

**ML180DFE SERIES UNITS**

ML180DFE series units are mid-efficiency gas furnaces used for downflow applications only, manufactured with Lennox Duralok heat exchangers formed of aluminized steel. ML180DFE units are available in heating capacities of 44,000 to 110,000 Btuh and cooling applications 1.5 to 5 tons. Refer to Engineering Handbook for proper sizing.

Units are factory equipped for use with natural gas. Kits are available for conversion to LP/Propane operation. ML180DFE model units are equipped with a hot surface ignition system and a constant torque ECM motor. The motor is programmed to provide constant torque at each of the five selectable speed taps. All units use a redundant gas valve to assure safety shut-off as required by C.S.A.

All specifications in this manual are subject to change. Procedures outlined in this manual are presented as a recommendation only and do not supersede or replace local or state codes. In the absence of local or state codes, the guidelines and procedures outlined in this manual (except where noted) are recommended only and do not constitute code.



**⚠ CAUTION**

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

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**⚠ WARNING**



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

**⚠ WARNING**

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

## SPECIFICATIONS

Gas	Model No.	ML180DF045E36A	ML180DF070E36A	ML180DF070E36B
Heating Performance	<sup>1</sup> AFUE	80%	80%	80%
	Input - Btuh	44,000	66,000	66,000
	Output - Btuh	36,000	54,000	54,000
	Temperature rise range - °F	15 - 45	30 - 60	30 - 60
	Gas Manifold Pressure (in. w.g.) Nat. Gas / LPG/Propane	3.5 / 10.0	3.5 / 10.0	3.5 / 10.0
High Static - in. w.g.		0.50	0.50	0.50
Connections in.	Flue connection - in. round	4	4	4
	Gas pipe size IPS	1/2	1/2	1/2
Indoor Blower	Wheel nom. dia. x width - in.	10 x 8	10 x 10	10 x 10
	Motor Type	DC Brushless	DC Brushless	DC Brushless
	Motor output - hp	1/2	1/2	1/2
	Tons of add-on cooling	1.5 - 3	1.5 - 3	1.5 - 3
	Air Volume Range - cfm	355 - 1430	675 - 1460	430 - 1475
Electrical Data	Voltage	120 volts - 60 hertz - 1 phase		
	Blower motor full load amps	6.8	6.8	6.8
	Maximum overcurrent protection	15	15	15
Shipping Data	lbs. - 1 package	113	119	128

NOTE - Filters and provisions for mounting are not furnished and must be field provided.

<sup>1</sup> Annual Fuel Utilization Efficiency based on DOE test procedures and according to FTC labeling regulations. Isolated combustion system rating for non-weatherized furnaces.

## SPECIFICATIONS

Gas	Model No.	ML180DF090E48B	ML180DF110E60C
Heating Performance	<sup>1</sup> AFUE	80%	80%
	Input - Btuh	88,000	110,000
	Output - Btuh	72,000	90,000
	Temperature rise range - °F	30 - 60	30 - 60
	Gas Manifold Pressure (in. w.g.) Nat. Gas / LPG/Propane	3.5 / 10.0	3.5 / 10.0
High Static - in. w.g.		0.50	0.50
Connections in.	Flue connection - in. round	4	4
	Gas pipe size IPS	1/2	1/2
Indoor Blower	Wheel nom. dia. x width - in.	10 x 10	11-1/2 x 10
	Motor Type	DC Brushless	DC Brushless
	Motor output - hp	3/4	1
	Tons of add-on cooling	2.5 - 4	3 - 5
	Air Volume Range - cfm	680 - 1750	990 - 2410
Electrical Data	Voltage	120 volts - 60 hertz - 1 phase	
	Blower motor full load amps	8.4	10.9
	Maximum overcurrent protection	15	15
Shipping Data	lbs. - 1 package	140	160

NOTE - Filters and provisions for mounting are not furnished and must be field provided.

<sup>1</sup> Annual Fuel Utilization Efficiency based on DOE test procedures and according to FTC labeling regulations. Isolated combustion system rating for non-weatherized furnaces.

## OPTIONAL ACCESSORIES - ORDER SEPARATELY

	"A" Width Models	"B" Width Models	"C" Width Models
<b>CABINET ACCESSORIES</b>			
Downflow Combustible Flooring Base	11M59	11M60	11M61
<b>CONTROLS</b>			
iComfort® M30 Smart Wi-Fi Thermostat	15Z69	15Z69	15Z69
Remote Outdoor Air Temperature Sensor	X2658	X2658	X2658
Blower Relay Kit (for two-stage outdoor units)	85W66	85W66	85W66
Furnace Twinning Panel	Y3653	Y3653	Y3653
Furnace Twinning Kit	16W72	16W72	16W72
<b>FILTERS</b>			
<sup>1</sup> Downflow Filter Cabinet	51W06	51W07	51W08
	No. and Size of filter - in.	(1) 20 x 20 x 1	(2) 20 x 16 x 1
<b>NIGHT SERVICE KIT</b>			
Night Service Kit	84W47	84W47	84W47

<sup>1</sup> Cleanable polyurethane, frame-type filter.

## BLOWER DATA

### ML180DF045E36A PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds									
	High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	1430	285	1215	180	1035	120	995	110	930	100
0.10	1400	285	1175	185	995	130	885	100	850	90
0.20	1375	300	1145	200	950	140	840	110	725	85
0.30	1335	315	1120	210	915	145	790	115	665	95
0.40	1320	325	1075	220	870	155	745	125	625	100
0.50	1275	335	1045	230	835	165	715	135	565	105
0.60	1245	345	1000	235	785	170	655	140	520	115
0.70	1215	355	970	245	745	180	605	150	355	130
0.80	1175	365	925	255	695	185	555	155	400	130

### ML180DF070E36A PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds									
	High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	---	---	---	---	---	---	---	---	---	---
0.10	1460	348	1235	221	1150	179	1110	164	965	114
0.20	1420	360	1195	233	1115	193	1090	175	920	116
0.30	1395	371	1175	245	1070	196	1055	181	900	126
0.40	1375	380	1150	247	1045	207	1025	191	845	130
0.50	1335	378	1120	259	1010	211	990	198	820	143
0.60	1285	374	1075	260	985	221	955	206	770	144
0.70	1210	356	1065	274	955	225	915	209	730	154
0.80	1140	333	1020	276	920	237	890	219	675	158

**BLOWER DATA****ML180DF070E36B PERFORMANCE (Less Filter)**

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds									
	High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00										
0.10	1430	290	1275	175	1190	145	1155	135	1005	95
0.20	1400	295	1230	190	1125	160	1110	150	900	100
0.30	1360	310	1205	205	1085	160	1055	155	845	115
0.40	1310	325	1155	210	1050	175	1000	165	790	115
0.50	1280	335	1110	220	985	185	950	180	705	130
0.60	1250	350	1060	235	935	195	865	185	645	135
0.70	1220	355	1000	245	865	205	815	195	590	140
0.80	1165	365	935	250	795	210	750	200	480	145

**ML180DF090E48B PERFORMANCE (Less Filter)**

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds									
	High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	1750	385	1550	265	1430	205	1355	185	1195	130
0.10	1725	390	1495	270	1390	220	1320	195	1145	140
0.20	1695	405	1470	285	1340	235	1280	210	1105	145
0.30	1660	415	1425	300	1290	240	1225	215	1040	160
0.40	1615	430	1395	310	1250	255	1185	230	1005	170
0.50	1570	450	1360	325	1210	265	1145	240	945	180
0.60	1545	465	1295	340	1165	280	1085	255	865	185
0.70	N/A	N/A	1265	350	1120	295	1040	265	810	200
0.80	N/A	N/A	1215	365	1080	305	1000	275	755	210

**ML180DF110E60C PERFORMANCE (Less Filter)**

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds									
	High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	2410	625	2095	405	1875	295	1700	225	1635	180
0.10	2385	630	2100	415	1830	310	1610	240	1505	190
0.20	2325	650	2010	440	1760	330	1570	255	1375	195
0.30	2280	675	1940	460	1705	340	1500	260	1320	210
0.40	2235	690	1895	475	1635	365	1440	285	1265	225
0.50	2165	710	1845	490	1595	380	1380	300	1200	235
0.60	2125	735	1800	510	1545	390	1320	310	1170	250
0.70	2090	740	1755	530	1510	405	1285	325	1100	260
0.80	2035	760	1700	540	1460	425	1255	345	1030	275

# PARTS ARRANGEMENT

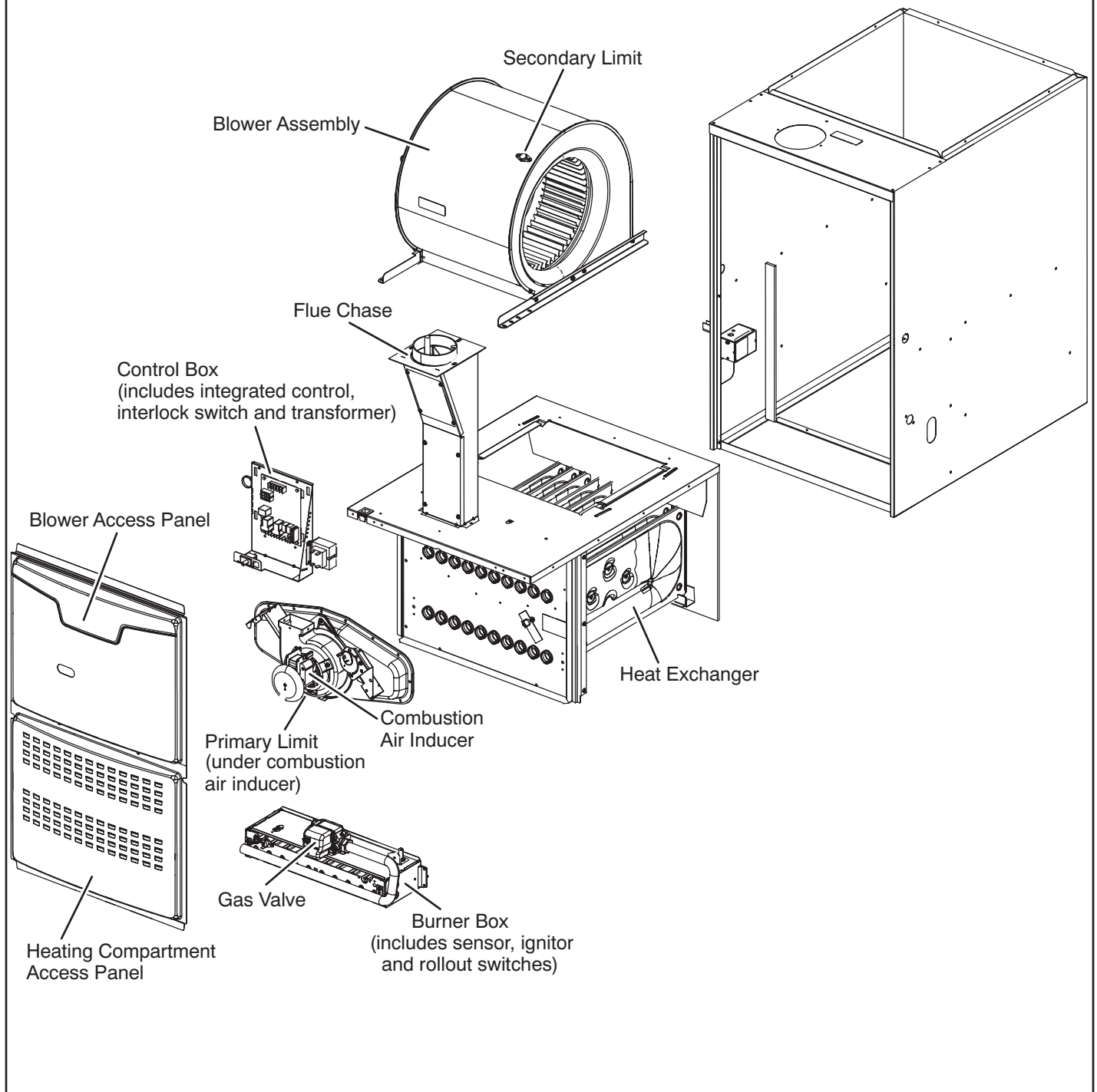


FIGURE 1

## I-UNIT COMPONENTS

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

### ELECTROSTATIC DISCHARGE (ESD) Precautions and Procedures



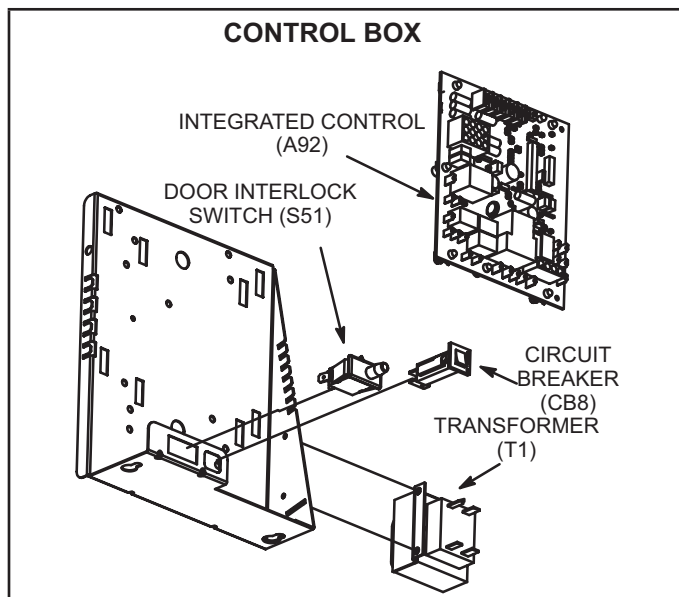
#### 1. Control Transformer (T1)

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

#### 2. Door Interlock Switch (S51)

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

**NOTE** - The door interlock switch is a safety switch. Do not by-pass or jumper switch.



**FIGURE 2**

#### 3. Circuit Breaker (CB8)

A 24V circuit breaker is also located in the control box. The switch provides overcurrent protection to the transformer (T1). The breaker is rated at 3A at 32V. If the current exceeds this limit the breaker will trip and all unit operation will shutdown. The breaker can be manually reset by pressing the button on the face.

