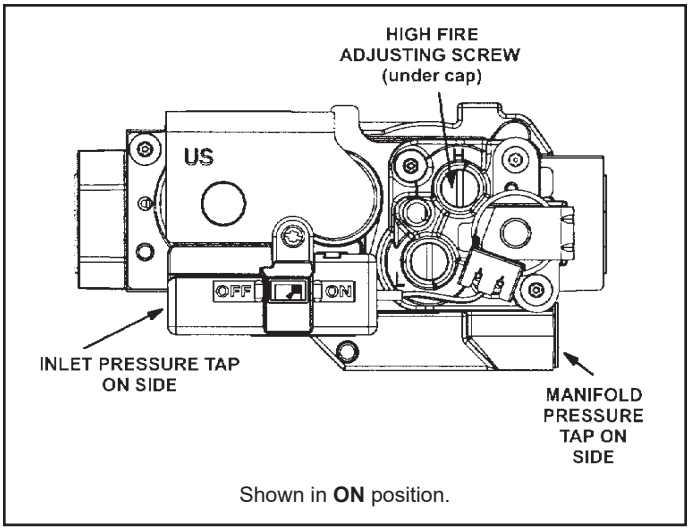


Figure 20. Honeywell Gas Valve

8. Move gas valve switch to ON position. Do not force. See Figure 19 and Figure 20.
9. Replace the heating compartment access panel.
10. Turn ON all electrical power to the unit.
11. Set the thermostat to desired setting.

    NOTE: *When unit is initially started, steps 1 through 11 may need to be repeated to purge air from gas line.*
12. If the appliance will not operate, follow the instructions "Turning Off Gas to Unit" and call your service technician or gas supplier.

Turning Off Gas to Unit

1. Set the thermostat to the lowest setting.
2. Turn off all electrical power to the unit if service is to be performed.
3. Remove the heating compartment access panel.
4. Move gas valve switch to OFF position. Do not force. See Figure 19 and Figure 20.
5. Replace the upper access panel.

Failure to Operate

If the unit fails to operate, check the following:

1. Is the thermostat calling for heat?
2. Are access panels securely in place?
3. Is the main disconnect switch closed?
4. Is there a blown fuse or tripped circuit breaker?
5. Is the filter dirty or plugged? Dirty or plugged filters will cause the limit control to shut the unit off.
6. Is gas turned on at the meter?
7. Is the manual main shut-off valve open?
8. Is the internal manual shut-off valve open?
9. Is the unit ignition system in lock out? If the unit locks out again, call the service technician to inspect the unit for blockages.
10. Is pressure switch closed? Obstructed flue will cause unit to shut off at pressure switch. Check flue and outlet for blockages.
11. Are flame rollout switches tripped? If flame rollout switches are tripped, call the service technician for inspection.

Gas Pressure Adjustment

Furnace should operate at least 5 minutes before checking gas flow. Determine time in seconds for two revolutions of gas through the meter. (Two revolutions assures a more accurate time.) Divide by two and compare to time in Table 7. If manifold pressure matches Table 9 and rate is incorrect, check gas orifices for proper size and restriction. Remove temporary gas meter if installed.

NOTE: *Shut unit off and remove manometer as soon as an accurate reading has been obtained. Take care to replace pressure tap plug.*

Gas Meter Clocking Chart				
Capacity	Seconds for One Revolution			
	Natural		LP	
	1 cu ft Dial	2 cu ft Dial	1 cu ft Dial	2 cu ft Dial
-070	55	110	136	272
-090	41	82	102	204
-110	33	66	82	164
	Natural - 1000 btu/cu ft		LP - 2500 btu/cu ft	

Table 7.

Supply Line Pressure

A threaded plug on the inlet side of the gas valve provides access to the supply pressure tap.

Honeywell Valve

1. Remove the threaded plug.
2. Install a field provided barbed fitting.
3. Connect a manometer.

White Rodgers Valve

1. Loosen threaded plug (removal not required).
2. Connect a manometer.

See Table 9 for supply line pressure. Replace or tighten the threaded plug after measurements have been taken.

Manifold Pressure

NOTE: *A pressure test adapter kit is available to facilitate manifold pressure measurement.*

1. Connect test gauge to manifold pressure tap (Figure 19 and Figure 20) on gas valve.
2. Ignite unit on high fire and let run for 5 minutes to allow for steady state conditions.
3. After allowing unit to stabilize for 5 minutes, record manifold pressure and compare to value given in Table 9.
4. If necessary, make adjustments. Figure 19 and Figure 20 show the location of high fire adjustment screw.
5. If an adjustment is made on high fire, re-check manifold pressure on low fire. Do not adjust low fire manifold pressure. If low fire manifold pressure is more than 1/2" above or below value specified in Table 9, replace valve.

Proper Combustion

Furnace should operate a minimum 15 minutes with correct manifold pressure and gas flow rate before checking combustion. Take combustion sample beyond the flue out let and compare to Table 8. The maximum carbon monoxide reading should not exceed 100 ppm.

Firing Rate	CO2% for Nat	CO2% for L.P.
High Fire	6.8 - 7.4	7.5 - 9.0
Low Fire	4.2 - 5.7	5.0 - 6.0

Table 8.

High Altitude

The manifold pressure, gas orifice and pressure switch may require adjustment or replacement to ensure proper operation at higher altitudes. See Table 9 for manifold pressures and Table 10 for pressure switch and gas conversion kits.

