

**EL296UHE SERIES UNITS**

EL296UHE series units are high efficiency condensing gas furnaces used for upflow or horizontal applications only, manufactured with Lennox Duralok heat exchangers formed of aluminized steel. EL296UHE units are available in heating capacities of 44,000 to 132,000 Btuh and cooling applications up to 5 tons. Refer to Product Specifications Manual for proper sizing.

Units are factory equipped for use with natural gas. Kits are available for conversion to LPG operation. EL296UHE model units are equipped with the SureLight® two-stage integrated control. EL296UHE unit meets the California Nitrogen Oxides (NOx) Standards and California Seasonal Efficiency requirements. 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 recommendations only and do not constitute code.

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

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

## SPECIFICATIONS

Gas Heating Performance	Model No.	EL296UH045XE36B	EL296UH070XE36B	EL296UH090XE48C
	AHRI Ref. No.	5625717	5625718	5625719
	<sup>1</sup> AFUE	96%	96%	96%
<b>High Fire</b>	Input - Btuh	44,000	66,000	88,000
	Output - Btuh	43,000	64,000	84,000
	Temperature rise range - °F	30-60	35-65	40-70
	Gas Manifold Pressure (in. w.g.) Nat. Gas / LPG/Propane	3.5 / 10.0	3.5 / 10.0	3.5 / 10.0
<b>Low Fire</b>	Input - Btuh	29,000	43,000	57,000
	Output - Btuh	28,000	42,000	55,000
	Temperature rise range - °F	20 - 50	25 - 55	30 - 60
	Gas Manifold Pressure (in. w.g.) Nat. Gas / LPG/Propane	1.7 / 4.5	1.7 / 4.5	1.7 / 4.5
<b>High static - in. w.g.</b>		0.5	0.5	0.5
<b>Connections in.</b>	Intake / Exhaust Pipe (PVC)	2 / 2	2 / 2	2 / 2
	Gas pipe size IPS	1/2	1/2	1/2
	Condensate Drain Trap (PVC pipe) - i.d.	3/4	3/4	3/4
	with furnished 90° street elbow with field supplied (PVC coupling) - o.d.	3/4 slip x 3/4 Mipt 3/4 slip x 3/4 MPT	3/4 slip x 3/4 Mipt 3/4 slip x 3/4 MPT	3/4 slip x 3/4 Mipt 3/4 slip x 3/4 MPT
<b>Indoor Blower</b>	Wheel nominal diameter x width - in.	10 x 8	10 x 8	10 x 10
	Motor Type	DC Brushless	DC Brushless	DC Brushless
	Motor output - hp	1/2	1/2	3/4
	Tons of add-on cooling	1.5 - 3	1.5 - 3	2.5 - 4
	Air Volume Range - cfm	520 - 1345	550 - 1380	760 - 1740
<b>Electrical Data</b>	Voltage	120 volts - 60 hertz - 1 phase		
	Blower motor full load amps	6.8	6.8	8.4
	Maximum overcurrent protection	15	15	15
<b>Shipping Data</b>	lbs. - 1 package	129	133	159

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 Heating Performance	Model No.	EL296UH110XE60C	EL296UH135XE60D
	AHRI Ref. No.	5625720	5625721
	<sup>1</sup> AFUE	96%	96%
<b>High Fire</b>	Input - Btuh	110,000	132,000
	Output - Btuh	106,000	127,000
	Temperature rise range - °F	40-70	45-75
	Gas Manifold Pressure (in. w.g.) Nat. Gas / LPG/Propane	3.5 / 10.0	3.5 / 10.0
<b>Low Fire</b>	Input - Btuh	72,000	86,000
	Output - Btuh	70,000	84,000
	Temperature rise range - °F	30-60	35-65
	Gas Manifold Pressure (in. w.g.) Nat. Gas / LPG/Propane	1.7 / 4.9	1.7 / 4.9
<b>High static - in. w.g.</b>		0.5	0.5
<b>Connections in.</b>	Intake / Exhaust Pipe (PVC)	2 / 2	2 / 2
	Gas pipe size IPS	1/2	1/2
	Condensate Drain Trap (PVC pipe) - i.d.	3/4	3/4
	with furnished 90° street elbow with field supplied (PVC coupling) - o.d.	3/4 slip x 3/4 Mipt 3/4 slip x 3/4 MPT	3/4 slip x 3/4 Mipt 3/4 slip x 3/4 MPT
<b>Indoor Blower</b>	Wheel nominal diameter x width - in.	11-1/2 x 10	11-1/2 x 10
	Motor Type	DC Brushless	DC Brushless
	Motor output - hp	1	1
	Tons of add-on cooling	3 - 5	3.5 - 5
	Air Volume Range - cfm	1055 - 2220	1260 - 2405
<b>Electrical Data</b>	Voltage	120 volts - 60 hertz - 1 phase	
	Blower motor full load amps	10.9	10.9
	Maximum overcurrent protection	15	15
<b>Shipping Data</b>	lbs. - 1 package	174	189

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

			"B" Width Models	"C" Width Models	"D" Width Models
<b>CABINET ACCESSORIES</b>					
Horizontal Suspension Kit - Horizontal only			51W10	51W10	51W10
Return Air Base - Upflow only			50W98	50W99	51W00
High Performance Economizer (Commercial Only)			10U53	10U53	10U53
<b>CONDENSATE DRAIN KITS</b>					
Condensate Drain Heat Cable	6 ft.		26K68	26K68	26K68
	24 ft.		26K69	26K69	26K69
Crawl Space Vent Drain Kit	US		51W18	51W18	51W18
	Canada		15Z70	15Z70	15Z70
<b>CONTROLS</b>					
Blower Relay Kit (for two-stage outdoor units)			85W66	85W66	85W66
Furnace Twinning Kit			16W72	16W72	16W72
iComfort® E30 Smart Wi-Fi Thermostat			20A65	20A65	20A65
Remote Outdoor Air Temperature Sensor			X2658	X2658	X2658
Night Service Kit			10B39	10B39	10B39
<b>FILTER KITS</b>					
<sup>1</sup> Air Filter and Rack Kit	Horizontal (end)		87L96	87L97	87L98
		Size of filter - in.	18 x 25 x 1	20 x 25 x 1	25 x 25 x 1
	Side Return	Single	44J22	44J22	44J22
		Ten Pack	66K63	66K63	66K63
		Size of filter - in.	16 x 25 x 1	16 x 25 x 1	16 x 25 x 1
<b>TERMINATION KITS</b>					
See Installation Instructions for specific venting information.					
Direct Vent	Concentric	US - 2 in.	71M80	69M29	---
		3 in.	---	60L46	60L46
		Canada - 2 in.	44W92	44W92	---
	Flush-Mount	3 in.	---	44W93	44W93
		US - 2, 2-1/2 or 3 in.	51W11	51W11	51W11
	Wall - Close Couple	Canada - 2, 2-1/2 or 3 in.	51W12	51W12	51W12
		US - 2 in.	22G44	---	---
	Wall - Close Couple WTK	3 in.	44J40	44J40	44J40
		Canada - 2 in.	30G28	---	---
	Roof Termination Flashing Kit (no vent pipe - 2 flashings)	3 in.	81J20	81J20	81J20
		2 in.	15F75	15F75	---
	Flue Coupling	3 in.	44J41	44J41	44J41
		2 in.	17H92	17H92	17H92

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

NOTE - Termination Kits (44W92, 44W93, 30G28, 51W12, 81J20) and Crawl Space Vent Drain Kit (15Z70) are certified to ULC S636 standard for use in Canada only.

## BLOWER DATA

### EL296UH045XE36B 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	1416	339	1286	239	1174	193	945	101	885	89
0.10	1395	348	1246	249	1139	198	911	111	847	96
0.20	1375	358	1206	258	1105	203	876	120	809	103
0.30	1348	367	1184	267	1079	215	839	122	768	109
0.40	1318	380	1160	278	1046	221	798	132	733	115
0.50	1294	386	1125	286	1014	230	755	139	694	124
0.60	1265	398	1097	296	987	239	710	145	652	132
0.70	1216	393	1066	304	957	247	665	156	606	136
0.80	1147	374	1043	314	923	256	624	160	569	145
0.90	1062	350	1010	320	889	267	589	166	532	151
1.00	941	314	917	301	846	271	556	177	486	156

### EL296UH070XE36B 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	1424	320	1270	228	1170	178	953	98	889	85
0.10	1395	333	1242	240	1137	190	912	107	851	94
0.20	1367	346	1214	252	1104	202	872	116	813	103
0.30	1332	362	1182	260	1071	213	832	123	762	110
0.40	1311	372	1153	274	1043	218	775	134	721	117
0.50	1287	382	1119	285	1001	231	735	141	675	125
0.60	1249	394	1087	294	968	241	681	148	625	134
0.70	1199	387	1055	306	934	249	641	156	581	142
0.80	1112	369	1013	316	891	259	596	166	540	149
0.90	1009	337	946	309	856	268	554	172	483	157
1.00	840	294	833	282	793	269	516	182	443	165

### EL296UH090XE48C 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	1749	383	1505	275	1414	200	1323	173	1198	131
0.10	1714	401	1490	284	1373	217	1286	186	1165	143
0.20	1679	419	1476	292	1332	233	1250	199	1131	155
0.30	1650	435	1440	312	1305	247	1219	214	1083	168
0.40	1630	456	1403	327	1271	258	1178	222	1050	176
0.50	1601	469	1377	334	1227	270	1142	232	1006	188
0.60	1567	478	1347	346	1196	283	1110	245	968	197
0.70	1489	461	1313	361	1165	291	1068	257	930	207
0.80	1390	433	1275	372	1126	306	1035	268	894	217
0.90	1237	387	1218	373	1091	315	990	277	843	228
1.00	1115	354	1075	337	1043	324	951	287	807	235

## BLOWER DATA

### EL296UH110XE60C PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Different Blower Speeds																			
	Bottom Return Air, Side Return Air with Return Air from Both Sides or Return Air from Bottom and One Side.										Single Side Return Air - Air volumes in <b>bold</b> (over 1800 cfm) require Optional Return Air Base and field fabricated transition to accommodate 20 x 25 x 1 in. air filter in order to maintain proper air velocity.									
	High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)		High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	2178	636	1915	438	1742	336	1665	279	1449	207	<b>2133</b>	<b>636</b>	<b>1847</b>	<b>437</b>	1679	334	1613	275	1435	200
0.10	2140	653	1877	449	1706	349	1616	292	1419	215	<b>2101</b>	<b>650</b>	<b>1821</b>	<b>449</b>	1650	346	1558	288	1383	209
0.20	2102	669	1840	461	1670	362	1566	304	1388	223	<b>2069</b>	<b>664</b>	1795	462	1621	357	1503	301	1331	217
0.30	2061	687	1799	477	1639	375	1518	317	1326	234	<b>2036</b>	<b>681</b>	1746	479	1575	373	1466	312	1289	229
0.40	2031	702	1758	492	1590	387	1480	328	1275	244	<b>1998</b>	<b>698</b>	1708	492	1538	383	1417	326	1235	241
0.50	1999	719	1721	507	1546	399	1427	341	1229	255	<b>1970</b>	<b>717</b>	1676	509	1497	397	1377	340	1183	254
0.60	1960	735	1683	519	1505	413	1390	351	1179	266	<b>1940</b>	<b>731</b>	1641	517	1460	408	1339	349	1152	262
0.70	1908	741	1637	534	1467	424	1351	361	1128	277	<b>1890</b>	<b>740</b>	1609	533	1417	423	1293	362	1099	274
0.80	1840	721	1609	550	1423	438	1299	374	1088	284	<b>1834</b>	<b>730</b>	1560	549	1375	437	1254	374	1047	286
0.90	1744	692	1569	561	1387	447	1257	386	1036	296	1741	702	1532	561	1339	447	1219	384	1011	296
1.00	1651	655	1539	573	1347	461	1218	397	984	305	1645	665	1496	574	1298	460	1177	397	970	304

### EL296UH135XE60D PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Different Blower Speeds																			
	Bottom Return Air, Side Return Air with Return Air from Both Sides or Return Air from Bottom and One Side.										Single Side Return Air - Air volumes in <b>bold</b> (over 1800 cfm) require Optional Return Air Base and field fabricated transition to accommodate 20 x 25 x 1 in. air filter in order to maintain proper air velocity.									
	High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)		High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	2303	913	2138	674	1982	493	1794	351	1621	273	<b>2299</b>	<b>916</b>	<b>2086</b>	<b>665</b>	1908	494	1722	358	1560	257
0.10	2300	922	2125	689	1948	508	1750	368	1576	287	<b>2274</b>	<b>936</b>	<b>2058</b>	<b>680</b>	1880	509	1690	366	1524	269
0.20	2298	932	2111	703	1914	522	1706	385	1531	302	<b>2248</b>	<b>957</b>	<b>2030</b>	<b>695</b>	1852	523	1659	374	1488	282
0.30	2252	960	2074	720	1880	537	1681	398	1489	310	<b>2214</b>	<b>970</b>	1997	712	1829	537	1621	394	1446	297
0.40	2227	974	2050	737	1850	550	1629	412	1439	322	<b>2194</b>	<b>990</b>	1974	727	1799	554	1595	407	1407	308
0.50	2188	971	2015	757	1809	570	1597	421	1387	334	<b>2153</b>	<b>994</b>	1947	745	1771	567	1562	418	1356	321
0.60	2114	946	1984	770	1771	585	1553	439	1351	346	<b>2104</b>	<b>980</b>	1928	762	1742	583	1519	434	1322	333
0.70	2048	911	1944	785	1730	600	1516	451	1312	356	<b>2044</b>	<b>949</b>	1897	778	1705	596	1474	447	1277	345
0.80	1962	858	1893	797	1705	616	1485	462	1267	368	1962	907	1856	794	1671	616	1449	458	1230	356
0.90	1857	806	1838	774	1665	628	1427	477	1209	382	1873	853	1809	793	1637	629	1402	473	1189	368
1.00	1780	775	1754	739	1625	642	1387	488	1177	392	1756	801	1733	769	1594	643	1362	487	1148	381

# PARTS IDENTIFICATION

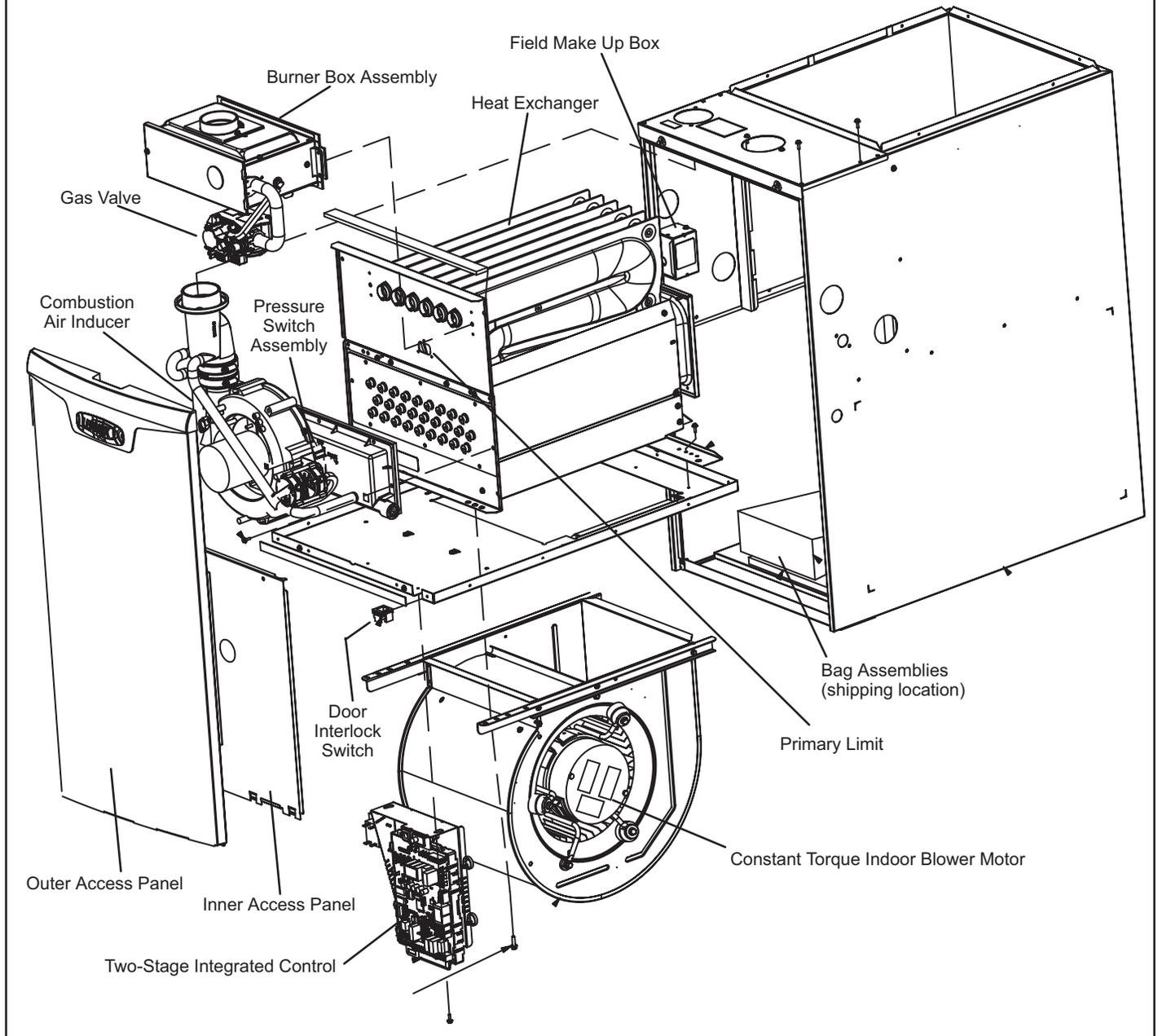


FIGURE 1

## I-UNIT COMPONENTS

EL296UHE unit components are shown in FIGURE 1. The gas valve, combustion air inducer and burners can be accessed by removing the access panel. Electrical components are in the control box (FIGURE 2) found in the blower section.