#### 4. Integrated Control (A92)

103217-03 & 107163-01

### **WARNING**

**Shock hazard.**

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

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

The hot surface ignition control system consisting of an integrated control (figure 3 with control terminal designations in tables 1, 2 and 3), sensor and ignitor (figure 6). The integrated control and ignitor work in combination to ensure furnace ignition and ignitor durability. The integrated control, controls all major furnace operations. The integrated control also features a RED LED for troubleshooting and two accessory terminals rated at (1) one amp. The nitride ignitor is made from a non-porous, high strength proprietary ceramic material that provides long life and trouble free maintenance.

#### Electronic Ignition (Figure 4)

On a call for heat the integrated control monitors the combustion air inducer pressure switch. The control will not begin the heating cycle if the pressure switch is closed (bypassed). Once the pressure switch is determined to be open, the combustion air inducer is energized. When the differential in the pressure switch is great enough, the pressure switch closes and a 15-second pre-purge begins. If the pressure switch is not proven within 2-1/2 minutes, the integrated control goes into Watchguard-Pressure Switch mode for a 5-minute re-set period.

After the 15-second pre-purge period, the ignitor warms up for 20 seconds during which the gas valve opens at 19 seconds for a 4-second trial for ignition. The ignitor remains energized for the first 3 seconds during the 4 second trial. If ignition is not proved during the 4-second period, the integrated control will try four more times with an inter-purge and warm-up time between trials of 35 seconds. After a total of five trials for ignition (including the initial trial), the integrated control goes into Watchguard-Flame Failure mode. After a 60-minute reset period, the integrated control will begin the ignition sequence again.

**TABLE 1**

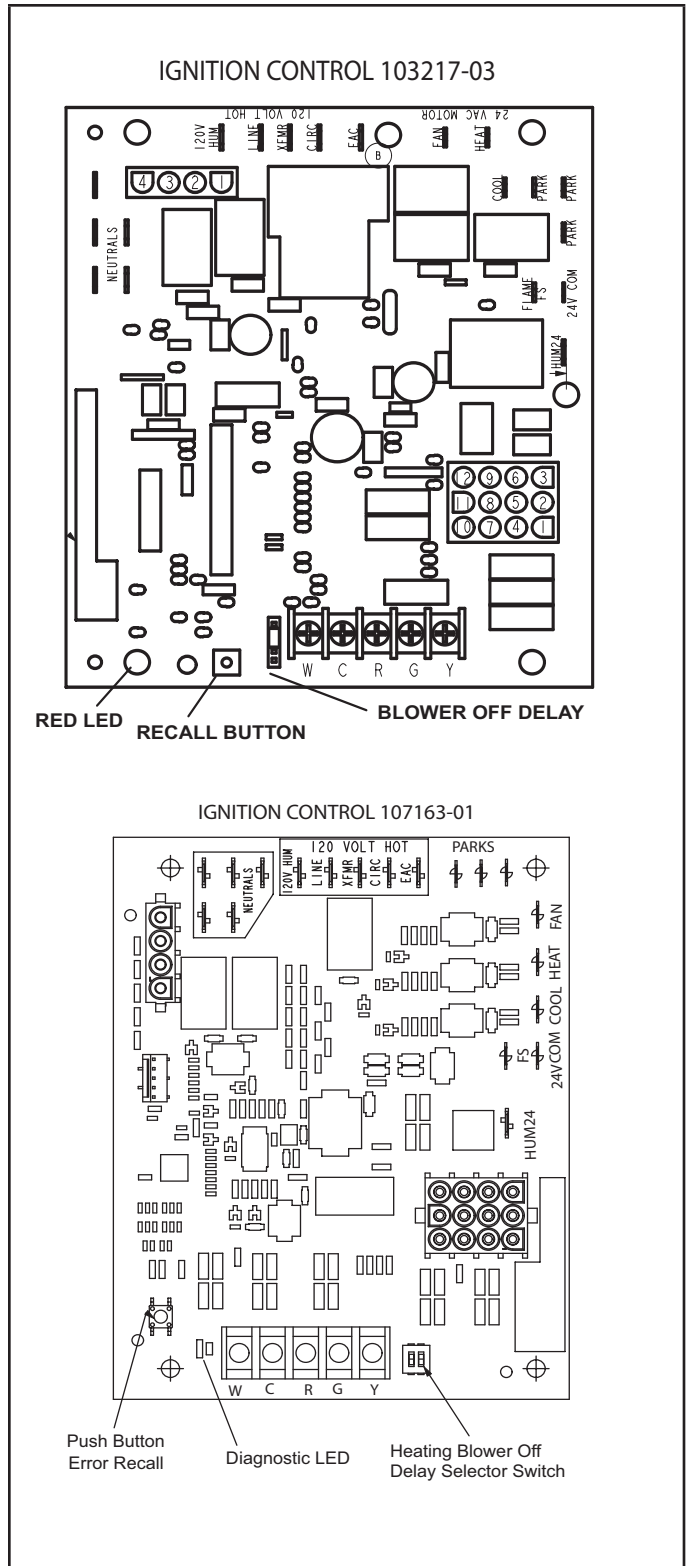
4-Pin Terminal Designation	
PIN #	FUNCTION
1	Combustion Air Inducer Line
2	Ignitor Line
3	Combustion Air Inducer Neutral
4	Ignitor Neutral

**TABLE 2**

12-Pin Terminal Designations	
PIN #	FUNCTION
1	High Limit Output
2	IFC 103217-03 Not Used IFC 107163-01 Flame Sense
3	24V Line
4	Not Used
5	Rollout Switch Out
6	24V Neutral
7	High Limit Input
8	Ground
9	Gas Valve Common
10	Pressure Switch In
11	Rollout Switch In
12	Gas Valve Out

**TABLE 3**

1/4" Quick Connect Terminals	
120HUM	Humidifier 120VAC
LINE	120VAC
XFMR	Transformer 120VAC
CIRC	Indoor blower 120VAC
EAC	Indoor air quality accessory 120VAC
NEUTRALS	Common 120VAC
HUM24	Humidifier 24VAC
3/16" Quick Connect Terminals	
COOL	Cooling tap 24VAC
HEAT	Heating tap 24VAC
FAN	Continuous blower 24 VAC
PARK (no power)	Park terminal for speed taps
FS	Flame sense
24 COM	Common 24VAC



**FIGURE 3**

**TABLE 4**  
**Ignition Control 103217-02**

<b>RED LED Flash Code<sup>2</sup></b>	<b>Diagnostic Codes / Status of Furnace</b>
Off	No power to control or board fault detected
Heartbeat <sup>1</sup>	Normal Operation - Idle, Continuous Fan, Cool
1	Reverse Line Voltage Polarity
2	Improper Earth Ground
3	Burner failed to light, or lost flame during heat demand
4	Low Flame Signal - check flame sensor
5	Watchguard - burner failed to light, exceeded maximum number of retries or recycles.
6	Ignitor Circuit Failure - not available on this control
7	Primary or Secondary Limit Open or Watchguard Mode - Limit Switch Open longer than 3 minutes
8	Rollout Switch Open
9	Pressure Switch failed to close or opened during heat demand
10	Watchguard - Pressure Switch opened 5 times during one heat demand
11	Pressure Switch stuck closed prior to activation of combustion air inducer
12	Flame Sensed without gas valve energized
13	Low Line Voltage
<b>Notes</b>	
Note 1	A "Heartbeat" is indicated by a "Slow Flash" - 1 sec on 1 sec off, repeating
Note 2	Error codes are indicated by a "rapid flash" - the LED flashes X times at ½ second on ½ second off, remains off for 3 seconds then repeats.
Note3	Last 10 error codes are stored in memory including when power is shut off to the unit. - To recall, press and release button, most recent will be displayed first, LED off for 3 sec, then next error code is displayed, etc. To clear error codes, depress and hold button longer than 5 seconds.

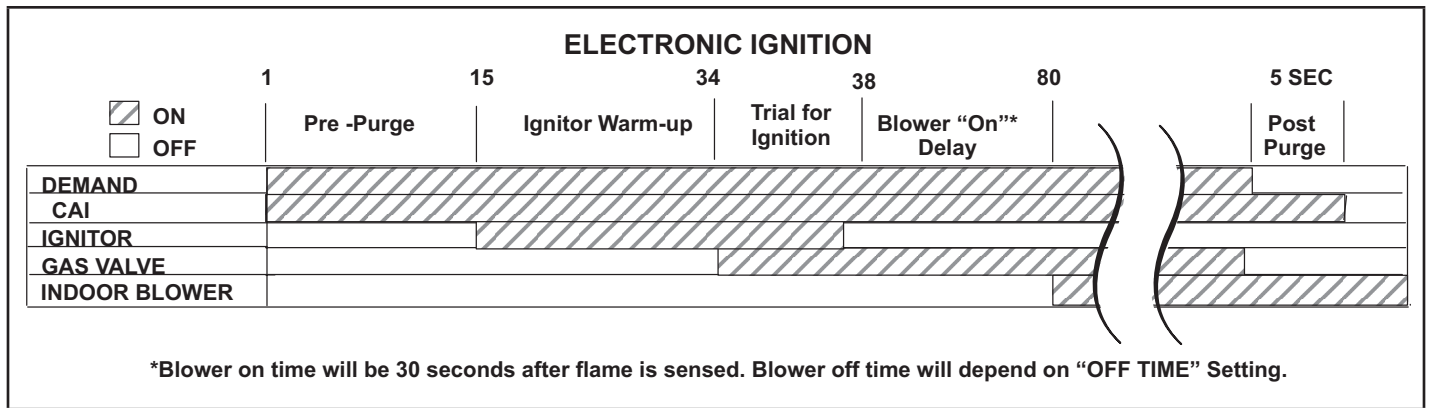


**TABLE 5**  
**Ignition Control 103217-03**

RED LED Flash Code <sup>2</sup>	Diagnostic Codes / Status of Furnace
Off	No power to control or board fault detected
Heartbeat <sup>1</sup>	Normal Operation - Idle, Continuous Fan, Cool
Continuous Rapid Flash	Call For Heat / Burner Operation
1	Reverse Line Voltage Polarity
2	Improper Earth Ground
3	Burner failed to light, or lost flame during heat demand
4	Low Flame Signal - check flame sensor
5	Watchguard - burner failed to light, exceeded maximum number of retries or recycles.
6	Not Used
7	Primary or Secondary Limit Open or Watchguard Mode - Limit Switch Open longer than 3 minutes
8	Rollout Switch Open
9	Pressure Switch failed to close or opened during heat demand
10	Watchguard - Pressure Switch opened 5 times during one heat demand
11	Pressure Switch stuck closed prior to activation of combustion air inducer
12	Flame Sensed without gas valve energized
13	Low Line Voltage
Notes	
Note - 1	A "Heartbeat" is indicated by a "Slow Flash" - 1 sec on 1 sec off, repeating
Note - 2	Error codes are indicated by a "rapid flash" - the LED flashes X times at ½ second on ½ second off, remains off for 3 seconds then repeats.
Note - 3	Last 10 error codes are stored in memory including when power is shut off to the unit. - To recall, press and release button, most recent will be displayed first, LED off for 3 sec, then next error code is displayed, etc. To clear error codes, depress and hold button longer than 5 seconds.

**Ignition Control 107163-01**

<b>RED LED Flash Code</b>	<b>Diagnostic Codes / Status of Furnace</b>
Off	No Power to Control or Board Fault Detected
On	Board Fault Detected
Fast Heartbeat <sup>3</sup>	Call for Heat / Burner Operation
Slow Heartbeat <sup>1</sup>	Normal Operation – Idle, Continuous Fan, or Cool
1 Flash <sup>2</sup>	Reverse Line Voltage Polarity or Phasing of 120V power
2 Flashes <sup>2</sup>	Improper earth ground
3 Flashes <sup>2</sup>	Burner failed to light, or lost flame during heat demand
4 Flashes <sup>2</sup>	Low flame signal – check flame sensor
5 Flashes <sup>2</sup>	Watchguard – burner failed to light, exceeded maximum number of retries/ recycles, 1 hour lockout
6 Flashes <sup>2</sup>	Not used
7 Flashes <sup>2</sup>	Primary or Secondary limit switch open or Watchguard mode – Limit Switch open longer than 3 minutes
8 Flashes <sup>2</sup>	Roll-out Switch Open
9 Flashes <sup>2</sup>	Pressure Switch failed to close or opened during heat demand, inducer on
10 Flashes <sup>2</sup>	Watchguard - Pressure switch opened 5 times during a single heating demand
11 Flashes <sup>2</sup>	Pressure switch stuck closed prior to activation of Combustion Air Inducer
12 Flashes <sup>2</sup>	Flame sensed without gas valve energized
13 Flashes <sup>2</sup>	Low line voltage
<b>Notes</b>	
Note - 1	A slow heartbeat is indicated by 1s on / 1s off. It is used for idle, continuous fan and cool modes.
Note - 2	Error codes are indicated by a “rapid flash” - the LED flashes X times at ½ second on ½ second off, remains off for 3 seconds then repeats.
Note - 3	A fast heartbeat is indicated by 0.5s on / 0.5s off. It is only used during a heat call.
Note - 4	Last 10 error codes are stored in memory including when power is shut off to the unit. - To recall, press, and release button, most recent will be displayed first, LED off for 3 sec, then next error code is displayed, etc. To clear error codes, depress and hold button longer than 5 seconds.



