SERVICE AND TECHNICAL SUPPORT MANUAL

Variable Speed Motor, Two−Stage
35” Tall, High Efficiency Condensing Gas Furnace
(F/G)9MVE

Save this manual for future reference.

Safety Labeling and Signal Words

DANGER, WARNING, CAUTION, and NOTE
The signal words **DANGER, WARNING**, **CAUTION**, and **NOTE** are used to identify levels of hazard seriousness. The signal word **DANGER** is only used on product labels to signify an immediate hazard. The signal words **WARNING**, **CAUTION**, and **NOTE** will be used on product labels and throughout this manual and other manual that may apply to the product.

DANGER − Immediate hazards which will result in severe personal injury or death.

WARNING − Hazards or unsafe practices which could result in severe personal injury or death.

CAUTION − Hazards or unsafe practices which may result in minor personal injury or product or property damage.

NOTE − Used to highlight suggestions which will result in enhanced installation, reliability, or operation.

Signal Words in Manuals

The signal word **WARNING** is used throughout this manual in the following manner:

⚠ WARNING

The signal word **CAUTION** is used throughout this manual in the following manner:

⚠ CAUTION

Signal Words on Product Labeling

Signal words are used in combination with colors and/or pictures or product labels.

⚠ Safety−alert symbol

When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

TABLE OF CONTENTS

MODELS

(F/G)9MVE0401410A
(F/G)9MVE0401712A
(F/G)9MVE0601412A
(F/G)9MVE0601714A
(F/G)9MVE0801716A
(F/G)9MVE0802120A
(F/G)9MVE1002120A
(F/G)9MVE1202422A

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440 04 4801 04 9/15/2018

SAFETY CONSIDERATIONS

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause death, personal injury, or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory–authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses, protective clothing, and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes, the current editions of the National Fuel Gas Code (NFCG) NFPA 54/ANSI Z223.1, and the National Electrical Code (NEC) NFPA 70.

In Canada refer to the current editions of the National standards of Canada CAN/CSA–B149.1 and .2 Natural Gas and Propane Installation Codes, and Canadian Electrical Code CSA C22.1.

Recognize safety information. This is the safety–alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury. Understand these signal words; DANGER, WARNING, and CAUTION. These words are used with the safety–alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

⚠ WARNING

FIRE, EXPLOSION, ELECTRICAL SHOCK, AND CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in dangerous operation, personal injury, death, or property damage.

Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, explosion, fire, electrical shock, or other conditions which may cause personal injury or property damage. Consult a qualified service agency, local gas supplier, or your distributor or branch for information or assistance. The qualified service agency must use only factory–authorized and listed kits or accessories when modifying this product.

⚠ WARNING

FIRE, EXPLOSION, ELECTRICAL SHOCK, AND CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in dangerous operation, personal injury, death, or property damage.

Furnaces shall NOT be twinned (i.e. tandem or staged operation) unless approved in factory technical specifications literature for the furnace. A factory authorized, field–supplied Twinning Kit MUST be used. Consult furnace pre–sale literature for specific models approved for twinning and the correct twinning kit. Twinned furnaces must be installed on both a common supply AND a common return duct system as shown in the Twinning Kit Installation Instructions. Only two furnaces can be twinned on a common supply and return duct system using a factory authorized twinning kit.

⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in personal injury, death, or property damage.

Solvents, cements and primers are combustible. Keep away from heat, sparks and open flame. Use only in well–ventilated areas. Avoid breathing in vapor or allowing contact with skin or eyes.

⚠ CAUTION

FURNACE RELIABILITY HAZARD

Failure to follow this caution may result in unit component damage.

Application of this furnace should be indoors with special attention given to vent sizing and material, gas input rate, air temperature rise, unit leveling, and unit sizing.

START–UP CHECK SHEET
For Variable Speed Models (F/G)9MVE

(This sheet is optional. Keep for future reference.)

Date of Start–Up:_____

Dealer Name:_____

Address:_____

City, State(Province), Zip or Postal Code:_____

_____

Phone:_____

Owner Name:_____

Address:_____

City, State(Province), Zip or Postal Code:_____

_____

Model Number:_____

Serial Number:_____

Setup Checks

Check the box when task is complete.

All Electrical Connections Tight? ☐

Have hoses been relocated for furnace U/D/H application? ☐

Condensate Drain Connected? ☐

Condensate Drain Trapped? ☐

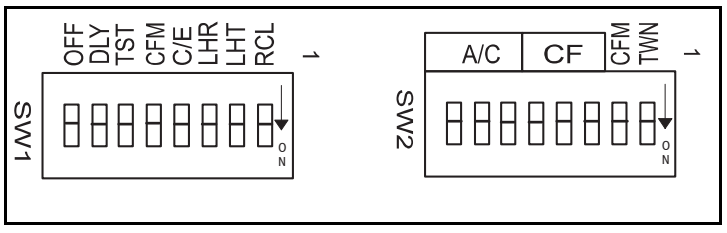
Manual Gas Shut–off Upstream of Furnace/Drip Leg ☐

Gas Valve turned ON? ☐

Type of Gas: Natural: ☐ Propane: ☐

Filter Type and Size:_____

Shade in Final Furnace Settings Below:



Calculated Input (BTU) Rate: (See *Checks and Adjustments* Section).

Heating Check

Measured Line Pressure During High Heat: _____

Measured Manifold Pressure: High Heat_____

Low Heat _____

Temperature of Supply Air: High Heat _____

Low Heat _____

Temperature of Return Air: _____

Temperature Rise (Supply – Return): High Heat _____

Low Heat _____

In Rise Range (see furnace rating plate)? ☐

Static Pressure (Ducts) High Heat: Supply _____

Return _____

Optional Check: CO? _____

CO2? _____

Cooling Check

Temperature of Supply Air: _____

Temperature of Return Air: _____

Temperature Difference: _____

Static Pressure (Ducts) Cooling: Supply _____

Return _____

Dealer Comments:_____

_____

_____

_____

_____

_____

_____

_____

START–UP, ADJUSTMENT, AND SAFETY CHECK

NOTICE

IMPORTANT INSTALLATION AND START–UP PROCEDURES

Failure to follow this procedure may result in a nuisance smoke or odor complaint.

The manifold pressure, gas rate by meter clocking, temperature rise and operation must be checked after installation. Minor smoke and odor may be present temporarily after start–up from the manufacturing process. Some occupants are more sensitive to this minor smoke and odor. It is recommended that doors and windows be open during the first heat cycle.

General

1. Furnace must have a 115-v power supply properly connected and grounded.

NOTE: Proper polarity must be maintained for 115-v wiring. Control status indicator light flashes code 10 and furnace does not operate if polarity is incorrect or if the furnace is not grounded.

2. Thermostat wire connections at terminals R, W/W1, G, and Y/Y2 must be made at 24-v terminal block on furnace control.
3. Natural gas service pressure must not exceed 0.5 psig (14- in. w.c., 350 Pa), but must be no less than 0.16 psig (4.5-in. w.c., 1125 Pa).
4. Blower door must be in place to complete 115-v electrical circuit and supply power to furnace components.

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in intermittent unit operation or performance satisfaction.

These furnaces are equipped with a manual reset limit switch in burner assembly. This switch opens and shuts off power to the gas valve if an overheat condition (flame rollout) occurs in burner assembly. Correct inadequate combustion–air supply or improper venting condition before resetting switch. DO NOT jumper this switch.

Before operating furnace, check flame rollout manual reset switch for continuity. If necessary, press button to reset switch.

EAC-1 terminal is energized whenever blower operates. HUM terminal is only energized when blower is energized in heating.

Setup Switches

There are four sets of setup switches on the furnace control board. These switches configure the furnace for correct application requirement. They also select the airflow settings for Air Conditioning and Continuous Fan CFM.

The Setup Switch locations are shown and described on **Figure 4**, **Figure 5** and **Table 5**. The setup switches are also shown on the unit wiring label.

Setup Switches (SW1)

The furnace control has 8 setup switches that may be set to meet the application requirements. To set these setup switches for the appropriate requirement:

1. Remove blower door.
2. Locate setup switches on furnace control.
3. Configure the set-up switches as necessary for the application.
4. Replace blower door.

NOTE: If a bypass humidifier is used, setup switch SW1-3 (Low Heat Rise Adjust) should be in ON position. This compensates for the increased temperature in return air resulting from bypass.

Setup Switch (SW2)

Setup switches SW2 are used for applications used for Twinning two furnaces of the same model and BTU's and to adjust airflow. SW2–2 is used to adjust airflow. Refer to the Adjustments section for set up switch configurations. Refer to **Figure 5** for configuration of SW2 airflow options.

1. Remove blower door.
2. Locate setup switch SW2 on furnace control.
3. Configure the switches as necessary for the application.
4. Replace blower door.

Continuous Fan (CF) Setup Switches (SW2–5, SW2–4, SW2–3)

The CF setup switches are used to select desired airflow when thermostat is in continuous fan mode or to select low-cooling airflow for two-speed cooling units. Refer to the Adjustments section for set up switch configurations.

To set the desired cooling airflow:

1. Remove blower door.
2. Locate CF setup switches on furnace control.
3. Determine air conditioning tonnage used for low cooling (when used) or desired continuous fan airflow.
4. Configure the switches for the required airflow.
5. Replace blower door.

Air Conditioning (A/C) Setup Switches (SW2–6, SW2–7, SW2–8)

The air conditioning setup switches are used to match furnace airflow to required cooling airflow or high stage cooling airflow when a two–stage outdoor unit is used. Refer to the Adjustments section for set up switch configurations.

To set the desired cooling airflow:

1. Remove blower door.
2. Locate A/C setup switches on furnace control.
3. Determine air conditioning tonnage used.
4. Configure the switches for the required cooling airflow.
5. Replace blower door.

NOTE: Incorrect airflow caused by improper A/C switch setup may cause condensate blow-off or frozen indoor coil in the cooling mode.

Prime Condensate Trap with Water

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow these warnings could result in personal injury or death.

Failure to use a properly configured trap or NOT water-priming trap before operating furnace may allow positive pressure vent gases to enter the structure through drain tube. Vent gases contain carbon monoxide which is tasteless and odorless.

⚠ CAUTION

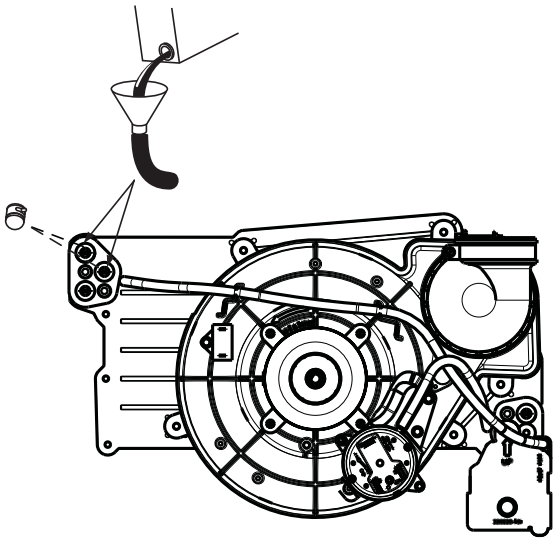
UNIT OPERATION HAZARD

Failure to follow this caution may result in intermittent unit operation or performance satisfaction.

Condensate trap must be PRIMED or proper draining may not occur. The condensate trap has two internal chambers which can ONLY be primed by pouring water into the inducer drain side of condensate trap.

1. Remove upper and middle collector box drain plugs opposite of the condensate trap. (See **Figure 1**)
2. Connect field-supplied 5/8-in. (16 mm) ID tube with attached funnel (see **Figure 1**) to upper collector box drain connection.
3. Pour one quart (liter) of water into funnel/tube. Water should run through collector box, overfill condensate trap, and flow into open field drain.
4. Remove funnel; replace collector box drain plug.
5. Connect field-supplied 5/8-in. (16 mm) ID tube to middle collector box drain port.
6. Pour one quart (liter) of water into funnel/tube. Water should run through collector box, overfill condensate trap, and flow into open field drain.
7. Remove funnel and tube from collector box and replace collector box drain plug.

Figure 1 Priming Condensate Drain



Representative drawing only, some models may vary in appearance.

L11F065

Purge Gas Lines

If not previously done, purge the lines after all connections have been made and check for leaks.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

Never purge a gas line into a combustion chamber. Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

Adjustments

⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

DO NOT bottom out gas valve regulator adjusting screw. This can result in unregulated manifold pressure and result in excess overfire and heat exchanger failures.

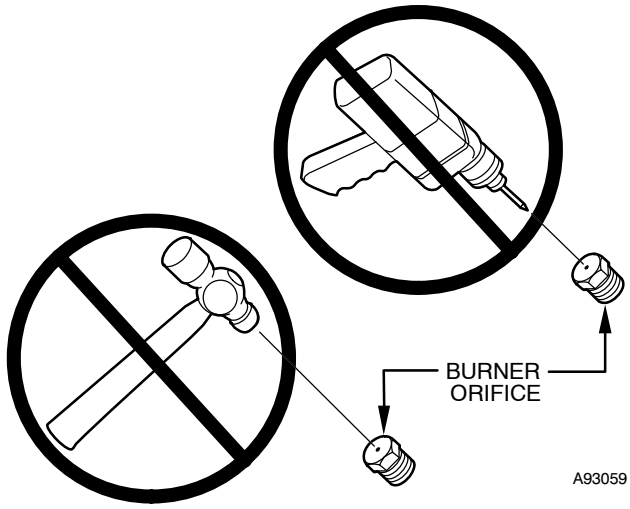
⚠ CAUTION

FURNACE DAMAGE HAZARD

Failure to follow this caution may result in reduced furnace life.

DO NOT redrill orifices. Improper drilling (burrs, out–of–round holes, etc.) can cause excessive burner noise and misdirection of burner flames. This can result in flame impingement of heat exchangers, causing failures. (See **Figure 2**)

Figure 2 Orifice Hole



For proper operation and long term reliability the furnace input rate must be within +/– 2 percent of input rate on furnace rating plate, or as adjusted for altitude.

The gas input rate on rating plate is for installation at altitudes up to 2000 ft. (610 M).

NOTICE

The NATURAL GAS manifold pressure adjustments in **Table 3** compensate for BOTH altitude AND gas heating value. DO NOT apply an additional de–rate factor to the pressures shown in **Table 3**.

The heating content of natural gas at altitude may already provide for a reduction in capacity or altitude. Refer to **Table 3**. No adjustments to the furnace may be necessary at altitude for certain gas heating values.

Refer to the instructions provided in the factory-specified Propane conversion kit for instructions for setting gas manifold pressures for Propane applications.

In the USA, the input rating for altitudes above 2000 ft. (610 M) must be reduced by 2 percent for each 1000 ft. (305 M) above sea level refer to **Table 1**. The natural gas manifold pressures

in **Table 3** adjust for BOTH altitude and natural gas heating value.

In Canada, the input rating must be reduced by 5 percent for altitudes of 2000 ft. (610 M) to 4500 ft. (1372 M) above sea level. The natural gas manifold pressures in **Table 3** adjust for BOTH altitude and natural gas heating value.

Table 1	Altitude Derate Multiplier for U.S.A.	
ALTITUDE FT. (M)	PERCENT OF DERATE	DERATE MULTIPLIER FACTOR*
0–2000 (0–610)	0	1.00
2001–3000 (610–914)	4–6	0.95
3001–4000 (914–1219)	6–8	0.93
4001–5000 (1219–1524)	8–10	0.91
5001–6000 (1524–1829)	10–12	0.89
6001–7000 (1829–2134)	12–14	0.87
7001–8000 (2134–2438)	14–16	0.85
8001–9000 (2438–2743)	16–18	0.83
9001–10,000 (2743–3048)	18–20	0.81

* Derate multiplier factors are based on midpoint altitude for altitude range.

NOTE: **For Canadian altitudes of 2000 to 4500 ft. (610 to 1372 M), use USA altitudes of 2001 to 3000 ft. (610 to 914 M)** in **Table 3**.

To adjust manifold pressure to obtain the proper input rate, first, determine if the furnace has the correct orifice installed. At higher altitudes or different gas heat contents, it may be necessary to change the factory orifice to a different orifice.

Tables have been provided in the furnace Service and Technical Manual to match the required orifice to the manifold pressure to the heat content and specific gravity of the gas. to do this:

1. Obtain average yearly gas heat value (at installed altitude) from local gas supplier.
2. Obtain average yearly gas specific gravity from local gas supplier.
3. Find installation altitude in **Table 3**.
4. Find closest natural gas heat value and specific gravity in **Table 3**. Follow heat value and specific gravity lines to point of intersection to find orifice size and low–and high–heat manifold pressure settings for proper operation.
5. Check and verify burner orifice size in furnace. NEVER ASSUME ORIFICE SIZE. ALWAYS CHECK AND VERIFY.

NOTICE

If orifice hole appears damaged or it is suspected to have been redrilled, check orifice hole with a numbered drill bit of correct size. Never redrill an orifice. A burr–free and squarely aligned orifice hole is essential for proper flame characteristics.

6. Replace orifice with correct size, if required by **Table 3**. Use only factory–supplied orifices. See EXAMPLE.

EXAMPLE 1:

0 - 2000 ft. (0 - 609.6M) altitude
Heating value = 1050 Btu/cu ft.
Specific gravity = 0.62
Therefore: Orifice No. 44

(Furnace is shipped with No. 44 orifices. In this example, all main burner orifices are the correct size and do not need to be changed to obtain proper input rate.)

Manifold pressure: 3.4-in. w.c. (847 Pa) for high heat, 1.4-in. w.c. (349 Pa) for low heat

NOTE: To convert gas manifold Table pressures to Pascals, multiply the in.w.c. value by 249.1 Pa/in. w.c. (1 in. wc. = 249.1 Pa).

Check Inlet Gas Pressure

The inlet gas pressure must be checked with the furnace operating in maximum heat. This is necessary to make sure the inlet gas pressure does not fall below the minimum pressure of 4.5 in. w.c. (1121 Pa).

1. Make sure the gas supply is turned off to the furnace and at the electric switch on the gas valve.
2. Loosen set screw on inlet tower pressure tap no more than one full turn with a 3/32–in. hex wrench or remove the 1/8–in. NPT plug from the inlet pressure tap on the gas valve.
3. Connect a manometer to the inlet pressure tap on gas valve.
4. Turn on furnace power supply.
5. Turn gas supply manual shutoff valve to ON position.
6. Turn furnace gas valve switch to ON position.
7. Jumper the R to W/W1 and W2 thermostat connections at the furnace control board.
8. When main burners ignite, confirm inlet gas pressure is between 4.5 in. w.c. (1125 Pa) and 13.6 in. w.c.(3388 Pa).
9. Remove jumper across thermostat connections to terminate call for heat. Wait until the blower off delay is completed.
10. Turn furnace gas valve electric switch to OFF position.
11. Turn gas supply manual shutoff valve to OFF position.
12. Turn off furnace power supply.
13. Remove water column manometer or similar device from manifold pressure tap.

⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

Inlet pressure tap set screw must be tightened and 1/8–in. NPT pipe plug must be installed to prevent gas leaks.

14. Tighten set screw on inlet tower pressure tap with 3/32–in. hex wrench, or if 1/8–in. NPT plug was removed, apply pipe dope sparingly to end of plug and re–install in the gas valve.
15. Re-install cap over adjustment screw on the top of the gas valve.

Adjust Manifold Pressure

1. Adjust manifold pressure to obtain low fire input rate. (See **Figure 3**)
   a. Turn gas valve ON/OFF switch to OFF.
   b. Loosen set screw on manifold tower pressure tap no more than one full turn with a 3/32–in. hex wrench, or remove the 1/8 inch NPT plug from the manifold pressure tap on the gas valve. See **Figure 3.**
   c. Connect a water column manometer or similar device to manifold pressure tap.
   d. Turn gas valve ON/OFF switch to ON.

e. Move setup SW1—2 on furnace control to ON position to lock furnace in low–heat operation. (See **Figure 4** and **Figure 5**)
f. Manually close blower door switch.
g. Jumper R and W/W1 thermostat connections on control to start furnace. (See **Figure 4**)
h. Remove regulator adjustment cap from low heat gas valve pressure regulator (See **Figure 3**) and turn low–heat adjusting screw (3/16 or smaller flat–tipped screwdriver) counterclockwise (out) to decrease input rate or clockwise (in) to increase input rate.