EL296UHE units are factory equipped with a bottom return air panel in place. The panel is designed to be field removed as required for bottom air return. Markings are provided for side return air and may be cut out in the field.

### ELECTROSTATIC DISCHARGE (ESD) Precautions and Procedures

**⚠ CAUTION**

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

#### A- Control Box

##### 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 is wired in series with line voltage. When the inner blower access panel is removed the unit will shut down.

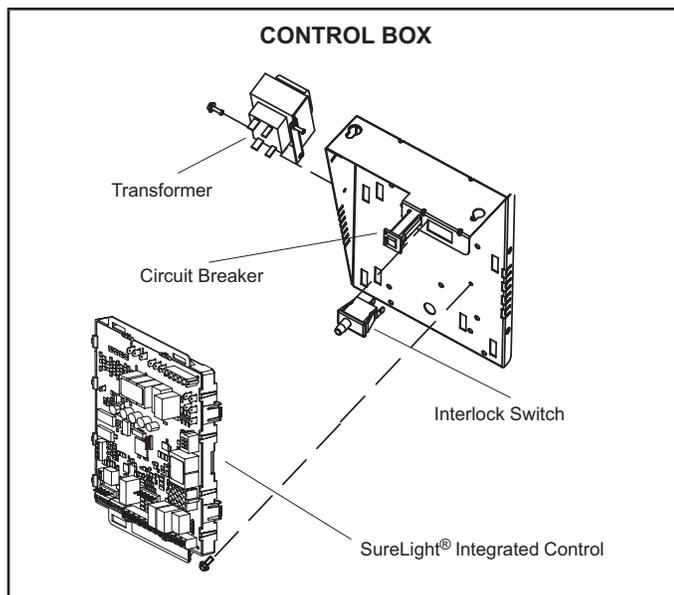


FIGURE 2

##### 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 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. See FIGURE 3.

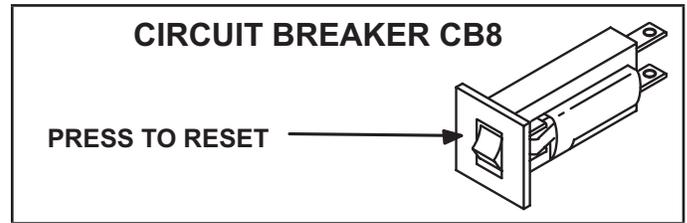


FIGURE 3

### ⚠ WARNING

**Shock hazard.**

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

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

#### 4. Integrated Control (A92)

##### 103699 and 107048

Units are equipped with the SureLight® two-stage, integrated control. The system consists of a ignition / blower control (FIGURE 4 and FIGURE 5) with control pin designations in TABLE 1 and TABLE 2 and ignitor (FIGURE 15). The control and ignitor work in combination to ensure furnace ignition and ignitor durability. The control provides gas ignition, safety checks and indoor blower control with two-stage gas heating.

The furnace combustion air inducer, gas valve and indoor blower are controlled in response to various system inputs such as thermostat signal, pressure and limit switch signal and flame signal. The control features a seven-segment LED display, indicating furnace status and error codes. The LED flashes in single digits. For example using table 4 under LIMIT CODE, an "E" followed by "2" followed by "5" followed by "0", the limit switch circuit is open. The control also has two unpowered (dry) 1/4" contacts for a humidifier and a 120 volt accessory terminal. Both rated at (1) one amp each.

##### Electronic Ignition

At the beginning of the heat cycle the integrated control monitors the first stage and second stage combustion air inducer pressure switch. The control will not begin the heating cycle if the first stage pressure switch is closed (bypassed). Likewise the integrated control will not begin the second stage heating cycle if the second stage pressure switch is closed, and will remain in first stage heat. However, if the second stage pressure switch closes during the first stage heat pre-purge, the control will allow second stage heat. Once the first stage pressure switch is determined to be open, the combustion air inducer is energized on low (first stage) heat speed. When the differential in the pressure switch is great enough, the pressure switch closes and a 15-second pre-purge begins.

After the 15-second pre-purge period, the SureLight® ignitor warms up for 20 seconds after which the gas valve opens for a 4-second trial for ignition. The ignitor remains energized during the trial until flame is sensed. If ignition is not proved during the 4-second period, the 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 control goes into Watchguard- Flame Failure mode. After a 60-minute reset period, the control will begin the ignition sequence again.

**NOTE** - During abnormal conditions such as low supply voltage or low outdoor temperatures and the low fire pressure switch does not close, the combustion air inducer will switch to high speed. After the low & high pressure switch close, the unit will proceed with a 15 sec pre-purge, followed by a 20 sec ignitor warm up, then ignition on high-fire. After 10 to 20 seconds of high fire operation the unit will switch to low fire.

**Two Stage Operation / Thermostat Selection DIP Switch**

The control can be utilized in two modes: SINGLE-STAGE thermostat or TWO-STAGE thermostat. The thermostat selection is made using a DIP switch and must be positioned for the particular application. DIP switch 1, labeled T<sup>h</sup>STAT HEAT STAGE is factory-set in the OFF position for use with a two-stage thermostat. Move the DIP switch to ON for use with a single stage thermostat.

While in the single-stage thermostat mode, the burners will always fire on first-stage heat. The combustion air inducer will operate on low speed and indoor blower will operate on low heat speed. The unit will switch to second stage heat after a “recognition period”. DIP switch 2, labeled SECOND STAGE DELAY, is factory set in the OFF position for a 7 minute recognition period. The switch can be moved to the ON position for a 12 minute recognition period, after which time the unit will switch to second-stage heat.

While in the two-stage thermostat mode, the burners will fire on first-stage heat. The combustion air inducer will operate on low speed and indoor blower will operate on low heat speed. The unit will switch to second-stage heat on call from the indoor thermostat. If there is a simultaneous call for first and second stage heat, the unit will fire on first stage heat and switch to second stage heat after 30 seconds of operation. See Sequence of Operation flow charts in the back of this manual for more detail.

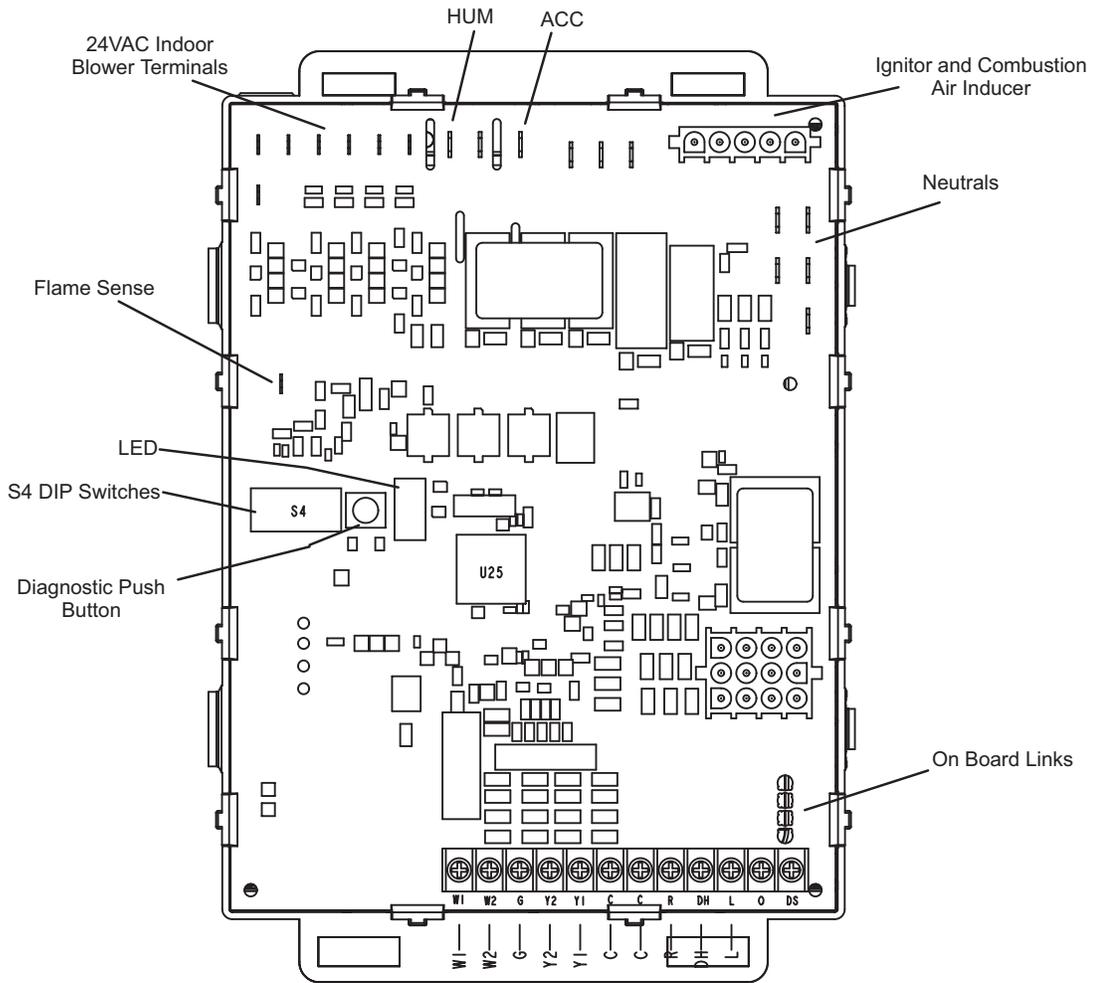
**TABLE 1**

<b>SureLight® Control 5 Pin Terminal Designation</b>	
<b>Pin #</b>	<b>Function</b>
1	Ignitor
2	Combustion Air Inducer High Speed
3	Combustion Air Inducer Low Speed
4	Combustion Air Inducer Neutral
5	Ignitor Neutral

**TABLE 2**

<b>SureLight® Control 12 Pin Terminal Designation</b>	
<b>Pin #</b>	<b>Function</b>
1	Gas Valve Second Stage
2	Pressure Switch Second Stage
3	Rolout Switch
4	Ground
5	24V Hot
6	Primary Limit In
7	Gas Valve First Stage
8	Gas Valve Common
9	24V Neutral
10	Ground
11	Primary Limit Out
12	Pressure Switch First Stage

**INTEGRATED CONTROL**



**3/16" QUICK CONNECT TERMINALS**

- FLAME SENSE SIGNAL
- HI COOL 24VAC
- HI HEAT 24VAC
- LO COOL 24VAC
- LO HEAT 24VAC
- PARK
- PARK
- COMMON 24VAC

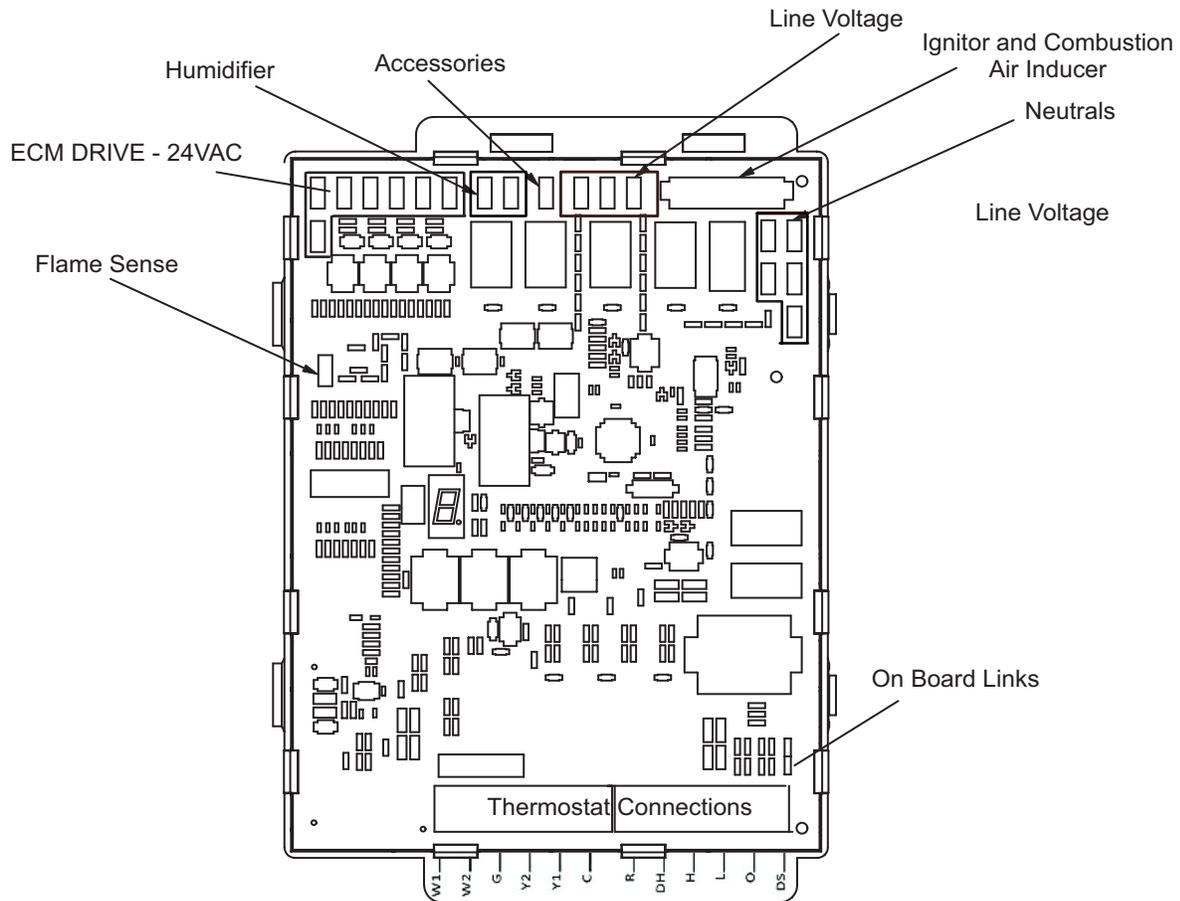
**1/4" QUICK CONNECT TERMINALS**

- NEUTRALS = 120 VAC NEUTRAL
- HUM = UNPOWERED NORMALLY OPEN (DRY) CONTACTS
- LI = 120 VAC INPUT TO CONTROL
- ACC = 120 VAC OUTPUT TO OPTIONAL ACCESSORY

**THERMOSTAT CONNECTIONS (TB1)**

- DS = DEHUMIDIFICATION SIGNAL
- W2 = HEAT DEMAND FROM 2ND STAGE T/STAT
- W1 = HEAT DEMAND FROM 1ST STAGE T/STAT
- R = CLASS 2 VOLTAGE TO THERMOSTAT
- G = MANUAL FAN FROM T'STAT
- C = THERMOSTAT SIGNAL GROUND CONNECTED TO TRANSFORMER GRD (TR) & CHASIS GROUND (GRD)
- Y1 = THERMOSTAT 1ST STAGE COOL SIGNAL
- Y2 = THERMOSTAT 2ND STAGE COOL SIGNAL
- O = THERMOSTAT SIGNAL TO HEAT PUMP REVERSING VALVE
- DH = NOT USED
- L = NOT USED

**FIGURE 4**



**3/16" QUICK CONNECT TERMINALS**

- HI COOL (24VAC)
- LO COOL (24VAC)
- HI HEAT (24VAC)
- LO HEAT (24VAC)
- PARK (two un-powered terminals for unused motor speed taps)
- FLAME SENSE

**1/4" QUICK CONNECT TERMINALS**

- FLIM (two un-powered, normally open/dry contacts)

**THERMOSTAT CONNECTIONS**

- DS= Dehumidification signal
- W2= Heat demand from 2<sup>nd</sup> stage Tstat
- W1= Heat demand from 1<sup>st</sup> stage Tstat (white)
- R= Class 2 voltage to thermostat
- G= Manual fan from Tstat (green)
- C= Tstat signal ground connected to transformer Ground (TR) & Chasis ground (GRD)
- Y1= Tstat 1<sup>st</sup> stage cool signal
- Y2= Tstat 2<sup>nd</sup> stage cool signal