**FIGURE 4**

**Fan Time Control**

**Ignition Control 103217-03**

**Heating Fan On Time**

The fan on time of 30 seconds is not adjustable.

**Heating Fan Off Time**

Fan off time (time that the blower operates after the heat demand has been satisfied) can be adjusted by moving the jumper to a different setting. The unit is shipped with a factory fan off setting of 90 seconds. For customized comfort, monitor the supply air temperature once the heat demand is satisfied. Note the supply air temperature at the instant the blower is de-energized.

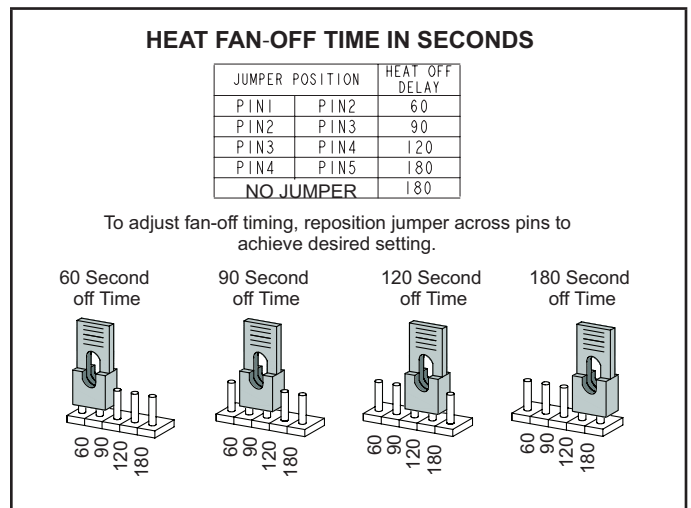
Adjust the fan-off delay to achieve a supply air temperature between 90° - 110° at the instant the blower is de-energized. (Longer delay times allow for lower air temperature, shorter delay times allow for higher air temperature).

**Cooling Fan On Time**

The fan on time is 2 seconds and is not adjustable.

**Cooling Fan Off Time**

The control has a 45 second fan off delay after cooling demand has been met. This delay is factory set and not adjustable.

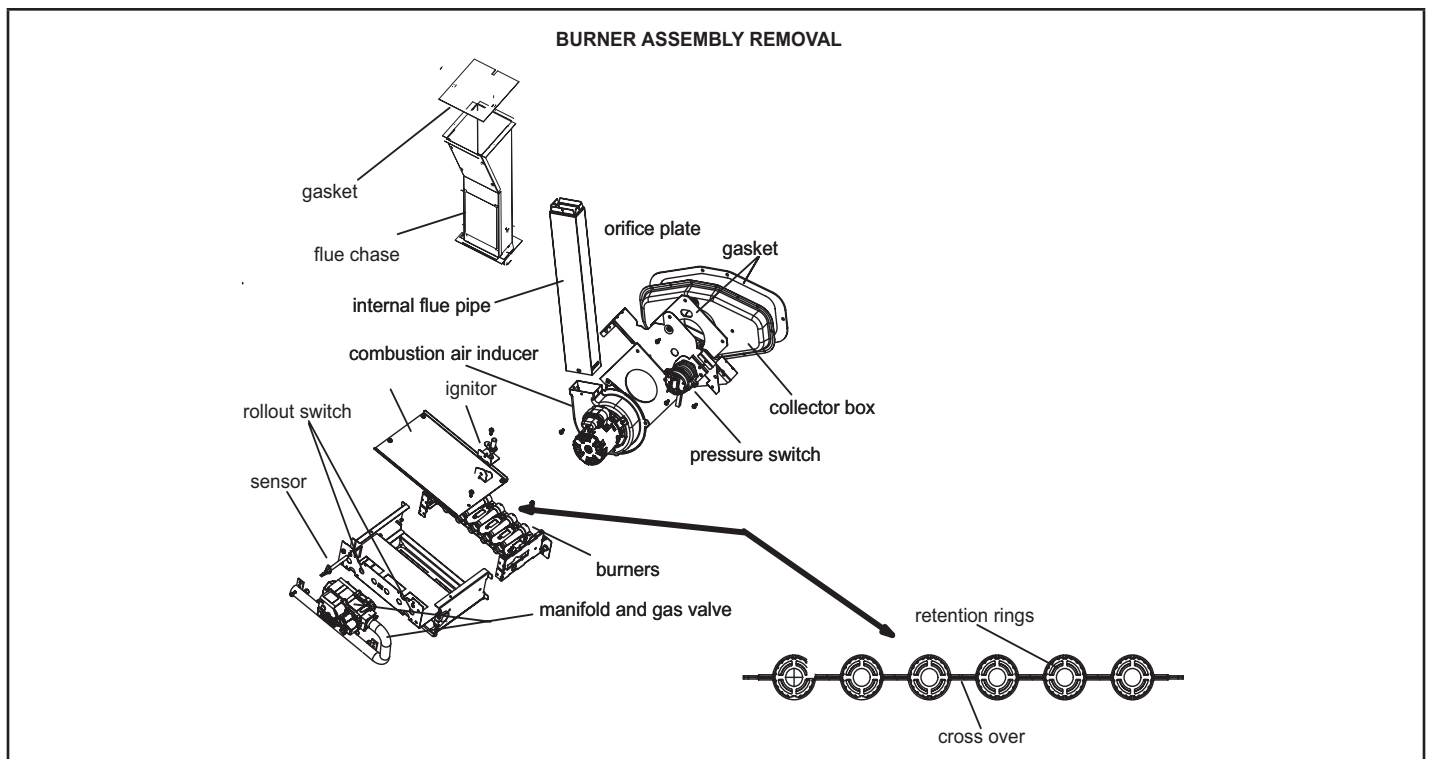


**FIGURE 5**

**Ignition Control 107163-01**

The heat fan-on time of 30 seconds is not adjustable. The heat fan-off delay (amount of time that the blower operates after the heat demand has been satisfied) may be adjusted by changing the two position dip switch on the integrated control, to one of four selections. Blower off delay is factory set at 90 seconds. For other blower off delay settings, please refer to the following chart:

Blower Delay Select		
	SW2-1	SW2-2
60	OFF	ON
90	OFF	OFF
120	ON	OFF
180	ON	ON
Factory Setting is 90		



**FIGURE 6**

### 5. Flame Rollout Switches (Figure 6)

Flame rollout switch (S47) is a high temperature limit. Each furnace is equipped with two identical switches. The limit is a N.C. SPST manual-reset limit connected in series with the integrated control A92. When S47 senses rollout, the integrated control immediately stops ignition and closes the gas valve. If unit is running and flame rollout is detected, the gas valve will close and integrated control will be disabled. Rollout can be caused by a blocked heat exchanger, blocked flue or lack of combustion air. The switch has a factory setpoint of 210°F and cannot be adjusted. To manually reset a tripped switch, push the reset button located on the control.

### 6. Primary Limit Control

The primary limit on is located in the heating vestibule panel under the combustion air inducer. See figure 1. When excess heat is sensed in the heat exchanger, the limit will open. If the limit is open, the integrated control energizes the supply air blower and closes the gas valve. The limit automatically resets when unit temperature returns to normal.

The switch must reset within three minutes or SureLight® control will go into Watchguard for one hour. The switch is factory set and cannot be adjusted. The switch may have a different setpoint for each unit model number. If limit switch must be replaced, refer to Lennox ProductZone repair parts list.

### 7. Flame Sensor (Figure 6)

A flame sensor is located on the left side of the burner support. The sensor is mounted on the flame rollout plate and the tip protrudes into the flame envelope of the left-most burner. The sensor can be removed for service

(clean with steel wool) without removing any part of the burners. During operation, flame is sensed by current passed through the flame and sensing electrode. The integrated control allows the gas valve to remain open as long as flame signal is sensed.

A microamp DC meter is needed to check the flame signal on the integrated control

Flame (microamp) signal is an electrical current which passes from the integrated control to the sensor during unit operation. Current passes from the sensor through the flame to ground to complete a safety circuit.

#### To Measure Flame Signal - Integrated Control:

Use a digital readout meter capable of reading DC microamps. See figure 8 and table 6 for flame signal check.

- 1 - Set the meter to the DC amps scale.
- 2 - Turn off supply voltage to control.
- 3 - 3 - Remove sensor wire from integrated control.
- 4 - Connect (-) lead to flame sensor wire.
- 5 - Connect (+) lead to Terminal FS on integrated control.
- 6 - Turn supply voltage on and close thermostat contacts to cycle system.
- 7 - When main burners are in operation for two minutes, take reading.

**TABLE 6**

Flame Signal in Microamps		
Normal	Low	Drop Out
1.5 or greater	0.5 - 1.4	0.4 or less

# Measuring Flame Signal (Typical Furnace and Control)

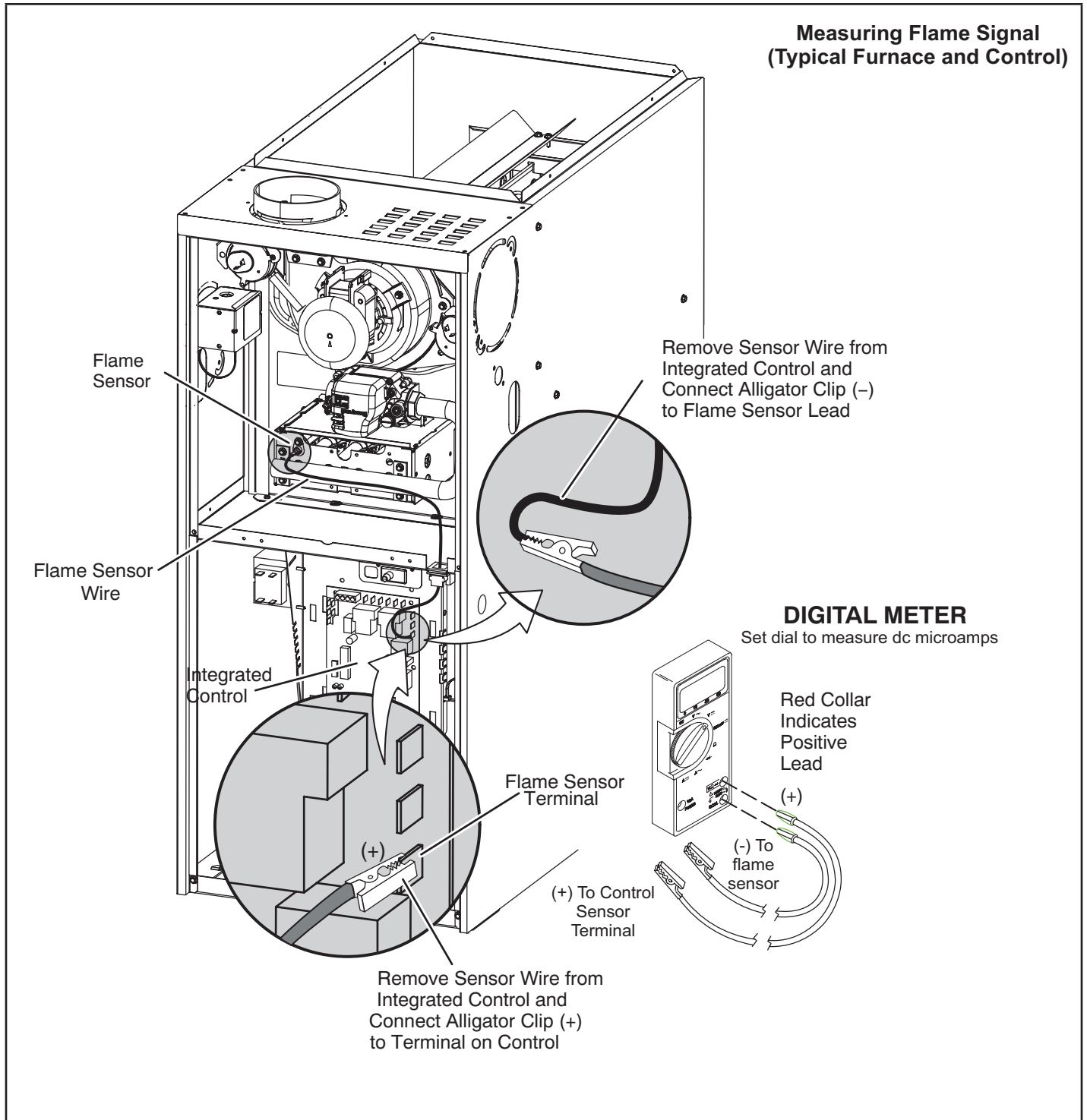


FIGURE 7

## 8. Ignitor (Figure 6)

The nitride ignitor used units is made from a proprietary ceramic material. To check ignitor, measure its resistance and voltage. A value of 39 to 70 ohms indicates a good ignitor. Voltage to the ignitor should be 120VAC. See figure 8 for resistance, and voltage check.