Capacity	Gas	Orifice Size 0 - 7500 ft.[1]	Orifice Size 7501 - 10000 ft.	Manifold Pressure in. w.g. 0 - 4500 ft.		Manifold Pressure in. w.g. 4501 - 7500 ft.		Manifold Pressure in. w.g. 7501 - 10000 ft.[2]		Supply Line Pressure in. w.g.	
				Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire	Min	Max
070	Natural	.063	.055	1.7	3.5	1.6	3.4	1.7	3.5	4.5	13.0
	LP / propane[3]	.034	.032	4.5	10.0	4.5	10.0	4.5	10.0	11.0	13.0
090	Natural	.063	.055	1.7	3.5	1.5	3.2	1.7	3.5	4.5	13.0
	LP / propane[3]	.034	.032	4.5	10.0	4.5	10.0	4.5	10.0	11.0	13.0
110	Natural	.063	.055	1.7	3.5	1.5	3.2	1.7	3.5	4.5	13.0
	LP / propane[3]	.034	.032	4.5	10.0	4.5	10.0	4.5	10.0	11.0	13.0

[1] This is the only permissible derate for these units.

[2] Natural gas high altitude orifice kit required.

[3] A natural to L.P./propane gas changeover kit is necessary to convert this unit. Refer to the changeover kit installation instruction for the conversion procedure.

NOTE: Units may be installed at altitudes up to 4500 ft. above sea level without modifications.

Table 9. Manifold and Supply Line Pressure 0 - 10,000 ft.

		Natural Gas High Altitude Conversion Kit			Pressure Switch			LP High Alt. Conversion Kit		
MODEL NUMBER	Description	0-4500	4500-7500	7500-10,000	0-4500	4500-7500	7500-10,000	0-4500	4500-7500	7500-10,000
070	80% Upflow 2-Stage Variable Speed	Not Required		51W01	Not Required	NR	73W35	11K48		11K47
090						69W56				
110										

Table 10. High Altitude Pressure Switch and Gas Conversion Kits

Proper Ground and Voltage

A poorly grounded furnace can contribute to premature ignitor failure. Use the following procedure to check for ground and voltage to the integrated control.

1. Measure the AC voltage between Line Neutral (spade terminals) and “C” terminal (low voltage terminal block) on the integrated control. See Figure 21. A wide variation in the voltage between Line Neutral and “C” as a function of load indicates a poor or partial ground. Compare the readings to Table 11. If the readings exceed the maximum shown in Table 11, make repairs before operating the furnace.
2. In addition, measure the AC voltage from Line Hot to Line Neutral (spade terminals) on the integrated control. See Figure 22. This voltage should be in the range of 97 to 132 VAC

Furnace Status	Measurement VAC	
	Expected	Maximum
Power On Furnace Idle	0.3	2
CAI / Ignitor Energized	0.75	5
Indoor Blower Energized	Less than 2	10

Table 11.

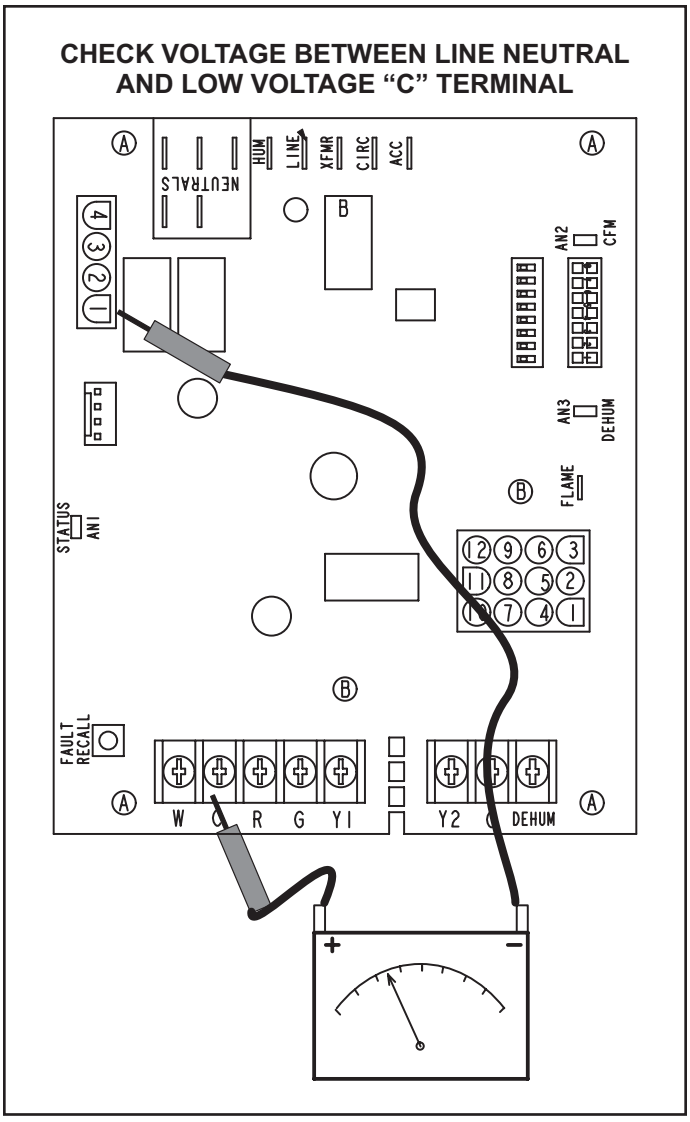


Figure 21.