**FIGURE 5**

# INTEGRATED CONTROL CONFIGURATION GUIDE

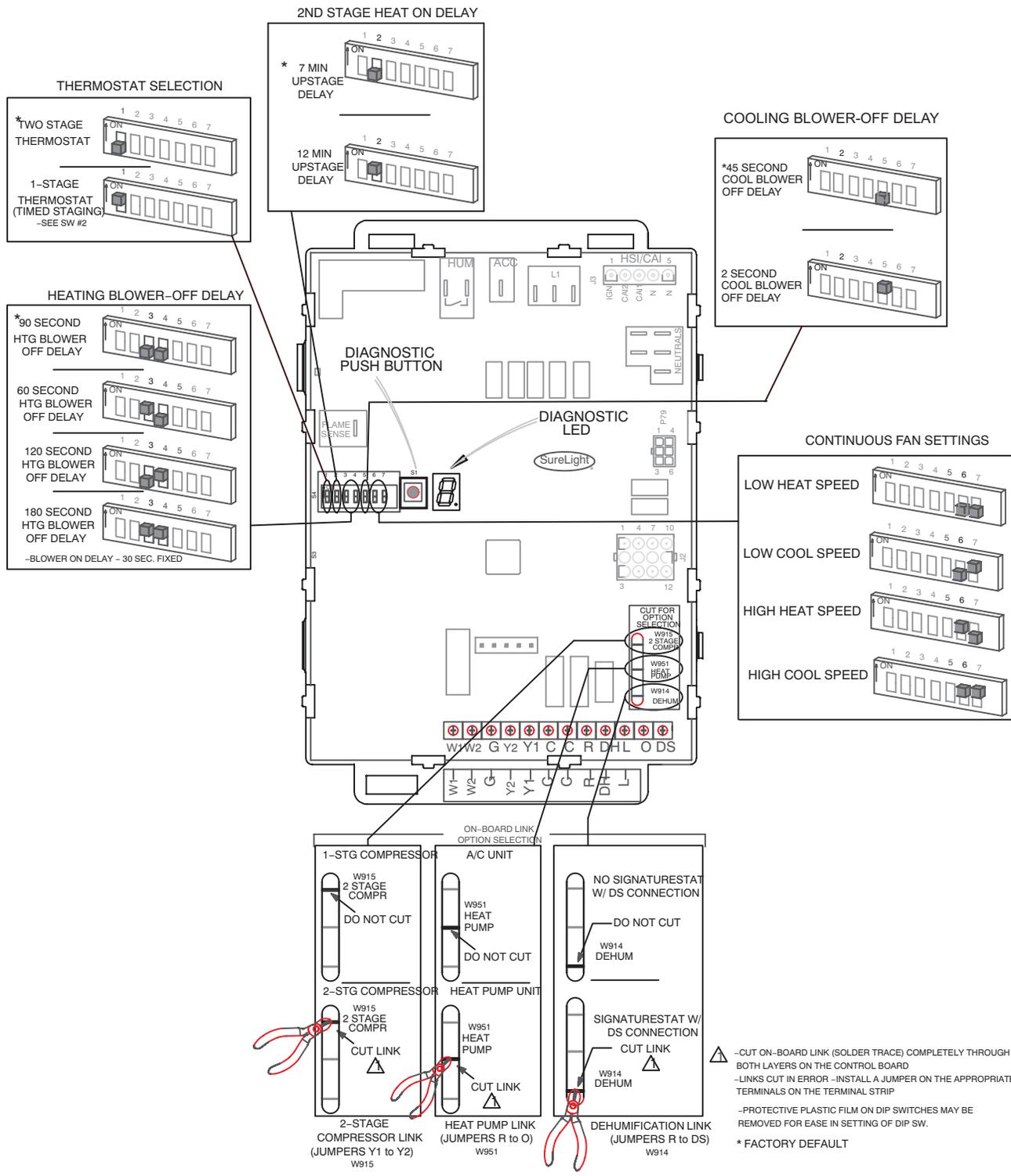


FIGURE 6

**TABLE 3**  
**Integrated Control Diagnostic Modes**

Display	Action (when button released)
No Change	Remain in idle mode
Solid "E"	Enter diagnostic recall mode
Solid "F"	Enter flame signal mode

**TABLE 4**

Code	Diagnostic Codes/Status of Equipment	Action Required to Clear and Recover
.	Idle mode (Decimal blinks at 1 Hertz -- 0.5 second ON, 0.5 second OFF).	
C	Cooling stage (1 second ON, 0.5 second OFF) 1 or 2 displayed / Pause / Repeat codes.	
d	Dehumidification mode (1 second ON, 1 second OFF) / Pause / Repeat Codes).	
H	Gas Heat Stage (1 second ON, 0.5 second OFF) 1 or 2 displayed / Pause / Repeat codes. Blinking during ignition.	
h	Heat pump stage.	
E110	Low line voltage.	Line Voltage Low (Voltage lower than nameplate rating). Check power line voltage and correct. Alarm clears 5 seconds after fault recovered.
E111	Line voltage polarity reversed.	Reverse line power voltage wiring. System resumes normal operation 5 seconds after fault recovered.
E112	Ground not detected.	System shuts down. Provide proper earth ground. System resumes normal operation 5 seconds after fault recovered.
E113	High line voltage.	Line Voltage High (Voltage higher than nameplate rating). Provide power voltage within proper range. System resumes normal operation 5 seconds after fault recovered.
E114	Line voltage frequency out-of-range.	No 60 Hertz Power. Check voltage and line power frequency. Correct voltage and frequency problems. System resumes normal operation 5 seconds after fault recovered.
E115	Low 24V - Control will restart if the error recovers.	24-Volt Power Low (Range is 18 to 30 volts). Check and correct voltage. Check for additional power-robbing equipment connected to system. May require installation of larger VA transformer to be installed in furnace / air handler. Clears after fault recovered.
E117	Poor ground detected (Warning only).	Provide proper grounding for unit. Check for proper earth ground to the system. Warning only will clear 30 seconds after fault recovered.

\* No change implies the display will continue to show whatever is currently being displayed for normal operation (blinking decimal, active error code, heat state, etc.)

### Diagnostic LED

The seven-segment diagnostic LED displays operating status, error codes and other information. The table beginning on Page 11 lists diagnostic LED codes.

### Diagnostic Push Button

The diagnostic push button is located adjacent to the seven-segment diagnostic LED. This button is used to enable the Error Code Recall "E" mode and the Flame Signal "F" mode. Press the button and hold it to cycle through a menu of options. Every five seconds a new menu item will be displayed. When the button is released, the displayed item will be selected. Once all items in the menu have been displayed, the menu resumes from the beginning until the button is released.

### Error Code Recall Mode

Select "E" from the menu to access the most recent 10 error codes. Select "c" from the Error Code Recall menu to clear all error codes. Button must be pressed a second time while "c" is flashing to confirm command to delete codes.

Press the button until a solid "≡" is displayed to exit the Error Code Recall mode.

### Flame Signal Mode

Select "F" from the menu to access the flame signal mode. The integrated control will display the flame current on seven-segment LED in in micro amps (uA). Flame signal mode is exited after any of the following:

- Power is reset
- Pressing and holding push button until 3 horizontal lines "≡" are displayed
- 10 minutes after entering the flame sense mode.

**TABLE 4 Continued**

<b>Code</b>	<b>Diagnostic Codes/Status of Equipment</b>	<b>Action Required to Clear and Recover</b>
E125	Control failed self-check, internal error, failed hardware. Will restart if error recovers. Integrated control not communicating. Covers hardware errors (flame sense circuit faults, pin shorts, etc.).	Hardware problem on the control. Cycle power on control. Replace if problem prevents service and is persistent. Critical alert. Cleared 300 seconds after fault recovered.
E200	Hard lockout - Rollout circuit open or previously open.	Correct cause of rollout trip, or replace flame rollout switch. Test furnace operation. Cleared after fault recovered.
E204	Gas valve mis-wired.	Check gas valve operation and wiring. Clears when repaired.
E205	Gas valve control relay contact shorted.	Check wiring on control and gas valve. If wiring is correct, replace control.
E206	Gas valve second-stage relay failure.	Furnace will operate on 1st stage for remainder of the heating demand. Will clear after fault recovered. If unable to operate 2nd stage, replace control.
E207	Hot surface ignitor sensed open.	Measure resistance of hot surface ignitor. Replace if open or not within specified range found in IOM. Resumes normal operation after fault is cleared.
E223	Low pressure switch failed open.	Check pressure (inches w.c.) of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E224	Low pressure switch failed closed.	Check pressure (inches w.c.) of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E225	High pressure switch failed open.	Check pressure (inches w.c.) of high pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E226	High pressure switch failed closed.	Check operation of high pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E227	Low pressure switch open during trial for ignition or run mode.	Check pressure (inches w.c.) of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E229	Ignition on High Fire - Information Only.	Code is displayed if 1) low pressure switch fails to close, then furnace will switch to high speed inducer to close both low and high pressure switches, then furnace lights on high fire, or 2) if continuous fan is active, furnace lights on high fire for 60 seconds to improve heat exchanger warm up time.
E240	Low flame current - Run mode.	Check micro-amperes of flame sensor using control diagnostics or field-installed mode. Clean or replace sensor. Measure voltage of neutral to ground to ensure good unit ground. Alert clears after current heat call has been completed.
E241	Flame sensed out of sequence - Flame still present.	Shut off gas. Check for gas valve leak. Replace, if necessary. Alert clears when fault is recovered.
E250	Limit switch circuit open.	Check for proper firing rate on furnace. Ensure there is no blockage in heater. Check for proper air flow. If limit not closed within 3 minutes, unit will go into 1-hour soft lockout. Resumes normal operation after fault is cleared.

**TABLE 4 Continued**

<b>Code</b>	<b>Diagnostic Codes/Status of Equipment</b>	<b>Action Required to Clear and Recover</b>
E270	Soft lockout - Exceeded maximum number of retries. No flame current sensed.	Check for proper gas flow. Ensure that ignitor is lighting burner. Check flame sensor current. Clears when heat call finishes successfully.
E271	Soft lockout - Exceeded maximum number of retries. Last retry failed due to the pressure switch opening.	Check pressure (inches w.c.) of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Clears when heat call finishes successfully.
E272	Soft lockout - Exceeded maximum number of recycles. Last recycle due to the pressure switch opening.	Check operation of low pressure switch to see if it is stuck closed on heat call. Check pressure (inches w.c.) of high pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Clears when heat call finishes successfully.
E273	Soft lockout - Exceeded maximum number of recycles. Last recycle due to flame failure.	Check micro-amperes of flame sensor using control diagnostics or field-installed mode. Clean or replace sensor. Measure voltage of neutral to ground to ensure good unit ground. Clears when heat call finishes successfully.
E274	Soft lockout - Exceeded maximum number of recycles. Last recycle failed due to the limit circuit opening or limit remained open longer than 3 minutes.	Shut down system. 1-hour soft lockout. Check firing rate and air flow. Check for blockage. Clears when heat call finishes successfully.
E275	Soft lockout - Flame sensed out of sequence. Flame signal is gone.	Shut off gas. Check for gas valve leak. 1-hour soft lockout. Clears when flame has been proven stable.
E290	Ignitor circuit fault - Failed ignitor or triggering circuitry.	Measure resistance of hot surface ignitor. Replace if open or not within specifications. 1-hour soft lockout. Clears when flame has been proven stable.

## Integrated Control DIP Switches

EL296UHE units are equipped with a two-stage integrated control. This control manages ignition timing, heating mode fan off delays and indoor blower speeds based on selections made using the control dip switches and jumpers.

The control includes an internal watchguard feature which automatically resets the ignition control when it has been locked out. After one hour of continuous thermostat demand for heat, the watchguard will break and remake thermostat demand to the furnace and automatically reset the control to relight the furnace.

### Heating Operation DIP Switch Settings

**Switch 1 -- Thermostat Selection --** This unit may be used with either a single-stage or two-stage thermostat. The thermostat selection is made using a DIP switch which must be properly positioned for the particular application. The DIP switch is factory-positioned for use with a two-stage thermostat. If a single-stage thermostat is to be used, the DIP switch must be repositioned.

- Select "OFF" for two-stage heating operation controlled by a two-stage heating thermostat (factory setting);
- Select "ON" for two-stage heating operation controlled by a single-stage heating thermostat. This setting provides a timed delay before second-stage heat is initiated.

**Switch 2 --- Second Stage Delay (Used with Single-Stage Thermostat Only) --** This switch is used to determine the second stage on delay when a single-stage thermostat is being used. The switch is factory-set in the OFF position, which provides a 7-minute delay before second-stage heat is initiated. If the switch is toggled to the ON position, it will provide a 12-minute delay before second-stage heat is initiated. This switch is only activated when the thermostat selector jumper is positioned for SINGLE-stage thermostat use.

### Indoor Blower Operation DIP Switch Settings

#### Switches 3 and 4 -- Heating Mode Blower-Off Delay --

The blower-on delay of 30 seconds is not adjustable. The blower-off delay (time that the blower operates after the heating demand has been satisfied) can be adjusted by moving switches 3 and 4 on the integrated control. The unit is shipped from the factory with a blower-off delay of 90 seconds.

The blower off delay affects comfort and is adjustable to satisfy individual applications. Adjust the blower off delay to achieve a supply air temperature between 90° and 110°F at the exact moment that the blower is de-energized. Longer off delay settings provide lower supply air temperatures; shorter settings provide higher supply air temperatures. TABLE 5 provides the blower off timings that will result from different switch settings.

**TABLE 5**

**Blower Off Heating Mode Delay Switch Settings**

Blower Off Delay Seconds	Switch 3	Switch 4
60	On	Off
90 (factory)	Off	Off
120	Off	On
180	On	On

**Switch 5 -- Cooling Mode Blower-Off Delay--** The unit is shipped from the factory with the dip switch positioned OFF for a 45 second delay. TABLE 6 provides the cooling mode off delay settings.

**TABLE 6**

**Blower Off Cooling Mode Delay Switch Settings**

Blower Off Delay Seconds	Switch 5
45 (factory)	Off
2	On

**Switches 6 and 7 -- Continuous Fan Mode --** Continuous fan speed can be controlled by changing DIP switch positions. TABLE 7 below provides DIP switch settings for continuous fan mode.

**TABLE 7**

**Continuous Fan Mode Settings**

Continuous Fan Mode	Switch 6	Switch 7
Low Heat Speed (Factory Setting)	Off	Off

#### On-Board Link W914 Dehum

On-board link W914, is a clippable connection between terminals R and DS on the integrated control. W914 must be cut when the furnace is installed with a thermostat which features humidity control. If the link is not cut, terminal "DS" will remain energized not allowing the blower to reduce to low cool speed upon a call for dehumidification.

#### On-Board Link W951 Heat Pump (R to O)

On-board link W951 is a clippable connection between terminals R and O on the integrated control. W951 must be cut when the furnace is installed in applications which include a heat pump unit and a thermostat which features dual fuel use. If the link is left intact, terminal "O" will remain energized eliminating the HEAT MODE in the heat pump.

#### On-Board Link W915 2 Stage Compr (Y1 to Y2)

On-board link W915 is a clippable connection between terminals Y1 and Y2 on the integrated control. W915 must be cut if two-stage cooling will be used. If the Y1 to Y2 link is not cut the outdoor unit will operate in second-stage cooling only.

## IMPORTANT

**If any onboard link is cut by mistake, install a jumper across the corresponding terminals on the low voltage terminal strip. Do not replace control.**

## B- Indoor Blower Motor

### **! IMPORTANT**

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

EL296UHE 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.

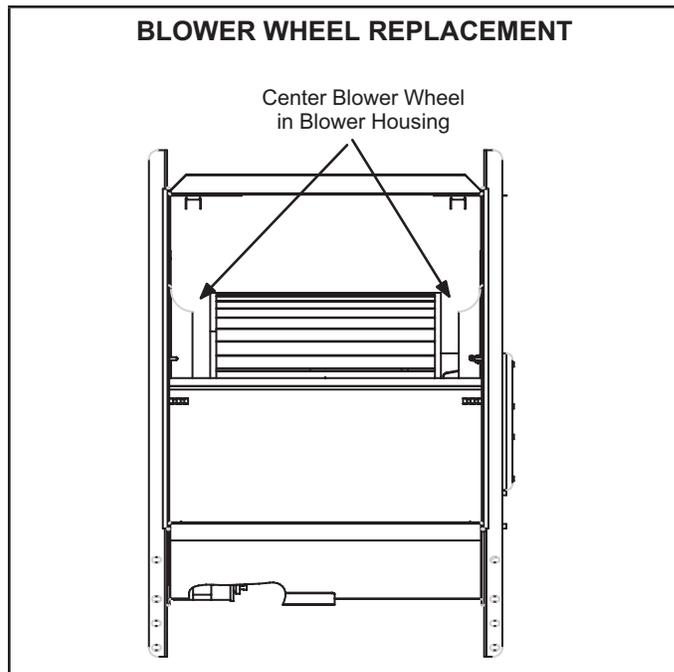
### **Troubleshooting the Motor**

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

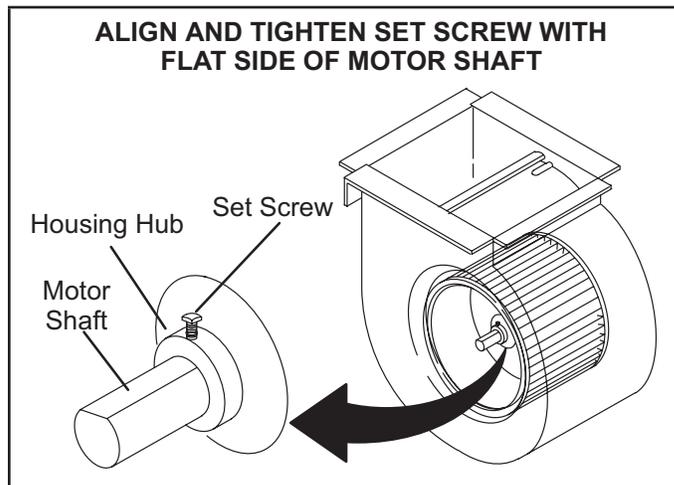
- 1 - Shut off power to unit.
- 2 - Remove input connectors J48 and J49 motor. See FIGURE 9 for troubleshooting procedure.

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

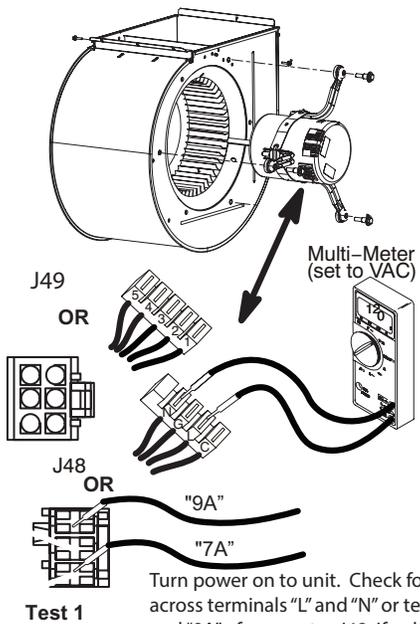
If replacing the indoor blower motor or blower wheel is necessary, placement is critical. The blower wheel must be centered in the blower housing as shown in FIGURE 7. When replacing the indoor blower motor the set screw must be aligned and tightened with the motor shaft as shown in FIGURE 8.