**NOTE -** The ML180UDFE(X) furnace contains electronic components that are polarity sensitive. Make sure that the furnace is wired correctly and is properly grounded.

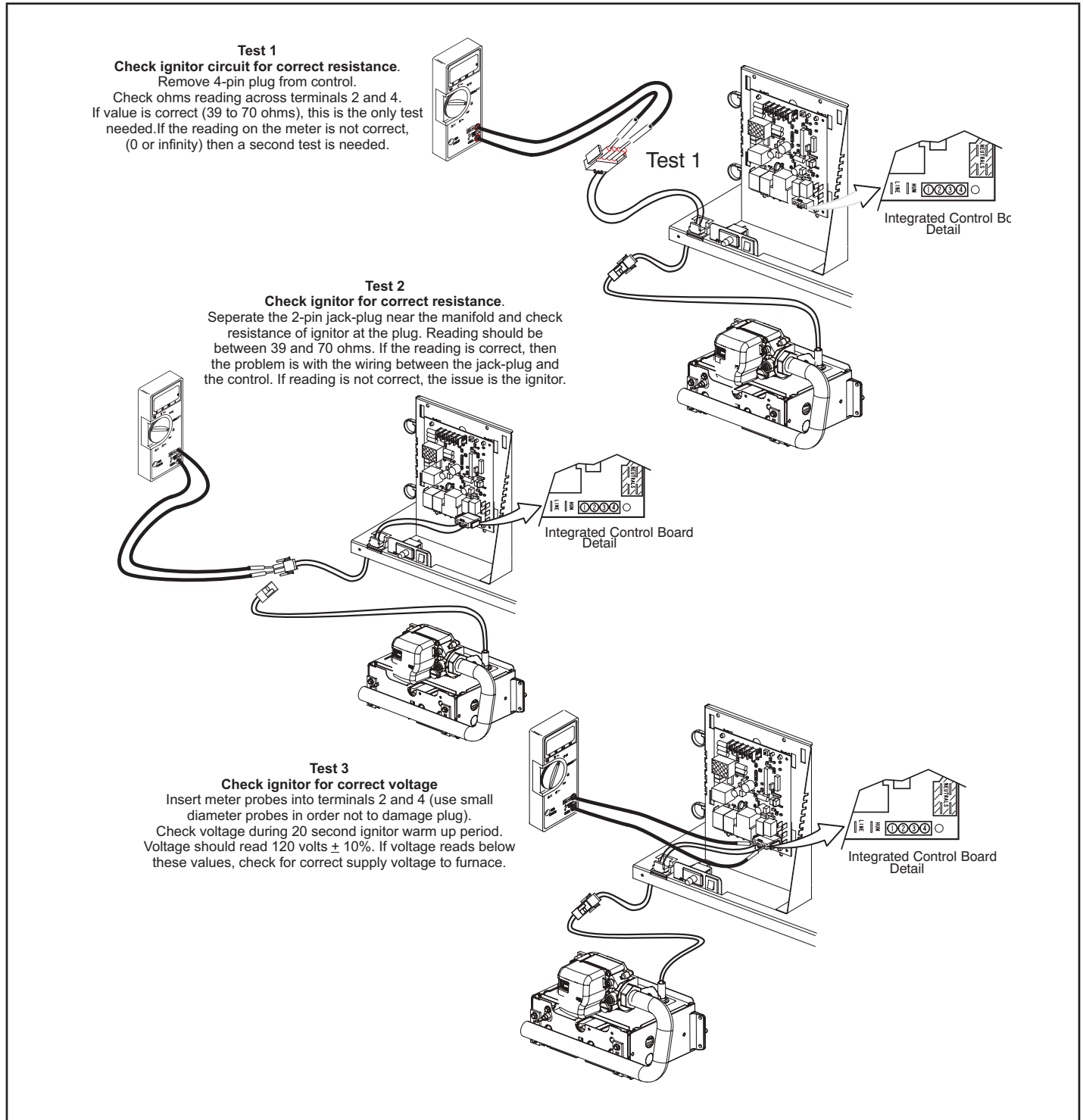


FIGURE 8

## 9. Gas Valve (Figure 6)

The ML180UHE(X) uses an internally redundant gas valve to assure safety shut-off. If the gas valve must be replaced, the same type valve must be used. 24VAC terminals and valve switch are located on the valve. All terminals on the gas valve are connected to wires from the integrated control. 24V applied to the terminals energizes the valve.

Inlet and outlet pressure taps are located on the valve. A regulator adjustment screw is located on the valve. LPG changeover kits are available from Lennox. Kits include burner orifices and a gas valve regulator spring.

## 10. Combustion Air Inducer (B6)

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

A pressure switch mounted on the combustion air inducer orifice plate is used to prove inducer operation. The combustion air inducer orifice will be different for each model.

See table 7 for orifice sizes. The switch monitors air pressure in the inducer housing. During normal operation, the pressure in the housing is negative. If pressure becomes less negative (signifying any obstruction in the flue) the pressure switch opens. When the pressure switch opens, the integrated control (A92) immediately de-energizes the gas valve to prevent burner operation.

**TABLE 7**

Model	C.A.I. Orifice Size
045E36A	1.045"
070E36B	1.316"
090E48B	1.531"
110E60C	1.690"

## 11. Combustion Air Inducer Pressure Switch (S18)

Units are equipped with a combustion air pressure switch located on the combustion air inducer orifice bracket. The switch is connected to the combustion air inducer housing by means of a flexible silicone hose. It monitors negative air pressure in the combustion air inducer housing.

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

On start-up, the switch senses that the combustion air inducer is operating. It closes a circuit to the integrated control when pressure inside the combustion air inducer decreases to a certain set point. Set points vary depending on unit size. See table 8. The pressure sensed by the switch is negative relative to atmospheric pressure. If the flue becomes obstructed during operation, the switch senses a loss of negative pressure (pressure becomes more equal with atmospheric pressure) and opens the circuit to the integrated control and gas valve. A bleed port on the switch allows relatively dry air in the vestibule to purge switch tubing, to prevent condensate build up.

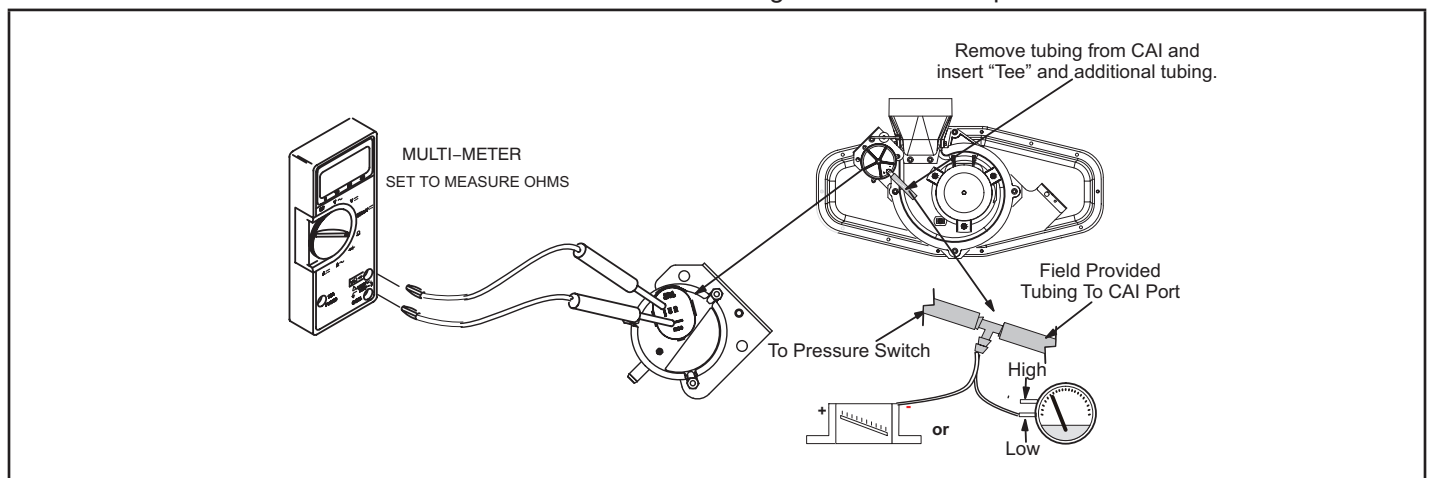
**TABLE 8**

Unit	inches wc	
	Make	Break $\pm$ 0.05
045E36A	-0.75	-0.60
07036EB	-0.80	-0.65
090E48B	-0.75	-0.60
110E60C	-0.80	-0.65

The switch is factory set and is not field adjustable. It is a safety shut-down control in the furnace and must not be bypassed for any reason. If switch is closed or by-passed, the integrated control will not initiate ignition at start up.

### Troubleshooting

See figure 9 for measuring operating pressure and checking resistance in the pressure switch.



**FIGURE 9**

## 12. Blower Motor

### **! IMPORTANT**

Each blower is statically and dynamically balanced as an assembly before installation in the unit.

ML180DFE units are equipped with a constant torque ECM motor. It has a DC motor coupled to an electronic control module both contained in the same motor housing. The motor is programmed to provide constant torque at each of the five selectable speed taps. Each tap requires 24 volts to energize.

### Input Voltage Requirements

The circuit is designed to be operated with AC voltage. To enable a tap requires 12 to 33VAC. Expected current draw will be less than 20mA.

### Troubleshooting

Troubleshooting the motor is an easy process. Follow steps below.

- 1 - Shut off power to unit.
- 2 - Remove input plugs P48 and P49 from motor. See figure 13 for troubleshooting procedure.

**NOTE - Figure 13 is typical ignition control illustration.**

If correct voltage is present in tests 1 and 2 and motor is not operating properly, replace motor. The motor is not field repairable.

If replacing the indoor blower motor or blower wheel is necessary, placement is critical. The blower wheel must be centered in the blower housing as shown in figure 10. When replacing the indoor blower motor the set screw must be aligned and tightened with the motor shaft as shown in figure 11.

### 13. Secondary Limit Controls

The secondary limit is located in the blower compartment on the back side of the blower housing. See figure 12. When excess heat is sensed in the blower compartment, the limit will open. If the limit is open, the furnace control energizes the supply air blower and closes the gas valve. The limit automatically resets when unit temperature returns to normal. The secondary limit cannot be adjusted.

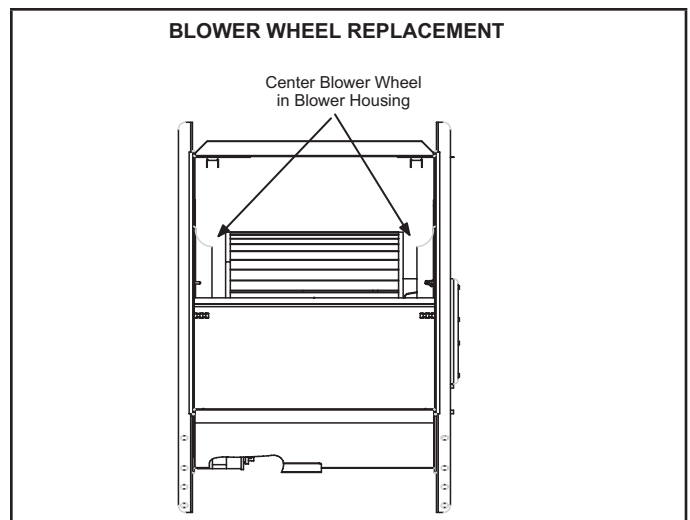


FIGURE 10

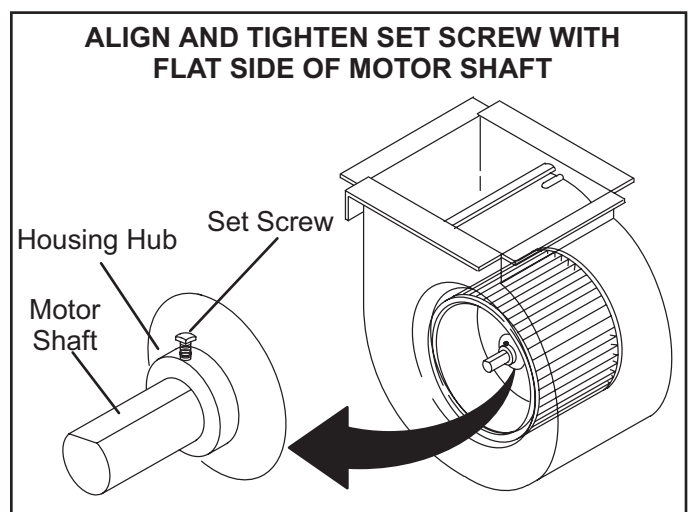


FIGURE 11

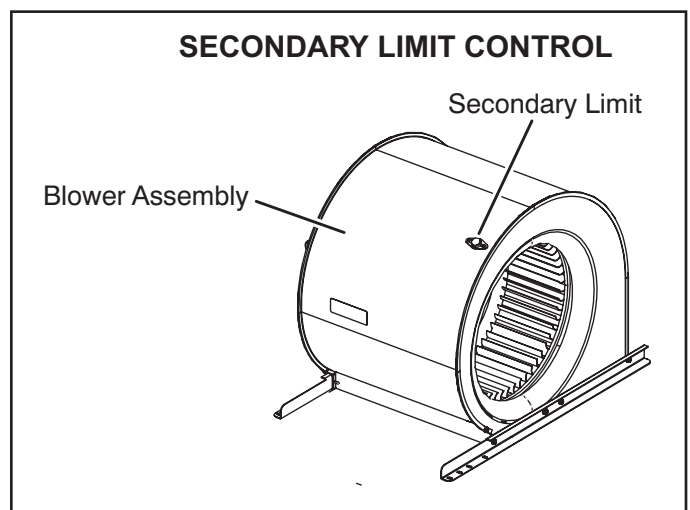


FIGURE 12





## Replacing the Motor Module

- 1 - Disconnect electrical power to unit.
- 2 - Remove unit access panel.
- 3 - Unplug the two harnesses from the motor control module. See figure 14.