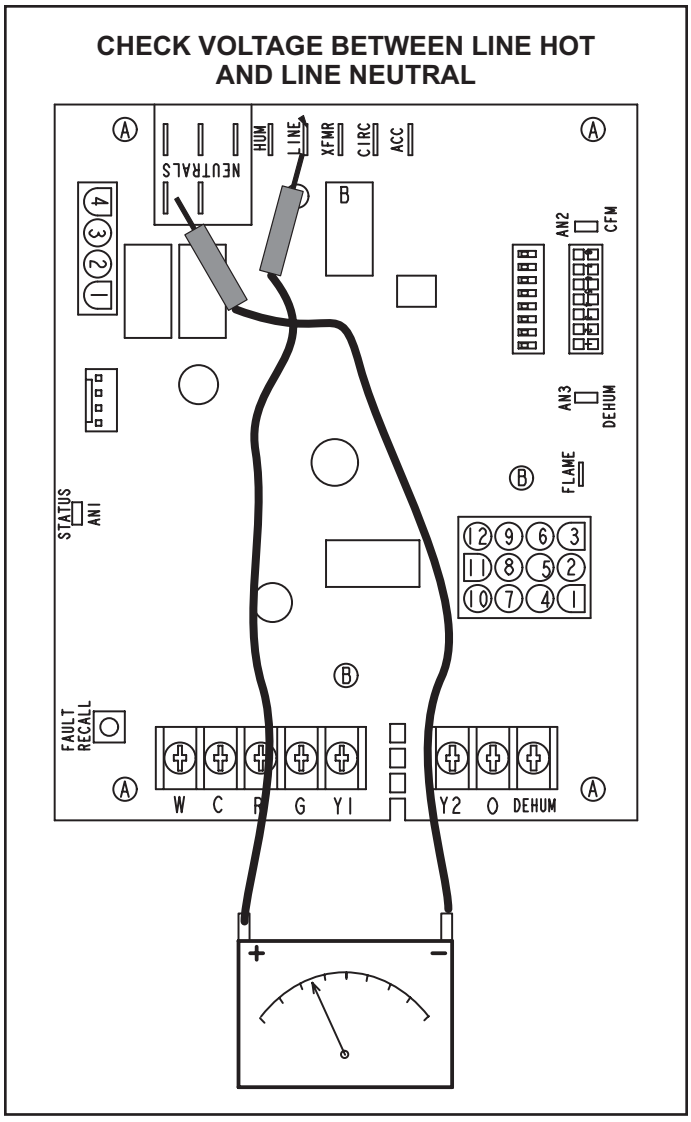


Figure 22.

Typical Operating Characteristics

Blower Operation and Adjustment

NOTE: *The following is a generalized procedure and does not apply to all thermostat controls.*

1. Blower operation is dependent on thermostat control system.
2. Generally, blower operation is set at thermostat subbase fan switch. With fan switch in ON position, blower operates continuously. With fan switch in AUTO position, blower cycles with demand or runs continuously while heating or cooling circuit cycles.
3. Depending on the type of indoor thermostat, blower and entire unit will be off when the system switch is in OFF position.

Temperature Rise

Temperature rise for NF80UV 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 “TEMP. RISE °F” listed on the unit rating plate.

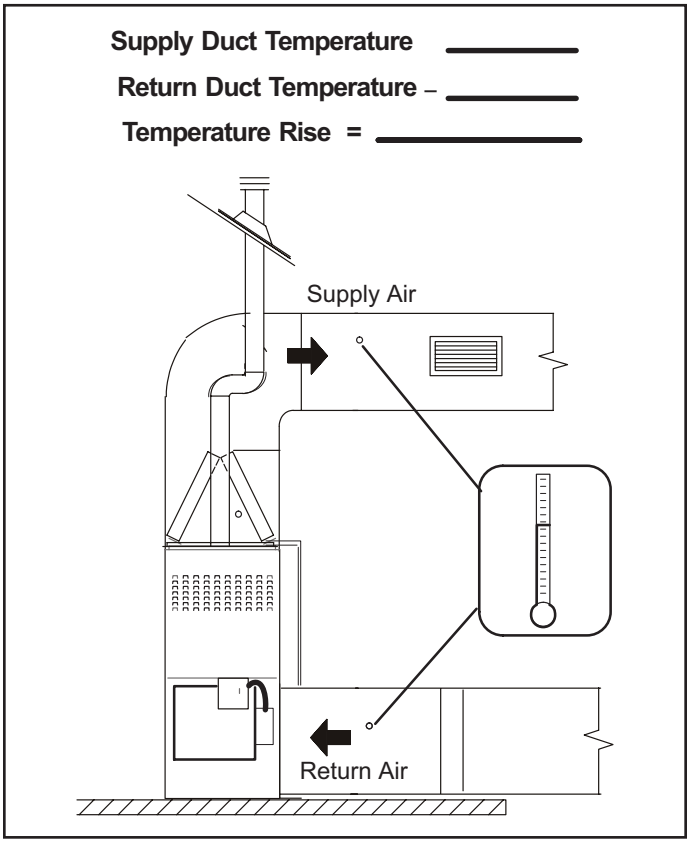


Figure 23. Temperature Rise

External Static Pressure

1. Tap locations shown in Figure 24.
2. Punch a 1/4” diameter hole in supply and return air plenums. 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 manometer to the return duct as above.
3. With only the blower motor running and the evaporator coil dry, observe the manometer reading. Adjust blower motor speed to deliver the air desired according to the job requirements. For heating speed external static pressure drop must not be more than 0.5” W.C. For cooling speed external static pressure drop must not be more than 0.8” W.C.
4. Seal the hole when the check is complete.