**FIGURE 7**

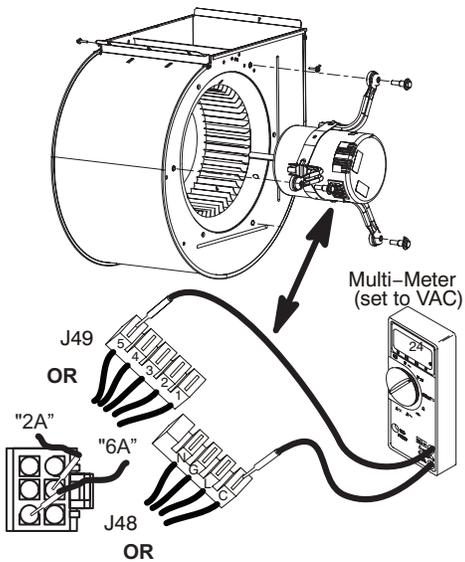


**FIGURE 8**



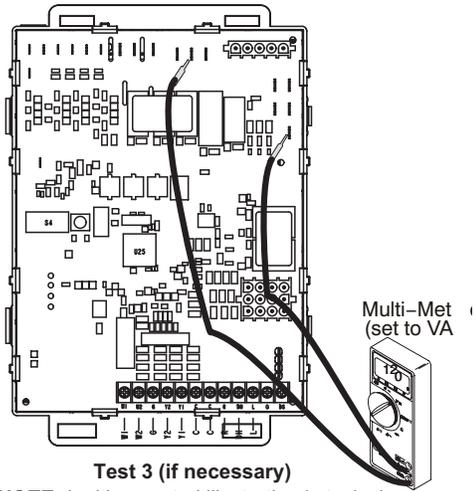
**Test 1**

Turn power on to unit. Check for 120 volts across terminals "L" and "N" or terminals "7A" and "9A" of connector J48. If voltage is present continue to test 2. If voltage is not present problem may be upstream of J48. Proceed to test3.



**Test 2**

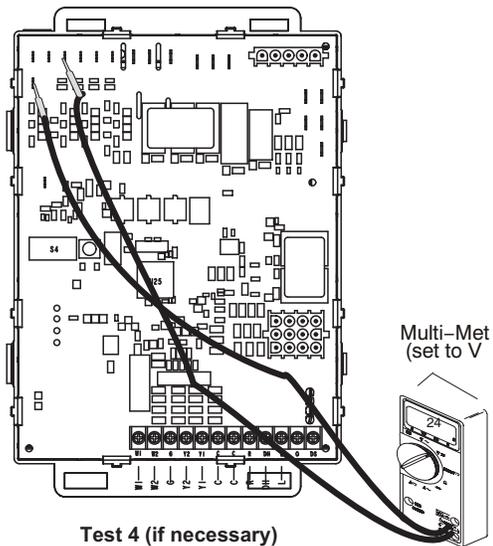
Switch thermostat to CONTINUOUS FAN MODE. For units using 4 and 5 position connector blocks, test for 24 volts terminal "C" of J48 and the tap used for continuous fan on J49 (1, 2, 3, 4 or 5). For units using 3 and 6 position connectors, test for 24 volts between pin "6A" and the pin used for continuous fan on connector J49 (1, 2, 3, 4 or 5).



**Test 3 (if necessary)**

*NOTE- Ignition control illustration is typical*

Check for 120 volts across terminals "L1" and "Neutrals" on the integrated control. If voltage is present, problem is with the harness. If voltage is not present problem may be with the integrated control.



**Test 4 (if necessary)**

*NOTE- Ignition control illustration is typical*

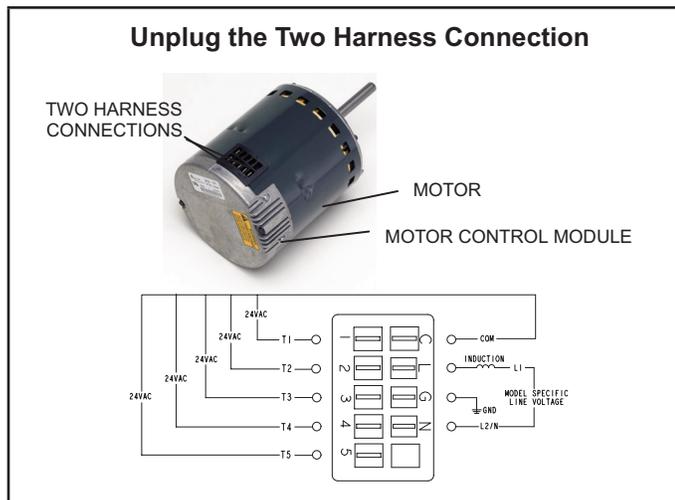
Check for 24 volts across terminals "24 COM" and the "active speed tap" on the integrated control. If voltage is present, problem is with the harness. If voltage is not present problem may be with the integrated control.

**FIGURE 9**

## Replacing the Motor Module

**NOTE** - Not all motors have field replaceable control modules. Only motors that utilize a 4 pin power connector and 5 pin signal connector as shown below may have replaceable controls. Motors that use a 3 pin power connector and 6 pin signal connector do not have field replaceable control modules. In the event of failure, the entire motor must be replaced.

- 1 - Disconnect electrical power to unit.
- 2 - Remove unit access panel.
- 3 - Unplug the two harnesses from the motor control module. See FIGURE 10.



**FIGURE 10**

- 4 - Remove the two hex head bolts securing the motor control module to the motor (FIGURE 11).



**FIGURE 11**

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

## Testing the Motor (FIGURE 12)

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 12**

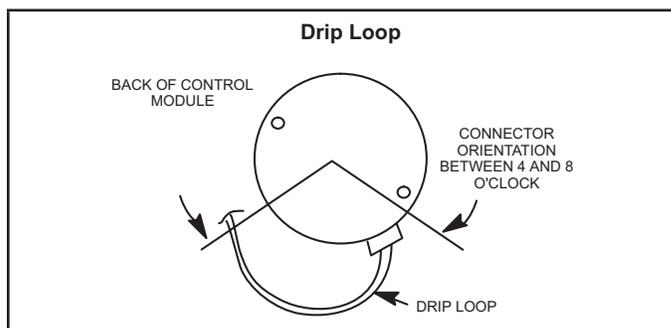
**TABLE 8**

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 11. 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 (FIGURE 13). This will direct moisture away from the motor and its electric connections on the motor.



**FIGURE 13**

## C- Heating Components

### 1. Ignitor

The SureLight® ignitor is made of durable silicon nitride. The integrated control provides 120 volts to the ignitor for a consistent ignition and long ignitor life. Ohm value should be 39 to 70. See FIGURE 15 for ignitor location and FIGURE 16 for ignitor check out.

**NOTE** - The EL296UHE furnace contains electronic components that are polarity sensitive. Make sure that the furnace is wired correctly and is properly grounded.

### 2. Flame Sensor

A flame sensor is located on the left side of the burner support. See FIGURE 15. The sensor tip protrudes into the flame envelope of the left-most burner. The sensor can be removed for service without removing any part of the burners. During operation, flame is sensed by current passed through the flame and sensing electrode. The SureLight control allows the gas valve to remain open as long as flame signal is sensed. To check flame sense signal use the push-button found on the integrated control and go to Field Test Mode. The menu will display the flame signal. See TABLE 9 for flame signal.

**TABLE 9**  
**Flame Signal in Microamps**

Normal	Low	Drop Out
2.6 or greater	2.5 or less	.06

### 3. Gas Valve

The valve (FIGURE 15) is internally redundant to assure safety shut-off. If the gas valve must be replaced, the same type valve must be used. 24VAC terminals and gas control knob are located on the valve. A wire harness connects the terminals from the gas valve to the electronic ignition control. 24V applied to the terminals energizes the valve.

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

### 4. Flame Rollout Switches (S47)

Flame rollout switch is a high temperature limit located on top of the burner box, one on each side.- See FIGURE 15. The limit is a N.C. SPST manual-reset limit. When S47 senses rollout, the circuit breaks and the ignition control immediately stops ignition and closes the gas valve. Rollout can be caused by a blocked heat exchanger, flue or lack of combustion air. The wswitch is factory set to trip (open) at 210°F and cannot be adjusted. The switch can be manually reset. To manually reset a tripped switch, push the reset button located on the control.

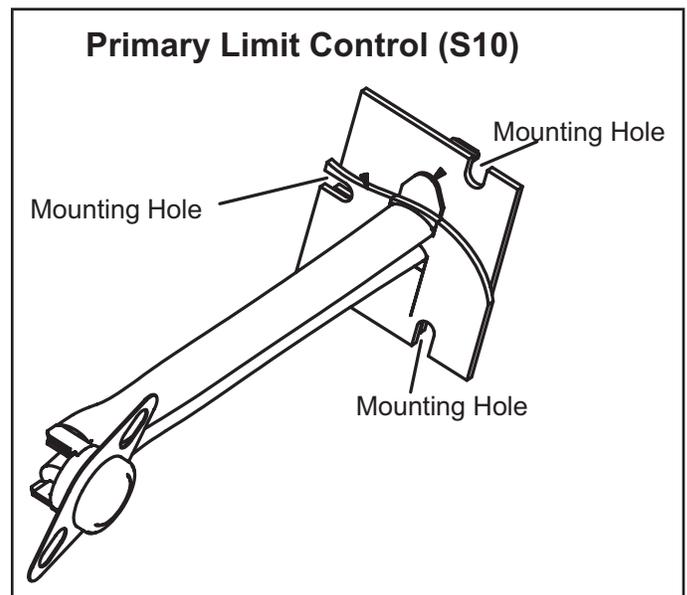
## 5. Burners

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

### 6. Primary Limit Control (S10)

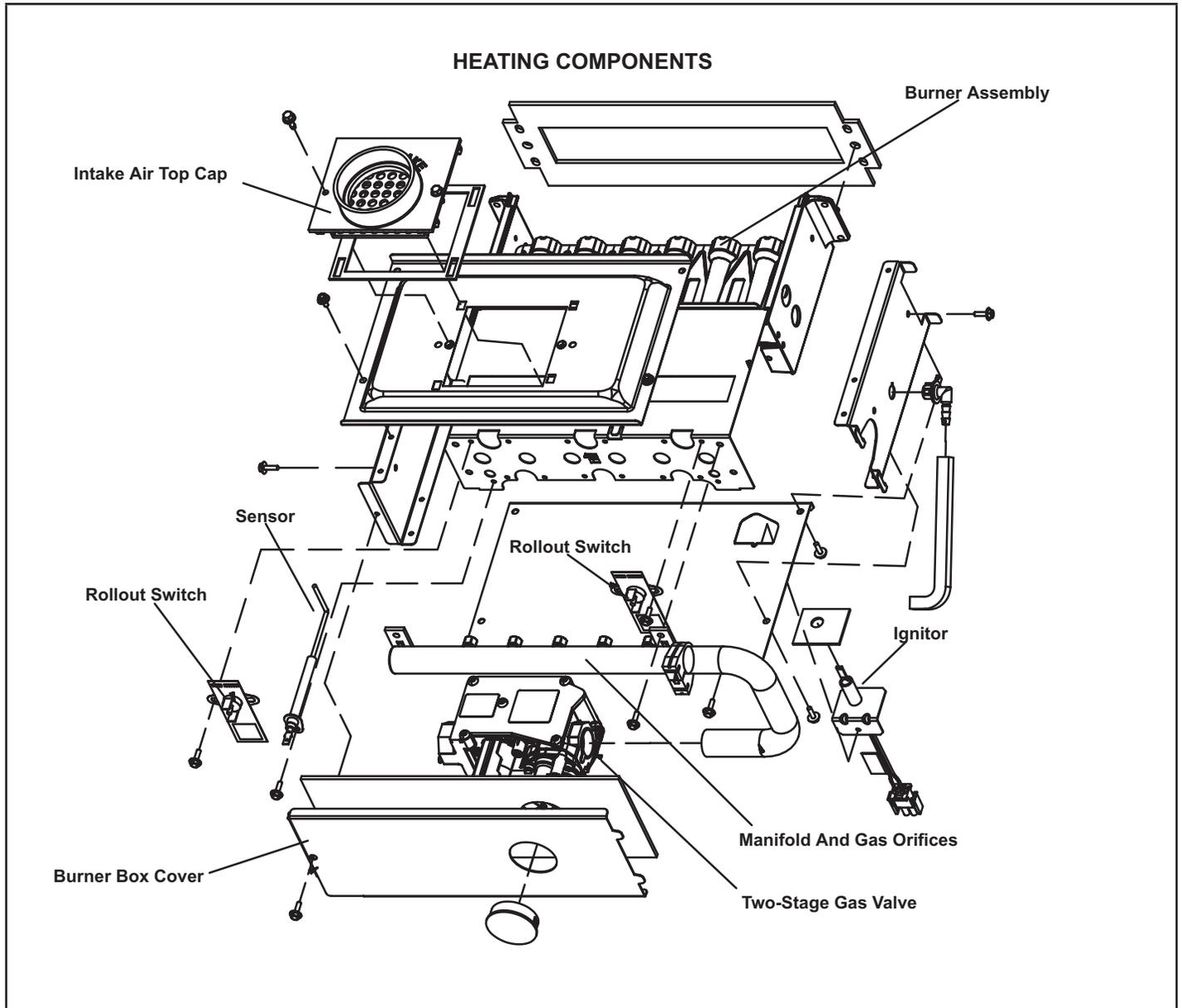
The primary limit (S10) is located in the heating vestibule panel. When excess heat is sensed in the heat exchanger, the limit will open. If the limit is open, the furnace control energizes the supply air blower and closes the gas valve. The limit automatically resets when unit temperature returns to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

The switch may have a different set point for each unit model number. See Lennox Repair Parts Handbook if limit switch must be replaced. When removing switch make note of orientation. When replacing switch make sure the three mounting holes are lined up with the screw holes in the vestibule for correct orientation.



**FIGURE 14**

**HEATING COMPONENTS**

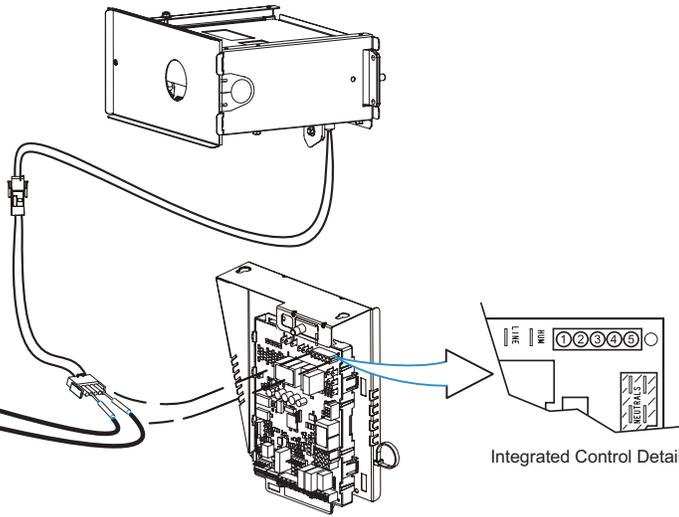
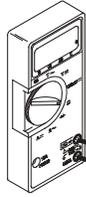


**FIGURE 15**

**Test 1**  
**Check ignitor circuit for correct resistance.**

Remove 5-pin plug from control.  
Check ohms reading across terminals 1 and 5.  
Reading should be between 39 and 70 ohms. If value is correct, this is the only test needed. If the reading on the meter is not correct, (0 or infinity) then a second test is needed.

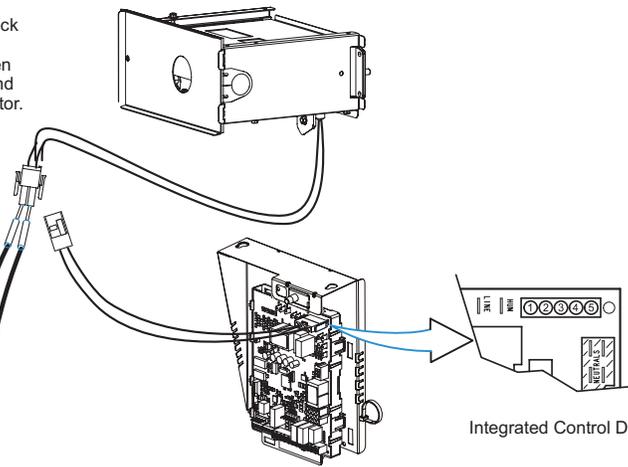
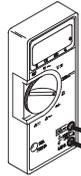
Meter  
(set to ohms)



Integrated Control Detail

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

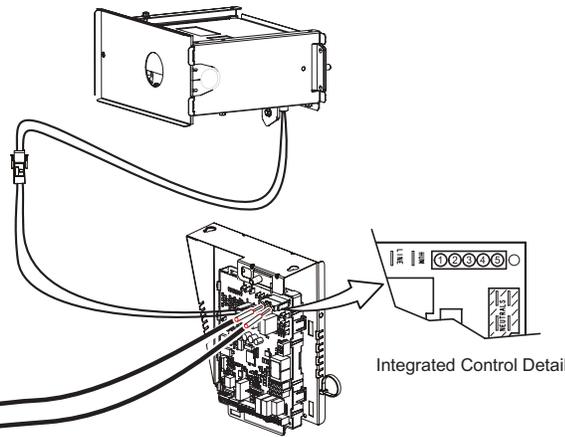
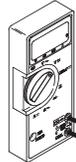
Meter  
(set to ohms)



Integrated Control Detail

**Test 3**  
**Check ignitor for correct voltage**  
Insert meter probes into terminals 1 and 5 (use small diameter probes in order not to damage plug).  
Check voltage during 20 second ignitor warm up period.  
Voltage should read 120 volts  $\pm$  10%. If voltage reads below these values, check for correct supply voltage to furnace.