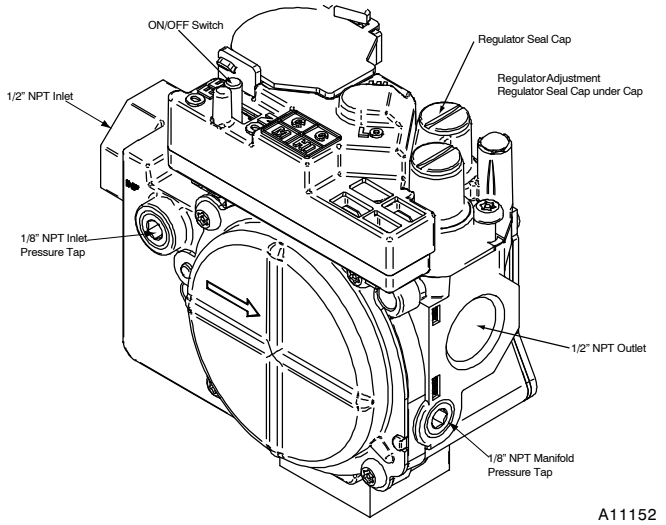
NOTICE

DO NOT set low–heat manifold pressure less than 1.3–in. w.c. (324 Pa) or more than 1.7–in. w.c. (423 Pa) for natural gas. If manifold pressure is outside this range, change main burner orifices.

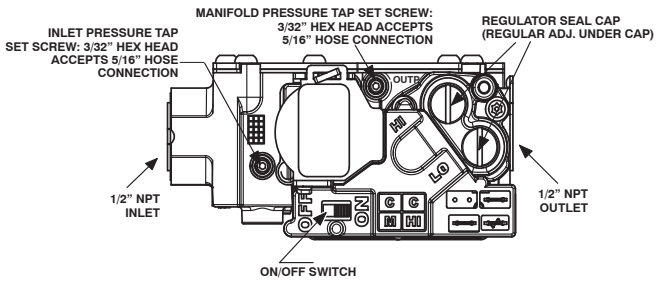
i. Install low–heat regulator adjustment cap.
j. Move setup switch SW1–2 to OFF position after completing low–heat adjustment.
k. Leave manometer or similar device connected and proceed to Step 2.

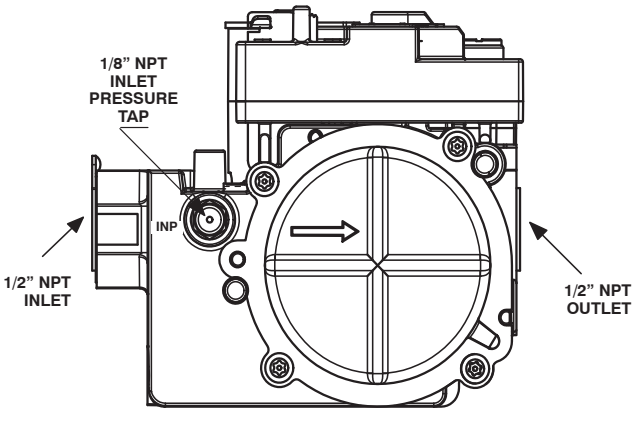
2. Adjust manifold pressure to obtain high fire input rate. (See **Figure 3**)
   a. Jumper R to W/W1 and W2 thermostat connections on furnace control. This keeps furnace locked in high–heat operation.
   b. Remove regulator adjustment cap from high–heat gas valve pressure regulator (See **Figure 3**) and turn high heat adjusting screw (3/16–in. or smaller flat–tipped screwdriver) counterclockwise (out) to decrease input rate or clockwise (in) to increase input rate.

Figure 3 **Redundant Automatic Gas Control Valve (2–Stage) without Tower Pressure Ports**



Automatic Gas Valve (Two–Stage) with Tower Pressure Ports





NOTICE

DO NOT set high–heat manifold pressure less than 3.2–in. w.c. (797 Pa) or more than 3.8 in. w.c. (947 Pa) for natural gas. If required manifold pressure is outside this range, change main burner orifices to obtain manifold pressure in this range.

c. When correct input is obtained, replace caps that conceal gas valve regulator adjustment screws. Main burner flame should be clear blue, almost transparent. (See **Figure 14**)
d. Remove jumpers R to W/W1 and R to W2.

3. Verify natural gas input rate by clocking meter.

NOTE: Contact your HVAC distributor or gas supplier for metric gas meter Tables, if required.

a. Turn off all other gas appliances and pilots served by the meter.
b. Move setup switch SW1–2 to ON position. This keeps furnace locked in low–heat operation when only W/W1 is energized.
c. Jumper R to W/W1.
d. Run furnace for 3 minutes in low–heat operation.

e. Measure time (in sec) for gas meter to complete 1 revolution and note reading. The 2 or 5 cubic feet dial provides a more accurate measurement of gas flow.
f. Refer to **Table 2** for cubic ft. of gas per hr.
g. Multiply gas rate cu ft./hr by heating value (Btuh/cu ft.) to obtain input.
h. If clocked rate does not match required input from Step 1, increase manifold pressure to increase input or decrease manifold pressure to decrease input. Repeat steps b through e until correct low−heat input is achieved. Re−install low heat regulator seal cap on gas valve.
i. Jumper R to W/W1, and W2. This keeps furnace locked in high−heat operation when both W/W1 and W2 are energized.
j. Repeat items (d) through (h) for high−heat operation, repeating Step 2 and adjusting the high−heat regular screw, as required.

4. Restore furnace to normal operating condition.
   a. Turn gas valve On/Off switch to OFF.
   b. Remove water column manometer or similar device from manifold pressure tap.

⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

Manifold pressure tap set screw must be tightened or 1/8−in. NPT pipe plug must be installed to prevent gas leaks.

   c. Tighten set screw on manifold tower pressure tap with 3/32−in. hex wrench, or if 1/8−in. NPT plug was removed, apply pipe dope sparingly to end of plug and re−install in the gas valve.
   d. Turn gas valve On/Off switch to ON.
   e. Move setup SW1−2 on furnace control to position required for attached thermostat (OFF for single−stage thermostats, ON for two−stage thermostats).
   f. Check for gas leaks and verify furnace operation.

Figure 4 Example of Variable Speed Furnace Control for Variable Speed ECM Blower Motor

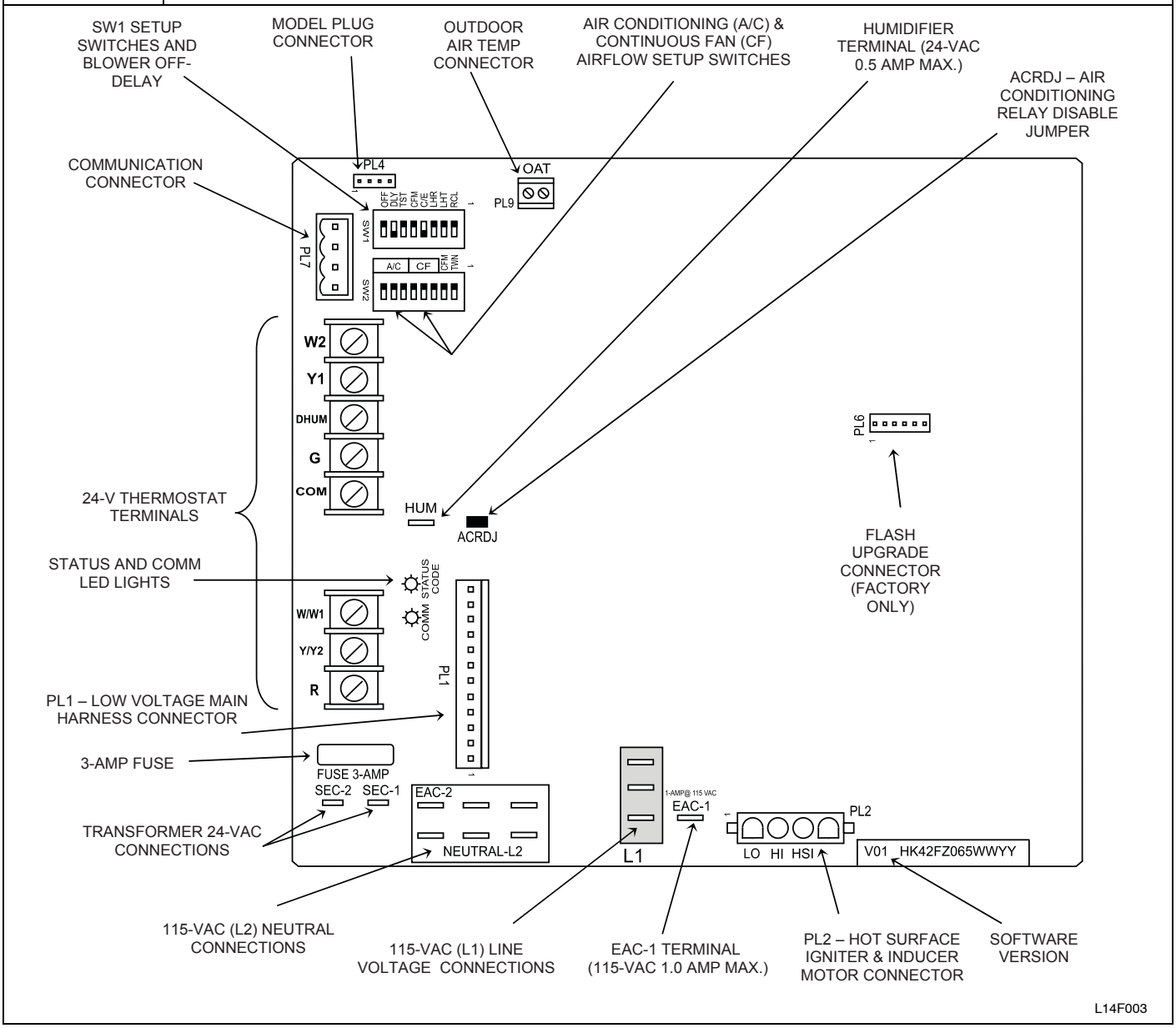


Table 2	Gas Rate (CU ft./hr)						
SECONDS FOR 1 REVOLUTION	SIZE OF TEST DIAL			SECONDS FOR 1 REVOLUTION	SIZE OF TEST DIAL		
	1 Cu Ft.	2 Cu Ft.	5 Cu Ft.		1 Cu Ft.	2 Cu Ft.	5 Cu Ft.
10	360	720	1800	50	72	144	360
11	327	655	1636	51	71	141	355
12	300	600	1500	52	69	138	346
13	277	555	1385	53	68	136	340
14	257	514	1286	54	67	133	333
15	240	480	1200	55	65	131	327
16	225	450	1125	56	64	129	321
17	212	424	1059	57	63	126	316
18	200	400	1000	58	62	124	310
19	189	379	947	59	61	122	305
20	180	360	900	60	60	120	300
21	171	343	857	62	58	116	290
22	164	327	818	64	56	112	281
23	157	313	783	66	54	109	273
24	150	300	750	68	53	106	265
25	144	288	720	70	51	103	257
26	138	277	692	72	50	100	250
27	133	267	667	74	48	97	243
28	129	257	643	76	47	95	237
29	124	248	621	78	46	92	231
30	120	240	600	80	45	90	225
31	116	232	581	82	44	88	220
32	113	225	563	84	43	86	214
33	109	218	545	86	42	84	209
34	106	212	529	88	41	82	205
35	103	206	514	90	40	80	200
36	100	200	500	92	39	78	196
37	97	195	486	94	38	76	192
38	95	189	474	96	38	75	188
39	92	185	462	98	37	74	184
40	90	180	450	100	36	72	180
41	88	176	439	102	35	71	178
42	86	172	429	104	35	69	173
43	84	167	419	106	34	68	170
44	82	164	409	108	33	67	167
45	80	160	400	110	33	65	164
46	78	157	391	112	32	64	161
47	76	153	383	116	31	62	155
48	75	150	375	120	30	60	150
49	73	147	367				

Table 3 | **Orifice Size and Manifold Pressure (in. w.c.) for Gas Input Rate – Two–Stage**

TWO-STAGE FURNACE

(TABULATED DATA BASED ON 20,000 BTUH HIGH-HEAT / 13,000 BTUH LOW-HEAT PER BURNER, DERATED 2%/1000 FT (305M) ABOVE SEA LEVEL)

ALTITUDE RANGE ft (m)		AVG. GAS HEAT VALUE AT ALTITUDE (Btu/cu ft)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Mnfld Press High/Low	Orifice No.	Mnfld Press High/Low	Orifice No.	Mnfld Press High/Low	Orifice No.	Mnfld Press High/Low
U.S.A. and Canada		900	43	3.8 / 1.6	42	3.2 / 1.4	42	3.3 / 1.4	42	3.4 / 1.4
	0	925	43	3.6 / 1.5	43	3.7 / 1.6	43	3.8 / 1.6	42	3.2 / 1.4
	(0)	950	43	3.4 / 1.4	43	3.5 / 1.5	43	3.6 / 1.5	43	3.7 / 1.6
		975	**44**	**3.7 / 1.6**	**44**	**3.8 / 1.6**	43	3.4 / 1.5	43	3.6 / 1.5
	to	1000	**44**	**3.5 / 1.5**	**44**	**3.6 / 1.5**	**44**	**3.8 / 1.6**	43	3.4 / 1.4
		1025	**44**	**3.3 / 1.4**	**44**	**3.5 / 1.5**	**44**	**3.6 / 1.5**	**44**	**3.7 / 1.6**
	2000	1050	**44**	**3.2 / 1.3**	**44**	**3.3 / 1.4**	**44**	**3.4 / 1.4**	**44**	**3.5 / 1.5**
	(610)	1075	45	3.7 / 1.6	45	3.8 / 1.6	**44**	**3.3 / 1.4**	**44**	**3.4 / 1.4**
		1100	46	3.7 / 1.6	46	3.8 / 1.6	45	3.8 / 1.6	**44**	**3.2 / 1.4**
U.S.A. and Canada	U.S.A.	800	42	3.4 / 1.4	42	3.5 / 1.5	42	3.6 / 1.5	42	3.7 / 1.6
	2001 (611)	825	43	3.8 / 1.6	42	3.3 / 1.4	42	3.4 / 1.4	42	3.5 / 1.5
	to	850	43	3.6 / 1.5	43	3.7 / 1.6	42	3.2 / 1.3	42	3.3 / 1.4
	3000 (914)	875	43	3.4 / 1.4	43	3.5 / 1.5	43	3.7 / 1.5	43	3.8 / 1.6
		900	**44**	**3.7 / 1.6**	**44**	**3.8 / 1.6**	43	3.5 / 1.5	43	3.6 / 1.5
	Canada	925	**44**	**3.5 / 1.5**	**44**	**3.6 / 1.5**	**44**	**3.8 / 1.6**	43	3.4 / 1.4
	2001 (611)	950	**44**	**3.3 / 1.4**	**44**	**3.4 / 1.5**	**44**	**3.6 / 1.5**	**44**	**3.7 / 1.6**
	to	975	**44**	**3.2 / 1.3**	**44**	**3.3 / 1.4**	**44**	**3.4 / 1.4**	**44**	**3.5 / 1.5**
	4500 (1372)	1000	46	3.8 / 1.6	45	3.8 / 1.6	**44**	**3.2 / 1.4**	**44**	**3.3 / 1.4**
U.S.A. Only		775	42	3.3 / 1.4	42	3.4 / 1.4	42	3.5 / 1.5	42	3.6 / 1.5
	3001	800	43	3.8 / 1.6	42	3.2 / 1.4	42	3.3 / 1.4	42	3.4 / 1.4
	(915)	825	43	3.6 / 1.5	43	3.7 / 1.6	43	3.8 / 1.6	42	3.2 / 1.4
		850	**44**	**3.8 / 1.6**	43	3.5 / 1.5	43	3.6 / 1.5	43	3.7 / 1.6
	to	875	**44**	**3.6 / 1.5**	**44**	**3.7 / 1.6**	43	3.4 / 1.4	43	3.5 / 1.5
	4000	900	**44**	**3.4 / 1.4**	**44**	**3.5 / 1.5**	**44**	**3.7 / 1.5**	**44**	**3.8 / 1.6**
	(1219)	925	**44**	**3.2 / 1.4**	**44**	**3.4 / 1.4**	**44**	**3.5 / 1.5**	**44**	**3.6 / 1.5**
		950	45	3.7 / 1.6	**44**	**3.2 / 1.3**	**44**	**3.3 / 1.4**	**44**	**3.4 / 1.4**
U.S.A. Only		750	42	3.3 / 1.4	42	3.4 / 1.4	42	3.5 / 1.5	42	3.6 / 1.5
	4001	775	43	3.7 / 1.6	43	3.8 / 1.6	42	3.3 / 1.4	42	3.4 / 1.4
	(1220)	800	43	3.5 / 1.5	43	3.6 / 1.5	43	3.7 / 1.6	43	3.8 / 1.6
		825	**44**	**3.8 / 1.6**	43	3.4 / 1.4	43	3.5 / 1.5	43	3.6 / 1.5
	to	850	**44**	**3.5 / 1.5**	**44**	**3.7 / 1.5**	**44**	**3.8 / 1.6**	43	3.4 / 1.4
	5000	875	**44**	**3.3 / 1.4**	**44**	**3.5 / 1.5**	**44**	**3.6 / 1.5**	**44**	**3.7 / 1.6**
	(1524)	900	**44**	**3.2 / 1.3**	**44**	**3.3 / 1.4**	**44**	**3.4 / 1.4**	**44**	**3.5 / 1.5**
		925	46	3.8 / 1.6	45	3.7 / 1.6	**44**	**3.2 / 1.4**	**44**	**3.3 / 1.4**
U.S.A. Only		725	42	3.2 / 1.4	42	3.3 / 1.4	42	3.4 / 1.5	42	3.5 / 1.5
	5001	750	43	3.7 / 1.5	43	3.8 / 1.6	42	3.2 / 1.4	42	3.3 / 1.4
	(1525)	775	43	3.4 / 1.4	43	3.5 / 1.5	43	3.7 / 1.5	43	3.8 / 1.6
		800	**44**	**3.7 / 1.6**	**44**	**3.8 / 1.6**	43	3.4 / 1.5	43	3.5 / 1.5
	to	825	**44**	**3.5 / 1.5**	**44**	**3.6 / 1.5**	**44**	**3.7 / 1.6**	**44**	**3.8 / 1.6**
	6000	850	**44**	**3.3 / 1.4**	**44**	**3.4 / 1.4**	**44**	**3.5 / 1.5**	**44**	**3.6 / 1.5**
	(1829)	875	45	3.7 / 1.6	**44**	**3.2 / 1.3**	**44**	**3.3 / 1.4**	**44**	**3.4 / 1.4**
		900	46	3.7 / 1.6	46	3.8 / 1.6	45	3.8 / 1.6	**44**	**3.2 / 1.4**
U.S.A. Only		675	42	3.4 / 1.4	42	3.5 / 1.5	42	3.6 / 1.5	42	3.8 / 1.6
	6001	700	42	3.2 / 1.3	42	3.3 / 1.4	42	3.4 / 1.4	42	3.5 / 1.5
	(1830)	725	43	3.6 / 1.5	43	3.7 / 1.6	43	3.8 / 1.6	42	3.3 / 1.4
		750	43	3.4 / 1.4	43	3.5 / 1.5	43	3.6 / 1.5	43	3.7 / 1.6
	to	775	**44**	**3.6 / 1.5**	**44**	**3.7 / 1.6**	43	3.4 / 1.4	43	3.5 / 1.5
	7000	800	**44**	**3.4 / 1.4**	**44**	**3.5 / 1.5**	**44**	**3.6 / 1.5**	**44**	**3.7 / 1.6**
	(2133)	825	**44**	**3.2 / 1.3**	**44**	**3.3 / 1.4**	**44**	**3.4 / 1.4**	**44**	**3.5 / 1.5**
		850	46	3.8 / 1.6	45	3.8 / 1.6	**44**	**3.2 / 1.4**	**44**	**3.3 / 1.4**