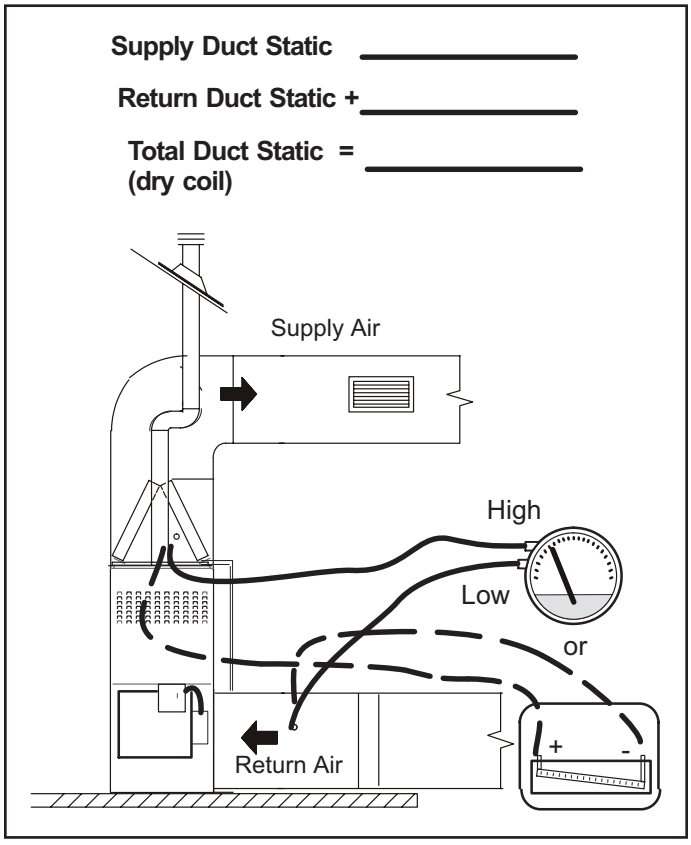


Figure 24. External Static Pressure

Maintenance

At the beginning of each heating season, system should be checked as follows by a qualified service technician:

⚠ IMPORTANT

If a high-efficiency filter is being installed as part of this system to ensure better indoor air quality, the filter must be properly sized. High-efficiency filters have a higher static pressure drop than standard-efficiency glass/foam filters. If the pressure drop is too great, system capacity and performance may be reduced. The pressure drop may also cause the limit to trip more frequently during the winter and the indoor coil to freeze in the summer, resulting in an increase in the number of service calls.

Before using any filter with this system, check the specifications provided by the filter manufacturer against the data given in the appropriate Product Specifications.

⚠ WARNING

Fire Hazard. Use of aluminum wire with this product may result in a fire, causing property damage, severe injury or death. Use copper wire only with this product.

⚠ WARNING

Failure to use properly sized wiring and circuit breaker may result in property damage. Size wiring and circuit breaker(s) per Technical Specifications and unit rating plate.

1. Check wiring for loose connections, voltage at indoor unit and amperage of indoor motor.
2. Check the condition of the belt and shaft bearings if applicable.
3. Inspect all gas pipe and connections for leaks.
4. Check the cleanliness of filters and change if necessary (monthly).

Furnace Cabinet Width	Filter Size	
	Side Return	Bottom Return
14-1/2”	16 x 25 x 1 (1)	14 x 25 x 1 (1)
17-1/2”		16 x 25 x 1 (1)
21”		20 x 25 x 1 (1)

Table 12.

5. Check the condition and cleanliness of burners and heat exchanger and clean if necessary.
6. Check the cleanliness of blower assembly and clean the housing, blower wheel and blower motor if necessary. The blower motors are prelubricated for extended bearing life. No further lubrication is needed.
7. Inspect the combustion air inducer and clean if necessary.
8. Evaluate the heat exchanger integrity by inspecting the heat exchanger per the AHRI heat exchanger inspection procedure. This procedure can be viewed at www.ahrinet.org.
9. Ensure sufficient combustion air is available to the furnace. Fresh air grilles and louvers (on the unit and in the room where the furnace is installed) must be properly sized, open and unobstructed to provide combustion air.
10. Inspect the furnace venting system to make sure it is in place, structurally sound, and without holes, corrosion, or blockage. Vent system must be free and clear of obstructions and must slope upward away from the furnace. Vent system should be installed per the National Fuel Gas Code.
11. Inspect the furnace return air duct connection to ensure the duct is sealed to the furnace. Check for air leaks on supply and return ducts and seal where necessary.
12. Check the condition of the furnace cabinet insulation and repair if necessary.
13. Perform a complete combustion analysis during the furnace inspection to ensure proper combustion and operation. Consult Service Literature for proper combustion values.
14. Verify operation of CO detectors and replace batteries as required.

Perform a general system test. Turn on the furnace to check operating functions such as the start-up and shut-off operation.

1. Check the operation of the ignition system, inspect and clean flame sensor. Check microamps before and after. Check controls and safety devices (gas valve, flame sensor, temperature limits). Consult Service Manual for proper operating range. Thermal Limits should be checked by restricting airflow and not disconnecting the indoor blower.
2. Verify that system total static pressure and airflow settings are within specific operating parameters.
3. Clock gas meter to ensure that the unit is operating at the specified firing rate. Check the supply pressure and the manifold pressure. On two-stage gas furnaces check the manifold pressure on high fire and low fire. If manifold pressure adjustment is necessary, consult the Service Literature for unit specific information on adjusting gas pressure. Not all gas valves are adjustable. Verify correct temperature rise.