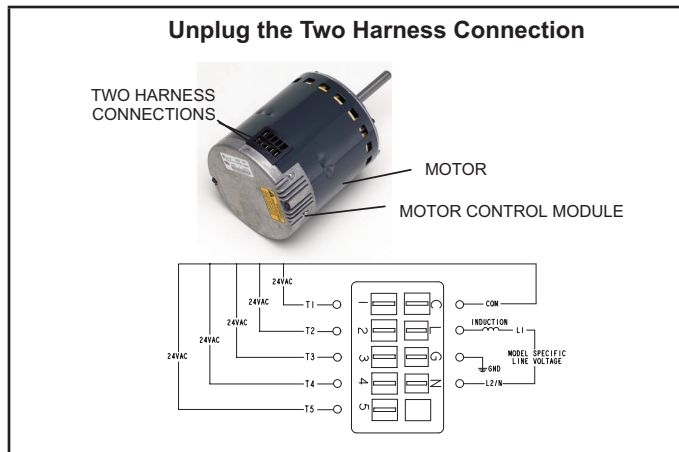


FIGURE 14

- 4 - Remove the two hex head bolts securing the motor control module to the motor. See figure 15.



FIGURE 15

- 5 - Slide the motor control module away from the motor to access and disconnect the internal three wire connector. It is not necessary to remove blower motor itself. Set both hex head bolts aside.

## Testing the Motor (Figure16)

If any motor fails the below tests, do not install the new control module. The motor is defective and it also must be replaced. The new control can fail if placed on a defective motor.

- 1 - Using an ohmmeter check the resistance from any one of the motor connector pins to the aluminum end plate of the motor. This resistance should be greater than 100k ohms.
- 2 - Check the resistances between each of the three motor connector pins. These should all read approximately the same resistance within an ohm.
- 3 - Check to see if the blower wheel spins freely.



FIGURE 16

TABLE 9

Scale	Measurement range in words	ohms
2 M	two megohm-two million ohms	0 - 2,000,000
200 K	two hundred kilo-ohm-two hundred thousand ohms	0 - 200,000
20 K	twenty kilo-ohm-twenty thousand ohms	0 - 20,000
2 K	two kilo-ohm two-thousand ohms	0 - 2,000
200	two hundred ohms	0 - 200

## Motor Module Installation

All replacement motor control modules look similar; however, each module is designed for a specific motor size. It is very important to make sure that you are using the correct replacement motor control module. **USE OF THE WRONG MOTOR CONTROL MODULE MAY RESULT IN UNEXPECTED UNIT OPERATION.**

- 1 - Verify electrical power to unit is disconnected.
- 2 - Connect three-wire harness from motor to control module.
- 3 - Mount new motor control module to motor using two hex head bolts removed in figure 15. Torque bolts to 22 inch pounds or 1/16th clock wise turn.
- 4 - Reconnect the two harnesses to the motor control module.
- 5 - The electrical connectors of the motor should be facing down to form a drip loop (figure17). This will directs moisture away from the motor and its electric connections on the motor.

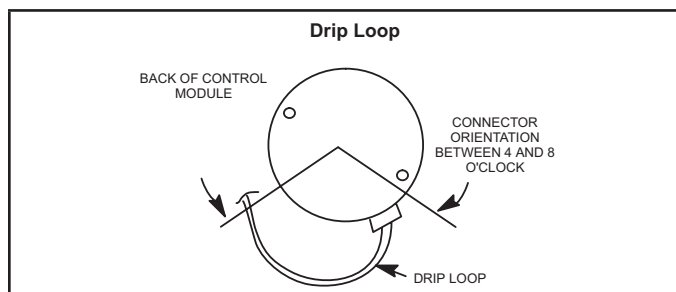


FIGURE 17

## II- PLACEMENT AND INSTALLATION

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

## III- START-UP

### A- Heating Start-Up

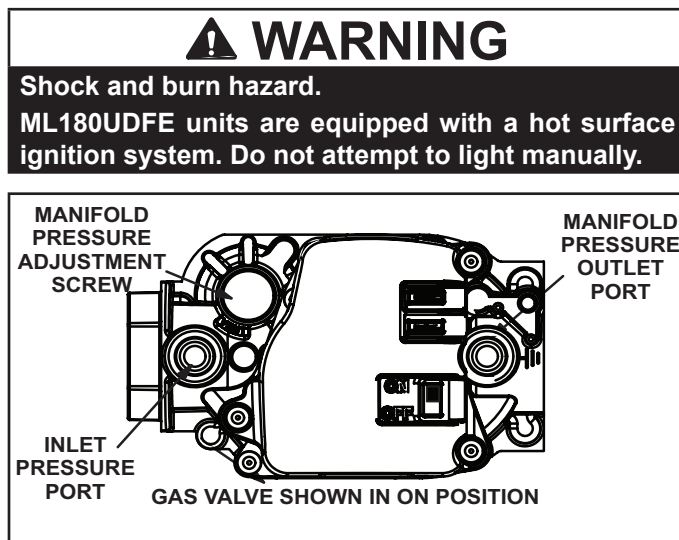


FIGURE 18

- 1 - **STOP!** Read the safety information at the beginning of this section.
- 2 - Set the thermostat to the lowest setting.
- 3 - Turn off all electrical power to the unit.
- 4 - This furnace is equipped with an ignition device which automatically lights the burners. Do not try to light the burners by hand.
- 5 - Remove the upper access panel.
- 6 - Move gas valve switch to OFF position. Do not force. See figure 18.
- 7 - Wait five minutes to clear out any gas. If you then smell gas, STOP! Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions. If you do not smell gas go to next step.
- 8 - Move gas valve switch to ON position. Do not force. See figure 18.
- 9 - Replace the upper access panel.
- 10 - Turn on all electrical power to to the unit.
- 11 - Set the thermostat to desired setting.

**NOTE** - When unit is initially started, steps 1 through 11 may need to be repeated to purge air from gas line.

- 12 - If the appliance will not operate, follow the instructions "Turning Off Gas to Unit" and call the gas supplier.

### Turning Off Gas to Unit

- 1 - Set the thermostat to the lowest setting.
- 2 - Turn off all electrical power to the unit if service is to be performed.
- 3 - Remove the upper access panel.
- 4 - Move gas valve switch to OFF position. Do not force. See figure 18.
- 5 - Replace the upper access panel.

### B- Safety or Emergency Shutdown

Disconnect main power to unit. Close manual and main gas valves.

### C- Extended Period Shutdown

Turn off thermostat or set to "UNOCCUPIED" mode. Close all gas valves (both internal and external to unit) to guarantee no gas leaks into combustion chamber. Turn off power to unit. All access panels and covers must be in place and secured.

## IV-HEATING SYSTEM SERVICE CHECKS

### A- C.S.A. Certification

All units are C.S.A. design certified without modifications. Refer to the ML180DFE Installation Instruction.

### B- Gas Piping

Gas supply piping should not allow more than 0.5"W.C. drop in pressure between gas meter and unit. Supply gas pipe must not be smaller than unit gas connection. Compounds used on gas piping threaded joints should be resistant to action of liquefied petroleum gases.

### C- Testing Gas Piping

## CAUTION

If a flexible gas connector is required or allowed by the authority that has jurisdiction, black iron pipe shall be installed at the gas valve and extend outside the furnace cabinet.

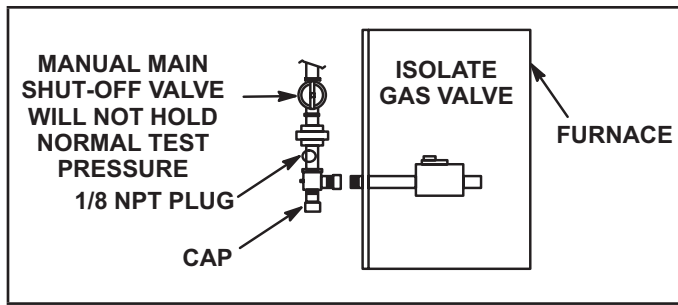
## IMPORTANT

In case emergency shutdown is required, turn off the main shut-off valve and disconnect the main power to unit. These controls should be properly labeled by the installer.

## WARNING

Do not exceed 600 in-lbs (50 ft-lbs) torque when attaching the gas piping to the gas valve.

When pressure testing gas lines, the gas valve must be disconnected and isolated. Gas valves can be damaged if subjected to more than 0.5psig (14" W.C.). See figure 19. If the pressure is equal to or less than 0.5psig (14"W.C.), close the manual shut-off valve before pressure testing to isolate furnace from gas supply.



**FIGURE 19**

When checking piping connections for gas leaks, use preferred means. Kitchen detergents can cause harmful corrosion on various metals used in gas piping. Use of a specialty Gas Leak Detector is strongly recommended. It is available through Lennox under part number 31B2001. See Corp. 8411-L10, for further details.

Do not use matches, candles, flame or any other source of ignition to check for gas leaks.

### D- Gas Pressure Adjustment

#### Gas Flow (Approximate)

**TABLE 10**

GAS METER CLOCKING CHART				
Unit	Seconds For One Revolution			
	Natural		LP/Propane	
	1 cu ft Dial	2 cu ft Dial	1 cu ft Dial	2 cu ft Dial
-045	80	160	200	400
-070	55	110	136	272
-090	41	82	102	204
-110	33	66	82	164
-135	27	54	68	136

Natural-1000 btu/cu ft LP-2500 btu/cu ft

Furnace should operate at least 5 minutes before checking gas flow. Determine time in seconds for two revolutions of gas through the meter. (Two revolutions assures a more accurate time.) Divide by two and compare to time in table 10. If manifold pressure matches table 12 and rate is incorrect, check gas orifices for proper size and restriction. Remove temporary gas meter if installed.

**NOTE** - To obtain accurate reading, shut off all other gas appliances connected to meter.

### E- Supply and Manifold Pressure

#### Supply Pressure Measurement

- 1 - Remove the threaded plug from the inlet side of the gas valve and install a field-provided barbed fitting. Connect to a test gauge to measure supply pressure.

- 2 - Start unit and allow 5 minutes for unit to reach steady state.
- 3 - After allowing unit to stabilize for 5 minutes, record supply pressure and compare to value given in table 12.

#### Manifold Pressure Measurement

- 1 - Remove the threaded plug from the outlet side of the gas valve and install a field-provided barbed fitting. Connect to a test gauge to measure manifold pressure.
- 2 - Start unit and allow 5 minutes for unit to reach steady state.
- 3 - While waiting for the unit to stabilize, observe the flame. Flame should be stable and should not lift from burner. Natural gas should burn blue.
- 4 - After allowing unit to stabilize for 5 minutes, record manifold pressure and compare to value given in table 12.

**NOTE** - Shut unit off and remove manometer as soon as an accurate reading has been obtained. Take care to remove barbed fitting and replace threaded plug.

### F- Proper Combustion

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

**TABLE 11**

ML180DFE Unit	CO <sub>2</sub> % Nat	CO <sub>2</sub> % LP
-045	6.8 - 7.4	7.5 - 9.0
-070		
-090		
-110		

### G- High Altitude

The manifold pressure may require adjustment and combustion air pressure switch may need replacing to ensure proper combustion at higher altitudes. Refer to table 12 for manifold pressure and table 13 for pressure switch change and gas conversion kits.