A11252A

Table 3 (cont.) Orifice Size and Manifold Pressure (in. w.c.) for Gas Input Rate – Two–Stage

TWO-STAGE FURNACE

(TABULATED DATA BASED ON 20,000 BTUH HIGH-HEAT / 13,000 BTUH LOW-HEAT PER BURNER, DERATED 2%/1000 FT (305M) ABOVE SEA LEVEL)

ALTITUDE RANGE ft (m)		AVG. GAS HEAT VALUE AT ALTITUDE (Btu/cu ft)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Mnfld Press High/Low	Orifice No.	Mnfld Press High/Low	Orifice No.	Mnfld Press High/Low	Orifice No.	Mnfld Press High/Low
U.S.A. Only		**650**	42	3.4 / 1.4	42	3.5 / 1.5	42	3.6 / 1.5	42	3.7 / 1.6
	7001	**675**	43	3.8 / 1.6	42	3.2 / 1.4	42	3.3 / 1.4	42	3.4 / 1.5
	(2134)	**700**	43	3.5 / 1.5	43	3.7 / 1.5	43	3.8 / 1.6	42	3.2 / 1.4
	to	**725**	**44**	**3.8 / 1.6**	43	3.4 / 1.4	43	3.5 / 1.5	43	3.6 / 1.5
		750	**44**	**3.5 / 1.5**	**44**	**3.7 / 1.5**	**44**	**3.8 / 1.6**	43	3.4 / 1.4
	8000	**775**	**44**	**3.3 / 1.4**	**44**	**3.4 / 1.4**	**44**	**3.5 / 1.5**	**44**	**3.7 / 1.5**
	(2438)	**800**	45	3.8 / 1.6	**44**	**3.2 / 1.4**	**44**	**3.3 / 1.4**	**44**	**3.4 / 1.4**
		825	46	3.7 / 1.6	46	3.8 / 1.6	45	3.8 / 1.6	**44**	**3.2 / 1.4**
U.S.A. Only		**625**	42	3.4 / 1.4	42	3.5 / 1.5	42	3.6 / 1.5	42	3.7 / 1.6
	8001	**650**	43	3.8 / 1.6	42	3.2 / 1.4	42	3.3 / 1.4	42	3.4 / 1.4
	(2439)	**675**	43	3.5 / 1.5	43	3.6 / 1.5	43	3.7 / 1.6	42	3.2 / 1.3
	to	**700**	**44**	**3.7 / 1.6**	43	3.4 / 1.4	43	3.5 / 1.5	43	3.6 / 1.5
		725	**44**	**3.5 / 1.5**	**44**	**3.6 / 1.5**	**44**	**3.7 / 1.6**	**44**	**3.8 / 1.6**
	9000	**750**	**44**	**3.3 / 1.4**	**44**	**3.4 / 1.4**	**44**	**3.5 / 1.5**	**44**	**3.6 / 1.5**
	(2743)	**775**	45	3.7 / 1.6	**44**	**3.2 / 1.3**	**44**	**3.3 / 1.4**	**44**	**3.4 / 1.4**
U.S.A. Only	**9001**	**600**	42	3.3 / 1.4	42	3.4 / 1.5	42	3.6 / 1.5	42	3.7 / 1.6
	(2744)	**625**	43	3.7 / 1.6	42	3.2 / 1.3	42	3.3 / 1.4	42	3.4 / 1.4
	to	**650**	43	3.5 / 1.5	43	3.6 / 1.5	43	3.7 / 1.6	43	3.8 / 1.6
		675	**44**	**3.7 / 1.6**	**44**	**3.8 / 1.6**	43	3.4 / 1.4	43	3.5 / 1.5
	10000	**700**	**44**	**3.4 / 1.4**	**44**	**3.5 / 1.5**	**44**	**3.7 / 1.5**	**44**	**3.8 / 1.6**
	(3048)	**725**	**44**	**3.2 / 1.3**	**44**	**3.3 / 1.4**	**44**	**3.4 / 1.4**	**44**	**3.5 / 1.5**

* Orifice numbers shown in **BOLD** are factory-installed.

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Adjust Temperature Rise

NOTE: Blower door must be installed when taking temperature rise reading. Leaving blower door off will result in incorrect temperature measurements, due to possible changes in duct static pressure and airflow.

⚠ CAUTION

FURNACE DAMAGE HAZARD

Failure to follow this caution may result in:

- Overheating the heat exchangers or condensing flue gases in heat exchanger areas not designed for condensate.
- Shortened furnace life.
- Component damage.

Temperature rise must be within limits specified on furnace rating plate. Recommended operation is at midpoint of rise range or slightly above.

Furnace must operate within ranges of temperature rise specified on the furnace rating plate.

When setup switch SW1–4 is ON, operation will be near the high end of the rise range for improved comfort.

Determine air temperature rise as follows:

1. Place thermometers in return and supply ducts as near furnace as possible. Be sure thermometers do not see heat exchanger so that radiant heat does not affect readings. This practice is particularly important with straight–run ducts.
2. When thermometer readings stabilize, subtract return–air temperature from supply–air temperature to determine air temperature rise.

NOTE: Temperature rise can be determined for low–heat operation by locking the furnace in each mode of operation. The mode of operation is based on the position of set up switch SW1–2 on the furnace control board.

This furnace is capable of automatically providing proper airflow to maintain the temperature rise within the range specified on furnace rating plate. If temperature rise is outside this range, proceed as follows:

a. Check gas input for low– and high–heat operation.

b. Check derate for altitude if applicable.

c. Check all return and supply ducts for excessive restrictions causing static pressure greater than 0.5–in. w.c.

d. Ensure Low Heat Rise Adjust switch SW1–3 on furnace control is in ON position when a bypass humidifier is used. (See **Figure 4** for switch location.)

e. Check Troubleshooting Guide for Variable–Speed Condensing Furnaces.

To lock the furnace in Low Heat:

1. Turn SW1-2 ON at the furnace control. Set up switch
2. Connect a jumper across R and W/W1 at the thermostat terminals at the furnace control.
3. Allow the burners to ignite and the blower to turn on.
4. Allow the supply temperature to stabilize and verify the proper rise range.

If the temperature rise is too high or too low in Low Heat:

1. Remove jumpers from R and W/W1.
2. Wait until the blower off delay is completed.
3. Turn 115 VAC power off.
4. Check the position of Set up switch SW1-3. When set to ON, airflow is raised 18% for Low Heat. Factory default position is OFF.
5. Turn 115 VAC power on.
6. Re--check Low Heat Temperature Rise

To lock the furnace in High Heat:

1. Connect a jumper across R and W/W1 and W2 at the thermostat terminals at the furnace control.
2. Allow the burners to ignite and the blower to turn on.
3. Allow the supply temperature to stabilize and verify the proper rise range.

If the temperature rise is too high or too low in High Heat:

1. Remove jumpers from R and W/W1 and W2.
2. Wait until the blower off delay is completed.
3. Turn 115 VAC power off.
4. Check the position of Set up switch SW1-4. When set to OFF and SW1-3 is set to OFF, airflow is raised 7% for Low Heat and 10% for High Heat. Factory default position is ON. If SW1-3 is ON and SW1-4 is OFF, airflow is raised 18% for Low Heat and 10% for High Heat
5. Turn 115 VAC power on.
6. Re-check High Heat Temperature Rise.

After the temperature rise has been verified:

1. Remove jumpers from thermostat terminals.
2. Allow the blower off delay to complete.
3. Turn Set up switches SW1-2 to the desired position.
4. Proceed to “Adjust Blower Off Delay” or install blower door if complete.

⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

Reinstall manifold pressure tap plug in gas valve to prevent gas leak.

⚠ CAUTION

FURNACE OVERHEATING HAZARD

Failure to follow this caution may result in reduced furnace life.

Recheck temperature rise. It must be within limits specified on the rating plate. Recommended operation is at the mid–point of rise range or slightly above.

Adjust Blower Off Delay (Heat Mode)

a. Remove blower door if installed.

b. Turn Dip switch SW1–7 or SW1–8 ON or OFF for desired blower off delay. (See **Table 4** and **Figure 4**, **Figure 5**)

Table 4	Blower Speed Taps	
DESIRED HEATING MODE BLOWER OFF DELAY (SEC.)	SETUP SWITCH (SW1–7 and –8) POSITION	
90	OFF	OFF
120	ON	OFF
150	OFF	ON
180	ON	ON

Adjust Cooling Airflow – High–Speed and Low–Speed Cooling

The ECM blower can be adjusted for a range of airflows for low–speed or high–speed cooling. See **Table 5**–Air Delivery – CFM (with Filter) and **Figure 5**. Furnace Setup Switches and Descriptions. Depending on the model size, the cooling airflow can be adjusted from 1.5 tons to 6 tons of nominal cooling based on 350 CFM ton.

NOTE: 6 ton airflow will truncate at 2200 CFM on applicable models.

The high–speed or single–speed cooling airflow is adjusted by turning setup switches SW2–6, SW2–7 and SW2–8 either ON or OFF. Select the required airflow from **Table 5**. **Table 5** is based on 350 CFM per ton. For other CFM per ton setup switch selections, see **Figure 4**, **Figure 5** and **Figure 16**.

The Continuous Fan airflow selection via setup switches SW2–3, SW2–4 and SW2–5 is also the airflow for low–speed cooling when the furnace is used with a two–speed cooling or heat pump unit. Adjust the Continuous Fan CFM setup switches SW2–3, SW2–4 and SW2–5 to match the airflow required for low–speed cooling. Select the required airflow from **Table 5** and **Figure 5**.

NOTE: The airflow selected via SW2–3, SW2–4 and SW2–5 (low–speed cooling airflow) cannot exceed the airflow selected via SW2–6, SW2–7 and SW2–8 (high–speed cooling airflow). For other CFM per ton setup switch selections, see **Figure 4** and **Figure 5**.

For a complete explanation of cooling airflow, refer to the section titled “Sequence of Operation.”

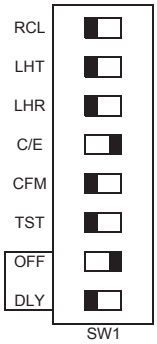
Adjust Continuous Fan Airflow/Low Speed Cooling Airflow

NOTE: When the furnace is used with a two–speed cooling or heat pump unit, the airflow selected for Continuous Fan via setup switch SW2–3, SW2–4 and SW2–5 will also be the airflow used for low–speed cooling, and vice versa.

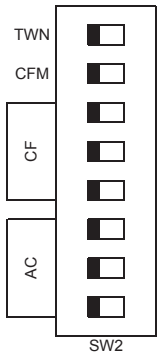
NOTE: When the furnace is used with a two–speed cooling or heat pump unit, adjust the Continuous Fan CFM setup switches SW2–3, SW2–4 and SW2–5 to match the airflow required for low–speed cooling.

Select the required Continuous Fan airflow using setup switches SW2–3, SW2–4 and SW2–5 as shown in **Figure 5** and **Table 5**.

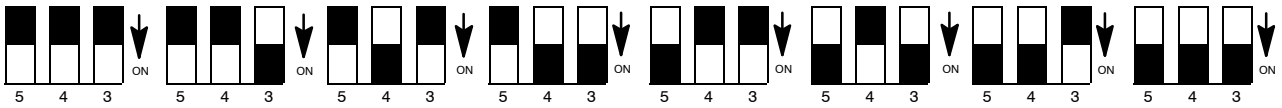
Figure 5 Furnace Setup Switch Description



SETUP SWITCH	SWITCH NAME	NORMAL POSITION	DESCRIPTION OF USE
SW1-1	Status Code Recovery	OFF	Turn ON to retrieve up to 7 stored status codes for troubleshooting assistance when R thermostat lead is disconnected.
SW1-2	Low Heat Only (Adaptive Heat Mode when SW1-2 is OFF)	OFF	When SW1-2 is OFF allows two-stage operation with a single stage thermostat. Turn ON when using two-stage thermostat to allow Low Heat operation when R to W/W1 closes and High Heat operation when R to W/W1 and W2 close.
SW1-3	Low Heat Rise Adjustment	OFF	Turn ON to increase Low Heat airflow by 18 percent. This compensates for increased return air temperature caused with bypass humidifier.
SW1-4	Comfort/ Efficiency Adjustment	ON	Turn ON to decrease Low Heat airflow by approximately 7 percent and High Heat airflow by approximately 10 percent for maximum comfort.
SW1-5	CFM per ton adjust	OFF	Turn ON for 400 CFM per ton, Turn OFF for 350 CFM per ton. See also SW2.
SW1-6	Component Self Test	OFF	Turn ON to initiate Component Self Test for troubleshooting assistance when R thermostat lead is disconnected. Turn OFF when Self Test is completed.
SW1-7 & SW1-8	Blower OFF delay	ON or OFF	Blower Off Delay time – adjustable 90 seconds to 180 seconds. See table in Adjustments section or refer to unit wiring diagram.
SW2-1	Twining	OFF	Allows for selection of furnace Main (OFF) or Secondary (ON) when Twinned furnace setup is required. See kit instructions for further directions on installation and setup.
SW2-2	CFM per ton Adjust	OFF	Allows additional CFM per ton selections when used with SW1-5 325 CFM per ton (nominal) when SW2-2 ON and SW1-5 OFF 350 CFM per ton (nominal) when SW2-2 OFF and SW1-5 OFF 370 CFM per ton (nominal) when SW2-2 ON and SW1-5 ON 400 CFM per ton (nominal) when SW2-2 OFF and SW1-5 ON See Air Delivery Tables for model specific CFM vs. static pressure
SW2-6, 7, 8	AC (Cooling Airflow)	OFF	The AC setup switches select desired cooling or high stage cooling (two-stage units) airflow. See Cooling Air Delivery Tables for specific switch settings.
SW2-3, 4, 5	CF (Continuous Fan)	OFF	The CF setup switches select desired Continuous Fan Airflow The CF switch position is the low cooling airflow selection for two-stage cooling units. The CFM values are shown in the Air Delivery Tables below for SW2 settings. SW2-3, 4, 5 cannot be set for airflow higher than SW 2-6, 7, 8. See Continuous Fan Air Flow Table for specific switch settings.



BASED ON 350 CFM/TON (Factory Default: SW1–5 = OFF, SW2–2 = OFF)

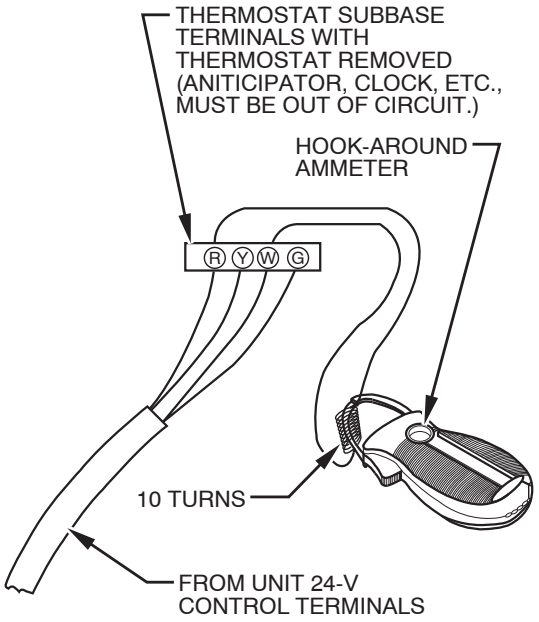
Model Size								
040-10	525	525	700	875	875	875	875	875
040-12	525	525	700	875	1050	1050	1050	1050
060-12	525	525	700	875	1050	1050	1050	1050
060-14	525	525	700	875	1050	1225	1225	1225
080-16	525	525	700	875	1050	1225	1400	1400
080-20	700	700	875	1050	1225	1400	1750	1750
100-20	700	700	875	1050	1225	1400	1750	1750
120-22	875	700	875	1050	1225	1400	1750	1925

Adjust Thermostat Heat Anticipator

a. Mechanical thermostat. Set thermostat heat anticipator to match the amp. draw of the electrical components in the R–W/W1 circuit. Accurate amp. draw readings can be obtained at the wires normally connected to thermostat subbase terminals, R and W. The thermostat anticipator should NOT be in the circuit while measuring current.
   (1.) Set SW1–2 switch on furnace control board to ON.
   (2.) Remove thermostat from subbase or from wall.
   (3.) Connect an amp. meter as shown in **Figure 6** across the R and W subbase terminals or R and W wires at wall.
   (4.) Record amp. draw across terminals when furnace is in low heat and after blower starts.
   (5.) Set heat anticipator on thermostat per thermostat instructions and install on subbase or wall.
   (6.) Turn SW1–2 switch OFF.
   (7.) Install blower door.

b. Electronic thermostat: Set cycle rate for 3 cycles per hr.

Figure 6 Amp. Draw Check with Ammeter



Check Safety Controls

The flame sensor, gas valve, and pressure switch were all checked in the Start–up procedure section as part of normal operation.

1. Check Main Limit Switch
   This control shuts off combustion system and energizes air–circulating blower motor, if furnace overheats. By using this method to check limit control, it can be established that limit is functioning properly and will operate if there is a restricted return–air supply or motor failure. If limit control does not function during this test, cause must be determined and corrected.
   a. Run furnace for at least 5 minutes.
   b. Gradually block off return air with a piece of cardboard or sheet metal until the limit trips.
   c. Unblock return air to permit normal circulation.
   d. Burners will re–light when furnace cools down.
2. Check Pressure Switch(es)
   This control proves operation of the draft inducer blower.
   a. Turn off 115–v power to furnace.
   b. Disconnect inducer motor lead wires from wire harness.
   c. Turn on 115–v power to furnace.
   d. Set thermostat to “call for heat” and wait 1 minute. When pressure switch is functioning properly, hot surface igniter should **NOT** glow and control diagnostic light flashes a status code 3. If hot surface igniter glows when inducer motor is disconnected, shut down furnace immediately.
   e. Determine reason pressure switch did not function properly and correct condition.
   f. Turn off 115–v power to furnace.
   g. Reconnect inducer motor wires, replace door, and turn on 115–v power.
   h. Blower will run for 90 seconds before beginning the call for heat again.
   i. Furnace should ignite normally.

Checklist

1. Put away tools and instruments. Clean up debris.
2. Verify that switches SW1–1 and SW1–6 are OFF and other setup switches are set as desired. Verify that switches SW1–7 and SW1–8 for the blower OFF DELAY are set as desired per **Table 4**.
3. Verify that blower and control doors are properly installed.
4. Verify that there are no unsealed openings in the blower shelf or casing.
5. Cycle test furnace with room thermostat.
6. Check operation of accessories per manufacturer’s instructions.
7. Review Home Owner’s Information with owner.
8. Attach literature packet to furnace.