Cleaning the Heat Exchanger and Burners

NOTE: *Use papers or protective covering in front of the furnace during cleaning.*

1. Turn off both electrical and gas power supplies to furnace.
2. Remove flue pipe and top cap (some applications top cap can remain) from the unit.
3. Label the wires from gas valve, rollout switches, primary limit switch and make-up box then disconnect them.
4. Remove the screws that secure the combustion air inducer/pressure switch assembly to the collector box. Carefully remove the combustion air inducer to avoid damaging blower gasket. If gasket is damaged, it must be replaced to prevent leakage.
5. Remove the collector box located behind the combustion air inducer. Be careful with the collector box gasket. If the gasket is damaged, it must be replaced to prevent leakage.
6. Disconnect gas supply piping. Remove the four screws securing the burner manifold assembly to the vestibule panel and remove the assembly from the unit.
7. Remove screws from both sides, top and bottom of vestibule panel.
8. Remove heat exchanger. It may be necessary to spread cabinet side to allow more room. If so, remove five screws from the left side or right side of cabinet. See Figure 25.
9. Backwash using steam. Begin from the burner opening on each clam. Steam must not exceed 275°F.
10. To clean burners, run a vacuum cleaner with a soft brush attachment over the face of burners. Visually inspect inside the burners and crossovers for any blockage caused by foreign matter. Remove any blockage. Figure 26 shows burner detail.
11. To clean the combustion air inducer visually inspect and using a wire brush clean where necessary. Use compressed air to clean off debris and any rust.
12. Reinstall heat exchanger in vestibule. (Replace the five screws in the cabinet from step 10 if removed).
13. Reinstall collector box and combustion air assembly. Reinstall all screws to the collector box and combustion air inducer. Failure to replace all screws may cause leaks. Inspect gaskets for any damage and replace if necessary.
14. Reinstall burner box and manifold assembly.
15. Reconnect all wires.
16. Reconnect top cap and vent pipe to combustion air inducer outlet.
17. Reconnect gas supply piping.
18. Turn on power and gas supply to unit.
19. Set thermostat and check for proper operation.
20. Check all piping connections, factory and field, for gas leaks. Use a leak detecting solution or other preferred means.

⚠ CAUTION

Some soaps used for leak detection are corrosive to certain metals. Carefully rinse piping thoroughly after leak test has been completed. Do not use matches, candles, flame or other sources of ignition to check for gas leaks.

21. If a leak is detected, shut gas and electricity off and repair leak.
22. Repeat steps 20 and 21 until no leaks are detected.
23. Replace access panel.

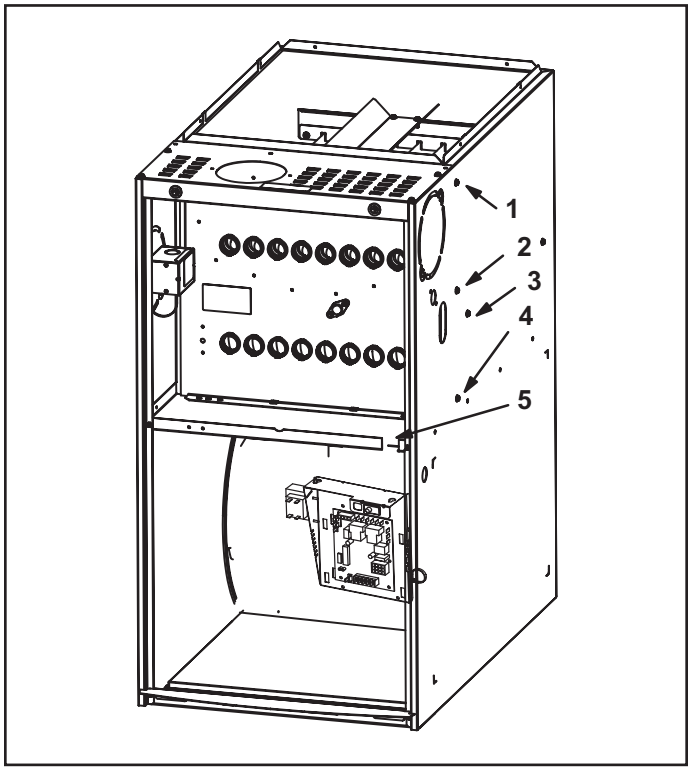


Figure 25. Remove 5 screws if necessary (either side of cabinet)