Meter  
(set to AC volts)



Integrated Control Detail

FIGURE 16

## 7. Combustion Air Inducer (B6) and Cold End Header Box

All EL296UHE units use a two-speed combustion air inducer to move air through the burners and heat exchanger during heating operation. The blower uses a 120VAC motor. The motor operates during all heating operation and is controlled by integrated control control A92. The inducer also operates for 15 seconds before burner ignition (pre-purge) and for 5 seconds after the gas valve closes (post-purge).

The inducer operates on low speed during first-stage heat, then switches to high speed for second stage heat. The combustion air inducer is installed on the cold end header box (CEHB). The cold end header box is a single piece made of hard plastic. The box has an internal channel where the combustion air inducer creates negative pressure at unit start up. The channel contains an orifice used to regulate flow created by the combustion air inducer. The box has pressure taps for the combustion air inducer pressure switch hoses. The pressure switch measures the pressure differential across the cold end header box orifice or difference in the channel and the box. **If replacement is necessary the gaskets used to seal the box to the vestibule panel and the combustion air inducer to the box, must also be replaced.**

A pressure switch measures the pressure differential across the CEHB orifice to prove inducer operation. The CEHB orifice will be different for each model. See TABLE 10 for orifice sizes. When the proving switch opens, the furnace control (A92) immediately closes the gas valve to prevent burner operation.

**TABLE 10**

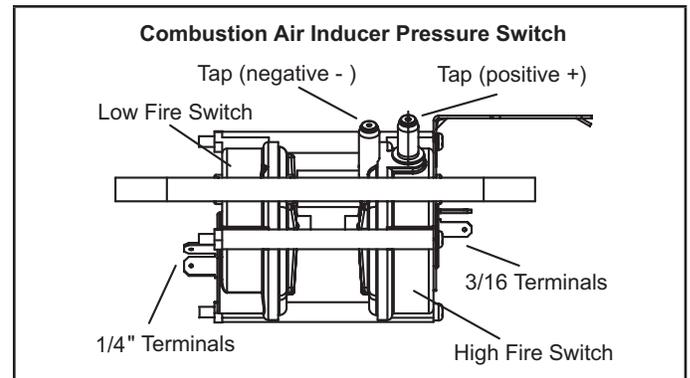
Unit	CEHB Orifice Size
-045 all - numbers	0.618
-070-1 & -2	0.810
-070-3 & later	0.920
-090-1	0.920
-090-2 and later	0.905
-110-1	1.040
-110-2 and later	1.070
-135 all - numbers	1.235

## 8. Combustion Air Inducer Pressure Switch (S18) (FIGURE 17)

EL296UHE series units are equipped with a dual combustion air pressure switch (first and second stage) located on the CEHB. The switch is connected to the cold end header box by means of flexible silicone hoses. It monitors negative differential pressure across the cold end header box orifice.

The switches are a single-pole single-throw pressure switches electrically connected to the integrated control. The purpose of the switches is to prevent burner operation if the combustion air inducer is not operating, the inlet or exhaust pipes or heat exchanger are restricted. On heat demand (first or second stage) the switch senses that the combustion air inducer is operating. It closes a circuit to the integrated control when pressure across the CEHB orifice becomes greater than the switch set point. Set

points vary depending on unit size. See TABLE 11. Both pressures sensed by the switches are negative relative to atmospheric pressure. If the inlet or exhaust pipes, or the heat exchanger become obstructed, the switch senses the loss of differential pressure and opens the circuit to the furnace 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.



**FIGURE 17**

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

**TABLE 11**  
**0- 4500'**

Unit	Set Point Low	Set Point High
-045	0.40	0.70
-070-1 & -2	0.50	0.90
-070-3 & later		0.85
-090		0.90
-110		0.90
-135	0.45	0.90

**TABLE 12**  
**4501 - 7500'**

Unit	Set Point Low	Set Point High
-045	0.35	0.55
-070-1 & -2	0.45	0.81
-070-3 & later	0.45	0.75
-090	0.50	0.85
-110	0.45	0.81
-135	0.45	0.85

**TABLE 13**  
**7501 - 10,000'**

Unit	Set Point Low	Set Point High
-045	0.35	0.50
-070-1 & -2	0.41	0.74
-070-3 & later	0.40	0.70
-090	0.45	0.81
-110	0.41	0.74
-135	0.41	0.74

## II-PLACEMENT AND INSTALLATION

All pipe, fittings, primer and solvent cement must conform with American National Standard Institute and the American Society for Testing and Materials (ANSI/ASTM) standards. The solvent shall be free flowing and contain no lumps, undissolved particles or any foreign matter that adversely affects the joint strength or chemical resistance of the cement. The cement shall show no gelation, stratification, or separation that cannot be removed by stirring. Refer to the TABLE 14 below for approved piping and fitting materials.

**TABLE 14  
PIPING AND FITTINGS SPECIFICATIONS**

Schedule 40 PVC (Pipe)	D1785
Schedule 40 PVC (Cellular Core Pipe)*	F891
Schedule 40 PVC (Fittings)	D2466
Schedule 40 CPVC (Pipe)	F441
Schedule 40 CPVC (Fittings)	F438
SDR-21 PVC or SDR-26 PVC (Pipe)	D2241
SDR-21 CPVC or SDR-26 CPVC (Pipe)	F442
Schedule 40 ABS Cellular Core DWV (Pipe)*	F628
Schedule 40 ABS (Pipe)	D1527
Schedule 40 ABS (Fittings)	D2468
ABS-DWV (Drain Waste & Vent) (Pipe & Fittings)	D2661
PVC-DWV (Drain Waste & Vent) Pipe & Fittings)	D2665
<b>PRIMER &amp; SOLVENT CEMENT</b>	<b>ASTM SPECIFICATION</b>
PVC & CPVC Primer	F656
PVC Solvent Cement	D2564
CPVC Solvent Cement	F493
ABS Solvent Cement	D2235
PVC/CPVC/ABS All Purpose Cement For Fittings & Pipe of the same material	D2564, D2235, F493
ABS to PVC or CPVC Transition Solvent Cement	D3188

\* Not approved as 12-1-2022

**TABLE 14 Continued**

<b>CANADA PIPE &amp; FITTING &amp; SOLVENT CEMENT</b>	<b>MARKING</b>
PVC & CPVC Pipe and Fittings	ULCS636
PVC & CPVC Solvent Cement	
ABS to PVC or CPVC Transition Cement	
<b>POLYPROPYLENE VENTING SYSTEM</b>	
PolyPro® by Duravent	UL 1738
InnoFlue® by Centrotherm	
<b>UL 1738 CERTIFIED GAS VENTING SYSTEM</b>	<b>MARKING</b>
PEX System1738 Schedule 40 PVC Pipes and Fittings	UL1738
IPEX System1738 PVC FGV Cement & Primer	

### **CAUTION**

**Solvent cements for plastic pipe are flammable liquids and should be kept away from all sources of ignition. Do not use excessive amounts of solvent cement when making joints. Good ventilation should be maintained to reduce fire hazard and to minimize breathing of solvent vapors. Avoid contact of cement with skin and eyes.**

Use PVC primer and solvent cement or ABS solvent cement meeting ASTM specifications, refer to Table 14. As an alternate, use all purpose cement, to bond ABS, PVC, or CPVC pipe when using fittings and pipe made of the same materials. Use transition solvent cement when bonding ABS to either PVC or CPVC.

Low temperature solvent cement is recommended during cooler weather. Metal or plastic strapping may be used for vent pipe hangers. Uniformly apply a liberal coat of PVC primer for PVC or use a clean dry cloth for ABS to clean inside socket surface of fitting and male end of pipe to depth of fitting socket.

**Canadian Applications Only** - Pipe, fittings, primer and solvent cement used to vent (exhaust) this appliance must be certified to ULC S636 and supplied by a single manufacturer as part of an approved vent (exhaust) system. In addition, the first three feet of vent pipe from the furnace flue collar must be accessible for inspection.

**TABLE 15  
OUTDOOR TERMINATION USAGE\***

Input Size	Vent Pipe Dia. in.	STANDARD				CONCENTRIC		
		Flush Mount Kit	Wall Kit		Field Fabricated	1-1.2 inch	2 inch	3 inch
			2 inch	3 inch		71M80 (US) 44W92 (CA)	69M29 (US) 44W92 (CA)	60L46 (US) 44W93 (CA)
		51W11 (US) 51W12 (CA)	22G44 (US) 30G28 (CA)	44J40 (US) 81J20 (CA)				
045	<sup>6</sup> 1-1/2	<sup>3</sup> YES	YES	<sup>1</sup> YES	<sup>5</sup> YES	<sup>2</sup> YES		
	2	<sup>3</sup> YES	YES	<sup>1</sup> YES	<sup>5</sup> YES	<sup>2</sup> YES		
	2-1/2	<sup>3</sup> YES	YES	<sup>1</sup> YES	<sup>5</sup> YES	<sup>2</sup> YES		
	3	<sup>3</sup> YES	YES	<sup>1</sup> YES	<sup>5</sup> YES	<sup>2</sup> YES		
070	<sup>6</sup> 1-1/2	<sup>3</sup> YES	YES	<sup>1</sup> YES	<sup>5</sup> YES	<sup>2</sup> YES		
	2	<sup>3</sup> YES	YES	<sup>1</sup> YES	<sup>5</sup> YES	<sup>2</sup> YES		
	2-1/2	<sup>3</sup> YES	YES	<sup>1</sup> YES	<sup>5</sup> YES	<sup>2</sup> YES		
	3	<sup>3</sup> YES	YES	<sup>1</sup> YES	<sup>5</sup> YES	<sup>2</sup> YES		
090	2	<sup>3</sup> YES		YES	<sup>5</sup> YES		YES YES	
	2-1/2	<sup>3</sup> YES		YES	<sup>5</sup> YES		YES YES	
	3	<sup>3</sup> YES		YES	<sup>5</sup> YES		YES YES	
110	2	YES		YES	<sup>5</sup> YES		YES YES	
	2-1/2	YES		YES	<sup>5</sup> YES		YES YES	
	3	YES		YES	<sup>5</sup> YES		YES YES	
135	3	YES		YES	<sup>5</sup> YES		YES	

NOTE - Standard Terminations do not include any vent pipe or elbows external to the structure. Any vent pipe or elbows external to the structure must be included in total vent length

calculations. See vent length tables.

\* Kits must be properly installed according to kit instructions.

1 Requires field-provided outdoor 1-1/2" exhaust accelerator.

2 Concentric kits 71M80 and 44W92 include 1-1/2" outdoor accelerator, when used with 045 and 070 input models. 1-1/2 in pipe must transition to 2 in pipe when used with a concentric kit.

3 Flush mount kits 51W11 and 51W12 includes 1-1/2 in. outdoor exhaust accelerator, required when used with 045, 070 and 090 input models. 1-1/2 in pipe must transition to 2 in pipe when used with the flushmount kit

4 Termination kits 30G28, 44W92, 44W93 and 81J20 are certified to ULC S636 for use in Canada only.

5 See TABLE 20 for vent accelerator requirements.

6 2 in to 1-1/2 in reducer required must be field provided.

**Joint Cementing Procedure**

All cementing of joints should be done according to the specifications outlined in ASTM D 2855.

- 1 - Measure and cut vent pipe to desired length.
- 2 - Debur and chamfer end of pipe, removing any ridges or rough edges. If end is not chamfered, edge of pipe may remove cement from fitting socket and result in a leaking joint.

**NOTE** - Check the inside of vent pipe thoroughly for any obstruction that may alter furnace operation.

- 3 - Clean and dry surfaces to be joined.
- 4 - Test fit joint and mark depth of fitting on outside of pipe.
- 5 - Uniformly apply a liberal coat of PVC primer for PVC or use a clean dry cloth for ABS to clean inside socket surface of fitting and male end of pipe to depth of fitting socket.

**⚠ DANGER**

**DANGER OF EXPLOSION!**

**Fumes from PVC glue may ignite during system check. Allow fumes to dissipate for at least 5 minutes before placing unit into operation..**

**NOTE** - Time is critical at this stage. Do not allow primer to dry before applying cement.

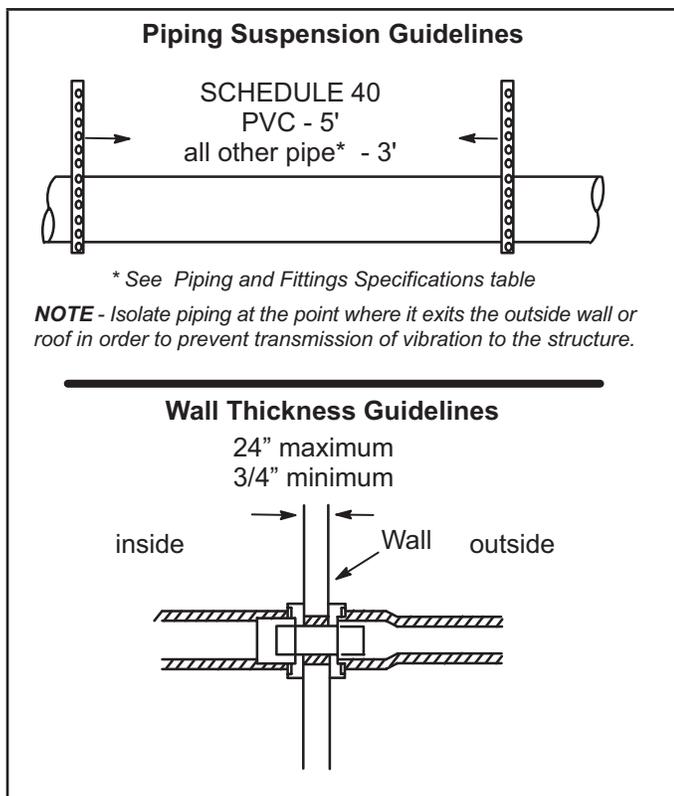
- 6 - Promptly apply solvent cement to end of pipe and inside socket surface of fitting. Cement should be applied lightly but uniformly to inside of socket. Take care to keep excess cement out of socket. Apply second coat to end of pipe.

- 7 - Immediately after applying last coat of cement to pipe, and while both inside socket surface and end of pipe are wet with cement, forcefully insert end of pipe into socket until it bottoms out. Turn PVC pipe 1/4 turn during assembly (but not after pipe is fully inserted) to distribute cement evenly. DO NOT turn ABS or cellular core pipe.

**NOTE** - Assembly should be completed within 20 seconds after last application of cement. Hammer blows should not be used when inserting pipe.

- 8 - After assembly, wipe excess cement from pipe at end of fitting socket. A properly made joint will show a bead around its entire perimeter. Any gaps may indicate an improper assembly due to insufficient solvent.
- 9 - Handle joints carefully until completely set.

### Venting Practices



**FIGURE 18**

- 1 - In areas where piping penetrates joists or interior walls, hole must be large enough to allow clearance on all sides of pipe through center of hole using a hanger.
- 2 - When furnace is installed in a residence where unit is shut down for an extended period of time, such as a vacation home, make provisions for draining condensate collection trap and lines.

### Removal of the Furnace from Common Vent

In the event that an existing furnace is removed from a venting system commonly run with separate gas appliances, the venting system is likely to be too large to properly vent the remaining attached appliances. Conduct the following test while each appliance is operating and the other appliances (which are not operating) remain connected to the common venting system. If the venting system has been installed improperly, you must correct the system as indicated in the general venting requirements section.

## **⚠ WARNING**

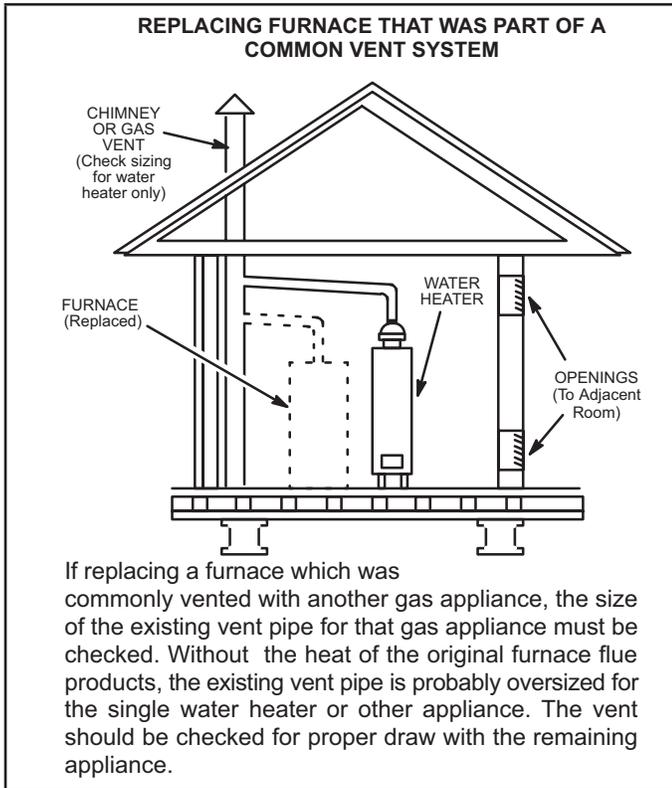
### **CARBON MONOXIDE POISONING HAZARD**

**Failure to follow the steps outlined below for each appliance connected to the venting system being placed into operation could result in carbon monoxide poisoning or death.**

**The following steps shall be followed for each appliance connected to the venting system being placed into operation, while all other appliances connected to the venting system are not in operation:**

- 1 - Seal any unused openings in the common venting system.
- 2 - Inspect the venting system for proper size and horizontal pitch. Determine that there is no blockage, restriction, leakage, corrosion, or other deficiencies which could cause an unsafe condition.
- 3 - Close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliances not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
- 4 - Follow the lighting instructions. Turn on the appliance that is being inspected. Adjust the thermostat so that the appliance operates continuously.
- 5 - After the main burner has operated for 5 minutes, test for leaks of flue gases at the draft hood relief opening. Use the flame of a match or candle.
- 6 - After determining that each appliance connected to the common venting system is venting properly, (step 3) return all doors, windows, exhaust fans, fireplace dampers, and any other gas-burning appliances to their previous mode of operation.