**⚠ IMPORTANT**

**For safety, shut unit off and remove manometer as soon as an accurate reading has been obtained. Take care to replace pressure tap plug.**

**TABLE 12**

## Manifold Pressure Settings at all Altitudes

Model Input Size	Gas	0 - 4500 ft.	4501 - 7500 ft .	7501 - 10,000 ft.	Line Pressure in. wg.	
					Min	Max
045	Nat	3.5	3.5	3.5	4.5	13.0
	LP/Propane	10.0	10.0	10.0	11.0	13.0
070	Nat	3.5	3.3	3.5	4.5	13.0
	LP/Propane	10.0	10.0	10.0	11.0	13.0
090	Nat	3.5	3.3	3.5	4.5	13.0
	LP/Propane	10.0	10.0	10.0	11.0	13.0
110	Nat	3.5	3.3	3.5	4.5	13.0
	LP/Propane	10.0	10.0	10.0	11.0	13.0

**TABLE 13**

## Pressure Switch and Gas Conversion Kits at all Altitudes

Model Input Size	High Altitude Pressure Switch Kit			High Altitude Natural Gas Orifice Kit	LP/Propane Orifice Kit		Natural Gas Orifice Kit
	0-4500 ft	4501-7500 ft	7501-10,000 ft	7501-10,000 ft	0-7500 ft	7501-10,000 ft	0-7500 ft
045	No Change	No Change	80W51	73W37	11K49	11K44	73W81
070		80W52					
090		No Change					
110		80W52					

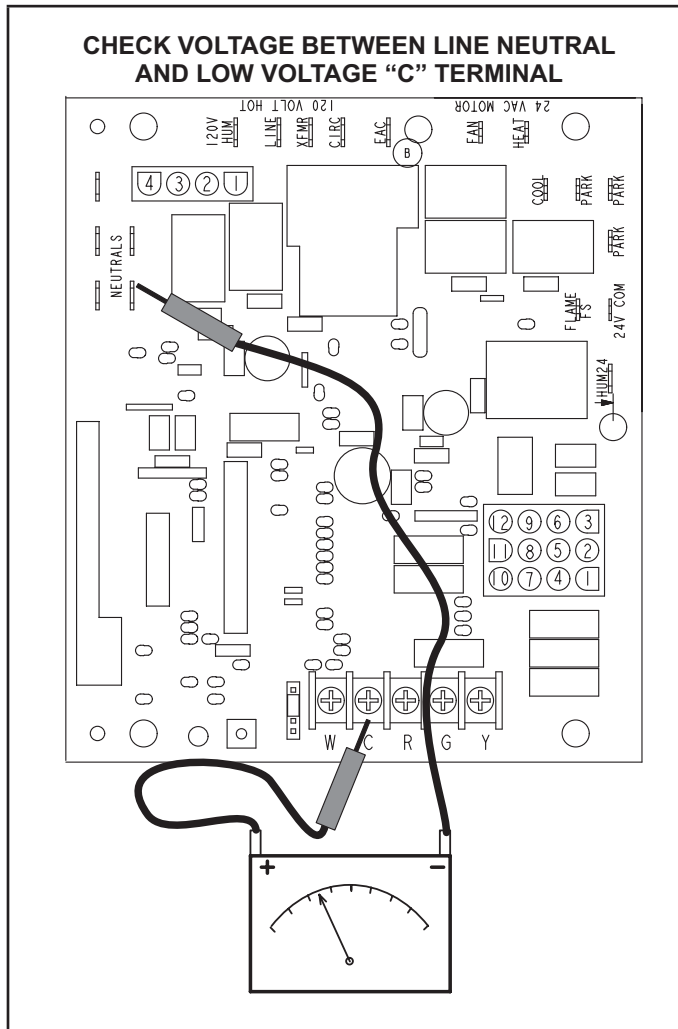
*NOTE - A natural to L.P. propane gas changeover kit is necessary to convert this unit. Refer to the changeover kit installation instruction for the conversion procedure.*

## H- Proper Ground and Voltage

A poorly grounded furnace can contribute to poor flame sense signal. Use the following procedure to check for ground and voltage to the integrated control.

- 1 - Measure the AC voltage between Line Neutral (spade terminals) and "C" terminal (low voltage terminal block) on the integrated control. See figure 20. A wide variation in the voltage between Line Neutral and "C" as a function of load indicates a poor or partial ground. Compare the readings to the table below. If the readings exceed the maximum shown in table 14, make repairs before operating the furnace.
- 2 - In addition, measure the AC voltage from Line Hot to Line Neutral (spade terminals) on the integrated control. See figure 21. This voltage should be in the range of 97 to 132 Vac.

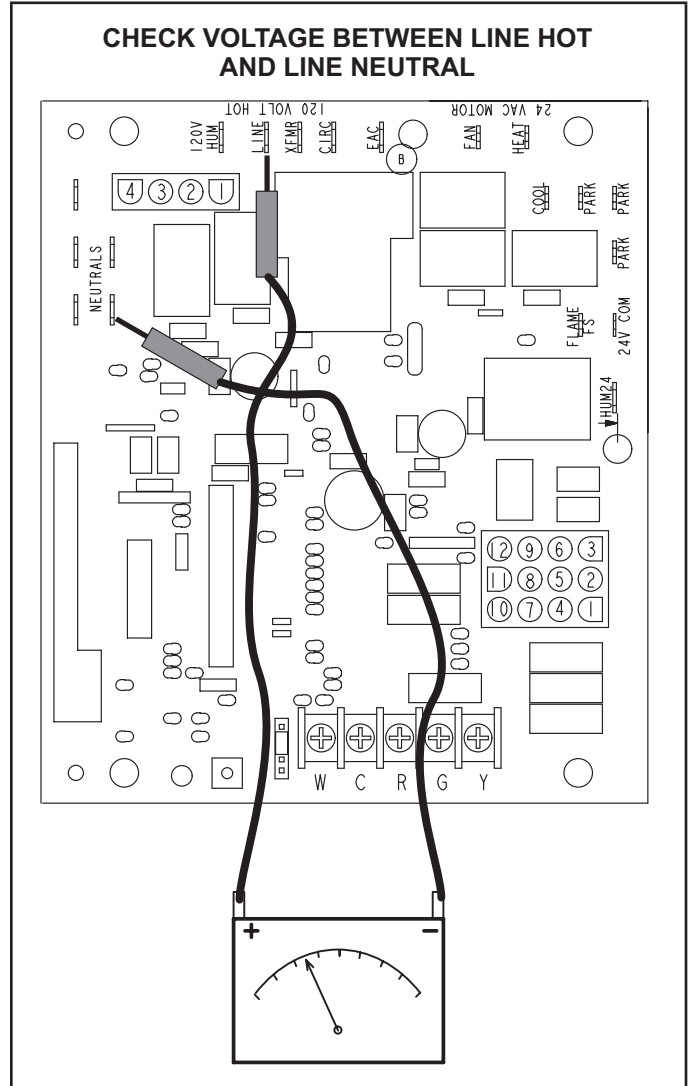
**NOTE** - Figures 21 and 22 are typical ignition control illustrations.



**FIGURE 20**

**TABLE 14**

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



**FIGURE 21**

### V-TYPICAL OPERATING CHARACTERISTICS

#### A-Blower Operation and Adjustment

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

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

## B-Temperature Rise (Figure 22)

Temperature rise for ML180DFE units depends on unit input, blower speed, blower horsepower and static pressure as marked on the unit rating plate. The blower speed must be set for unit operation within the range of "TEMP. RISE °F" listed on the unit rating plate.

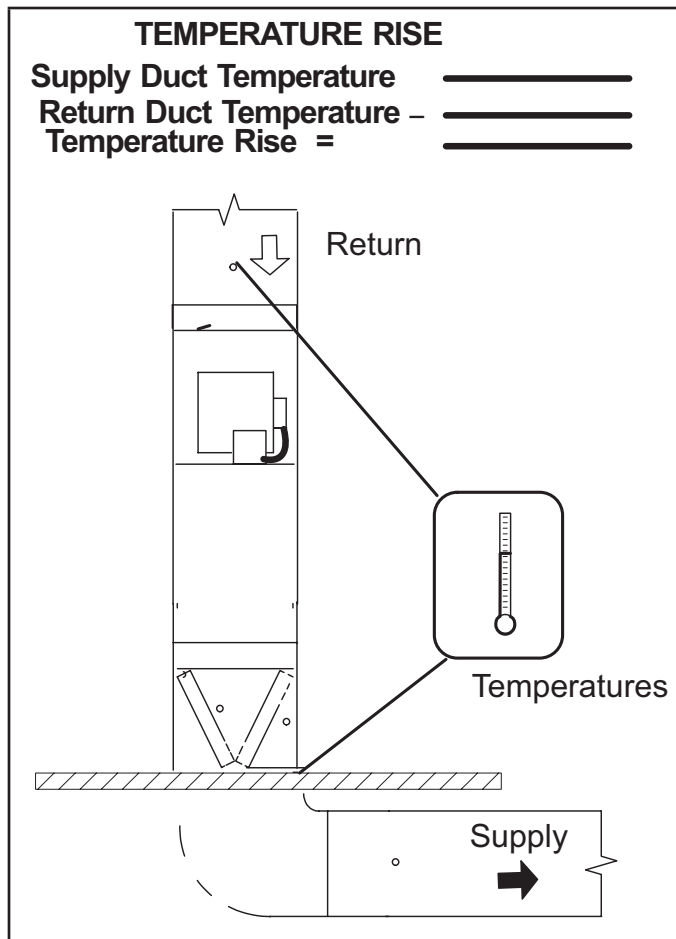


FIGURE 22

## C-External Static Pressur

- 1 - Tap locations shown in figure 23 .
- 2 - Punch a 1/4" diameter hole in supply and return air plenums. Insert manometer hose flush with inside edge of hole or insulation. Seal around the hose with permagum. Connect the zero end of the manometer to the discharge (supply) side of the system. On ducted systems, connect the other end of manometer to the return duct as above.
- 3 - With only the blower motor running and the evaporator coil dry, observe the manometer reading. Adjust blower motor speed to deliver the air desired according to the job requirements. For heating speed external static pressure drop must not be more than 0.5" W.C. For cooling speed external static pressure drop must not be more than 0.8" W.C.
- 4 - Seal the hole when the check is complete.

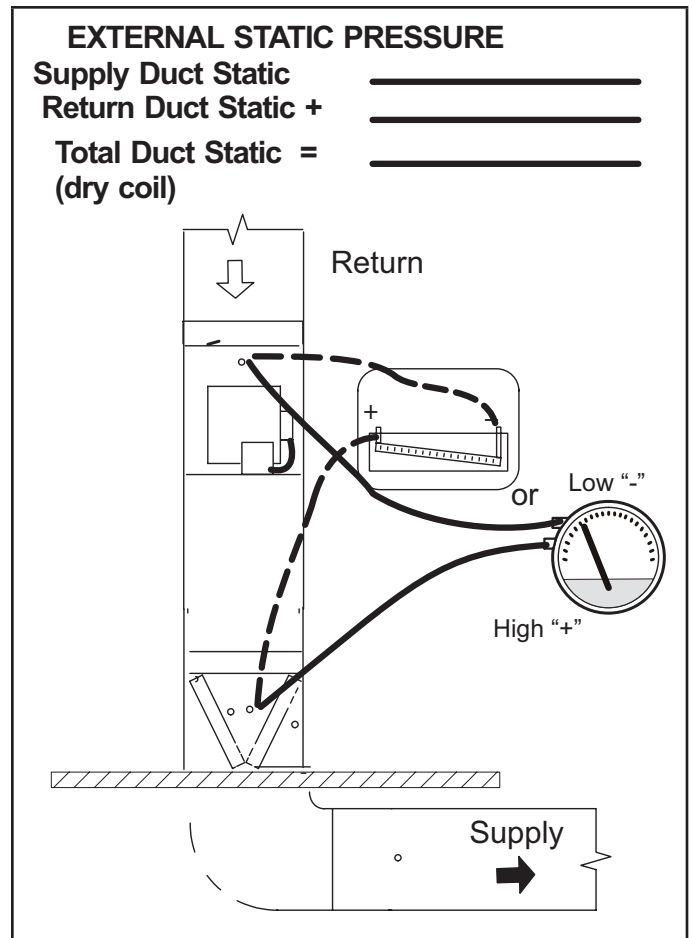


FIGURE 23

## D-Blower Speed Taps

Blower speed tap changes are made on the integrated control. See figure 3. The heating tap is connected to the "HEAT" terminal and the cooling tap is connected to the "COOL" terminal. The continuous blower tap is connected to the "FAN" terminal. Unused taps must be secured on dummy terminals labeled "PARK". To change out existing speed tap, turn off power and switch out speed tap with tap connected to "PARK". See blower speed tap table on unit diagram for motor tap colors for each speed.

## VI-MAINTENANCE

### Annual Furnace Maintenance

At the beginning of each heating season, and to comply with the **Lennox Limited Warranty**, your system should be checked by a licensed professional technician (or equivalent) as follows:

- 1 - Check wiring for loose connections, voltage at indoor unit and amperage of indoor motor.
- 2 - Check the condition of the belt and shaft bearings if applicable.
- 3 - Inspect all gas pipe and connections for leaks.
- 4 - Check the cleanliness of filters and change if necessary (monthly). See table 15.

## **IMPORTANT**

If a highefficiency filter is being installed as part of this system to ensure better indoor air quality, the filter must be properly sized. Highefficiency filters have a higher static pressure drop than standardefficiency glass/foam filters. If the pressure drop is too great, system capacity and performance may be reduced.

The pressure drop may also cause the limit to trip more frequently during the winter and the indoor coil to freeze in the summer, resulting in an increase in the number of service calls.

Before using any filter with this system, check the specifications provided by the filter manufacturer against the data given in the appropriate Lennox Product Specifications bulletin. Additional information is provided in Service and Application Note ACC002 (August 2000).

**TABLE 15**

Furnace Cabinet Width	Filter Size (inches)
A - 14-1/2"	14 X 25 X 1 (1)
B - 17-1/2"	16 X 25 X 1 (1)
C - 21"	20 x 25 x 1 (1)

- 5 - Check the condition and cleanliness of burners and heat exchanger and clean if necessary.
- 6 - Check the cleanliness of blower assembly and clean the housing, blower wheel and blower motor if necessary. The blower motors are prelubricated for extended bearing life. No further lubrication is needed.
- 7 - Inspect the combustion air inducer and clean if necessary.
- 8 - Evaluate the heat exchanger integrity by inspecting the heat exchanger per the AHRI heat exchanger inspection procedure. This procedure can be viewed at [www.ahrinet.org](http://www.ahrinet.org)
- 9 - Ensure sufficient combustion air is available to the furnace. Fresh air grilles and louvers (on the unit and in the room where the furnace is installed) must be properly sized, open and unobstructed to provide combustion air.