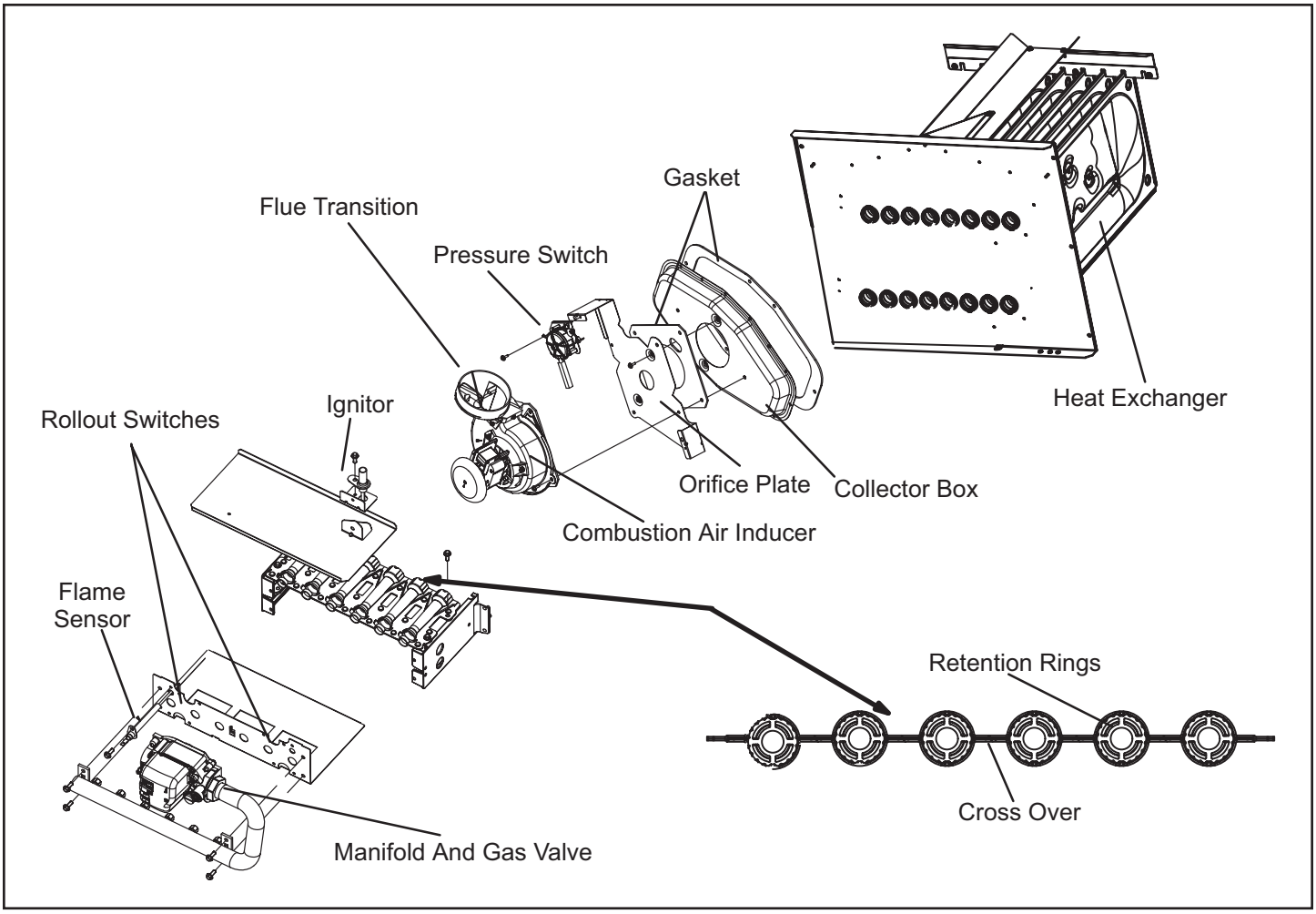
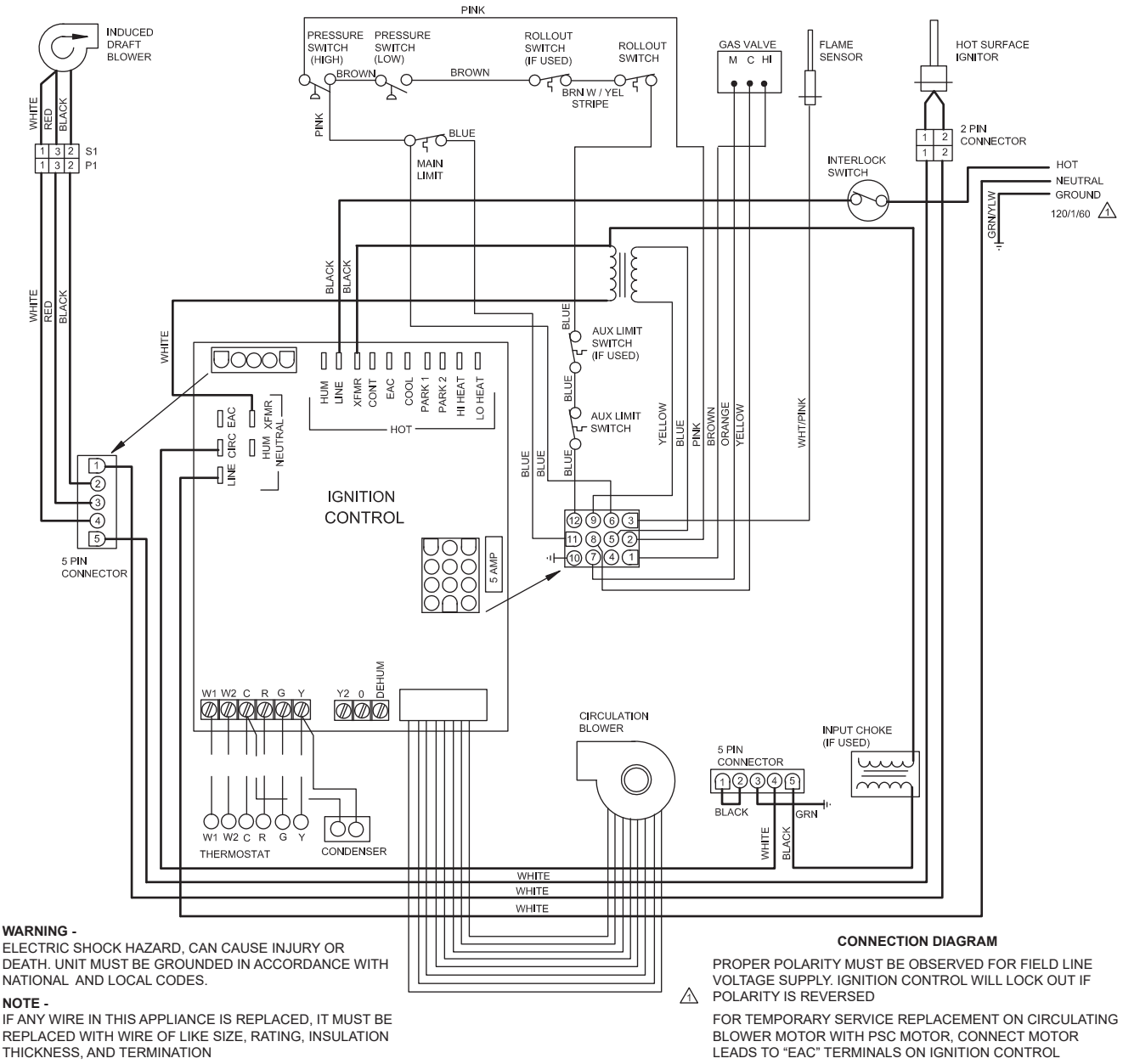