7 - If a venting problem is found during any of the preceding tests, the common venting system must be modified to correct the problem. Resize the common venting system to the minimum vent pipe size determined by using the appropriate tables in Appendix G. (These are in the current standards of the National Fuel Gas Code ANSI Z223.1.



**FIGURE 19**

**Exhaust Piping (FIGURE 20, FIGURE 22 and FIGURE 23)**

Route piping to outside of structure. Continue with installation following instructions given in piping termination section.

**⚠ CAUTION**

Do not discharge exhaust into an existing stack or stack that also serves another gas appliance. If vertical discharge through an existing unused stack is required, insert PVC pipe inside the stack until the end is even with the top or outlet end of the metal stack.

**⚠ CAUTION**

The exhaust vent pipe operates under positive pressure and must be completely sealed to prevent leakage of combustion products into the living space.

**Vent Piping Guidelines**

**NOTE** - Lennox has approved the use of DuraVent® and Centrotherm manufactured vent pipe and terminations as an option to PVC. When using the PolyPro® by DuraVent or InnoFlue® by Centrotherm venting system the vent pipe requirements stated in the unit installation instruction – minimum & maximum vent lengths, termination clearances, etc. – apply and must be followed. Follow the instructions provided with PolyPro by DuraVent and InnoFlue by Centrotherm venting system for assembly or if requirements are more restrictive. The PolyPro by DuraVent and InnoFlue by Centrotherm venting system must also follow the uninsulated and unconditioned space criteria listed in table 19.

**The EL296UHE can be installed as either a Non-Direct Vent or a Direct Vent gas central furnace.**

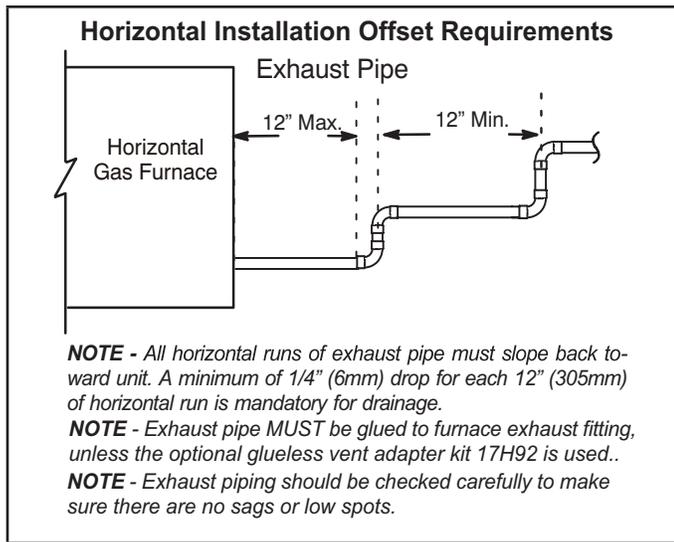
**NOTE** - In Non-Direct Vent installations, combustion air is taken from indoors or ventilated attic or crawlspace and flue gases are discharged outdoors. In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged outdoors.

**Intake and exhaust pipe sizing** -- Size pipe according to TABLE 16 and TABLE 17. Count all elbows inside and outside the home.

Regardless of the diameter of pipe used, the standard roof and wall terminations described in section Exhaust Piping Terminations should be used. Exhaust vent termination pipe is sized to optimize the velocity of the exhaust gas as it exits the termination. Refer to TABLE 20.

In some applications which permit the use of several different sizes of vent pipe, a combination vent pipe may be used. Contact Lennox' Application Department for assistance in sizing vent pipe in these applications.

**NOTE** - The exhaust collar on all models is sized to accommodate 2" Schedule 40 vent pipe. In horizontal applications, any transition to exhaust pipe larger than 2" must be made in vertical runs of the pipe. Therefore a 2" elbow must be added before the pipe is transitioned to any size larger than 2". This elbow must be added to the elbow count used to determine acceptable vent lengths. Contact the Application Department for more information concerning sizing of vent systems which include multiple pipe sizes.

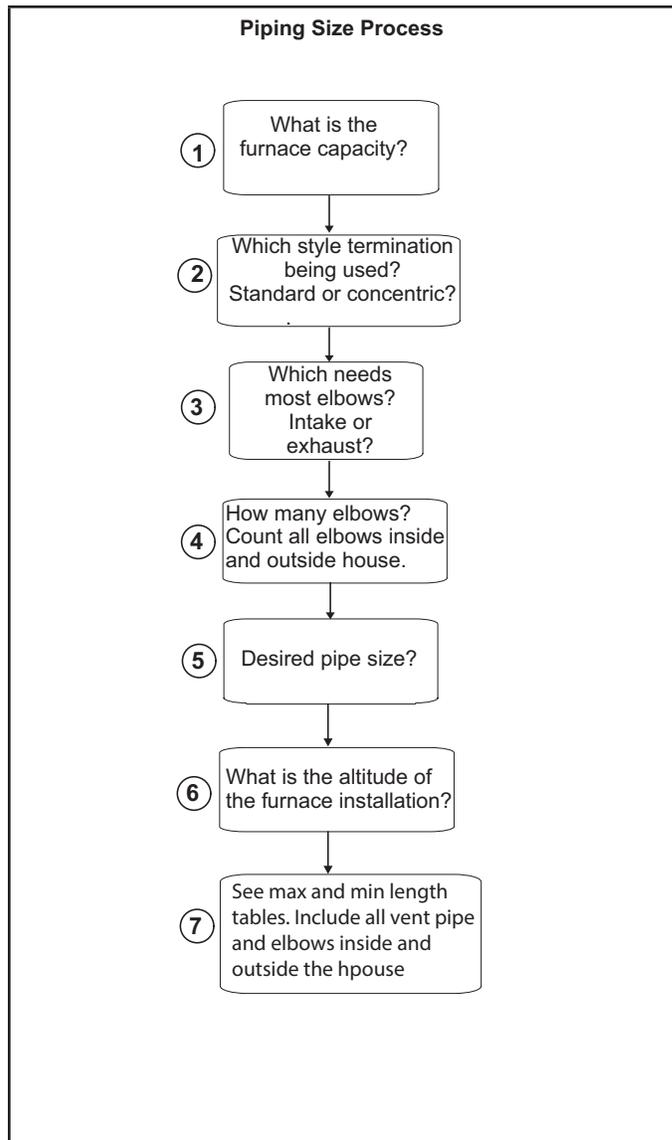


**FIGURE 20**

**TABLE 16  
MINIMUM VENT PIPE LENGTHS**

EL296UHE MODEL	MIN. VENT LENGTH*
045, 070, 090, 110, 135	15 ft. or 5 ft plus 2 elbows or 10 ft plus 1 elbow

\*Any approved termination may be added to the minimum length listed. Two 45 degree elbows are equivalent to one 90 degree elbow.



**FIGURE 21**

**⚠ IMPORTANT**  
Do not use screens or perforated metal in exhaust or intake terminations. Doing so will cause freeze-ups and may block the terminations.

**TABLE 17**

**Maximum Allowable Intake or Exhaust Vent Length in Feet**

NOTE - Size intake and exhaust pipe length separately. Values in table are for Intake OR Exhaust, not combined total. Both Intake and Exhaust must be same pipe size.

<b>Standard Termination at Elevation 0 - 4500 ft</b>																				
<b>Number Of 90° Elbows Used</b>	<b>1-1/2" Pipe</b>					<b>2" Pipe</b>					<b>2-1/2" Pipe</b>					<b>3" Pipe</b>				
	<b>Model</b>					<b>Model</b>					<b>Model</b>					<b>Model</b>				
	<b>045</b>	<b>070</b>	<b>090</b>	<b>110</b>	<b>135</b>	<b>045</b>	<b>070</b>	<b>090</b>	<b>110</b>	<b>135</b>	<b>045</b>	<b>070</b>	<b>090</b>	<b>110</b>	<b>135</b>	<b>045</b>	<b>070</b>	<b>090</b>	<b>110</b>	<b>135</b>
1	25	20	n/a	n/a	n/a	81	66	44	24	n/a	115	115	93	58	n/a	138	137	118	118	114
2	20	15				76	61	39	19		110	110	88	53		133	132	113	113	109
3	15	10				71	56	34	14		105	105	83	48		128	127	108	108	104
4	10	n/a				66	51	29	n/a		100	100	78	43		123	122	103	103	99
5	n/a					61	46	24			95	95	73	38		118	117	98	98	94
6						56	41	19			90	90	68	33		113	112	93	93	89
7						51	36	14			85	85	63	28		108	107	88	88	84
8						46	31	n/a			80	80	58	23		103	102	83	83	79
9						41	26				75	75	53	18		98	97	78	78	74
10		36				21	70		70		48	13	93	92		73	73	69		
<b>Standard Termination Elevation 4500 - 10,000 ft</b>																				
<b>Number Of 90° Elbows Used</b>	<b>1-1/2" Pipe</b>					<b>2" Pipe</b>					<b>2-1/2" Pipe</b>					<b>3" Pipe</b>				
	<b>Model</b>					<b>Model</b>					<b>Model</b>					<b>Model</b>				
	<b>045</b>	<b>070</b>	<b>090</b>	<b>110</b>	<b>135</b>	<b>045</b>	<b>070</b>	<b>090</b>	<b>110</b>	<b>135</b>	<b>045</b>	<b>070</b>	<b>090</b>	<b>110</b>	<b>135</b>	<b>045</b>	<b>070</b>	<b>090</b>	<b>110</b>	<b>135</b>
1	25	20	n/a	n/a	n/a	81	66	44	n/a	n/a	115	115	93	58	n/a	138	137	118	118	114
2	20	15				76	61	39			110	110	88	53		133	132	113	113	109
3	15	10				71	56	34			105	105	83	48		128	127	108	108	104
4	10	n/a				66	51	29			100	100	78	43		123	122	103	103	99
5	n/a					61	46	24			95	96	73	38		118	117	98	98	94
6						56	41	19			90	90	68	33		113	112	93	93	89
7						51	36	14			85	85	63	28		108	107	88	88	84
8						46	31	n/a			80	80	58	23		103	102	83	83	79
9						41	26				75	75	53	18		98	97	78	78	74
10		36				21	70				70	48	13	93		92	73	73	69	

See concentric terminations next page.

**TABLE 17 Continued**

**Maximum Allowable Intake or Exhaust Vent Length in Feet**

*NOTE - Size intake and exhaust pipe length separately. Values in table are for Intake OR Exhaust, not combined total. Both Intake and Exhaust must be same pipe size.*

<b>Concentric Termination at Elevation 0 - 4500 ft</b>																						
<b>Number Of 90° Elbows Used</b>	<b>1-1/2" Pipe</b>					<b>2" Pipe</b>					<b>2-1/2" Pipe</b>					<b>3" Pipe</b>						
	<b>Model</b>					<b>Model</b>					<b>Model</b>					<b>Model</b>						
	<b>045</b>	<b>070</b>	<b>090</b>	<b>110</b>	<b>135</b>	<b>045</b>	<b>070</b>	<b>090</b>	<b>110</b>	<b>135</b>	<b>045</b>	<b>070</b>	<b>090</b>	<b>110</b>	<b>135</b>	<b>045</b>	<b>070</b>	<b>090</b>	<b>110</b>	<b>135</b>		
1	20	15	n/a	n/a	n/a	73	58	42	22	n/a	105	105	89	54	n/a	121	121	114	114	105		
2	15	10				68	53	37	17		100	100	84	49		116	116	109	109	100		
3	10	n/a				63	48	32	12		95	95	79	44		111	111	104	104	95		
4	n/a					58	43	27	n/a		90	90	74	39		106	106	99	99	90		
5						53	38	22			85	85	69	34		101	101	94	94	85		
6						48	33	17			80	80	64	29		96	96	89	89	80		
7						43	28	12			75	75	59	24		91	91	84	84	75		
8						38	23	n/a			70	70	54	19		86	86	79	79	70		
9						33	18				65	65	49	14		81	81	74	74	65		
10						28	13	60			60	44	n/a	76		76	69	69	60			
<b>Concentric Termination Elevation 4500 - 10,000 ft</b>																						
<b>Number Of 90° Elbows Used</b>	<b>1-1/2" Pipe</b>					<b>2" Pipe</b>					<b>2-1/2" Pipe</b>					<b>3" Pipe</b>						
	<b>Model</b>					<b>Model</b>					<b>Model</b>					<b>Model</b>						
	<b>045</b>	<b>070</b>	<b>090</b>	<b>110</b>	<b>135</b>	<b>045</b>	<b>070</b>	<b>090</b>	<b>110</b>	<b>135</b>	<b>045</b>	<b>070</b>	<b>090</b>	<b>110</b>	<b>135</b>	<b>045</b>	<b>070</b>	<b>090</b>	<b>110</b>	<b>135</b>		
1	20	15	n/a	n/a	n/a	73	58	42	n/a	n/a	105	105	89	54	n/a	121	121	114	114	105		
2	15	10				68	53	37			100	100	84	49		116	116	109	109	100		
3	10	n/a				63	48	32			95	95	79	44		111	111	104	104	95		
4	n/a					58	43	27			n/a	n/a	90	90		74	39	106	106	99	99	90
5						53	38	22					85	85		69	34	101	101	94	94	85
6						48	33	17					80	80		64	29	96	96	89	89	80
7						43	28	12					75	75		59	24	91	91	84	84	75
8						38	23	n/a					70	70		54	19	86	86	79	79	70
9						33	18						65	65		49	14	81	81	74	74	65
10						28	13	60					60	44		n/a	76	76	69	69	60	

**TABLE 18**

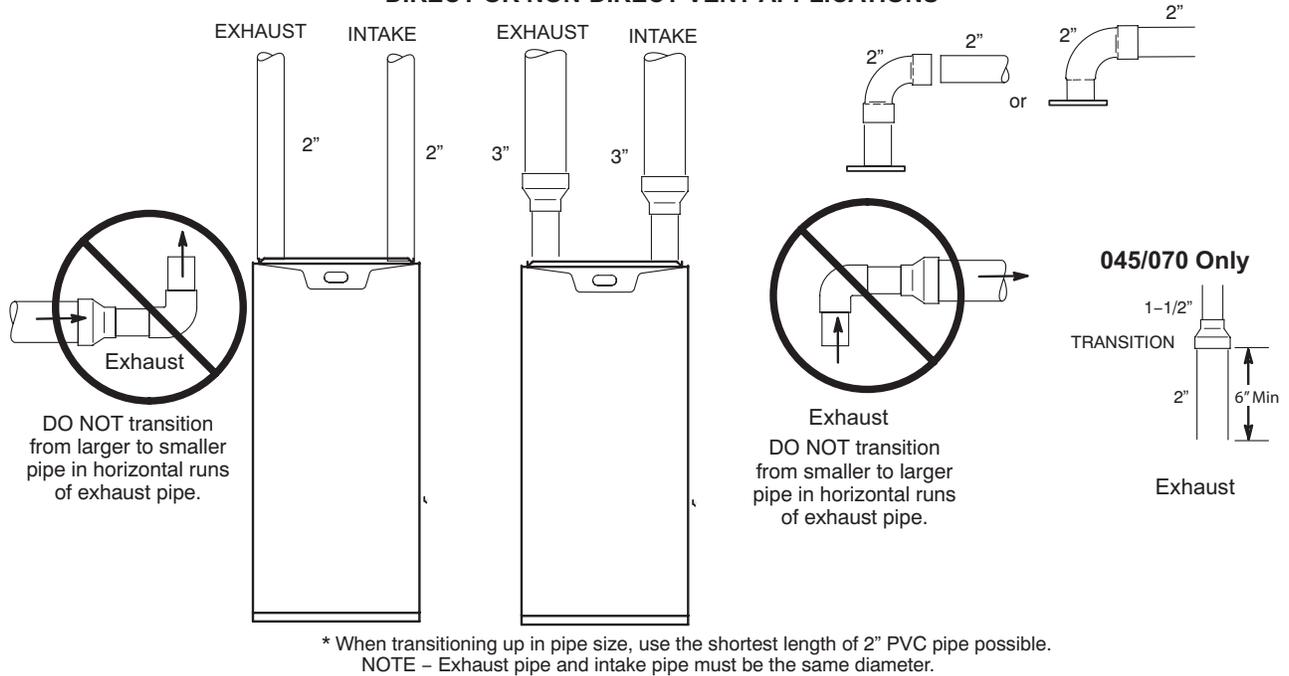
**Maximum Allowable Exhaust Vent Lengths With Furnace Installed in a Closet or Basement Using Ventilated Attic or Crawl Space For Intake Air in Feet**