Table 5		COOLING[4] AND HEATING AIR DELIVERY - CFM (Bottom Return[5] with filter)											
		(SW1-5 and SW2–2 set to OFF, except as indicated. See notes 1 and 2)											
Unit Size	**Cooling Switch Settings**			**External Static Pressure (ESP)**									
	SW2-8	SW2-7	SW2–6	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
040-10													
Clg Default:	OFF	OFF	OFF	1125	1080	1020	970	905	855	805	755	700	635
	OFF	OFF	ON	615	555	510	475	440	395	355	270	230	note 8
	OFF	ON	OFF	785	740	695	665	630	590	565	520	485	450
	OFF	ON	ON	990	950	910	875	850	815	770	720	670	615
Cooling (SW2)	ON	OFF	OFF	1125	1080	1020	970	905	855	805	755	700	635
	ON	OFF	ON	1125	1080	1020	970	905	855	805	755	700	635
	ON	ON	OFF	1125	1080	1020	970	905	855	805	755	700	635
	ON	ON	ON	1125	1080	1020	970	905	855	805	755	700	635
Clg SW2:	Maximum Clg Airflow [2]			1125	1080	1020	970	905	855	805	755	700	635
Heating (SW1)	High Heat Airflow [3]			815	770	725	695	660	625	595	550	510	475
	Low Heat Airflow [3]			660	605	560	530	495	450	415	340	300	note 7
040-12													
Clg Default:	OFF	OFF	ON	575	540	490	435	385	See note 4				
	OFF	ON	OFF	770	725	685	640	600	560	515	480	See note 4	
	OFF	ON	ON	945	910	875	835	800	770	735	695	665	635
Cooling (SW2)	ON	OFF	OFF	1140	1105	1075	1040	1005	970	930	885	835	790
	ON	OFF	ON	1250	1210	1165	1115	1065	1015	965	915	860	810
	ON	ON	OFF	1250	1210	1165	1115	1065	1015	965	915	860	810
	ON	ON	ON	1250	1210	1165	1115	1065	1015	965	915	860	810
Clg SW2:	Maximum Clg Airflow[2]			1250	1210	1165	1115	1065	1015	965	915	860	810
Heating (SW1)	High Heat Airflow[3]			860	825	785	745	705	670	630	595	565	525
	Low Heat Airflow[3]			650	595	545	500	460	415	365	320	275	note 7
060-12													
Clg Default:	OFF	OFF	OFF	1250	1210	1165	1115	1065	1015	955	895	815	745
	OFF	OFF	ON	605	565	510	455	420	See note 4				
	OFF	ON	OFF	785	750	705	675	630	585	See note 4			
	OFF	ON	ON	955	920	895	860	825	785	755	720	685	650
	ON	OFF	OFF	1135	1110	1080	1055	1020	990	935	880	825	745
	ON	OFF	ON	1250	1210	1165	1115	1065	1015	955	895	815	745
	ON	ON	OFF	1250	1210	1165	1115	1065	1015	955	895	815	745
	ON	ON	ON	1250	1210	1165	1115	1065	1015	955	895	815	745
Clg SW2:	Maximum Clg Airflow[2]			1250	1210	1165	1115	1065	1015	955	895	815	745
Heating (SW1)	High Heat Airflow[3]			1125	1100	1070	1045	1010	980	925	875	820	740
	Low Heat Airflow[3]			900	865	835	800	760	720	690	650	610	580
060-14													
Clg Default:	OFF	OFF	OFF	1330	1295	1260	1220	1190	1150	1110	1075	1045	1005
	OFF	OFF	ON	725	600	435	280	210	See note 4				
	OFF	ON	OFF	780	725	660	615	540	See note 4				
	OFF	ON	ON	975	925	875	835	785	750	690	655	610	570
Cooling (SW2)	ON	OFF	OFF	1160	1120	1090	1045	1010	970	920	885	840	800
	ON	OFF	ON	1330	1295	1260	1220	1190	1150	1110	1075	1045	1005
	ON	ON	OFF	1705	1650	1595	1545	1475	1415	1340	1275	1200	1105
	ON	ON	ON	1705	1650	1595	1545	1475	1415	1340	1275	1200	1105
Clg SW2:	Maximum Clg Airflow [2]			1705	1650	1595	1545	1475	1415	1340	1275	1200	1105
Heating (SW1)	High Heat Airflow [3]			1145	1105	1075	1030	995	955	905	870	825	785
	Low Heat Airflow [3]			870	820	760	720	655	620	560	525	470	435
080-16													
Clg Default:	OFF	OFF	OFF	1805	1765	1720	1665	1610	1540	1475	1400	1315	1235
	OFF	OFF	ON	775	635	455	230	See note 8					
	OFF	ON	OFF	840	740	675	625	555	See note 4				
	OFF	ON	ON	995	955	910	860	815	770	720	660	620	585
Cooling (SW2)	ON	OFF	OFF	1175	1140	1090	1060	1025	980	940	905	855	815
	ON	OFF	ON	1325	1280	1245	1210	1180	1140	1105	1070	1025	990
	ON	ON	OFF	1545	1515	1480	1445	1410	1380	1350	1315	1245	1175
	ON	ON	ON	1805	1765	1720	1665	1610	1540	1475	1400	1315	1235
Clg SW2:	Maximum Clg Airflow [2]			1805	1765	1720	1665	1610	1540	1475	1400	1315	1235
Heating (SW1)	High Heat Airflow [3]			1520	1490	1455	1420	1385	1355	1320	1285	1220	1155
	Low Heat Airflow [3]			1180	1145	1095	1065	1030	985	945	910	860	820

COOLING[4] AND HEATING AIR DELIVERY - CFM (Bottom Return[5] with filter)													
Unit Size	**Cooling Switch Settings**			**External Static Pressure (ESP)**									
	SW2-8	SW2-7	SW2-6	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
080-20													
Clg Default:	OFF	OFF	OFF	1905	1870	1825	1785	1750	1700	1665	1625	1560	1460
Cooling (SW2)	OFF	OFF	ON	950	770	620	515	440	365	See note 4			
	OFF	ON	OFF	1015	935	880	825	765	690	625	580	See note 4	
	OFF	ON	ON	1155	1105	1040	990	920	875	815	755	710	645
	ON	OFF	OFF	1335	1290	1245	1190	1145	1085	1040	990	930	890
	ON	OFF	ON	1520	1485	1435	1390	1340	1300	1255	1200	1160	1115
	ON	ON	OFF	1905	1870	1825	1785	1750	1700	1665	1625	1560	1460
	ON	ON	ON	2290	2230	2160	2085	2005	1915	1820	1730	1640	1525
Clg SW2:	Maximum Clg Airflow [2]			2290	2230	2160	2085	2005	1915	1820	1730	1640	1525
Heating (SW1)	High Heat Airflow [3]			1575	1535	1485	1445	1400	1350	1310	1260	1215	1170
	Low Heat Airflow [3]			1230	1170	1125	1065	1015	955	900	855	795	755
100-20													
Clg Default:	OFF	OFF	OFF	1890	1845	1800	1755	1700	1655	1610	1560	1510	1460
Cooling (SW2)	OFF	OFF	ON	1015	825	630	485	405	325	See note 4			
	OFF	ON	OFF	1080	895	815	740	690	615	555	475	See note 4	
	OFF	ON	ON	1155	1080	1020	940	890	825	785	710	660	590
	ON	OFF	OFF	1310	1260	1195	1140	1075	1025	970	925	875	810
	ON	OFF	ON	1520	1475	1425	1365	1315	1255	1210	1155	1110	1055
	ON	ON	OFF	1890	1845	1800	1755	1700	1655	1610	1560	1510	1460
	ON	ON	ON	2290	2230	2160	2085	2005	1915	1820	1730	1640	1525
Clg SW2:	Maximum Clg Airflow [2]			2290	2230	2160	2085	2005	1915	1820	1730	1640	1525
Heating (SW1)	High Heat Airflow [3]			1905	1865	1825	1775	1730	1685	1640	1590	1545	1490
	Low Heat Airflow [3]			1480	1435	1375	1330	1265	1215	1160	1115	1060	1005
120-22													
Clg Default:	OFF	OFF	OFF	2010	1960	1910	1850	1800	1750	1690	1645	1565	1480
Cooling (SW2)	OFF	OFF	ON	1015	805	645	550	480	See note 4				
	OFF	ON	OFF	1075	975	915	835	765	See note 4				
	OFF	ON	ON	1205	1135	1055	1000	935	See note 4				
	ON	OFF	OFF	1400	1330	1260	1190	1145	1080	1035	970	905	845
	ON	OFF	ON	1615	1550	1500	1435	1370	1325	1265	1215	1160	1110
	ON	ON	OFF	2010	1960	1910	1850	1800	1750	1690	1645	1565	1480
	ON	ON	ON	note 8	2375	2300	2205	2115	2010	1890	1750	1645	1550
Clg SW2:	Maximum Clg Airflow [2]			note 8	2375	2300	2205	2115	2010	1890	1750	1645	1550
Heating (SW1)	High Heat Airflow [3]			note 8	2375	2300	2205	2115	2010	1890	1750	1645	1550
	Low Heat Airflow [3]			1735	1675	1625	1560	1500	1455	1395	1345	1285	1225

NOTE:

1. Nominal 350 CFM/ton cooling airflow is delivered with SW1−5 and SW2−2 set to OFF.
   Set both SW1−5 and SW2−2 to ON for +7% airflow (nominal 370 CFM/ton).
   Set SW1−5 to ON and SW2−2 to OFF for +15% airflow (nominal 400 CFM/ton).
   Set SW2−2 to ON and SW1−5 to OFF for −7% airflow (nominal 325 CFM/ton).
   The above adjustments in airflow are subject to motor horspower range/capacity.
2. Maximum cooling airflow is achieved when switches SW2−6, SW2−7, SW2−8 and SW1−5 are set to ON, and SW2−2 is set to OFF.
3. All heating CFM's are when low heat rise adjustment switch (SW1−3) and comfort/efficiency adjustment switch (SW1−4) are both set to OFF.
4. Ductwork must be sized for high−heating CFM within the operational range of ESP. Operation within the blank areas of the chart is not recommended because high−heat operation will be above 1.0 ESP.
5. All airflows of 1880 CFM or less on 21" and 24.5" casing size furnaces are 5% less on side return only installations.
6. Airflows over 1800 CFM require bottom return, two−side return, or bottom and side return. A minimum filter size of 20" x 25" is required.
7. For upflow applications, air entering from one side into both the side of the furnace and a return air base counts as a side and bottom return.
8. Airflow not stable at this ESP.

SERVICE AND MAINTENANCE PROCEDURES

Untrained personnel can perform basic maintenance functions such as cleaning and replacing air filters. All other operations must be performed by trained service personnel. A qualified service person should inspect the furnace once a year.

⚠ WARNING

FIRE, INJURY OR DEATH HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

The ability to properly perform maintenance on this equipment requires certain knowledge, mechanical skills, tools, and equipment. If you do not possess these, do not attempt to perform any service and maintenance on this equipment other than those procedures recommended in the Owner's Manual.

⚠ CAUTION

ENVIRONMENTAL HAZARD

Failure to follow this caution may result in environmental pollution.

Remove and recycle all components or materials (i.e. oil, refrigerant, control board, etc.) before unit final disposal.

⚠ WARNING

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury or death, or property damage.

Before installing, modifying, or servicing system, main electrical disconnect switch must be in the OFF position and install a lockout tag. There may be more than one disconnect switch. Lock out and tag switch with a suitable warning label. Verify proper operation after servicing. Always reinstall access doors after completing service and maintenance.

⚠ CAUTION

ELECTRICAL OPERATION HAZARD

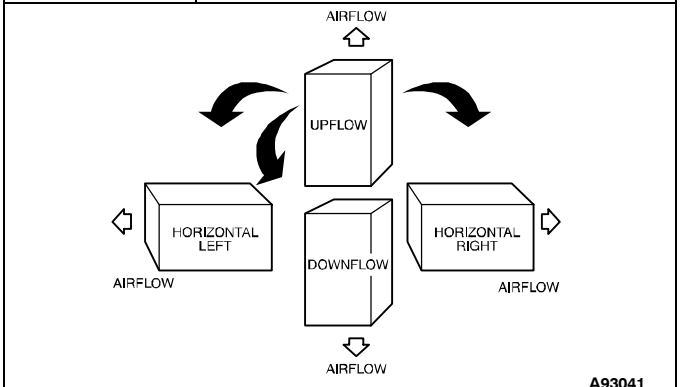
Failure to follow this caution may result in improper furnace operation or failure of furnace.

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

General

These instructions are written as if the furnace is installed in an upflow application. An upflow furnace application is where the blower is located below the combustion and controls section of the furnace, and conditioned air is discharged upward. Since this furnace can be installed in any of the 4 positions shown in **Figure 7**, you must revise your orientation to component location accordingly.

Figure 7 Multipoise Orientations



Electrical Controls and Wiring

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

There may be more than one electrical supply to the furnace. Check accessories and cooling unit for additional electrical supplies that must be shut off during furnace servicing. Lock out and tag switch with a suitable warning label.

The electrical ground and polarity for 115–v wiring must be properly maintained. Refer to **Figure 8** for field wiring information and to **Figure 16** for furnace wiring information.

NOTE: If the polarity is not correct, the STATUS LED on the control will flash code 10 and prevent the furnace from heating. The control system also requires an earth ground for proper operation of the control and flame–sensing electrode.

The 24–v circuit contains an automotive–type, 3–amp. fuse located on the control. (See **Figure 4**) Any shorts of the 24–v wiring during installation, service, or maintenance will cause this fuse to blow. If fuse replacement is required, use ONLY a 3–amp. fuse. The control LED display will be off when fuse needs to be replaced.

Troubleshooting

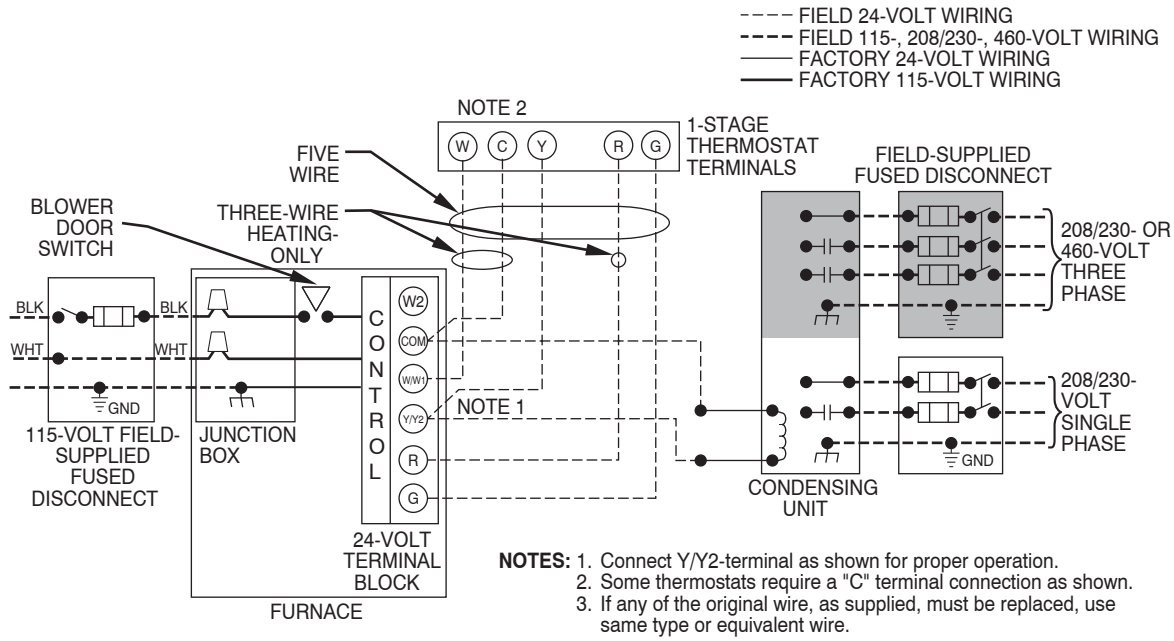
Refer to the service label. (See **Figure 15**—Service Label)

The Troubleshooting Guide – Flow Chart (See **Figure 17**) can be a useful tool in isolating furnace operation problems. Beginning with the word "Start," answer each question and follow the appropriate arrow to the next item.

The Guide – Flow Chart will help to identify the problem or failed component. After replacing any component, verify correct operation sequence.

Proper instrumentation is required to service electrical controls. The control in this furnace is equipped with a Status Code LED (Light–Emitting Diode) to aid in installation, servicing, and troubleshooting. Status codes can be viewed at the indicator in blower door. The amber furnace control LED is either a heartbeat, off or a code composed of 1 or 2 digits. The first digit is the number of short flashes, the second digit is the number of long flashes.

Figure 8 **Heating and Cooling Application Wiring Diagram with Single–Stage Thermostat**



For an explanation of status codes, refer to service label located on control door or **Figure 15**, and the troubleshooting guide which can be obtained from your distributor.

Retrieving Stored Fault Codes

The stored status codes will NOT be erased from the control memory, when 115– or 24–v power is interrupted. The control will store up to the last 7 Status Codes in order of occurrence.

1. To retrieve status codes, proceed with the following:

NOTE: NO thermostat signal may be present at control, and all blower–OFF delays must be completed.

a. Leave 115–v power to furnace turned on.
b. Look into blower door indicator for current LED status.
c. Remove blower door.

NOTE: The Status Codes cannot be retrieved by disconnecting the limit switch. To retrieve Status Codes, follow the procedure below.

2. Turn Setup Switch, SW1–1 “ON.”
3. Manually close blower door switch.
4. Control will flash up to 7 Status Codes.
5. The last Status Code, or 8th Code, will be a heartbeat.
6. Turn SW1–1 “OFF.”
7. A heartbeat amber LED will appear and indicates proper operation.
8. Release blower door switch, install control door and refer to the SERVICE label on the control door for more information.

Component Self–Test

Component Test can ONLY be initiated by performing the following:

1. Remove blower door.
2. Remove the wire from the “R” terminal of the control board.
3. Turn Setup Switch, SW–1–6 “ON.”
4. Manually close blower door switch.

Blower door switch opens 115–v power to control. No component operation can occur unless switch is closed. Caution must be taken when manually closing this switch for service purposes.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury, or death.

Blower door switch opens 115–v power to furnace control. No component operation can occur unless switch is closed. Exercise caution to avoid electrical shock from exposed electrical components when manually closing this switch for service purposes.

5. Component Test sequence will function as follows:

a. Inducer motor starts on high–speed and continues to run until Step (d.) of component test sequence.
b. Hot surface igniter is ON for 15 sec, then OFF.
c. Blower operates for 15 sec, then turns off.
d. Inducer motor goes to low–speed for 10 seconds, then turns off.
e. After component test is completed, one or more status codes (heartbeat, 2+5) will flash. See component test section of service label for explanation of status codes.

NOTE: To repeat component test, turn setup switch SW1–6 OFF then back ON.

f. Turn setup switch SW1–6 OFF.

6. Release blower door switch, reattach wire to “R” terminal on furnace control board and replace blower door.

Care and Maintenance

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

Never store flammable or combustible materials on, near, or in contact with the furnace, such as:

1. Spray or aerosol cans, rags, brooms, dust mops, vacuum cleaners, or other cleaning tools.
2. Soap powders, bleaches, waxes or other cleaning compounds, plastic or plastic containers, gasoline, kerosene, cigarette lighter fluid, dry cleaning fluids, or other volatile fluids.
3. Paint thinners and other painting compounds, paper bags, or other paper products. Exposure to these materials could lead to corrosion of the heat exchangers.

For continuing high performance and to minimize possible furnace failure, periodic maintenance must be performed on this furnace. Consult your local dealer about proper frequency of maintenance and the availability of a maintenance contract.

⚠ WARNING

ELECTRICAL SHOCK AND FIRE HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

Turn off the gas and electrical supplies to the furnace and install lockout tag before performing any maintenance or service. Follow the operating instructions on the label attached to the furnace.

⚠ WARNING

CARBON MONOXIDE POISONING AND FIRE HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

Never operate furnace without a filter or filtration device installed. Never operate a furnace with filter or filtration device access doors removed.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts, and servicing furnaces.

The minimum maintenance on this furnace is as follows:

1. Check and clean air filter each month or more frequently if required. Replace if torn.
2. Check blower motor and wheel for cleanliness each heating and cooling season. Clean as necessary.
3. Check electrical connections for tightness and controls for proper operation each heating season. Service as necessary.
4. Inspect burner compartment before each heating season for rust, corrosion, soot or excessive dust. If necessary, have furnace and burner serviced by a qualified service agency.
5. Inspect the vent pipe/vent system before each heating season for water leakage, sagging pipes or broken fittings. Have vent pipes/vent system serviced by a qualified service agency.
6. Inspect any accessories attached to the furnace such as a humidifier or electronic air cleaner. Perform any service or maintenance to the accessories as recommended in the accessory instructions.