Figure 26. Burner, Combustion Air Inducer Assembly, and Heat Exchanger Removal



WARNING -
ELECTRIC SHOCK HAZARD, CAN CAUSE INJURY OR DEATH. UNIT MUST BE GROUNDED IN ACCORDANCE WITH NATIONAL AND LOCAL CODES.

NOTE -
IF ANY WIRE IN THIS APPLIANCE IS REPLACED, IT MUST BE REPLACED WITH WIRE OF LIKE SIZE, RATING, INSULATION THICKNESS, AND TERMINATION

CONNECTION DIAGRAM

PROPER POLARITY MUST BE OBSERVED FOR FIELD LINE VOLTAGE SUPPLY. IGNITION CONTROL WILL LOCK OUT IF POLARITY IS REVERSED

FOR TEMPORARY SERVICE REPLACEMENT ON CIRCULATING BLOWER MOTOR WITH PSC MOTOR, CONNECT MOTOR LEADS TO “EAC” TERMINALS ON IGNITION CONTROL

NOTES:

1. PRESS AND RELEASE FAULT CODE HISTORY BUTTON TO DISPLAY FAULT CODES. TO ERASE CODES, PRESS AND HOLD BUTTON IN FOR MORE THAN 5 SECONDS.
2. IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE FURNACE MUST BE REPLACED WITH WIRING MATERIAL HAVING A TEMP. RATING OF AT LEAST 90°C.
3. PROPER POLARITY MUST BE OBSERVED FOR FIELD LINK VOLTAGE SUPPLY; IGNITION CONTROL WILL LOCK OUT IF POLARITY IS REVERSED.
4. FOR TEMPORARY SERVICE REPLACEMENT OF CIRCULATING BLOWER MOTOR WITH PSC MOTOR, CONNECT DESIRED SPEED TAP TO “EAC” TERMINAL AND NEUTRAL TAP TO NEUTRAL TERMINAL ON IGNITION CONTROL.
5. DO NOT CONNECT C (COMMON) CONNECTION BETWEEN INDOOR UNIT AND THERMOSTAT EXCEPT WHEN REQUIRED BY THE INDOOR THERMOSTAT. REFER TO THE THERMOSTAT INSTALLATION INSTRUCTIONS.
6. CHECK CODES FOR PROPER WIRING AND CIRCUIT PROTECTION BEFORE INSTALLATION.