*NOTE - Size intake and exhaust pipe length separately. Values in table are for Intake OR Exhaust, not combined total. Both Intake and Exhaust must be same pipe size.*

*NOTE - Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation*

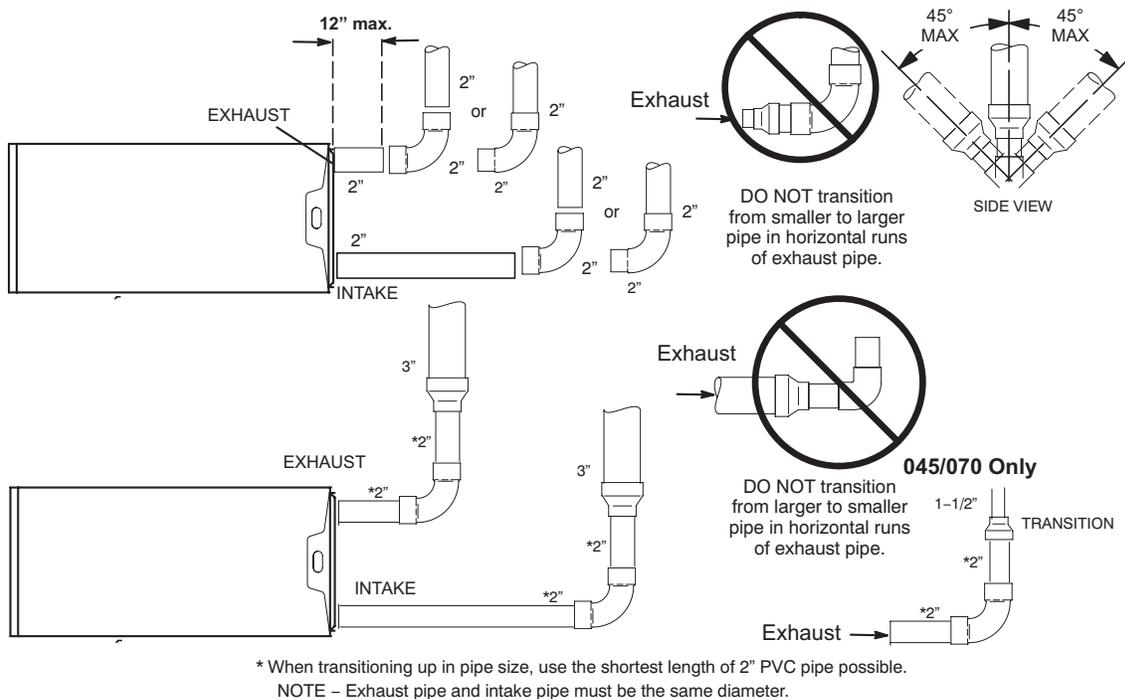
Standard Termination at Elevation 0 - 4500 ft																							
Number Of 90° Elbows Used	1-1/2" Pipe					2" Pipe					2-1/2" Pipe					3" Pipe							
	Model					Model					Model					Model							
	045	070	090	110	135	045	070	090	110	135	045	070	090	110	135	045	070	090	110	135			
1	20	15	n/a	n/a	n/a	71	56	34	14	n/a	100	100	78	43	n/a	118	117	98	98	94			
2	15	10				66	51	29	9		95	95	73	38		113	112	93	93	89			
3	10	61				46	24	4	90		90	68	33	108		107	88	88	84				
4	n/a	n/a				56	41	19	n/a		85	85	63	28		103	102	83	83	79			
5						51	36	14			80	80	58	23		98	97	78	78	74			
6						46	31	9			75	75	53	18		93	92	73	73	69			
7						41	26	4			70	70	48	13		88	87	68	68	64			
8						36	21	n/a			65	65	43	8		83	82	63	63	59			
9						31	16				60	60	38	3		78	77	58	58	54			
10						26	11				55	55	33	n/a		73	72	53	53	49			
Standard Termination Elevation 4500 - 10,000 ft																							
Number Of 90° Elbows Used			1-1/2" Pipe					2" Pipe					2-1/2" Pipe					3" Pipe					
			Model					Model					Model					Model					
	045	070	090	110	135	045	070	090	110	135	045	070	090	110	135	045	070	090	110	135			
1	20	15	n/a	n/a	n/a	71	56	34	n/a	n/a	100	100	78	43	n/a	118	117	98	98	94			
2	15	10				66	51	29			9	95	95	73		38	113	112	93	93	89		
3	10	61				46	24	4			90	90	68	33		108	107	88	88	84			
4	n/a	n/a				56	41	19			n/a	n/a	85	85		63	28	103	102	83	83	79	
5						51	36	14					80	80		58	23	98	97	78	78	74	
6						46	31	9					75	75		53	18	93	92	73	73	69	
7						41	26	4					70	70		48	13	88	87	68	68	64	
8						36	21	n/a					65	65		43	8	83	82	63	63	59	
9						31	16						60	60		38	3	78	77	58	58	54	
10						26	11						55	55		33	n/a	73	72	53	53	49	

**TYPICAL EXHAUST AND INTAKE PIPE CONNECTIONS IN UPFLOW  
DIRECT OR NON-DIRECT VENT APPLICATIONS**



**FIGURE 22**

**TYPICAL EXHAUST AND INTAKE PIPE CONNECTIONS IN HORIZONTAL DIRECT OR  
NON-DIRECT VENT APPLICATIONS (RIGHT HAND DISCHARGE SHOWN)**



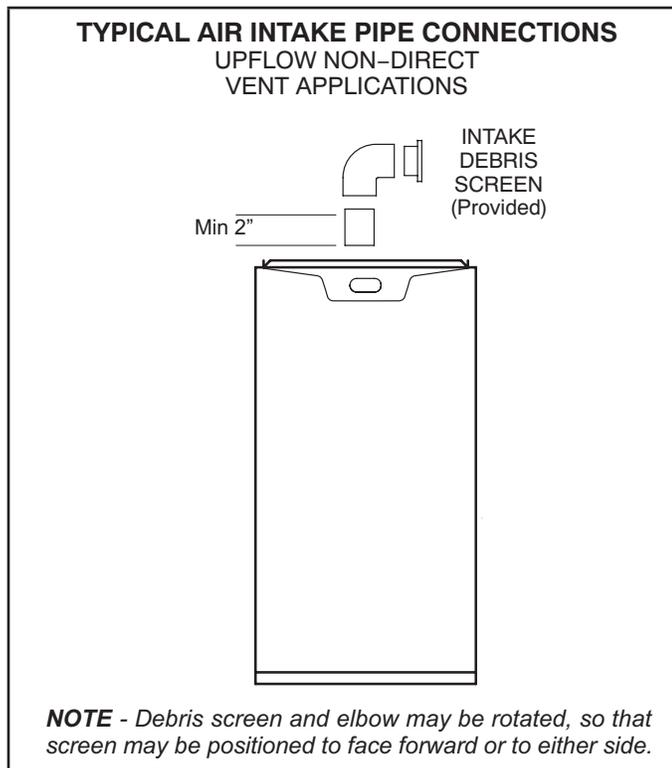
**FIGURE 23**

## Intake Piping

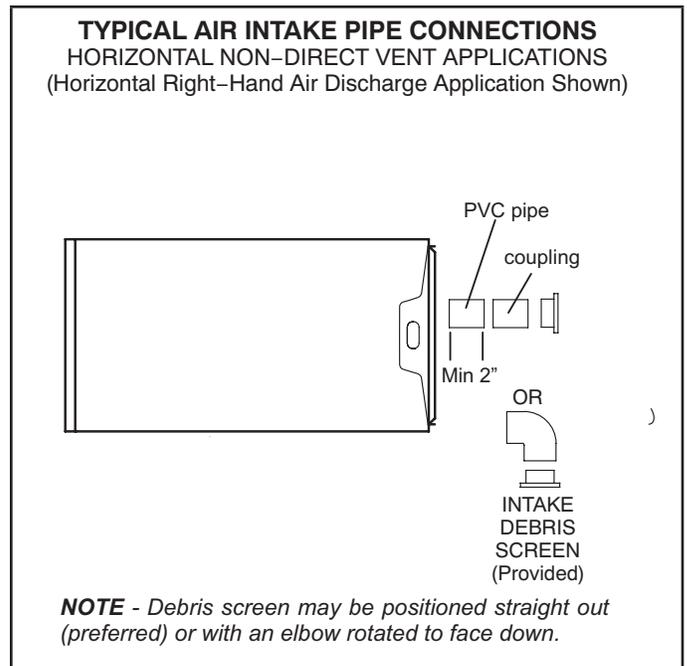
The EL296UHE furnace may be installed in either **direct vent or non-direct vent** applications. In non-direct vent applications, when intake air will be drawn into the furnace from the surrounding space, the indoor air quality must be considered and guidelines listed in Combustion, Dilution and Ventilation Air section must be followed.

Follow the next two steps when installing the unit in **Direct Vent** applications, where combustion air is taken from outdoors and flue gases are discharged outdoors. **The provided air intake screen must not be used in direct vent applications (outdoors).**

- 1 - Use transition solvent cement or a sheet metal screw to secure the intake pipe to the inlet air connector.
- 2 - Route piping to outside of structure. Continue with installation following instructions given in general guidelines for piping terminations and intake and exhaust piping terminations for direct vent sections. Refer to TABLE 17 for pipe sizes.



**FIGURE 24**



**FIGURE 25**

Follow the next two steps when installing the unit in **Non-Direct Vent applications** where combustion air is taken from indoors or ventilated attic or crawlspace and flue gases are discharged outdoors.

- 1 - Use field-provided materials and the factory-provided air intake screen to route the intake piping as shown in FIGURE 24 or FIGURE 25. Maintain a minimum clearance of 3" (76mm) around the air intake opening. The air intake opening (with the protective screen) should always be directed forward or to either side in the upflow position, and either straight out or downward in the horizontal position. **The air intake piping must not terminate too close to the flooring or a platform. Ensure that the intake air inlet will not be obstructed by loose insulation or other items that may clog the debris screen.**
- 2 - If intake air is drawn from a ventilated attic (FIGURE 26) or ventilated crawlspace (FIGURE 27) the exhaust vent length must not exceed those listed in TABLE 18. If 3" diameter pipe is used, reduce to 2" diameter pipe at the termination point to accommodate the debris screen.
- 3 - Use a sheet metal screw to secure the intake pipe to the connector, if desired.

## ⚠ CAUTION

If this unit is being installed in an application with combustion air coming in from a space serviced by an exhaust fan, power exhaust fan, or other device which may create a negative pressure in the space, take care when sizing the inlet air opening. The inlet air opening must be sized to accommodate the maximum volume of exhausted air as well as the maximum volume of combustion air required for all gas appliances serviced by this space.

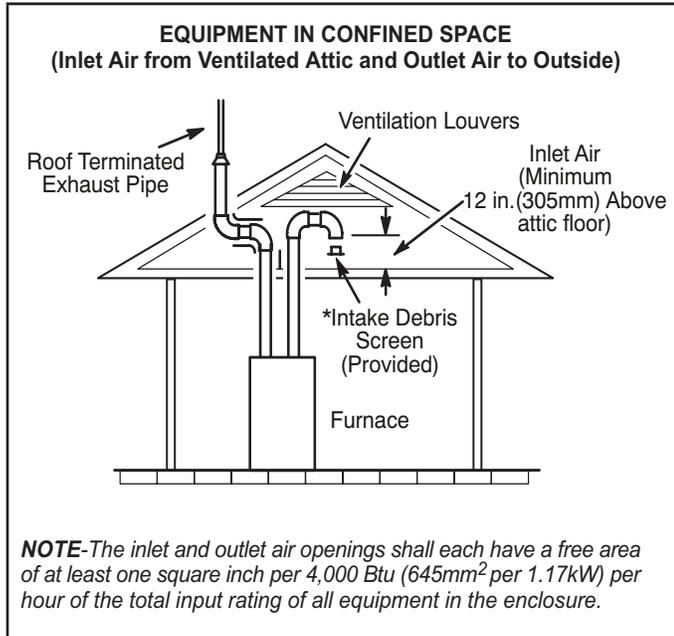


FIGURE 26

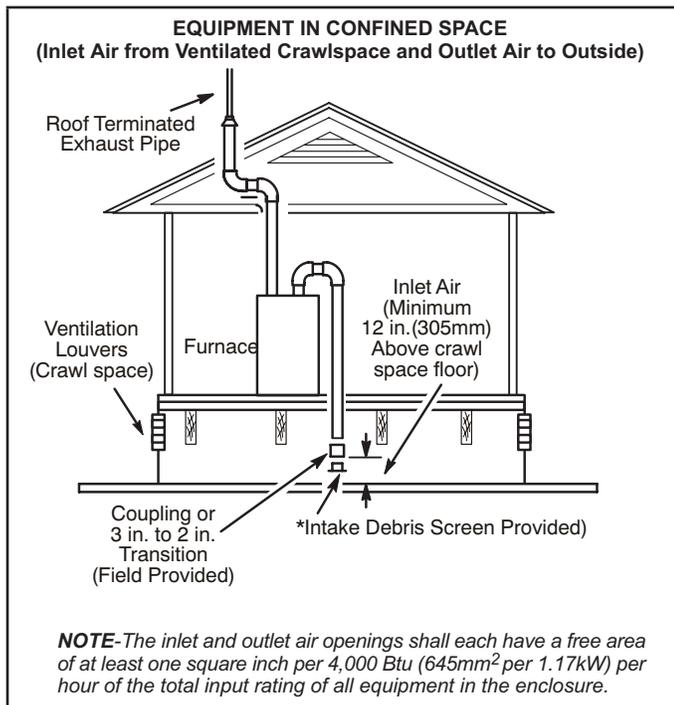


FIGURE 27

## General Guidelines for Vent Terminations

In Non-Direct Vent applications, combustion air is taken from indoors or ventilated attic or crawlspace and the flue gases are discharged to the outdoors. The EL296UHE is then classified as a non-direct vent, Category IV gas furnace.

In Direct Vent applications, combustion air is taken from outdoors and the flue gases are discharged to the outdoors. The EL296UHE is then classified as a direct vent, Category IV gas furnace.

In both Non-Direct Vent and Direct Vent applications, the vent termination is limited by local building codes. In the absence of local codes, refer to the current National Fuel Gas Code ANSI Z223-1/NFPA 54 in U.S.A., and current CSA-B149 Natural Gas and Propane Installation Codes in Canada for details. Position termination according to location given in FIGURE 29 or FIGURE 30. In addition, position termination so it is free from any obstructions and 12" above the average snow accumulation.

At vent termination, care must be taken to maintain protective coatings over building materials (prolonged exposure to exhaust condensate can destroy protective coatings). It is recommended that the exhaust outlet not be located within 6 feet (1.8m) of a condensing unit because the condensate can damage the painted coating.

**NOTE** - See TABLE 19 for maximum allowed exhaust pipe length without insulation in unconditioned space during winter design temperatures below 32°F (0°C). If required exhaust pipe should be insulated with 1/2" (13mm) Armaflex or equivalent. In extreme cold climate areas, 3/4" (19mm) Armaflex or equivalent may be necessary. Insulation must be protected from deterioration. Armaflex with UV protection is permissible. Basements or other enclosed areas that are not exposed to the outdoor ambient temperature and are above 32 degrees F (0°C) are to be considered conditioned spaces.

## ⚠ IMPORTANT

Do not use screens or perforated metal in exhaust or intake terminations. Doing so will cause freeze-ups and may block the terminations.

## ⚠ IMPORTANT

For Canadian Installations Only:

In accordance to CSA International B149 installation codes, the minimum allowed distance between the combustion air intake inlet and the exhaust outlet of other appliances shall not be less than 12 inches (305mm).

**TABLE 19**

**Maximum Allowable Exhaust Vent Pipe Length (in ft.<sup>3</sup>) Without Insulation In Unconditioned Space For Winter Design Temperatures Two - Stage High Efficiency Furnace**

Winter Design Temperatures <sup>1</sup> °F (°C)	Vent Pipe Diameter	Unit Input Size									
		045		070		090		110		135	
		PVC	<sup>2</sup> PP	PVC	<sup>2</sup> PP	PVC	<sup>2</sup> PP	PVC	<sup>2</sup> PP	PVC	<sup>2</sup> PP
32 to 21 (0 to -6)	1-1/2 in	22	n/a	20	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2 in	21	18	33	30	46	42	30	30	n/a	n/a
	2-1/2 in	16	n/a	26	n/a	37	n/a	36	n/a	n/a	n/a
	3 in	12	12	21	21	30	30	29	29	42	42
20 to 1 (-7 to -17)	1-1/2 in	12	n/a	20	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2 in	11	9	19	17	28	25	27	24	n/a	n/a
	2-1/2 in	7	n/a	14	n/a	21	n/a	20	n/a	n/a	n/a
	3 in	2	2	9	9	16	16	14	14	23	23
0 to -20 (-18 to -29)	1-1/2 in	8	n/a	13	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2 in	6	4	12	10	19	16	18	15	n/a	n/a
	2-1/2 in	1	n/a	7	n/a	13	n/a	12	n/a	n/a	n/a
	3 in	1	1	2	2	8	8	7	7	13	13

<sup>1</sup>Refer to 99% Minimum Design Temperature table provided in the current edition of the ASHRAE Fundamentals Handbook.