Cleaning and/or Replacing Air Filter

The air filter type may vary depending on the application or orientation. The filter is external to the furnace casing. There are no provisions for an internal filter with this furnace. See “Filter Arrangement” under the “Installation” section of this manual.

NOTE: If the filter has an airflow direction arrow, the arrow must point toward the blower.

To clean or replace filters, proceed as follows:

⚠ WARNING

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury or death, or property damage.

Before installing, modifying, or servicing system, main electrical disconnect switch must be in the OFF position and install a lockout tag. There may be more than one disconnect switch. Lock out and tag switch with a suitable warning label. Verify proper operation after servicing. Always reinstall access doors after completing service and maintenance.

1. Turn off electrical supply to furnace.
2. Remove filter cabinet door.
3. Slide filter out of cabinet.
4. If equipped with permanent, washable filter, clean filter by spraying cold tap water through filter in opposite direction of airflow. Rinse filter and let dry. Oiling or coating of the filter is not recommended.
5. If equipped with factory specified disposable media filter, replace only with a factory specified media filter of the same size.
6. Slide filter into cabinet.
7. Replace filter cabinet door.
8. Turn on electrical supply to furnace.

Blower Motor and Wheel Maintenance

To ensure long life, economy, and high efficiency, clean accumulated dirt and grease from blower wheel and motor annually.

The inducer and blower motors are pre−lubricated and require no additional lubrication. These motors can be identified by the absence of oil ports on each end of the motor.

The following items should be performed by a qualified service technician. Clean blower motor and wheel as follows:

1. Turn off electrical supply to furnace.
2. Remove blower door.

3. All factory wires can be left connected, but field thermostat and accessory wiring may need to be disconnected depending on their length and routing.
4. If the vent and combustion air pipe passes through the blower compartment, it will be necessary to remove the pipes from the blower compartment.

Disconnect the vent and combustion air pipe by:

a. Loosen the clamps on the vent couplings and combustion air pipe external to the furnace.
b. Separate the pipes from the couplings and move them aside.
c. Loosen the clamps on the vent couplings and combustion air pipe located on the blower shelf.
d. Separate the pipes from the blower compartment and set aside.
e. Remove the couplings from the pipe adapters and set aside.
f. After servicing the blower, reverse steps a through e.
g. Tighten all clamps 15 lb–in.

See **Figure 9** for steps 5 through 14.

5. Remove screws securing blower assembly to blower shelf and slide blower assembly out of furnace. Detach ground wire and disconnect blower motor harness plugs from blower motor.

NOTE: Blower wheel is fragile. Use care.

6. Clean blower wheel and motor by using a vacuum with soft brush attachment. Be careful not to disturb balance weights (clips) on blower wheel vanes. Do not bend wheel or blades as balance will be affected.
7. If greasy residue is present on blower wheel, remove wheel from the blower housing and wash it with an appropriate degreaser. To remove wheel:

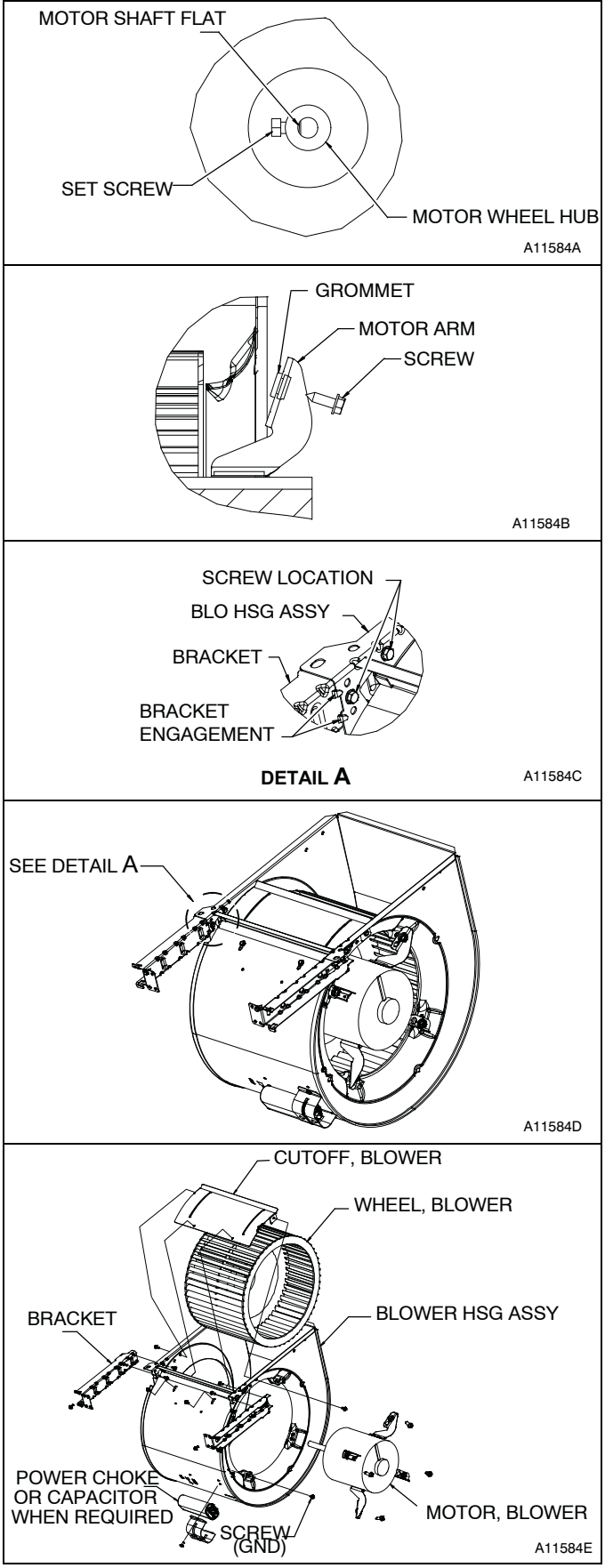
a. Mark blower wheel location on shaft before disassembly to ensure proper reassembly.
b. Loosen setscrew holding blower wheel on motor shaft.

NOTE: Mark blower mounting arms and blower housing so each arm is positioned at the same hole location during reassembly.

c. Mark blower wheel orientation and cutoff plate location to ensure proper reassembly.
d. Remove screws securing cutoff plate and remove cutoff plate from housing.
e. Remove bolts holding motor mounts to blower housing and slide motor and mounts out of housing.
f. Remove blower wheel from housing.
g. Clean wheel per instructions on degreaser cleaner. Do not get degreaser in motor.

8. Reassemble motor and blower wheel by reversing items 7b through 7f. Ensure wheel is positioned for proper rotation.
9. Torque motor mounting bolts to 40 +/– 10 lb–in. when reassembling.
10. Torque blower wheel set screw to 160 +/– 20 lb–in. when reassembling.
11. Verify that blower wheel is centered in blower housing and set screw contacts the flat portion of the motor shaft. Loosen set screw on blower wheel and reposition if necessary.

Figure 9 Blower Assembly



12. Spin the blower wheel by hand to verify that the wheel does not rub on the housing.
13. Reinstall blower assembly in furnace.
14. Reinstall 2 screws securing blower assembly to blower deck.
15. Reconnect blower leads to furnace control. Refer to furnace wiring diagram, and connect thermostat leads if previously disconnected.

NOTE: Be sure to attach ground wire and reconnect blower harness plugs to blower motor.

⚠ WARNING

ELECTRICAL OPERATION HAZARD

Failure to follow this warning could result in personal injury or death.

Blower door switch opens 115–v power to control. No component operation can occur unless switch is closed. Caution must be taken when manually closing this switch for service purposes.

16. Downflow or horizontal furnaces with vent pipe through furnace only:
    a. Install and connect short piece of vent pipe inside furnace to existing vent.
    b. Connect vent connector to vent elbow.
17. Turn on electrical supply. Manually close blower door switch. Use a piece of tape to hold switch closed. Check for proper rotation and speed changes between heating and cooling by jumpering R to G and R to Y/Y2 on furnace control thermostat terminals. If outdoor temperature is below 70°F (21°C), turn off circuit breaker to outdoor unit before running furnace in the cooling cycle. Turn outdoor circuit breaker on after completing cooling cycle. (See **Figure 4**)

NOTE: If R–W/W1 thermostat terminals are jumpered at the time blower door switch is closed, blower will run for 90 sec before beginning a heating cycle.

    a. Perform component self–test as shown at the bottom of the SERVICE label, located on the control door.
    b. Verify blower is rotating in the correct direction
18. If furnace is operating properly, RELEASE BLOWER DOOR SWITCH. Remove any jumpers or reconnect any disconnected thermostat leads. Replace blower door.
19. Turn on gas supply and cycle furnace through one complete heating cycle. Verify the furnace temperature rise as shown in Adjustments Section. Adjust temperature rise as shown in Adjustments Section.

Cleaning Burners and Flame Sensor

The following items must be performed by a qualified service technician. If the burners develop an accumulation of light dirt or dust, they may be cleaned by using the following procedure:

NOTE: Use a back-up wrench on the gas valve to prevent the valve from rotating on the manifold or damaging the mounting to the burner assembly.

⚠ WARNING

ELECTRICAL SHOCK AND FIRE HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

Turn off the gas and electrical supplies to the furnace and install lockout tag before performing any maintenance or service. Follow the operating instructions on the label attached to the furnace.

Refer to **Figure 10**.

1. Disconnect power at external disconnect, fuse or circuit breaker.
2. Turn off gas at external shut-off or gas meter.
3. Remove control door and set aside.
4. Turn electric switch on gas valve to OFF.
5. Disconnect the gas pipe from gas valve and remove pipe from the furnace casing.
6. Remove individual wires from terminals on gas valve (All other models).
7. Disconnect Hot Surface Igniter (HSI) wires from HSI.
8. Disconnect Flame Sensor wire from Flame Sensor.
9. Support the manifold and remove the 4 screws that secure the manifold assembly to the burner assembly and set aside. Note the location of the green/yellow wire and ground terminal.
10. Inspect the orifices in the manifold assembly for blockages or obstructions. Remove orifice and clean or replace orifice.
11. Remove the four screws that attach the top plate of the casing to the furnace.
12. Raise top plate up slightly and prop it up with a small piece of wood or folded cardboard.
13. Support the burner assembly and remove the screws that attach the burner assembly to the heat exchanger cell panel.
14. Remove wires from both rollout switches.
15. Slide one–piece burner out of slots on sides of burner assembly.
16. Remove the flame sensor from the burner assembly.
17. (Optional) Remove the Hot Surface Igniter (HSI) and bracket from the burner assembly.
18. Check igniter resistance. Nominal resistance is 40 to 70 ohms at room temperature and is stable over the life of the igniter.
19. Clean burner with a brush and a vacuum.
20. Clean the flame sensor with fine steel wool (0000 grade). Do not use sand paper or emery cloth.

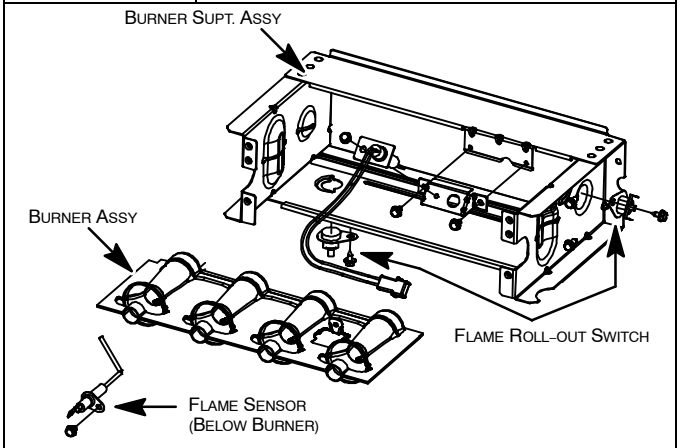
To reinstall burner assembly:

1. Install the Hot Surface Igniter (HSI) and bracket in burner assembly.
2. Install flame sensor on burner.

3. Align the edges of the one-piece burner with the slots in the burner assembly and slide the burners forward until they are fully seated in the burner assembly.
4. Align the orifices in the manifold assembly with the support rings on the end of the burner.
5. Insert the orifices in the support rings of the burners.

NOTE: If manifold does not fit flush against the burner, do not force the manifold on the burner assembly. The burners are not fully seated forward in the burner assembly. Remove the manifold and check burner positioning in the burner assembly assembly before re-installing the manifold.

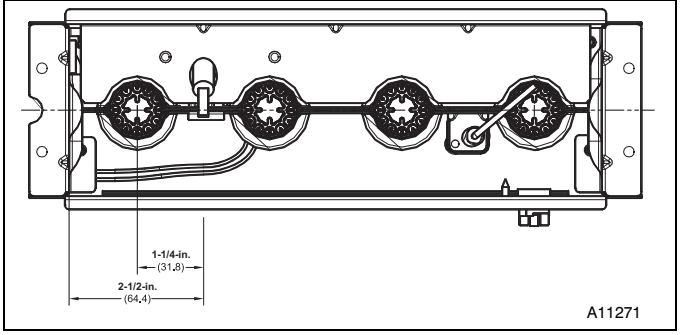
Figure 10 Burner Assembly



Representative drawing only, some models may vary in appearance.

6. Attach the green/yellow wire and ground terminal to one of the manifold mounting screws.
7. Install the remaining manifold mounting screws.
8. Check the igniter alignment. See **Figure 10**, **Figure 11** and **Figure 12**.

Figure 11 Igniter Position – Top View

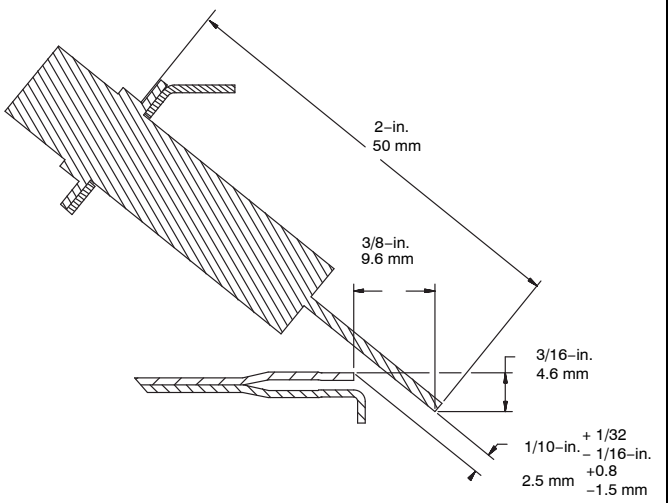


9. Attach the wires to the roll-out switches.
10. Align the burner assembly with the openings in the primary cell inlet panel and attach the burner assembly to the cell panel.
11. Connect the wire for the flame sensor.
12. Connect the wire for the Hot Surface Igniter.

NOTE: Use propane-resistant pipe dope to prevent leaks. Do not use Teflon tape.

13. Install the gas pipe to the gas valve.

Figure 12 Igniter Position – Side View



⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

Never purge a gas line into a combustion chamber. Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

14. Check for gas leaks with a commercially available soap solution made specifically for the detection of leaks.
15. Turn gas on at electric switch on gas valve and at external shut-off or meter
16. Turn power on at external disconnect, fuse or circuit breaker.
17. Run the furnace through two complete heating cycles to check for proper operation
18. Install control door when complete.

Servicing Hot Surface Igniter

The igniter does **NOT** require annual inspection. Check igniter resistance before removal. Refer to **Figure 10**, **Figure 11** and **Figure 12**.

1. Turn off gas and electrical supplies to furnace.
2. Remove control door.
3. Disconnect igniter wire connection.
4. Check igniter resistance. Igniter resistance is affected by temperature. Only check resistance when the igniter is at room temperature.
   a. Using an ohm meter, check resistance across both igniter leads in connector.
   b. Cold reading should be between 40 ohms and 70 ohms.

5. Remove igniter assembly.
   a. Using a 1/4−in. driver, remove the two screws securing the igniter mounting bracket to the burner assembly. (See **Figure 10**)
   b. Carefully withdraw the igniter and bracket assembly through the front of the burner assembly without striking the igniter on surrounding parts.
   c. Inspect igniter for signs of damage or failure.
   d. If replacement is required, remove the screw that secures the igniter on igniter bracket and remove the igniter.
6. To replace igniter and bracket assembly, reverse items 5a through 5d.
7. Reconnect igniter harness to the igniter, dressing the igniter wires to ensure there is no tension on the igniter itself. (See **Figure 10**)
8. Turn on gas and electrical supplies to furnace.
9. Verify igniter operation by initiating control board self−test feature or by cycling thermostat.
10. Replace control door.

Flushing Collector Box and Drainage System

⚠ WARNING

ELECTRICAL SHOCK AND FIRE HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

Turn off the gas and electrical supplies to the furnace and install lockout tag before performing any maintenance or service. Follow the operating instructions on the label attached to the furnace.

1. Turn off gas and electrical supplies to furnace.
2. Remove control door.
3. Disconnect pressure switch tube from pressure switch port.

NOTE: Ensure the pressure switch tube disconnected from the pressure switch is higher than the collector box opening or water will flow out of tube.

4. Remove the collector box plug from the top port on the upper corner of the collector box. (See **Figure 1**)
5. Attach a funnel with a flexible tube to port on the collector box.
6. Flush inside of collector box with water until discharge water from condensate trap is clean and runs freely.
7. Repeat steps 4 thru 6 with middle plug on upper corner of collector box.
8. Remove the pressure switch tube from the collector box.

NOTE: Do **NOT** blow into tube with tube connected to the pressure switch.

9. Clean pressure switch port on collect box with a small wire. Shake any water out of pressure switch tube.
10. Reconnect tube to pressure switch and pressure switch port.
11. Remove the relief tube from the port on the collector box and the trap.
12. Clean the relief port on collect box and the trap with a small wire. Shake any water out of the tube.
13. Reconnect relief tube to trap and collector box ports.

Cleaning Condensate Drain and Trap

NOTE: If the condensate trap is removed, a new gasket between the trap and collector box is required. Verify a condensate trap gasket is included in the service kit or obtain one from your local distributor.

1. Disconnect power at external disconnect, fuse or circuit breaker.
2. Turn off gas at external shut-off or gas meter.
3. Remove control door and set aside.
4. Turn electric switch on gas valve to OFF.
5. Disconnect external drain from condensate drain elbow or drain extension pipe inside the furnace and set aside.
6. Disconnect the condensate trap relief hose from collector box port and condensate trap.

NOTE: If condensate has a heat pad attached to the trap, trace the wires for the pad back to the connection point and disconnect the wires for the heat pad.

7. Remove the screw that secures the condensate trap to the collector box, remove the trap and set aside.
8. Remove the trap gasket from the collector box if it did not come off when the trap was removed.
9. Discard the old trap gasket.
10. Rinse condensate trap in warm water until trap is clean.
11. Flush condensate drain lines with warm water. Remember to check and clean the relief port on the collector box.
12. Shake trap dry.
13. Clean port on collector box with a small wire.

To re-install Condensate Drain and Trap:

1. Remove adhesive backing from condensate trap gasket
2. Install gasket on collector box
3. Align the condensate trap with the drain opening on the collector box and secure the trap with the screw
4. Attach the relief hose to the relief port on the condensate trap and collector box.
5. Secure tubing to prevent any sags or traps in the tubing.
6. Connect condensate drain elbow or drain extension elbow to the condensate trap
7. Connect the leads of the condensate heat pad (if used)
8. Connect external drain piping to the condensate drain elbow or drain extension pipe.
9. Turn gas on at electric switch on gas valve and at external shut-off or meter
10. Turn power on at external disconnect, fuse or circuit breaker.
11. Run the furnace through two complete heating cycles to check for proper operation
12. Install control door when complete.