Figure 27. Typical Field Wiring Diagram

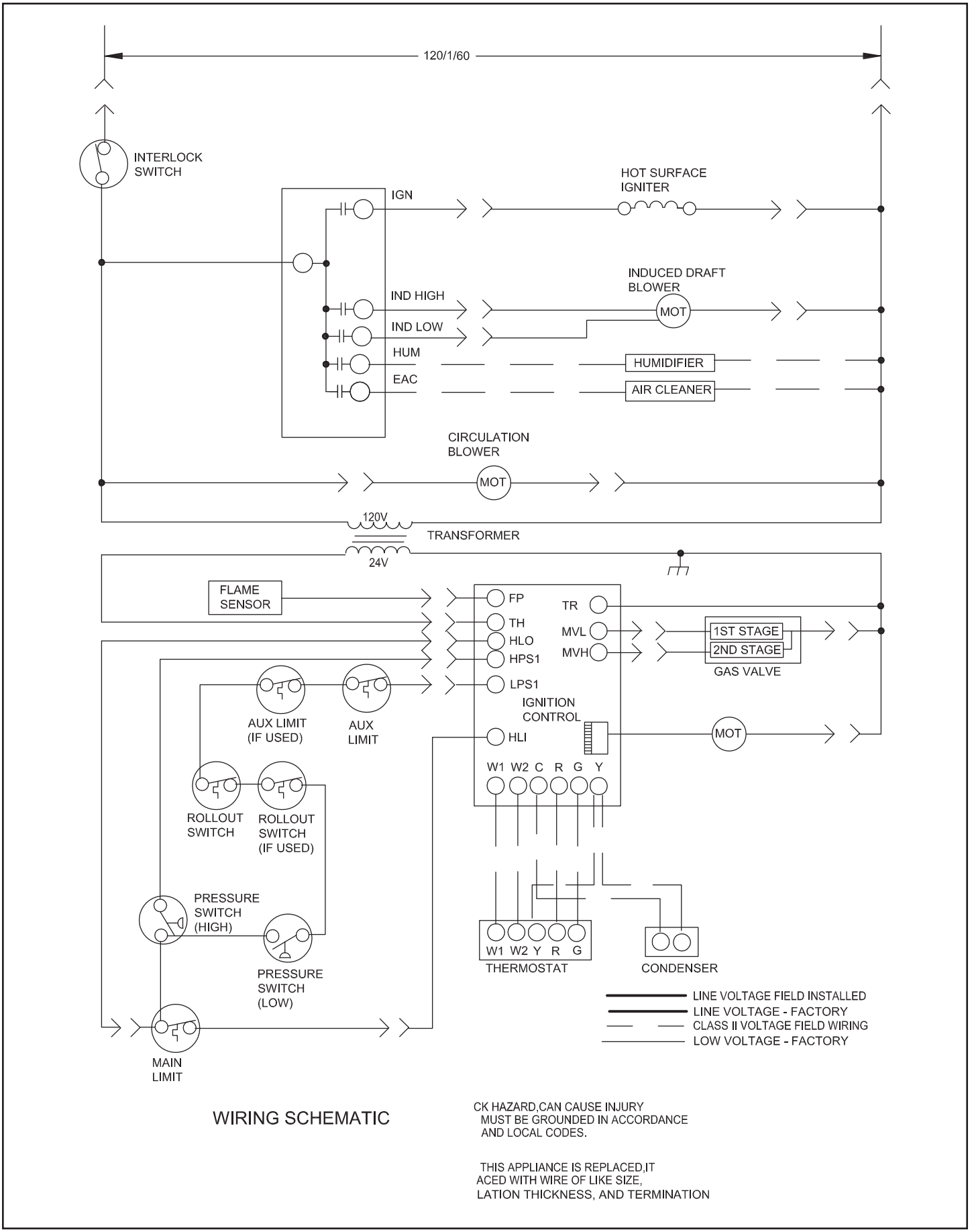


Figure 28. Wiring Schematic

Sequence of Operation

On a call for heat from the room thermostat, the control board performs a 1 second self check. Upon confirmation that the pressure switch contacts are in an open position, the control energizes the combustion blower on high speed. The control then checks for adequate combustion air by making sure the low-fire pressure switch contacts are closed.

The igniter energizes and is allowed to warm up for 20 seconds before the gas valve energizes on 1st stage and burners ignite. 45 seconds after the control confirms ignition has occurred, the control drops the combustion blower to low speed.

The circulating blower ramps up to 50% of 1st stage heat speed and operates at that speed for one minute (including ramp up time), then at 75% of 1st stage heat speed for an additional minute. After that, the circulating blower operates at full 1st stage heat speed until either the heat call is satisfied or the thermostat initiates a call for 2nd stage heat. On a call for 2nd stage heat, the control energizes the circulating air blower on full CFM 2nd stage heat.

If the automatic heat staging option is being used the furnace does not switch to 2nd stage heat in response to a call from the thermostat but instead operates at 1st stage heat for the duration of the selected time before automatically switching to 2nd stage heat.

When the call for heat is satisfied, the gas valve and combustion air blower shut down. The control board shuts off the gas valve and runs the combustion blower for an additional 15 seconds. The circulating air blower continues to run for 2 minutes at 82% of the selected heating speed (low fire or high fire) before ramping down.

In the event the unit loses ignition, the control will attempt to recycle up to five times before it goes into a 1 hour lockout. Lockout may be manually reset by removing power from the control for more than 1 second or removing the thermostat call for heat for more than 3 seconds.

If during a heating cycle the limit control senses an abnormally high temperature and opens, the control board deenergizes the gas valve and the combustion blower while the circulating blower ramps up to 2nd stage heat speed. The circulating blower remains energized until the limits are closed.

Fan On

When the thermostat is set for continuous fan operation and there is no demand for heating or cooling, a call for fan closes the R to G circuit and the circulating blower motor runs at 50% of the selected cooling CFM until switched off. When the call for fan is turned off, the control de-energizes the circulating blower.

Cooling

The unit is set up at the factory for single stage cooling. For two stage cooling operation, clip the jumper wire located between the Y to Y2 terminals on the integrated ignition/blower control board. If the active dehumidification feature is enabled, the circulating blower runs at 70% of the selected cooling speed as long as there is a call for dehumidification.

⚠ WARNING

The system must not be in either the passive or active dehumidification mode when charging a cooling system.

Single Stage Cooling

A call for cooling from the thermostat closes the R to Y circuit on the integrated ignition/blower control board. The control waits for a 1-second delay before energizing the circulating blower to 82% of the selected cooling CFM (passive dehumidification mode). After 7.5 minutes, the circulating blower automatically ramps up to 100% of the selected cooling airflow. When the call for cooling is satisfied, the circulating blower ramps back down to 82% of the selected cooling airflow for 1 minute, then shuts off.

Two-Stage Cooling

A call for 1st stage cooling from the thermostat closes the R to Y circuit on the control board. The control waits for a 1-second delay before energizing the circulating blower. The blower motor runs at 57% of the selected air flow for the first 7.5 minutes of the 1st stage cooling demand (passive dehumidification mode). After 7.5 minutes, the blower motor runs at 70% of the selected cooling air flow until 1st stage cooling demand is satisfied.

A call for 2nd stage cooling from the thermostat closes the R to Y2 circuit on the control board. The blower motor ramps up to 100% of the selected cooling air flow. When the demand for cooling is met, the blower ramps down to Y1 until satisfied, then ramps down to 57% for 1 minute, then turns off.

Heat Pump

For heat pump operation, clip the jumper wire located bellow the O terminal on the integrated ignition/blower control board. In heat pump mode, a call for heat will result in the circulating air blower operating at the selected cooling airflow after a brief ramp-up period.

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