- 10 - Inspect the furnace venting system to make sure it is in place, structurally sound, and without holes, corrosion, or blockage. Vent system must be free and clear of obstructions and must slope upward away from the furnace . Vent system should be installed per the National Fuel Gas Code
- 11 - Inspect the furnace return air duct connection to ensure the duct is sealed to the furnace. Check for air leaks on supply and return ducts and seal where necessary.
- 12 - Check the condition of the furnace cabinet insulation and repair if necessary.
- 13 - Perform a complete combustion analysis during the furnace inspection to ensure proper combustion and operation. Consult Service Literature for proper combustion values.
- 14 - Verify operation of CO detectors and replace batteries as required.

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

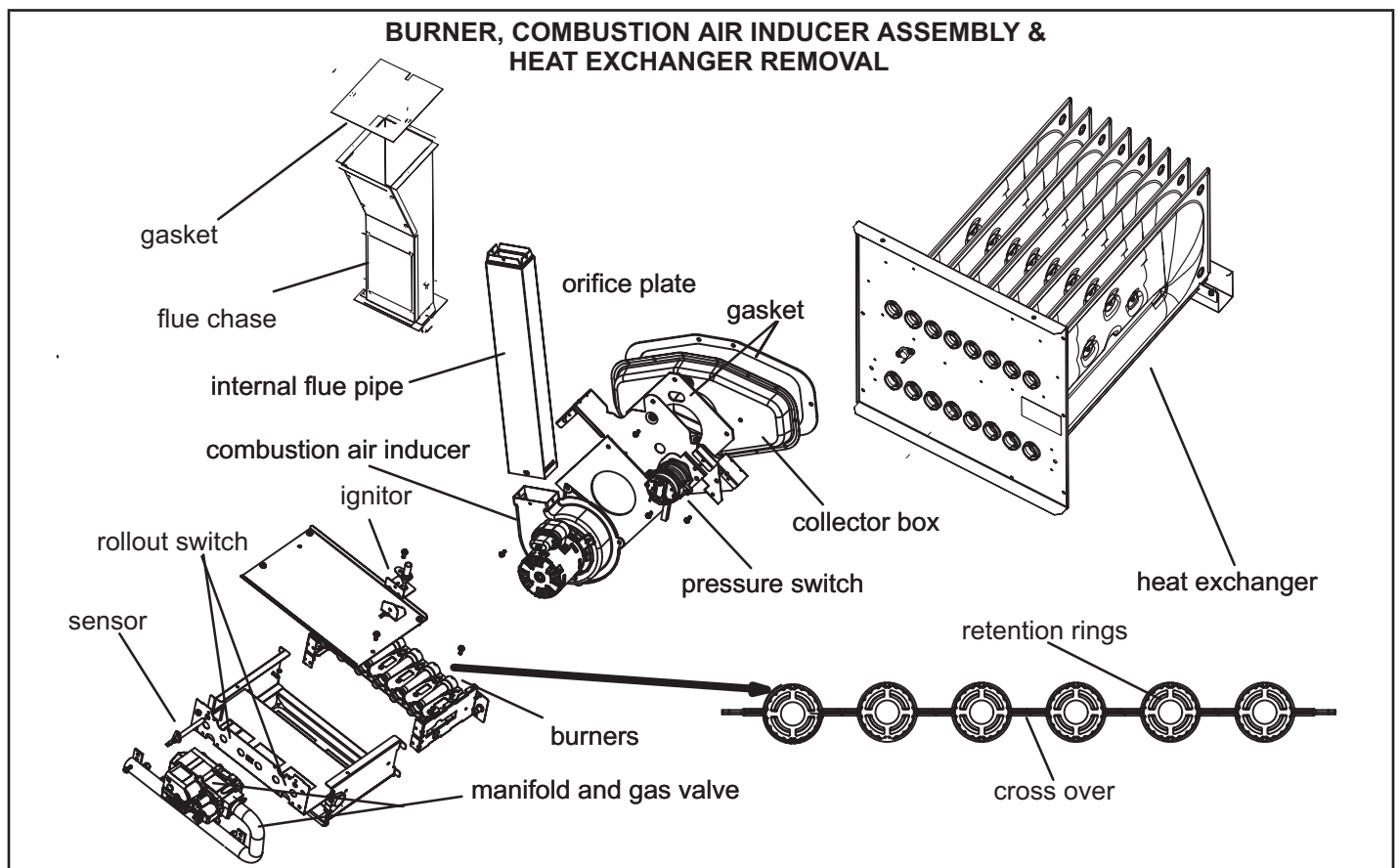
- 1 - Check the operation of the ignition system, inspect and clean flame sensor. Check microamps before and after. Check controls and safety devices (gas valve, flame sensor, temperature limits). Consult Service Manual for proper operating range. Thermal Limits should be checked by restricting airflow and not disconnecting the indoor blower. For additional details, please see Service and Application Note H049.
- 2 - Verify that system total static pressure and airflow settings are within specific operating parameters.
- 3 - Clock gas meter to ensure that the unit is operating at the specified firing rate. Check the supply pressure and the manifold pressure. On two-stage gas furnaces check the manifold pressure on high fire and low fire. If manifold pressure adjustment is necessary, consult the Service Literature for unit specific information on adjusting gas pressure. Not all gas valves are adjustable. Verify correct temperature rise.



## Cleaning the Heat Exchanger and Burners

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

- 1 - Turn off both electrical and gas power supplies to furnace.
- 2 - Remove flue pipe, top cap, flue chase and internal flue pipe assembly from the unit.
- 3 - Label the wires from gas valve, rollout switches, primary limit switch and make-up box then disconnect them.
- 4 - Remove the screws that secure the combustion air inducer/ pressure switch assembly to the collector box. Carefully remove the combustion air inducer to avoid damaging blower gasket. If gasket is damaged, it must be replaced to prevent leakage.
- 5 - Remove the collector box located behind the combustion air inducer. Be careful with the collector box gasket. If the gasket is damaged, it must be replaced to prevent leakage.
- 6 - Disconnect gas supply piping. Remove the four screws securing the burner manifold assembly to the vestibule panel and remove the assembly from the unit.
- 7 - Remove screws from both sides, top and bottom of vestibule panel.
- 8 - Remove heat exchanger. It may be necessary to spread cabinet side to allow more room. If so, remove five screws from the left side or right side of cabinet. See figure 25.
- 9 - Back wash using steam. Begin from the burner opening on each clam. Steam must not exceed 275°F.
- 10 - To clean burners, run a vacuum cleaner with a soft brush attachment over the face of burners. Visually inspect inside the burners and crossovers for any blockage caused by foreign matter. Remove any blockage. Figure 24 shows burner detail.



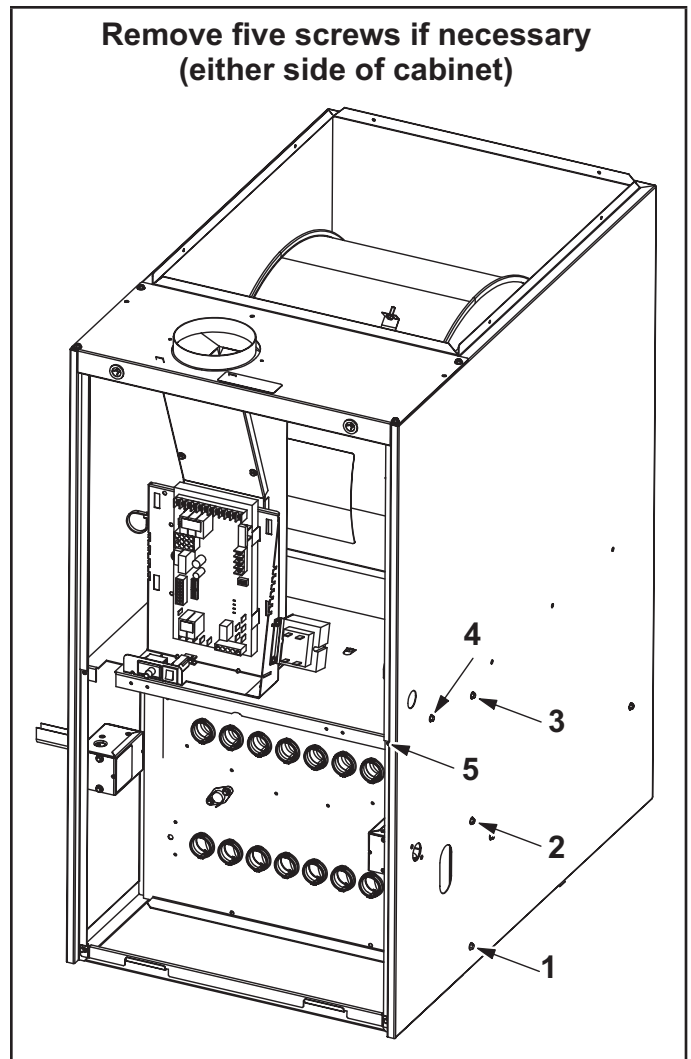
**FIGURE 24**

- 11 - To clean the combustion air inducer visually inspect and using a wire brush clean where necessary. Use compressed air to clean off debris and any rust.
- 12 - Reinstall heat exchanger in vestibule. (Replace the five screws in the cabinet from step 10 if removed).
- 13 - Reinstall collector box, combustion air assembly, internal flue pipe and flue chase. Seal with high temperature RTV. Reinstall all screws to the collector box and combustion air inducer. Failure to replace all screws may cause leaks. Inspect gaskets for any damage and replace if necessary.
- 14 - Reinstall burner box, manifold assembly and burner box cover.
- 15 - Reconnect all wires.
- 16 - Reconnect top cap and vent pipe to combustion air inducer outlet.
- 17 - Reconnect gas supply piping.
- 18 - Turn on power and gas supply to unit.
- 19 - Set thermostat and check for proper operation.
- 20 - Check all piping connections, factory and field, for gas leaks. Use a leak detecting solution or other preferred means.
- 21 - If a leak is detected, shut gas and electricity off and repair leak.

**⚠ CAUTION**

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

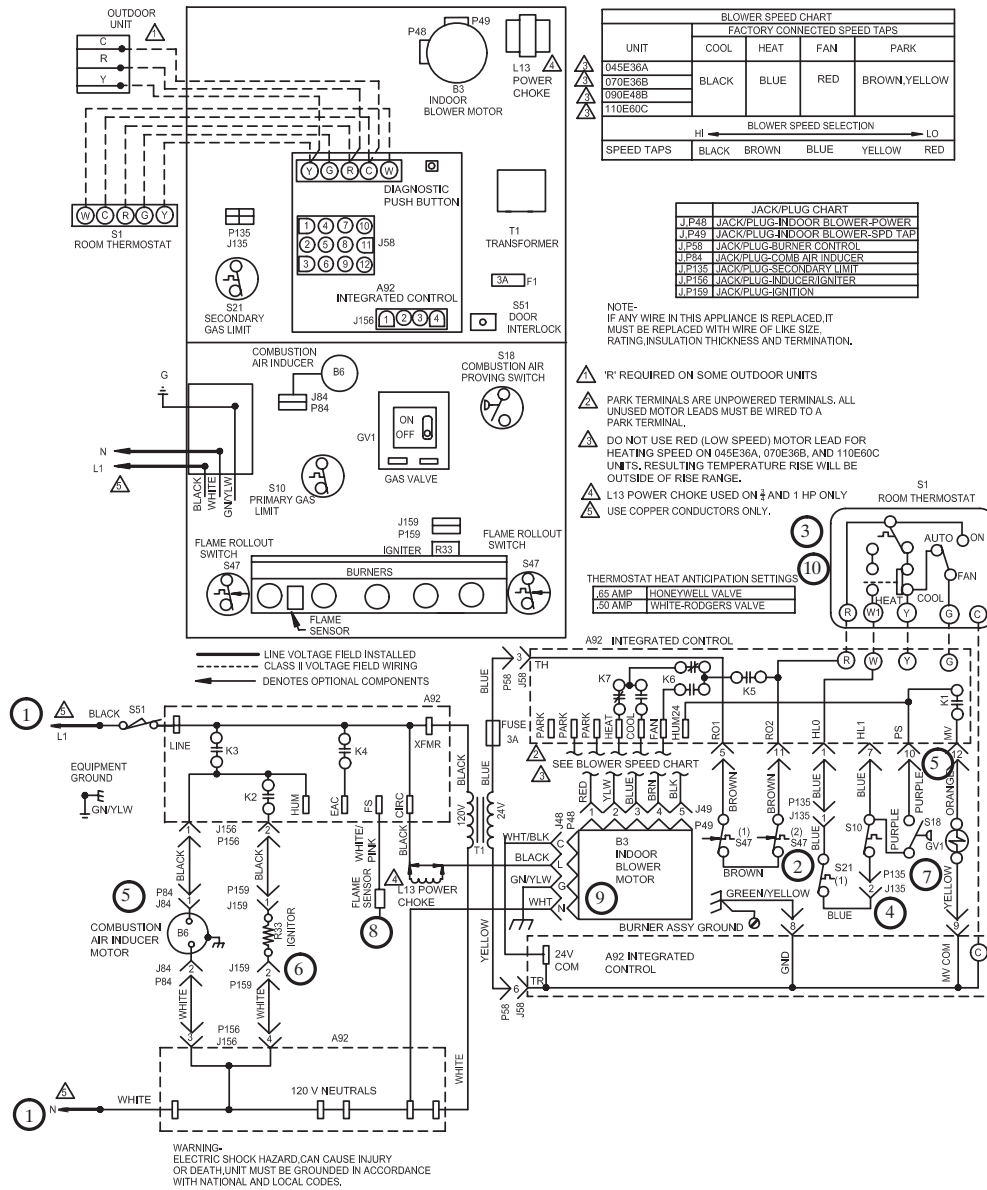
- 22 - Repeat steps 21 and 23 until no leaks are detected.
- 23 - Replace access panel.