Checking Heat Pad Operation (If Applicable)

In applications where the ambient temperature around the furnace is 32°F (0°C) or lower, freeze protection measures are required. If this application is where heat tape has been applied, check to ensure it will operate when low temperatures are present.

NOTE: The Heat Pad, when used, should be wrapped around the condensate drain trap. There is no need to use heat tape within the furnace casing. Most heat tapes are temperature activated, and it is not practical to verify the actual heating of the tape. Check the following:

1. Check for signs of physical damage to heat tape such as nicks, cuts, abrasions, gnawing by animals, etc.
2. Check for discolored heat tape insulation. If any damage or discolored insulation is evident, replace heat tape.
3. Check that heat tape power supply circuit is on.

Cleaning Heat Exchangers

The following items must be performed by a qualified service technician.

Primary Heat Exchangers

If the heat exchangers get an accumulation of light dirt or dust on the inside, they may be cleaned by the following procedure:

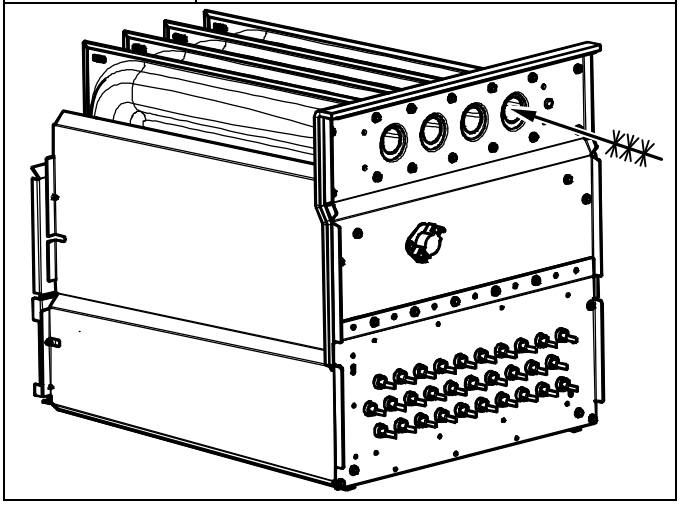
NOTE: If the heat exchangers get a heavy accumulation of soot and carbon, both the primary and secondary heat exchangers should be replaced rather than trying to clean them thoroughly due to their intricate design. A build−up of soot and carbon indicates that a problem exists which needs to be corrected, such as improper adjustment of manifold pressure, insufficient or poor quality combustion air, improper vent termination, incorrect size or damaged manifold orifice(s), improper gas, or a restricted heat exchanger (primary or secondary). Action must be taken to correct the problem.

1. Turn off gas and electrical supplies to furnace.
2. Remove control door.
3. Disconnect wires or connectors to flame rollout switch, gas valve, igniter, and flame sensor.
4. Using backup wrench, disconnect gas supply pipe from furnace gas control valve.
5. Remove two screws attaching top filler plate and rotate upwards to gain access to screws attaching burner assembly to cell panel.
6. Remove screws attaching burner assembly to cell panel. (See **Figure 10**)

NOTE: Burner cover, manifold, gas valve, and burner assembly should be removed as one assembly.

7. Clean heat exchanger openings with a vacuum and a soft brush. (See **Figure 13**)

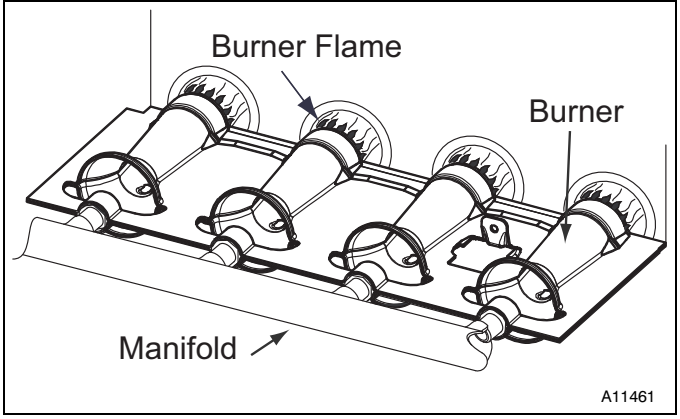
Figure 13 Cleaning Heat Exchanger Cell



NOTE: After cleaning, inspect the heat exchangers to ensure they are free of all foreign objects that may restrict flow of combustion products.

8. Reverse items 6 through 1 for reassembly.
9. Refer to furnace wiring diagram and reconnect wires to flame rollout switch, gas valve, igniter, and flame sensor.
10. Turn on gas and electrical supplies to furnace.
11. Check furnace operation through two complete heat operating cycles. Look at burners. Burner flames should be clear blue, almost transparent. (See **Figure 14**)
12. Check for gas leaks.

Figure 14 Burner Flame



⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

Never purge a gas line into a combustion chamber. Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

13. Replace main furnace door.

Secondary Heat Exchangers

The condensing side (inside) of the secondary heat exchanger CANNOT be serviced or inspected without complete removal of the heat exchanger assembly. Detailed information on heat exchanger removal can be obtained from your Distributor.

Winterization

⚠ CAUTION

UNIT AND PROPERTY DAMAGE HAZARD

Failure to follow this caution may result in unit component or property damage.

If the furnace is installed in an unconditioned space where the ambient temperatures may be 32° F (0° C) or lower, freeze protection measures must be taken to prevent property or product damage.

Since the furnace uses a condensing heat exchanger, some water will accumulate in the unit as a result of the heat transfer process. Therefore, once it has been operated, it cannot be turned off and left off for an extended period of time when temperatures will reach 32°F (0°C) or lower unless winterized. Follow these procedures to winterize your furnace:

⚠ CAUTION

UNIT COMPONENT DAMAGE HAZARD

Failure to follow this caution may result in damage to the furnace and other property damage.

Do not use ethylene glycol (automotive antifreeze coolant or equivalent). Failure of plastic components may occur.

1. Obtain propylene glycol (RV/swimming pool antifreeze or equivalent).
2. Turn off gas and electrical supplies to your furnace.
3. Remove furnace control door.
4. Remove the top unused rubber plug from the port on the collector box opposite the condensate trap. (See **Figure 1**)
5. Connect a field supplied 3/8−in. (9.5−mm) ID tube to the open port on the collector box
6. Insert a field supplied funnel into the tube.
7. Pour 1 quart of anti−freeze solution into the funnel/tube. Antifreeze should run through the collector box, overfill condensate trap and flow to an open drain.
8. Replace the rubber plug in the port on the collector box.
9. Remove the middle unused rubber plug from the port on the collector box opposite the condensate trap. See **Figure 1**.
10. Repeat Steps 5 through 8.
11. If a condensate pump is used, check with pump manufacturer to verify pump is safe for use with antifreeze used. Allow pump to start and pump anti−freeze to open drain.
12. Replace main door.
13. When furnace is re−started, flush condensate pump with clear water to check for proper operation before re−starting furnace.
14. Propylene glycol need not be removed before re−starting furnace.

Figure 15 **Service Label**

SERVICE

If status code recall is needed, disconnect the "R" thermostat lead, reset power, and put setup switch "SW1-1" in the ON position. To clear the status code history put setup switch "SW1-1" in the ON position and jumper thermostat terminals "R", "W/W1", and "Y/Y2" simultaneously until heartbeat is flashed. Stored status codes are erased automatically after 72 hours or as specified.

LED CODE	STATUS
CONTINUOUS OFF -	Check for 115VAC at Neutral and 24VAC at SEC-1 and SEC-2, and 24VAC fuse.
HEARTBEAT -	(bright - dim) Control has 24 VAC power.
ON SOLID -	Auto-reset after 1 hour lockout due to; - Gas valve relay contact stuck open - Flame sense circuit failure - Software check error Reset power to clear lockout. Replace control if status code repeats.

EACH OF THE FOLLOWING STATUS CODES IS A SINGLE OR TWO DIGIT NUMBER WITH THE FIRST NUMBER DETERMINED BY THE NUMBER OF SHORT FLASHES AND THE SECOND NUMBER AFTER THE PLUS (+) SIGN IS THE NUMBER OF LONG FLASHES.

OFF **SECONDARY VOLTAGE FUSE IS OPEN -** Check for: - Short circuit in secondary voltage (24VAC) wiring.

2 **PRESSURE SWITCH DID NOT OPEN -** Check for: -Obstructed pressure tubing - Pressure switch stuck closed

3 **LOW-HEAT PRESSURE SWITCH DID NOT CLOSE OR REOPENED -** Indicates the low-heat pressure switch input failed to close on a call for low-heat, or opened during low-heat. If opens during 5 minutes after ignition the next heating cycle will be restricted to high-heat. Check for: - Proper vent sizing - Plugged condensate drain - Excessive wind - Low inlet gas pressure (if LGPS used) - Improper pressure switch wiring - Restricted combustion air supply - Disconnected or obstructed pressure tubing - Water in vent piping, possible sagging pipe - Failed or "Out-of-Calibration" pressure switches

4 **LIMIT CIRCUIT FAULT -** Indicates a limit or flame rollout, is open or the furnace is operating in high-heat only mode due to 2 successive low heat limit trips. Blower will run for 4 minutes or until open switch remakes whichever is longer. If open longer than 3 minutes, code changes to lockout #7. If open less than 3 minutes status code #4 continues to flash until blower shuts off. Flame rollout switch requires manual reset. Check for: - Improper limit switch or no limit gasket - Defective switch or connections - Loose blower wheel - Improper low or high-heat gas input adjustment - Stuck high-heat solenoid in gas valve

5 **ABNORMAL FLAME-PROVING SIGNAL -** Flame is proved while gas valve is de-energized. Inducer will run until fault is cleared. Check for: - Leaky gas valve - Stuck-open gas valve

6 **IGNITION PROVING FAULT -** Control will try three more times before lockout #6 + 1 occurs. If flame signal lost during blower on-delay period, blower will come on for the selected blower off-delay. Check for: - Oxide buildup on flame sensor (clean with fine steel wool) - Proper flame sense microamps (.5 microamps D.C. min., 4.0 - 6.0 nominal) - Manual valve shut-off - Control ground continuity - Gas valve defective turned "OFF" - Low inlet gas pressure - Inadequate flame carryover or rough ignition - Defective Hot Surface Ignitor - Flame sensor must not be grounded - Green/yellow wire **MUST** be connected to furnace sheet metal

7 **LIMIT CIRCUIT LOCKOUT -** Lockout occurs if a limit or flame rollout switch is open longer than 3 minutes or 10 successive limit trips occurred during high-heat. - Control will auto reset after 3 hours. - Refer to #4

8 **GAS HEATING LOCKOUT -** Control will NOT auto reset. Check for: - Mis-wired gas valve - Defective control (valve relay)

9 **HIGH-HEAT PRESSURE SWITCH OR HPSR RELAY DID NOT CLOSE OR REOPENED -** Indicates the high-heat pressure switch input failed to close on a call for high-heat, or opened during high-heat. HPSR relay may be defective. Refer to status code #3.

10 **POLARITY -** Check for correct line voltage polarity. If units are twinned, check for proper low-voltage (24V) transformer phasing.

1 + 2 **BLOWER ON AFTER POWER UP (115VAC or 24VAC) -** Blower runs for 90 seconds, if unit is powered up during a call for heat (R-W/W1 closed) or (R-W/W1) opens during blower on-delay period.

2 + 5 **MODEL SELECTION OR SETUP ERROR -** Either indicates the model plug (PL4) is missing or incorrect or setup switch "SW1-1" or "SW1-6" is positioned improperly. If code flashes only 4 times on power-up control is defaulting to model selection stored in memory. Check the following: - Thermostat call with "SW1-1" ON - Thermostat call with "SW1-6" ON - "SW1-1" and "SW1-6" both ON together - Two different furnace models twinned - See Rating Plate for model plug number and resistance values if code flashes continuously

4 + 3 **LOW-HEAT PRESSURE SWITCH OPEN WHILE HIGH-HEAT PRESSURE SWITCH IS CLOSED -** Check for: - Plugged condensate drain - low inlet gas pressure (if LGPS used) - Improper pressure switch wiring - Water in vent piping, possibly sagging pipe - Stuck open low-heat pressure switch - Disconnected or obstructed pressure tubing

6 + 1 **IGNITION LOCKOUT -** Control will auto-reset after 3 hours. Refer to #6.

COMPONENT TEST

To initiate the component test sequence shut OFF the room thermostat or disconnect the "R" thermostat lead. Reset power and then put setup switch "SW1-6" in the ON position to start the component test sequence. Once initiated the furnace control will turn the inducer ON. The inducer motor will run for the entire test. The hot surface igniter and blower motor will be turned ON for 15 seconds each. When the blower is turned OFF the inducer will be switched to low speed for 10 seconds. When the component test is completed one or more of the following codes will flash.

CODE	DESCRIPTION
HEARTBEAT	Indicates no errors detected. Visual check of hot surface igniter, inducer, blower motor, required.
2 + 5	SETUP ERROR - Same as code 2 + 5 above.

To repeat component test turn setup switch "SW1-6" OFF and then back ON. After component test is completed put setup switch "SW1-6" in the OFF position and reconnect the "R" thermostat lead.

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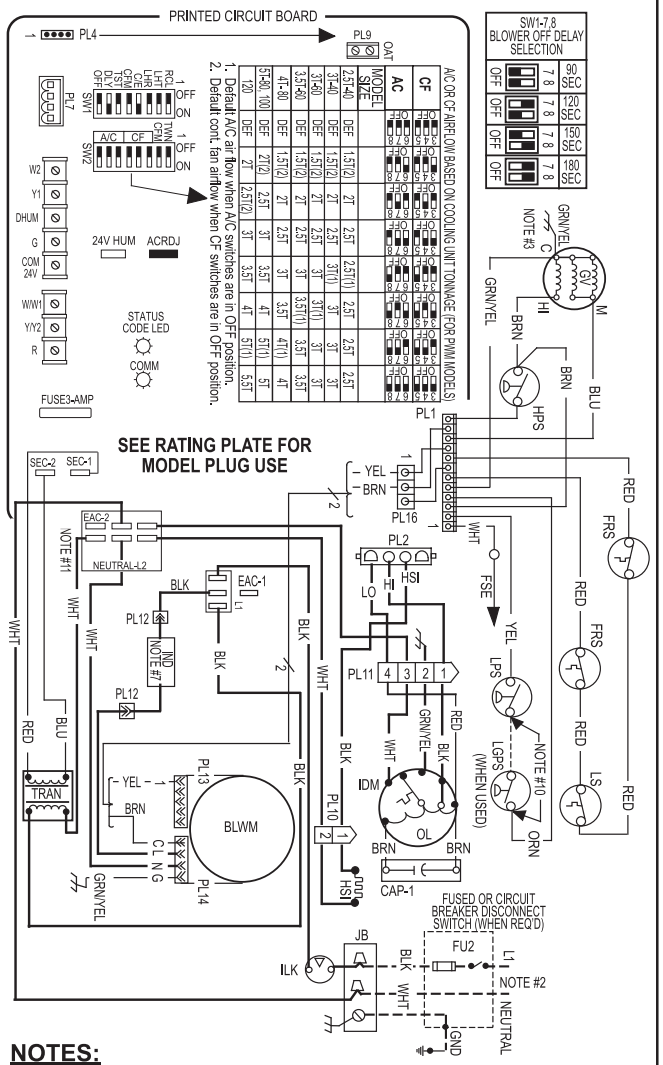
Figure 16 | **Wiring Diagram**

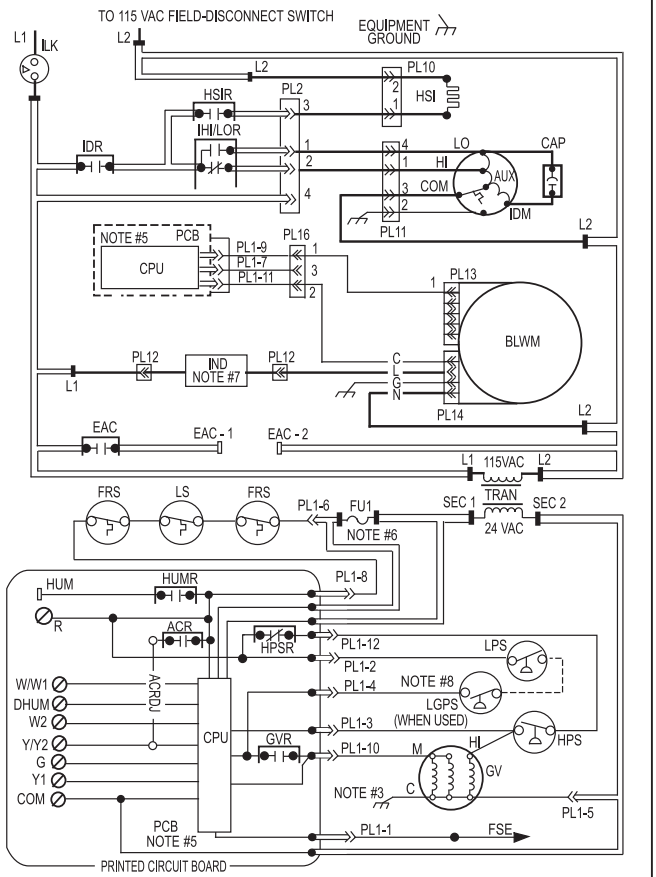
CONNECTION DIAGRAM



NOTES:

1. If any of the original equipment wire is replaced use wire rated for 105ºC.
2. Use only copper wire between the disconnect switch and the furnace junction box (JB).
3. This wire must be connected to furnace sheet metal for control to prove flame.
4. Symbols are electrical representation only.
5. Solid lines inside PCB are printed circuit board conductors and are not included in legend.
6. Replace only with a 3 amp fuse.
7. Inductor may be used with 3/4 hp and 1 hp ECM Blower motors. Review motor instructions if replacing motor to see to see if Inductor is required.
8. Factory connected when (LGPS) not used.
9. Blower off-delay, gas heating selections are (90, 120, 150, 180) seconds, cooling or heat pump 90 seconds or 5 seconds when dehumidify call is active.
10. Ignition lockout will occur after four consecutive usuccessful trials for ignition. Control will auto-reset after three hours.
11. Any of the 5 wires shown within the NEUTRAL L2 box can be connected to any terminal within the box.
12. Blower motor (BLWM) and Inducer motor (IDM) are locked-rotor overload protected by redundant electronic control circuits.

SCHEMATIC DIAGRAM



LEGEND

JUNCTION TERMINAL	FACTORY POWER WIRING (115VAC)
CONTROL TERMINAL	FACTORY CONTROL WIRING (24VAC)
PCB CONTROL TERMINAL	FIELD CONTROL WIRING (24VAC)
FIELD EARTH GROUND	CONDUCTOR ON CONTROL
EQUIPMENT GROUND	FIELD WIRING SCREW TERMINAL
	PLUG RECEPTACLE

ACR	Air Conditioning Relay, SPST (N.O.)
ACRDJ	Air Conditioning Relay Defeat Jumper
BLWM	Blower Motor (ECM)
CPU	Microprocessor/Circuitry
DHUM	DHUM Connection (24VAC)
EAC-1	Electronic Air Cleaner Connection (115VAC 1.0 Amp Max.)
EAC-2	Electronic Air Cleaner Connection (Common)
FRS	Flame-Rollout Switch, Man. Reset, SPST (N.C.)
FSE	Flame Proving Sensor Electrode
FU1	Fuse, 3 Amp, Automotive Blade Type Factory Installed
FU2	Fuse or Disconnect
GV	Gas Valve
GVR	Gas Valve Relay, DPST (N.O.)
HPS	High-Heat Pressure Switch, SPST (N.O.)
HPSR	High-heat Pressure Switch Relay SPST (N.C.)
HSI	Hot Surface Igniter (115VAC)
HSIR	Hot Surface Igniter Relay, SPST (N.O.)
HUM	24VAC Humidifier Connection (0.5 Amp Max.)
HUMR	Humidifier Relay, SPST (N.O.)
IDM	Induced Draft Motor, ECM
IDR	Inducer Motor Relay, SPST (N.O.)
IHI/LOR	Inducer Motor Speed Change Relay, SPDT
ILK	Blower Door Interlock Switch, SPST (N.O.)
IND	Inductor (Note #7)
LED	Light Emitting Diode for Status Codes
LGPS	Low Gas Pressure Switch, SPST (N.O.)
LPS	Low-heat Pressure Switch, SPST (N.O.)
LS	Limit Switch, Auto-Reset, SPST (N.C.)
PCB	Printed Circuit Board
PL1	12-Circuit Connector
PL2	4-Circuit HSI & IDM Connector
PL4	4-Circuit Model Plug Connector
PL7	4-Circuit Communication Connector
PL9	2-Circuit OAT Connector
PL10	2-Circuit HSI Connector
PL11	4-Circuit IDM Connector
PL12	1-Circuit Inductor Splice Connector
PL13	5-Circuit ECM Blower Ctrl. Connector
PL14	4-Circuit ECM Blower Power Connector
PL16	3-Circuit PWM Connector
SW1-1	Manual Switch, Status Code Recall
SW1-2	Manual Switch, Low Heat Only
SW1-3	Manual Switch, Low Heat Rise Adj.
SW1-4	Manual Switch, Comfort/Effy. Adj.
SW1-5	Manual Switch, Cooling CFM/Ton
SW1-6	Manual Switch, Component Test
SW1-7,8	Manual Switches, Blower Off-Delay
SW2-1	Manual Switch, Twinning Main (OFF) / Sec.
SW2-2	Manual Switch, Cooling CFM/Ton
SW2-3,4,5	Continuous Fan (Adjustable Airflow - CFM)
SW2-6,7,8	Air Conditioning (Adjustable Airflow - CFM)
TRAN	Transformer, 115VAC / 24VAC

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Figure 17 **Troubleshooting Guide – Flow Chart**

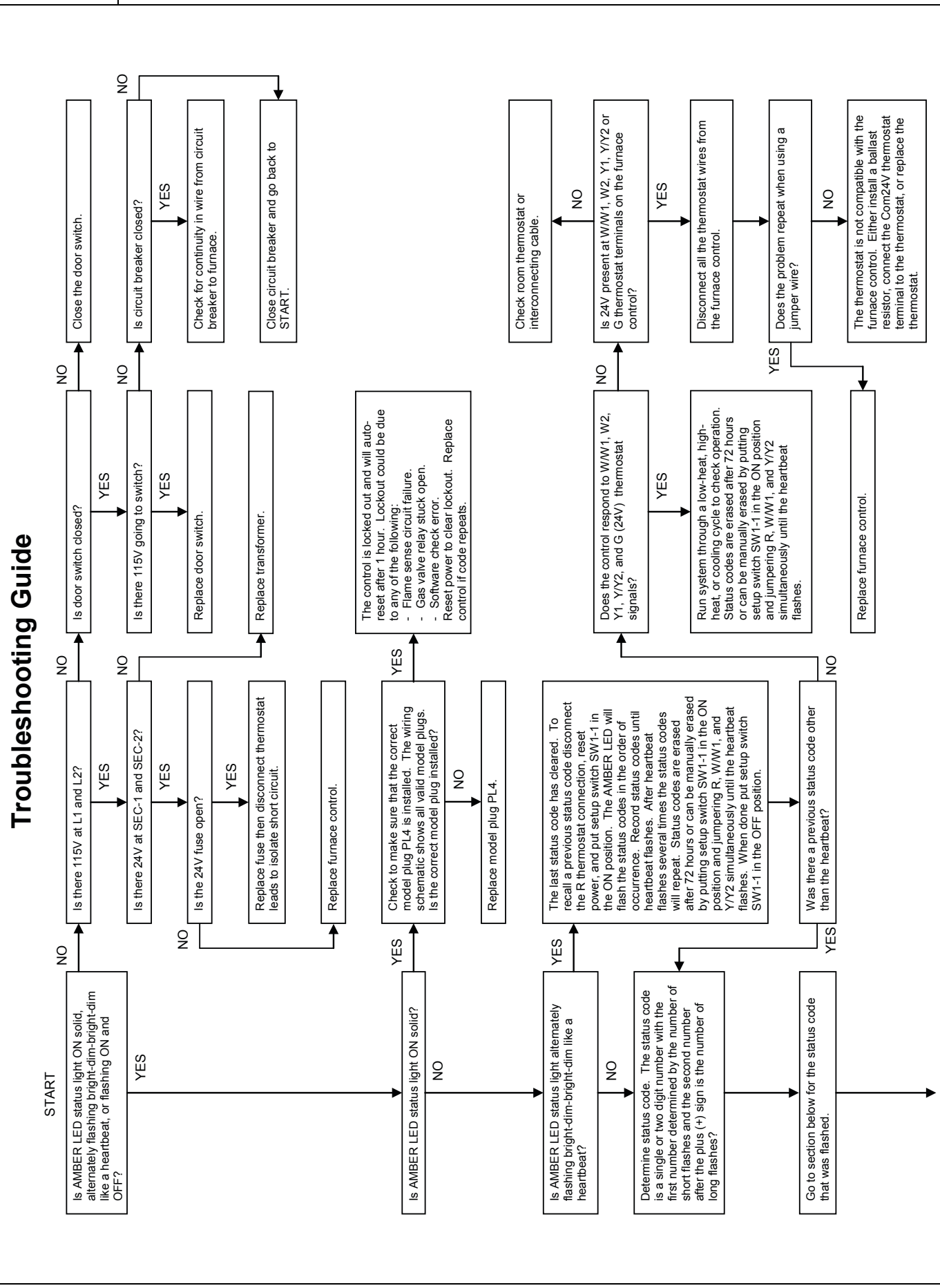
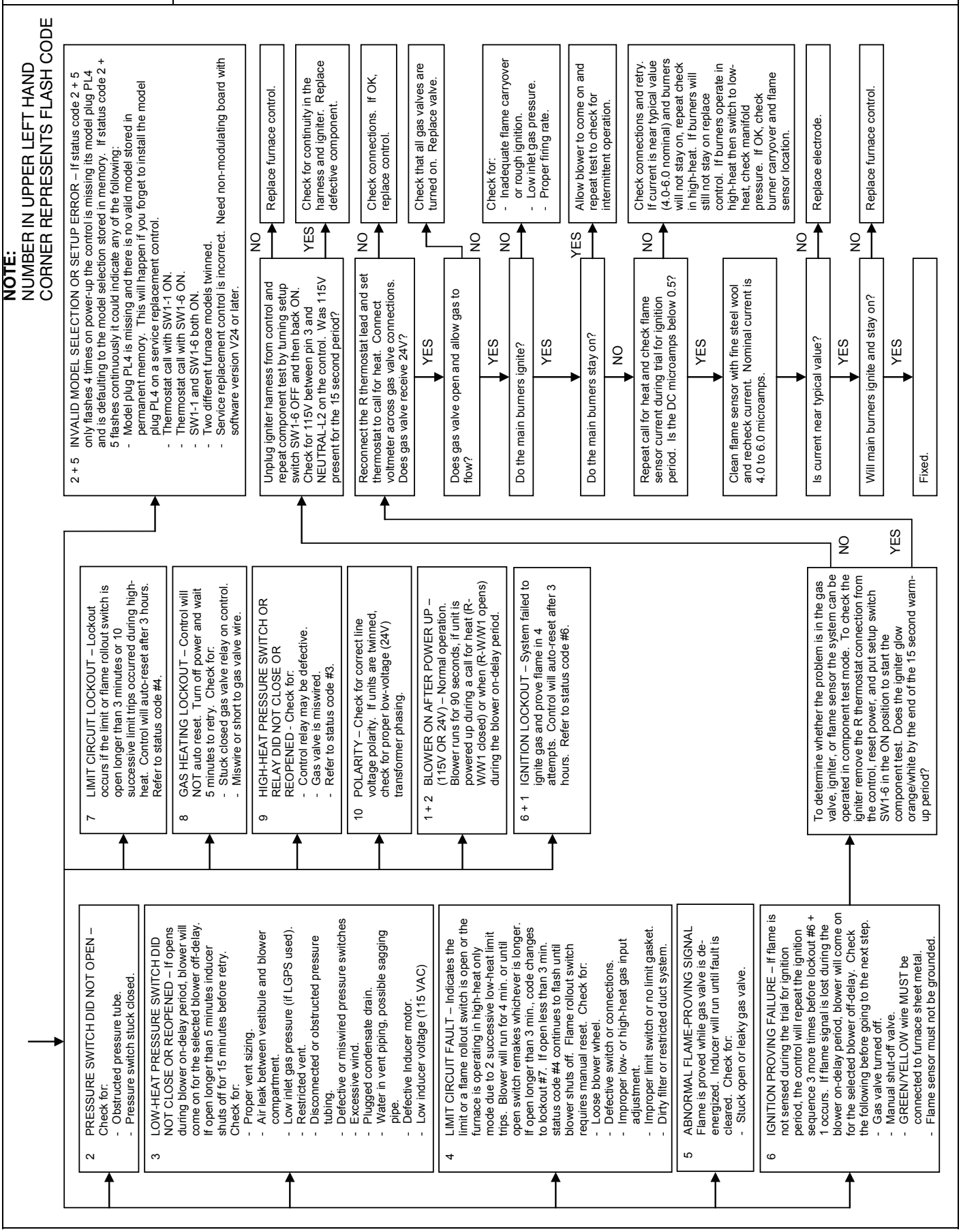


Figure 17 (CONT.) Troubleshooting Guide – Flow Chart



Sequence of Operation

NOTE: Furnace control must be grounded for proper operation or else control will lock out. Control is grounded through green/yellow wire routed to gas valve and burner box screw. Using the schematic diagram in **Figure 16**, follow the sequence of operation through the different modes. Read and follow the wiring diagram very carefully.

NOTE: If a power interruption occurs during a call for heat (W/W1 or W/W1–and–W2), the control will start a 90–second blower–only ON period two seconds after power is restored, if the thermostat is still calling for gas heating. The amber LED light will flash code 1+2 during the 90–second period, after which the LED will flash a heartbeat (bright–dim), as long as no faults are detected. After the 90–second period, the furnace will respond to the thermostat normally.

The blower door must be installed for power to be conducted through the blower door interlock switch ILK to the furnace control CPU, transformer TRAN, inducer motor IDM, blower motor BLWM, hot–surface igniter HSI, and gas valve GV.

1. Two–Stage Heating (Adaptive Mode) with Single–Stage Thermostat

NOTE: The low–heat only switch SW1–2 selects either the low–heat only operation mode when ON, (see item 2. below) or the adaptive heating mode when OFF in response to a call for heat. (See **Figure 5**) When the W2 thermostat terminal is energized it will always cause high–heat operation when the R–to–W circuit is closed, regardless of the setting of the low–heat only switch. This furnace can operate as a two–stage furnace with a single–stage thermostat because the furnace control CPU includes a programmed adaptive sequence of controlled operation, which selects low–heat or high–heat operation. This selection is based upon the stored history of the length of previous gas–heating periods of the single–stage thermostat.

The furnace will start up in either low– or high–heat. If the furnace starts up in low–heat, the control CPU determines the low–heat on–time (from 0 to 16 minutes) which is permitted before switching to high–heat.

If the power is interrupted, the stored history is erased and the control CPU will select low–heat for up to 16 minutes and then switch to high–heat, as long as the thermostat continues to call for heat. Subsequent selection is based on stored history of the thermostat cycle times.

The wall thermostat “calls for heat”, closing the R–to–W circuit. The furnace control performs a self–check, verifies the low–heat and high–heat pressure switch contacts LPS and HPS are open, and starts the inducer motor IDM in high–speed.

a. **Inducer Prepurge Period**

(1.) If the furnace control CPU selects low–heat operation the inducer motor IDM comes up to speed, the low–heat pressure switch LPS closes, and the furnace control CPU begins a 15–second prepurge period. If the low–heat pressure switch LPS fails to remain closed the inducer motor IDM will remain running at high–speed. After the low–heat pressure switch re–closes the furnace control CPU will begin a 15–second prepurge period, and continue to run the inducer motor IDM at high–speed.

(2.) If the furnace control CPU selects high–heat operation, the inducer motor IDM remains running at high–speed, and the high–heat pressure switch relay HPSR is de–energized to close the NC contact. When sufficient pressure is available the high–heat pressure switch HPS closes, and the high–heat gas valve solenoid GV–HI is energized. The furnace control CPU begins a 15–second prepurge period after the low–heat pressure switch LPS closes. If the high–heat pressure switch HPS fails to close and the low–heat pressure switch LPS closes, the furnace will operate at low–heat gas flow rate until the high–heat pressure switch closes for a maximum of 2 minutes after ignition.

b. **Igniter Warm–Up** –At the end of the prepurge period, the Hot–Surface Igniter HSI is energized for a 17–second igniter warm–up period.

c. **Trial–For–Ignition Sequence** –When the igniter warm–up period is completed the main gas valve relay contact GVR closes to energize the gas valve solenoid GV–M. The gas valve solenoid GV–M permits gas flow to the burners where it is ignited by the HSI. Five seconds after the GVR closes, a 2–second flame proving period begins. The HSI igniter will remain energized until the flame is sensed or until the 2–second flame proving period begins. If the furnace control CPU selects high–heat operation, the high–heat gas valve solenoid GV–HI is also energized.

d. **Flame–Proving** – When the burner flame is proved at the flame–proving sensor electrode FSE, the inducer motor IDM switches to low–speed unless the furnace is operating in high–heat, and the furnace control CPU begins the blower–ON delay period and continues to hold the gas valve GV–M open. If the burner flame is not proved within two seconds, the control CPU will close the gas valve GV–M, and the control CPU will repeat the ignition sequence for up to three more Trials–For–Ignition before going to Ignition–Lockout. Lockout will be reset automatically after three hours, or by momentarily interrupting 115 vac power to the furnace, or by interrupting 24 vac power at SEC1 or SEC2 to the furnace control CPU (not at W/W1, G, R, etc.). If flame is proved when flame should not be present, the furnace control CPU will lock out of Gas–Heating mode and operate the inducer motor IDM on high speed until flame is no longer proved.

e. **Blower–On delay** – If the burner flame is proven the blower–ON delays for low–heat and high–heat are as follows:
Low–heat – 45 seconds after the gas valve GV–M is opened the blower motor BLWM is turned ON at low–heat airflow.
High–heat – 25 seconds after the gas valve GV–M is opened the BLWM is turned ON at high–heat airflow. Simultaneously, the humidifier terminal HUM and electronic air cleaner terminal EAC–1 are energized and remain energized throughout the heating cycle.

f. **Switching from Low– to High–Heat** – If the furnace control CPU switches from low–heat to high–heat, the furnace control CPU will switch the inducer motor IDM speed from low to high. The high–heat pressure switch relay HPSR is de–energized to close the NC contact. When sufficient pressure is available the high–heat pressure switch HPS closes, and the high–heat gas valve solenoid GV–HI is energized. The blower motor BLWM will transition to high–heat airflow five seconds after the furnace control CPU switches from low–heat to high–heat.

g. **Switching from High– to Low–Heat** –The furnace control CPU will not switch from high–heat to low–heat while the thermostat R–to–W circuit is closed when using a single–stage thermostat.

h. **Blower–Off Delay** –When the thermostat is satisfied, the R to W circuit is opened, de–energizing the gas

valve GV–M, stopping gas flow to the burners, and de–energizing the humidifier terminal HUM. The inducer motor IDM will remain energized for a 15–second post–purge period. The blower motor BLWM and air cleaner terminal EAC–1 will remain energized at low–heat airflow or transition to low–heat airflow for 90, 120, 150, or 180 seconds (depending on selection at blower–OFF delay switches). The furnace control CPU is factory–set for a 120–second blower–OFF delay.

2. **Two–Stage Thermostat and Two–Stage Heating**
   See **Figure 18**–**Figure 21** for thermostat connections.

NOTE: In this mode the low–heat only switch SW1–2 must be ON to select the low–heat only operation mode in response to closing the thermostat R–to–W1 circuit. Closing the thermostat R–to–W1–and–W2 circuits always causes high–heat operation, regardless of the setting of the low–heat only switch.

The wall thermostat "calls for heat", closing the R–to–W1 circuit for low–heat or closing the R–to–W1–and–W2 circuits for high–heat. The furnace control performs a self–check, verifies the low–heat and high–heat pressure switch contacts LPS and HPS are open, and starts the inducer motor IDM in high–speed.

The start up and shut down functions and delays described in item 1. above apply to the 2–stage heating mode as well, except for switching from low– to high–Heat and vice versa.

a. **Switching from Low– to High–Heat** – If the thermostat R–to–W1 circuit is closed and the R–to–W2 circuit closes, the furnace control CPU will switch the inducer motor IDM speed from low to high. The high–heat pressure switch relay HPSR is de–energized to close the NC contact. When sufficient pressure is available the high–heat pressure switch HPS closes, and the high–heat gas valve solenoid GV–HI is energized. The blower motor BLWM will transition to high–heat airflow five seconds after the R–to–W2 circuit closes.

b. **Switching from High– to Low–Heat** –If the thermostat R–to– W2 circuit opens, and the R–to–W1 circuit remains closed, the furnace control CPU will switch the inducer motor IDM speed from high to low. The high–heat pressure switch relay HPSR is energized to open the NC contact and de–energize the high–heat gas valve solenoid GV–HI. When the inducer motor IDM reduces pressure sufficiently, the high–heat pressure switch HPS will open. The gas valve solenoid GV–M will remain energized as long as the low–heat pressure switch LPS remains closed. The blower motor BLWM will transition to low–heat airflow five seconds after the R–to–W2 circuit opens.

3. **Cooling mode**
   The thermostat "calls for cooling".
   a. **Single–Speed Cooling**–
      See **Figure 18** and **Figure 20** for thermostat connections
      The thermostat closes the R–to–G–and–Y circuits. The R–to– Y circuit starts the outdoor unit, and the R–to–G–and–Y/Y2 circuits start the furnace blower motor BLWM on cooling airflow. Cooling airflow is based on the A/C selection shown in **Table 5**. The electronic air cleaner terminal EAC–1 is energized with 115 vac when the blower motor BLWM is operating.
      When the thermostat is satisfied, the R–to–G–and–Y circuits are opened. The outdoor unit will stop, and the furnace blower motor BLWM will continue operating at cooling airflow for an additional 90 seconds. Jumper Y/Y2 to DHUM to reduce the cooling off–delay to 5 seconds. (See **Figure 4**)

   b. **Two–Stage Thermostat and Two–Speed Cooling**
      See **Figure 19** and **Figure 21** for thermostat connections

The thermostat closes the R–to–G–and–Y1 circuits for low–cooling or closes the R–to–G–and–Y1–and–Y2 circuits for high–cooling. The R–to–Y1 circuit starts the outdoor unit on low–cooling speed, and the R–to–G–and–Y1 circuit starts the furnace blower motor BLWM at low–cooling airflow which is the CF (continuous fan) selection as shown in **Figure 5**. The R–to–Y1–and–Y2 circuits start the outdoor unit on high–cooling speed, and the R–to– G–and–Y/Y2 circuits start the furnace blower motor BLWM at high–cooling airflow. High–cooling airflow is based on the A/C (air conditioning) selection shown in **Figure 5**.

The electronic air cleaner terminal EAC–1 is energized with 115 vac whenever the blower motor BLWM is operating.