**FIGURE 25**

## VII- Wiring and Sequence of Operation

### Schematic Wiring Diagram and Sequence of Operation

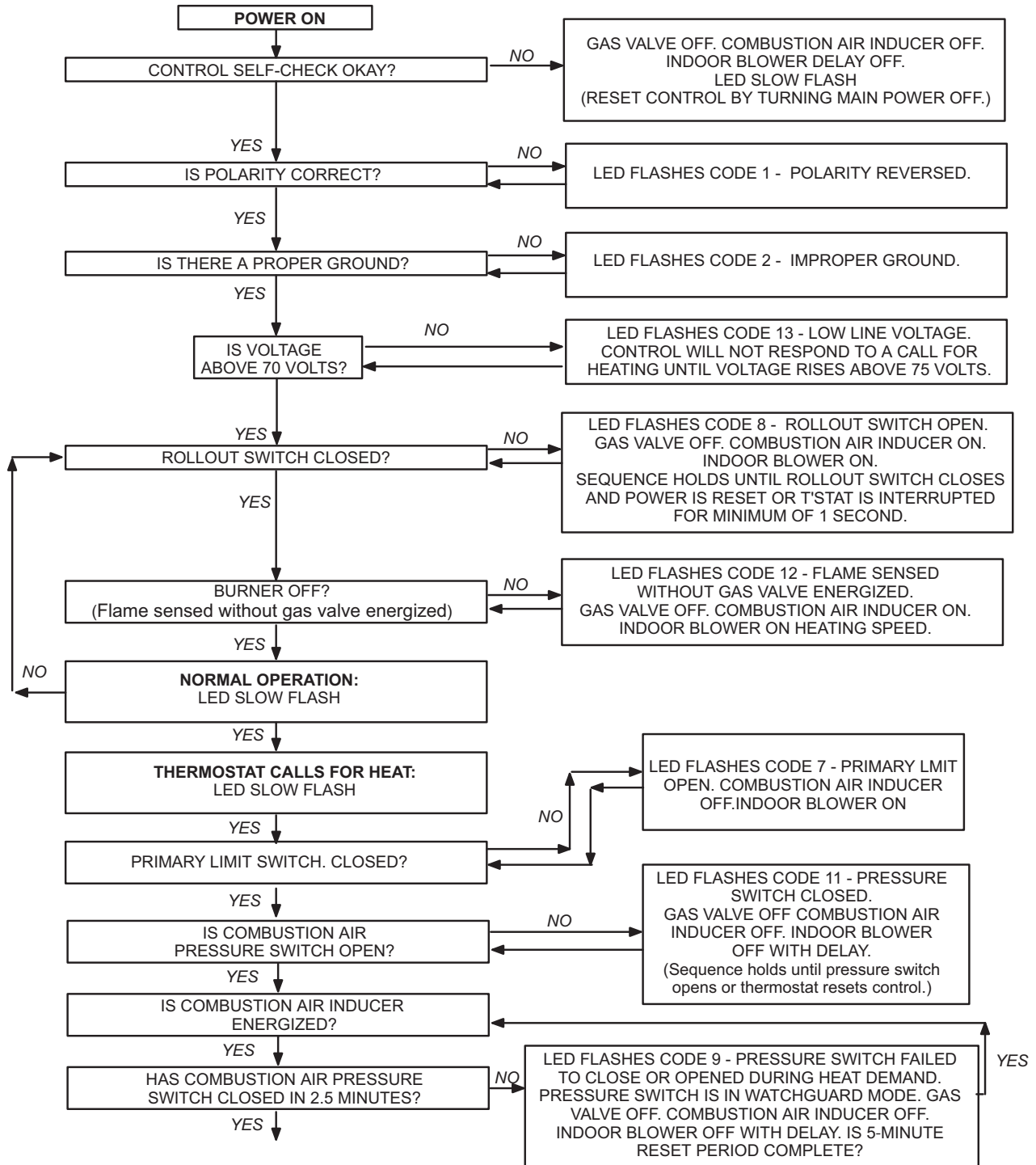


- Line voltage is applied to L1 and N. the T1 low voltage transformer is energized, and line voltage is applied to B3 indoor blower.
- S47 rollout switch(es) must be closed in order for 24V from transformer to be output on integrated control "R" to power thermostat.
- When there is a call for heat, W1 of the thermostat energizes W of the furnace control with 24VAC.
- A92 integrated control runs a self-check. S10 primary limit and S21 secondary limit contacts are found to be closed. Call for heat can continue.
- A92 integrated control energizes B6 combustion air inducer. S18 combustion air pressure switch closes. Once S18 closes, a 15-second pre-purge follows.
- A92 integrated control energizes R33 ignitor. A 20-second warm-up period begins.
- GV1 gas valve opens for a 4-second trial for ignition
- Flame is sensed, gas valve remains open for the heat call.
- After 30-second delay (from flame sensed), A92 integrated control applies 24VAC to Heat speed of B3 indoor blower.
- When heat demand is satisfied, W1 of the indoor thermostat de-energizes W of A92 ignition control which de-energizes GV1 gas valve. B6 combustion air inducer continues a 5-second post-purge period, and B3 indoor blower completes a selected OFF time delay.

## HEATING SEQUENCE OF OPERATION

### NORMAL HEATING MODE

### ABNORMAL HEATING MODE

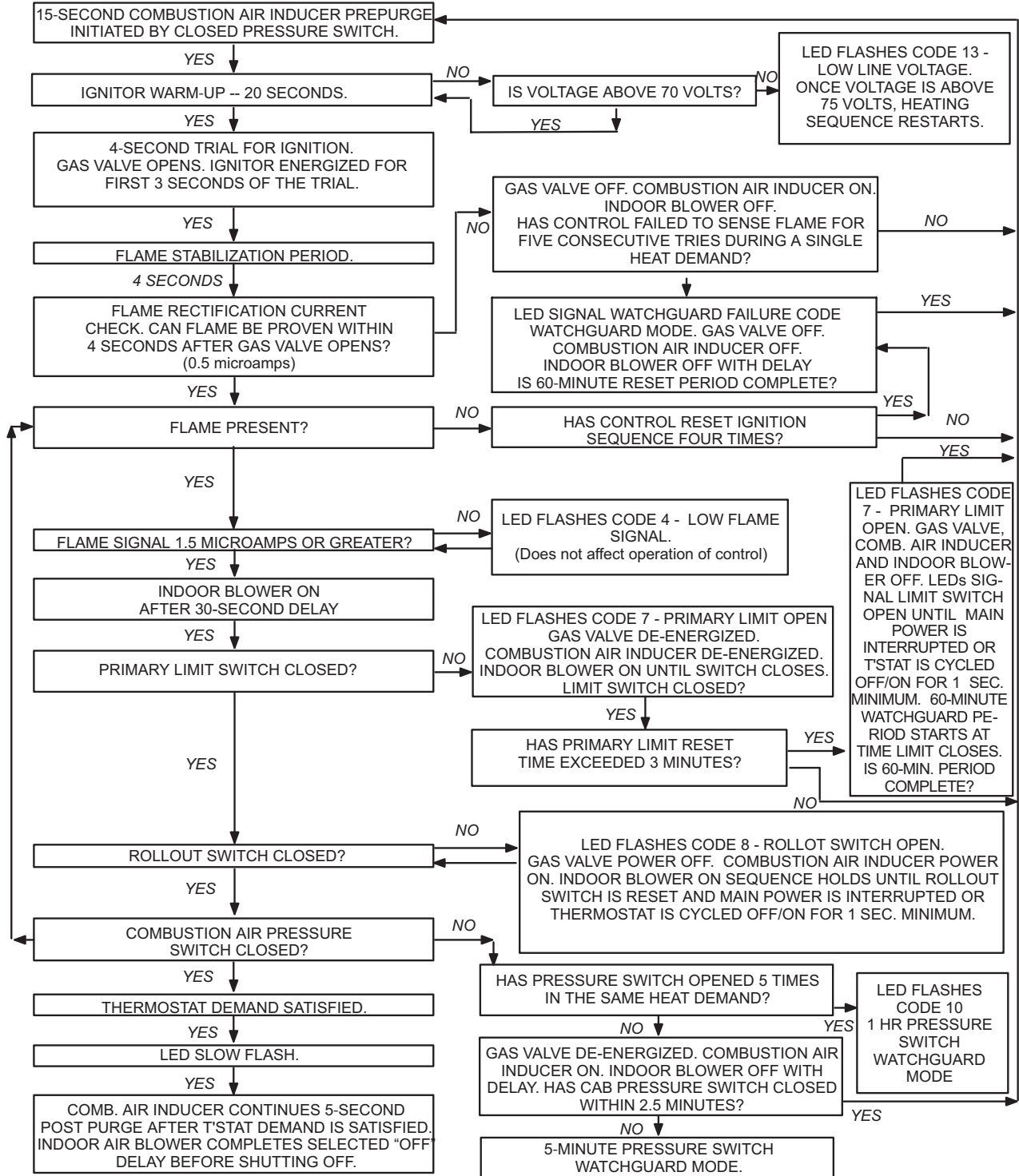


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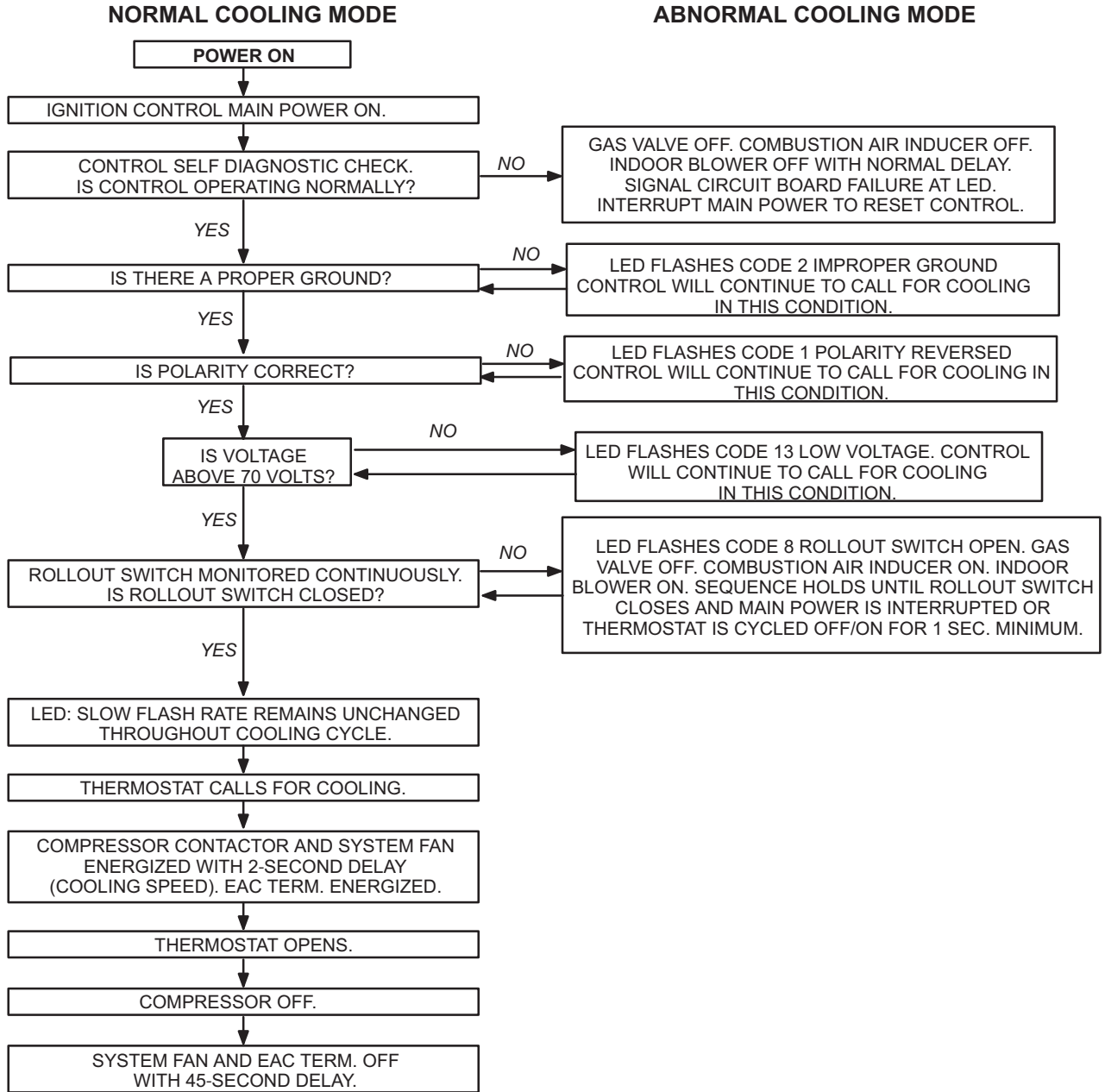
## HEATING SEQUENCE CONTINUED

### NORMAL HEATING MODE

### ABNORMAL HEATING MODE



## COOLING SEQUENCE OF OPERATION



### CONTINUOUS FAN SEQUENCE OF OPERATION