When the thermostat is satisfied, the R–to–G–and–Y1 or R–to–G–and–Y1–and–Y2 circuits are opened. The outdoor unit stops, and the furnace blower BLWM and electronic air cleaner terminal EAC–1 will remain energized for an additional 90 seconds. Jumper Y1 to DHUM to reduce the cooling off–delay to 5 seconds. (See **Figure 16**)

4. **Dehumidfy Mode**
   See **Figure 18**–**Figure 24** for thermostat connections.
   The H output on the humidify sensing thermostat should be connected to the furnace control thermostat terminal DHUM. When there is a dehumidify demand, the DHUM input is activated, which means 24 vac signal is removed from the DHUM input terminal. In other words, the DHUM input logic is reversed. The DHUM input is turned ON when no dehumidify demand exists.
   Activation/Deactivation
   Once 24 vac is detected by the furnace control on the DHUM input, the furnace control operates in dehumidify mode. If the DHUM input is low for more than 48 hours, the furnace control reverts back to non–dehumidify mode.
   The cooling operation described in Item 3, Cooling mode. above also applies to operation with a humidity sensing thermostat. The exceptions are listed below:
   a. **Low Cooling**–When the R–to–G–and–Y1 circuit is closed and there is a demand for dehumidification, the low cooling airflow demand is reduced by 10 percent.
   b. **High–Cooling**–When the R–to–G–and–Y/Y2 circuit is closed and there is a demand for dehumidification, the high cooling airflow demand is reduced by 10 percent.
   c. **Cooling off–delay**–When the "call for cooling" is satisfied and there is a demand for dehumidification, the cooling blower–off delay is decreased from 90 seconds to 5 seconds.

5. **Continuous Blower Mode**
   When the R–to–G circuit is closed by the thermostat, the blower motor BLWM will operate at continuous blower airflow. Continuous blower airflow selection is initially based on the CF (continuous fan) selection shown in **Figure 5**. Factory default is shown in **Figure 5**. Terminal EAC–1 is energized as long as the blower motor BLWM is energized.
   During the call for heat, the furnace control CPU will keep the blower motor BLWM to continuous blower airflow. The blower motor BLWM will remain ON until the main burners ignite then shut OFF and remain OFF for the blower–ON delay (45 seconds in low–heat, and 25 seconds in high–heat), allowing the furnace heat exchangers to heat up more quickly, then restarts at the end of the blower–ON delay period at low–heat or high–heat airflow, respectively.

The blower motor BLWM will revert to continuous−blower airflow after the heating cycle is completed. In high−heat, the furnace control CPU will drop the blower motor BLWM to low−heat airflow during the selected blower−OFF delay period before transitioning to continuous−blower airflow.

When the thermostat “calls for low−cooling”, the blower motor BLWM will switch to operate at low−cooling airflow. When the thermostat is satisfied, the blower motor BLWM will operate an additional 90 seconds at low−cooling airflow before transitioning back to continuous−blower airflow.

When the thermostat “calls for high−cooling”, the blower motor BLWM will operate at high cooling airflow. When the thermostat is satisfied, the blower motor BLWM will operate an additional 90 seconds at high−cooling airflow before transitioning back to continuous−blower airflow. When the R−to−G circuit is opened, the blower motor BLWM will continue operating for an additional 5 seconds, if no other function requires blower motor BLWM operation.

6. **Heat pump**

   See **Figure 20** and **Figure 21** for thermostat connections. When installed with a heat pump, the furnace control automatically changes the timing sequence to avoid long blower off times during demand defrost cycles. Whenever W/W1 is energized along with Y1 or Y/Y2, the furnace control CPU will transition to or bring on the blower motor BLWM at cooling airflow, low−heat airflow, or whichever is lowest. The blower motor BLWM will remain on until the main burners ignite then shut OFF and remain OFF for 25 seconds before coming back on at heating airflow. When the W/W1 input signal disappears, the furnace control begins a normal inducer post−purge period while changing the blower airflow. If Y/Y2 input is still energized the furnace control CPU will transition the blower motor BLWM airflow to cooling airflow. If Y/Y2 input signal disappears and the Y1 input is still energized the furnace control CPU will transition the blower motor BLWM to low−cooling airflow. If both the Y1 and Y/Y2 signals disappear at the same time, the blower motor BLWM will remain on at low−heat airflow for the selected blower−OFF delay period. At the end of the blower− OFF delay, the blower motor BLWM will shut OFF unless G is still energized, in which case the blower motor BLWM will operate at continuous blower airflow.

Component Self Test

Refer to page 18 for instructions.

Figure 18 **Variable Speed Furnace with Single Stage Air Conditioner**

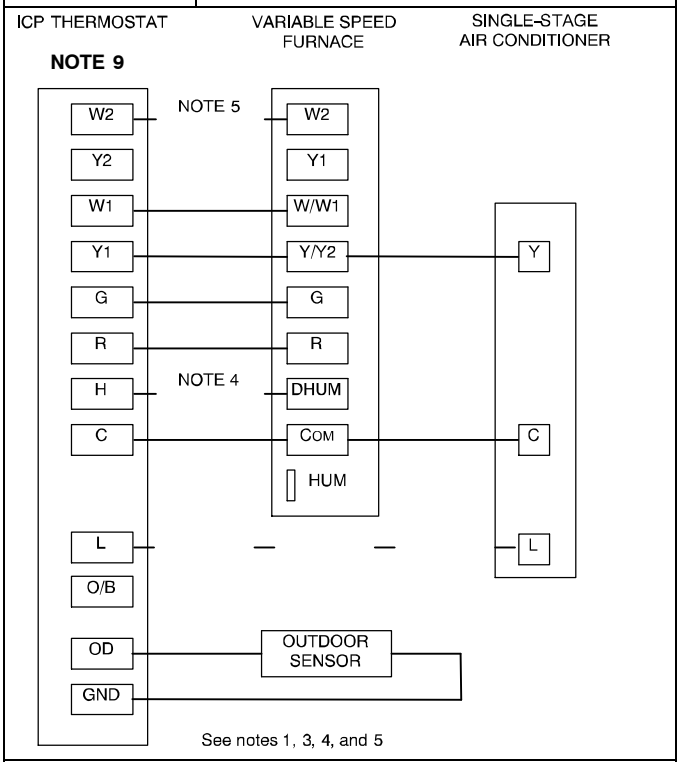


Figure 19 **Variable Speed Furnace with Two−Stage Air Conditioner**

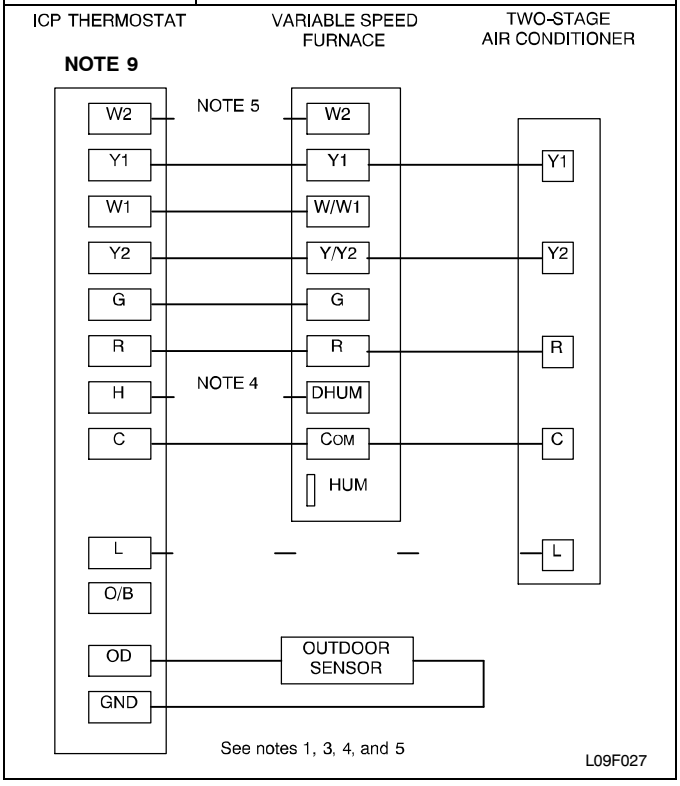


Figure 20 Variable Speed Furnace with Single Stage Heat Pump (Dual Fuel)

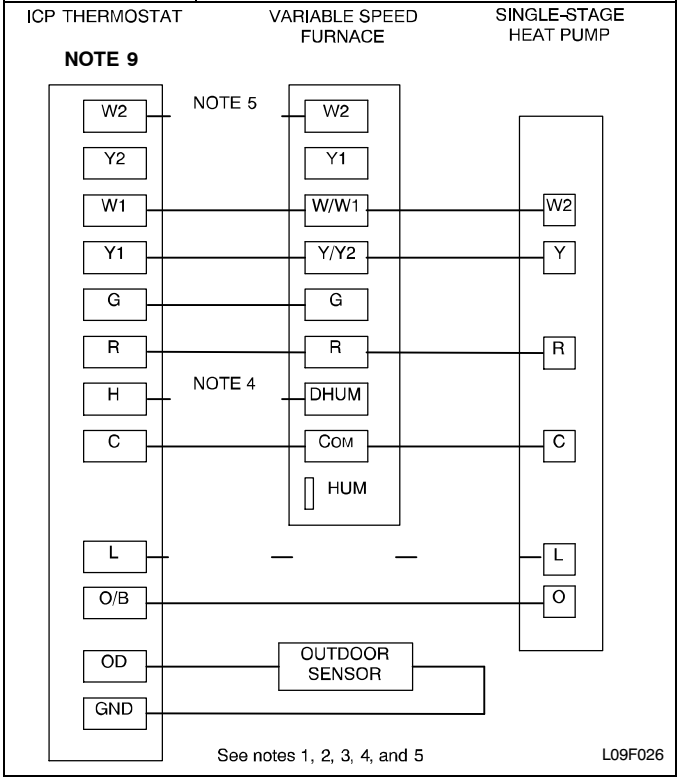


Figure 21 Variable Speed Furnace with Two–Stage Heat Pump (Dual Fuel)

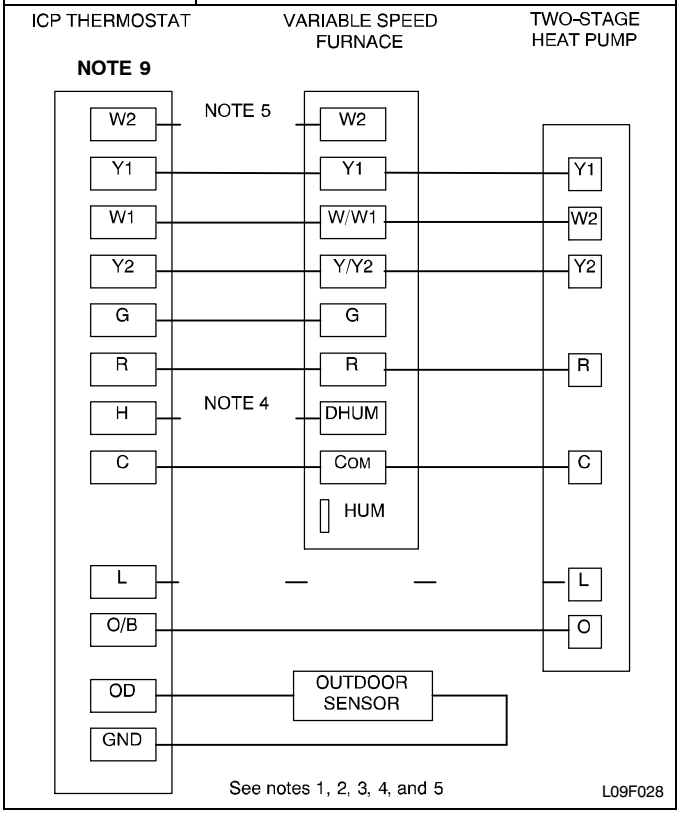


Figure 22 Variable Speed Furnace and Humidifier Only

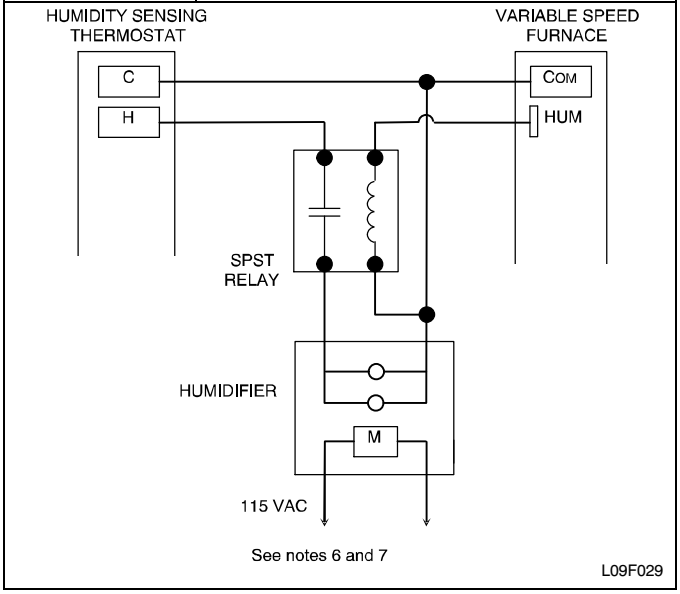


Figure 23 AC with Variable Speed Furnace, Humidifier, and Dehumidification

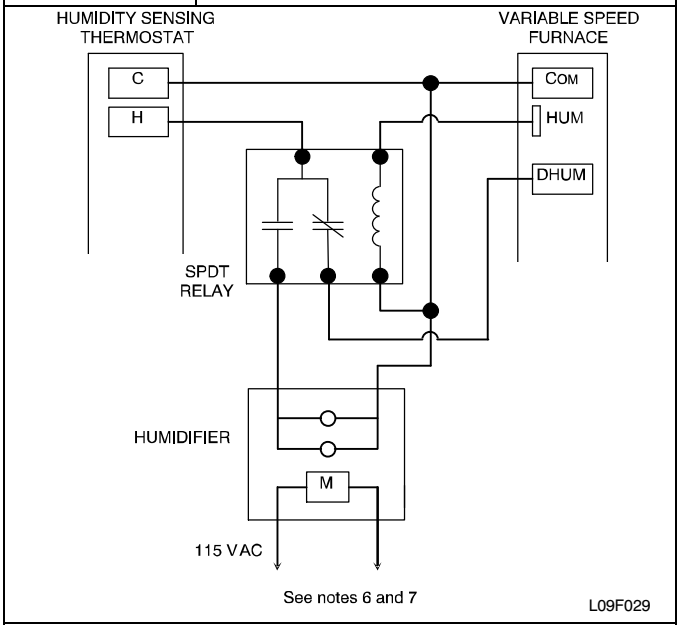
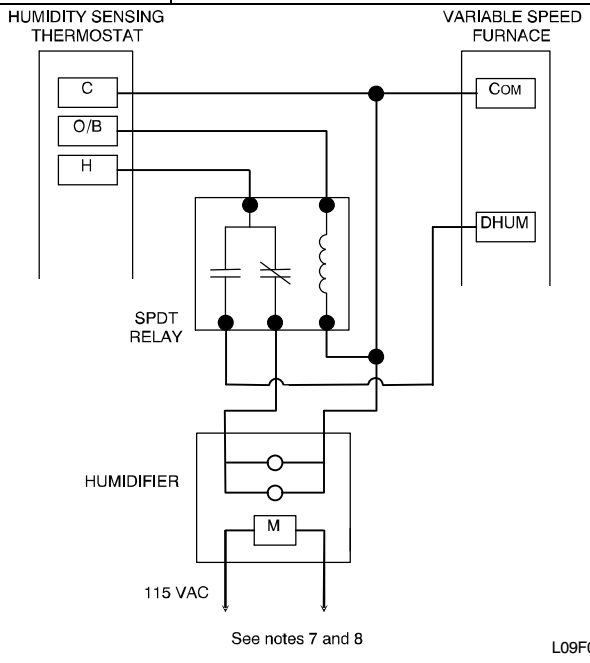


Figure 24 **HP with Variable Speed Furnace, Humidifier, and Dehumidification**



NOTES FOR FIGURES Figure 18 – Figure 24

1. Refer to outdoor equipment Installation Instructions for additional information and setup procedure.
2. Outdoor Air Temperature Sensor must be attached in all dual fuel applications.
3. Refer to ICP thermostat Installation Instructions for additional information and setup procedure.
4. When using a Humidity Sensing Thermostat, set DEHUMIDIFY OPTIONS to H DE–ENRGZD FOR DEHUM.
5. Optional connection. If wire is connected SW1–2 on VS furnace control should be set in ON position to allow ICP Thermostat to control the furnace staging.
6. HUM connection is 24 VAC and is energized when the blower turns on during a call for heat.
7. When connecting 115 VAC to humidifier use a separate 115 VAC supply.
8. When using a humidifier on a HP installation connect humidifier to hot water.
9. Thermostat signals may vary. Consult thermostat installation instructions for more information.

PARTS REPLACEMENT INFORMATION GUIDE

Casing Group
Control door
Blower door
Top filler plate
Bottom filler plate
Door Knob Assembly

Electrical Group
Control box
Junction box
Limit switch(es)
Circuit board
Door switch
Transformer
3–Amp fuse
Flame Rollout switch
Main Wiring harness
Blower Motor harness (when used)

Filter Group
Filter(s)

Blower Group
Cut–off Plate
Blower housing
Blower motor
Blower wheel
Capacitor (when used)
Capacitor strap (when used)
Power choke (where used)

Gas Control Group
Manifold
Burner
Orifice
Flame sensor
Hot surface igniter
Gas valve

Heat Exchanger group
Primary Heat Exchanger assembly
Primary Heat Exchanger cell panel
Secondary Heat Exchanger assembly
Coupling box
Containment Plate
Tubing Gaskets

Inducer Group
Pressure switch(es)
Inducer assembly
Inducer
Inducer motor
Motor Module (when used)
Inducer motor capacitor (when used)
Collector box
Condensate trap
Condensate trap elbow
Gaskets

⚠ WARNING

FIRE, EXPLOSION, ELECTRICAL SHOCK AND CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in dangerous operation, personal injury, death or property damage.

Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, explosion, fire, electrical shock, or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, local gas supplier, or your distributor or branch for information or assistance. The qualified installer or agency must use only factory-authorized and listed kits or accessories when modifying this product.

Have available the product/model number and the serial number located on the unit rating plate to ensure correct replacement parts.

TO OBTAIN INFORMATION ON PARTS: Consult your installing dealer or the classified section of your local telephone directory under the “Heating Equipment“ or “Air Conditioning Contractors and Systems” headings for dealer listing by brand name.

International Comfort Products
Consumer Relations Department
P.O. Box 128
Lewisburg, TN 37091, USA
931–270–4100

PRODUCT NOMENCLATURE

DIGIT POSITION	1	2	3	4	5	6, 7, 8	9, 10	11, 12	13	14
	G	**9**	**M**	**V**	**E**	**060**	**17**	**14**	**A**	**3 or 4**

G = Mainline Look 1
F = Mainline Look 2
N = Entry
9 = 90% – 100% **EFFICIENCY**

M = Multiposition
H = Horizontal
U = Upflow
D = Downflow **FEATURE**

A = Modulating Variable Speed ECM
V = Variable Speed
X = ECM
S = Single–stage
T = Two–stage **FEATURE**

B = Base AFUE Efficiency
E = Extra AFUE Efficiency
C = Communicating
D = Dual Certified 2–pipe or 1–pipe
R = 2–pipe only
S = Single–stage
T = Two–stage
N = Standard
L = Low Nox **FEATURE**

040 = 40,000 BTU/hr
060 = 60,000 BTU/hr
080 = 80,000 BTU/hr
100 = 100,000 BTU/hr
120 = 120,000 BTU/hr **INPUT HEAT**

14 = 14–3/16”
17 = 17–1/2”
21 = 21”
24 = 24–1/2” **CABINET WIDTH**

10 = 1000 CFM (max)
14 = 1400 CFM (max)
16 = 1600 CFM (max)
20 = 2000 CFM (max)
22 = 2200 CFM (max) **COOLING AIRFLOW**

SALES (MAJOR) REVISION DIGIT

ENGINEERING (MINOR) REVISION DIGIT