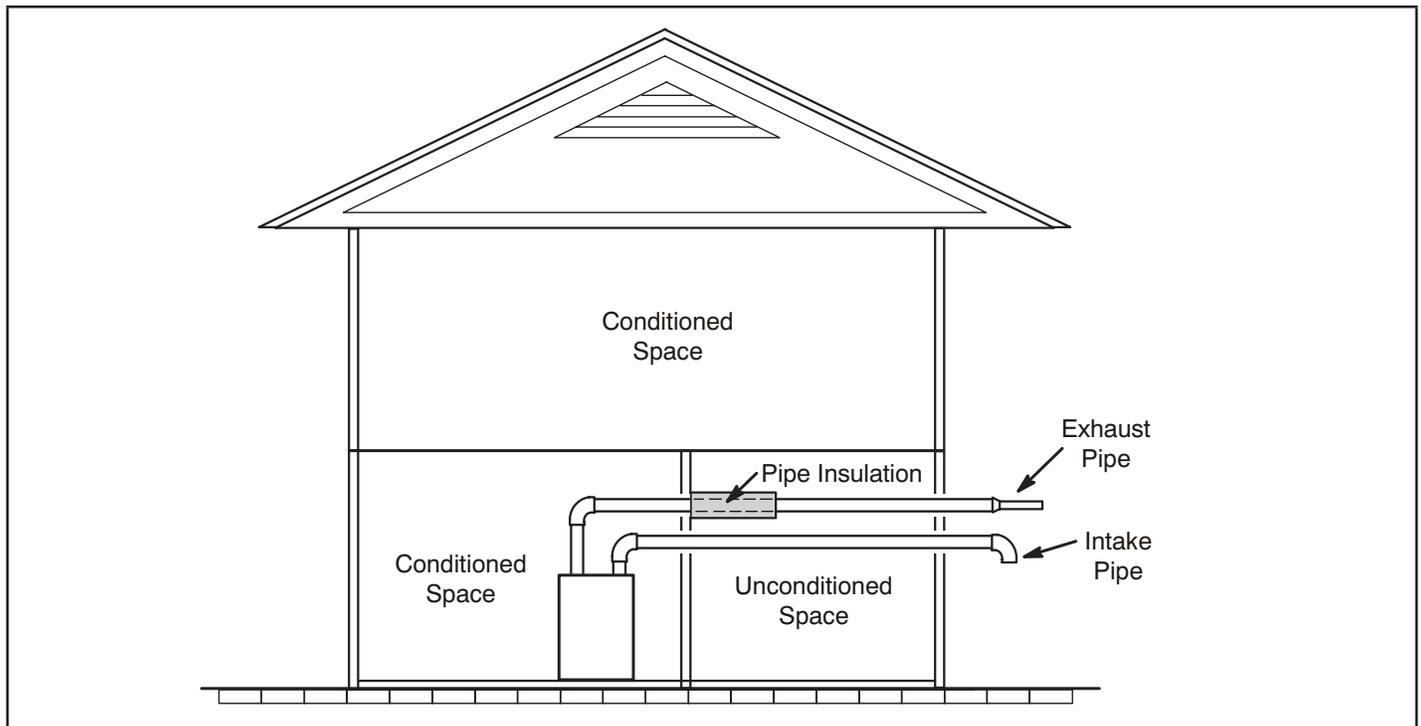
<sup>2</sup> Poly-Propylene vent pipe (PP) by Duravent and Centrotherm.

<sup>3</sup> Vent length in table is equivalent length. Consider each elbow as 5ft. of linear length.

NOTE - Concentric terminations are the equivalent of 5' and should be considered when measuring pipe length.

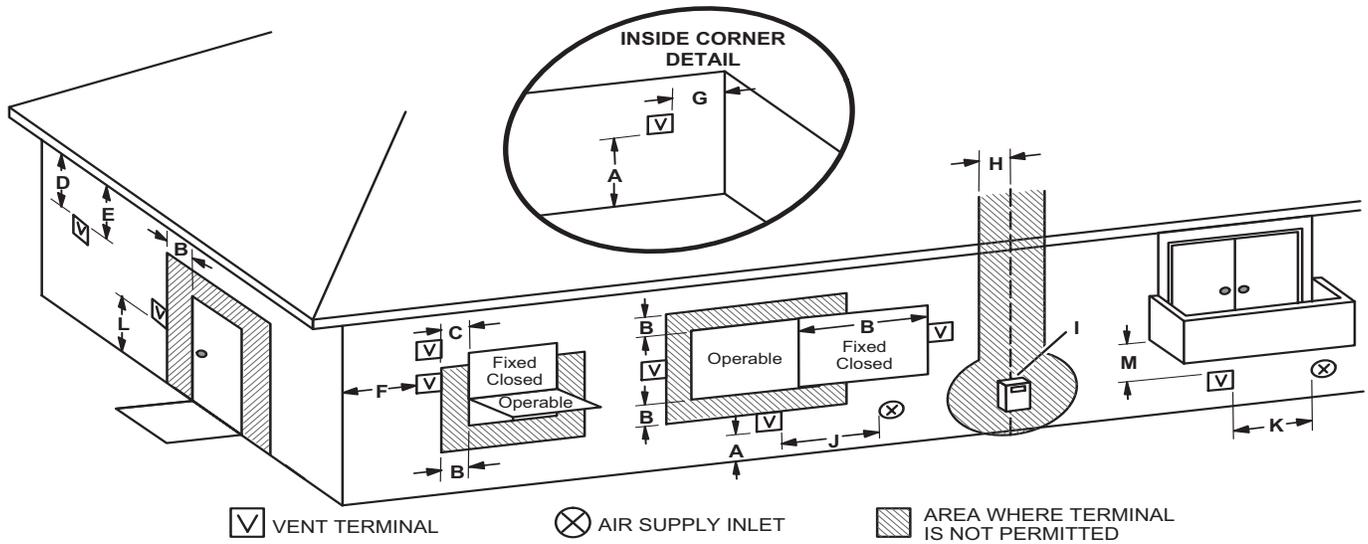
NOTE - Maximum uninsulated vent lengths listed may include the termination(vent pipe exterior to the structure) and cannot exceed 5 linear feet or the maximum allowable intake or exhaust vent length listed in TABLE 17 or TABLE 18 which ever is less.

NOTE - If insulation is required in an unconditioned space, it must be located on the pipe closest to the furnace. See FIGURE 28.



**FIGURE 28**

## VENT TERMINATION CLEARANCES FOR NON-DIRECT VENT INSTALLATIONS IN THE USA AND CANADA



	US Installations <sup>1</sup>	Canadian Installations <sup>2</sup>
A =	Clearance above grade, veranda, porch, deck or balcony	12 inches (305mm) or 12 in. (305mm) above average snow accumulation.
B =	Clearance to window or door that may be opened	4 feet (1.2 m) below or to side of opening; 1 foot (30cm) above opening
C =	Clearance to permanently closed window	* 12"
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (610 mm) from the center line of the terminal	* Equal to or greater than soffit depth.
E =	Clearance to unventilated soffit	* Equal to or greater than soffit depth.
F =	Clearance to outside corner	* No minimum to outside corner
G =	Clearance to inside corner	*
H =	Clearance to each side of center line extended above meter / regulator assembly	* 3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly
I =	Clearance to service regulator vent outlet	* 3 feet (.9m)
J =	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	4 feet (1.2 m) below or to side of opening; 1 foot (30 cm) above opening
K =	Clearance to mechanical air supply inlet	3 feet (.9m) above if within 10 feet (3m) horizontally
L =	Clearance above paved sidewalk or paved driveway located on public property	7 feet (2.1m)†
M =	Clearance under veranda, porch, deck or balcony	*12 inches (305mm)‡

<sup>1</sup> In accordance with the current ANSI Z223.1/NFPA 54 Natural Fuel Gas Code

<sup>2</sup> In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

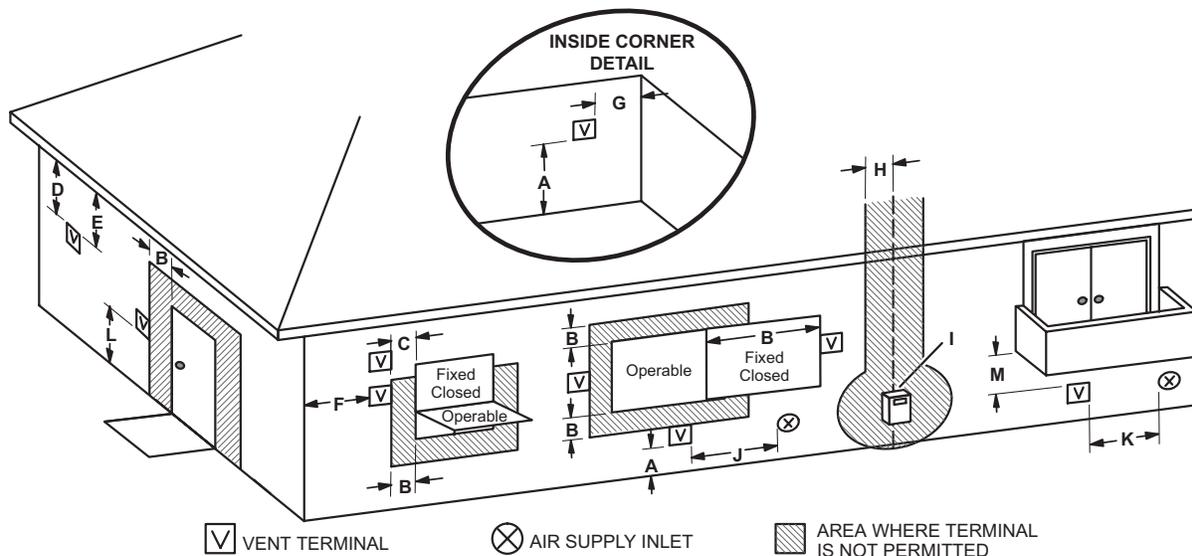
‡ Permitted only if veranda, porch, deck or balcony is fully open on a minimum of two sides beneath the floor. Lennox recommends avoiding this location if possible.

\*For clearances not specified in ANSI Z223.1/NFPA 54 or CSA B149.1, clearance will be in accordance with local installation codes and the requirements of the gas supplier and these installation instructions."

**NOTE** - This figure is intended to illustrate clearance requirement and does not serve as a substitute for locally adopted installation codes.

**FIGURE 29**

## VENT TERMINATION CLEARANCES FOR DIRECT VENT INSTALLATIONS IN THE US AND CANADA



		US Installations <sup>1</sup>	Canadian Installations <sup>2</sup>
A =	Clearance above grade, veranda, porch, deck or balcony	12 inches (305mm) or 12 in. (305mm) above average snow accumulation.	12 inches (305mm) or 12 in. (305mm) above average snow accumulation.
B =	Clearance to window or door that may be opened	6 inches (152mm) for appliances <10,000 Btuh (3kw), 9 inches (228mm) for appliances > 10,000 Btuh (3kw) and <50,000 Btuh (15 kw), 12 inches (305mm) for appliances > 50,000 Btuh (15kw)	6 inches (152mm) for appliances <10,000 Btuh (3kw), 12 inches (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36 inches (.9m) for appliances > 100,000 Btuh (30kw)
C =	Clearance to permanently closed window	* 12"	* 12"
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (610mm) from the center line of the terminal	* Equal to or greater than soffit depth	* Equal to or greater than soffit depth
E =	Clearance to unventilated soffit	* Equal to or greater than soffit depth	* Equal to or greater than soffit depth
F =	Clearance to outside corner	* No minimum to outside corner	* No minimum to outside corner
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter / regulator assembly	3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly	3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly
I =	Clearance to service regulator vent outlet	* 3 feet (.9m)	3 feet (.9m)
J =	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	6 inches (152mm) for appliances <10,000 Btuh (3kw), 9 inches (228mm) for appliances > 10,000 Btuh (3kw) and <50,000 Btuh (15 kw), 12 inches (305mm) for appliances > 50,000 Btuh (15kw)	6 inches (152mm) for appliances <10,000 Btuh (3kw), 12 inches (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36 inches (.9m) for appliances > 100,000 Btuh (30kw)
K =	Clearance to mechanical air supply inlet	3 feet (.9m) above if within 10 feet (3m) horizontally	6 feet (1.8m)
L =	Clearance above paved sidewalk or paved driveway located on public property	* 7 feet (2.1m)	7 feet (2.1m)†
M =	Clearance under veranda, porch, deck or balcony	*12 inches (305mm)‡	12 inches (305mm)‡

<sup>1</sup> In accordance with the current ANSI Z223.1/NFPA 54 Natural Fuel Gas Code

<sup>2</sup> In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

‡ Permitted only if veranda, porch, deck or balcony is fully open on a minimum of two sides beneath the floor. Lennox recommends avoiding this location if possible.

\*For clearances not specified in ANSI Z223.1/NFPA 54 or CSA B149.1, clearance will be in accordance with local installation codes and the requirements of the gas supplier and these installation instructions."

**NOTE** - This figure is intended to illustrate clearance requirements and does not serve as a substitute for locally adopted installation codes.

**FIGURE 30**

## Details of Intake and Exhaust Piping Terminations for Direct Vent Installations

**NOTE** - In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged to outdoors.

**NOTE** - Flue gas may be slightly acidic and may adversely affect some building materials. If any vent termination is used and the flue gasses may impinge on the building material, a corrosion-resistant shield (minimum 24 inches square) should be used to protect the wall surface. If the optional tee is used, the protective shield is recommended. The shield should be constructed using wood, plastic, sheet metal or other suitable material. All seams, joints, cracks, etc. in the affected area should be sealed using an appropriate sealant. See FIGURE 39.

Intake and exhaust pipes may be routed either horizontally through an outside wall or vertically through the roof. In attic or closet installations, vertical termination through the roof is preferred. FIGURE 31 through FIGURE 38 show typical terminations.

1 - Intake and exhaust terminations are not required to be in the same pressure zone. You may exit the intake on one side of the structure and the exhaust on another side (FIGURE 32). You may exit the exhaust out the roof and the intake out the side of the structure (FIGURE 33).

2 - Intake and exhaust pipes should be placed as close together as possible at termination end (refer to illustrations). Maximum separation is 3" (76MM) on roof terminations and 6" (152MM) on side wall terminations.

**NOTE** - When venting in different pressure zones, the maximum separation requirement of intake and exhaust pipe DOES NOT apply.

3 - On roof terminations, the intake piping should terminate straight down using two 90° elbows (See FIGURE 31).

4 - Exhaust piping must terminate straight out or up as shown. A reducer may be required on the exhaust piping at the point where it exits the structure to improve the velocity of exhaust away from the intake piping. See table 20.

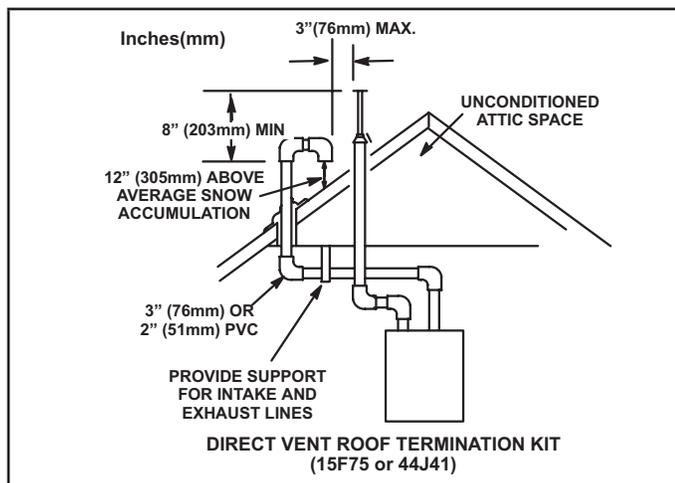


FIGURE 31

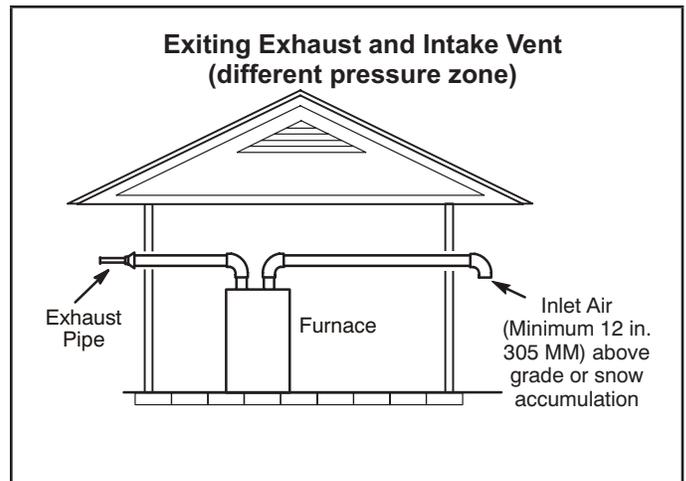


FIGURE 32

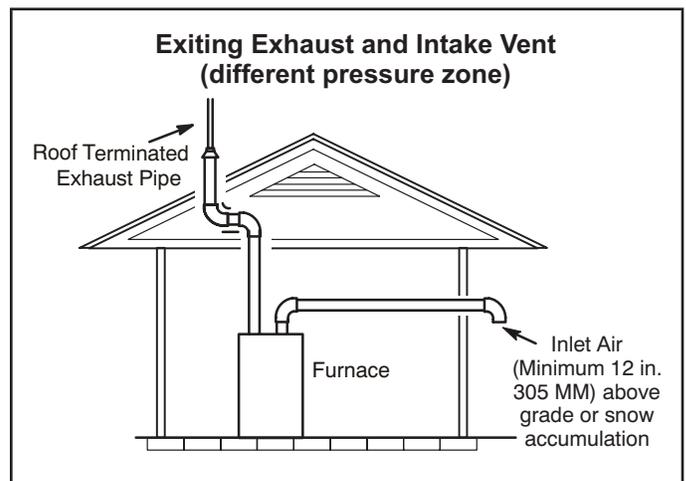


FIGURE 33

TABLE 20

### EXHAUST PIPE TERMINATION SIZE REDUCTION

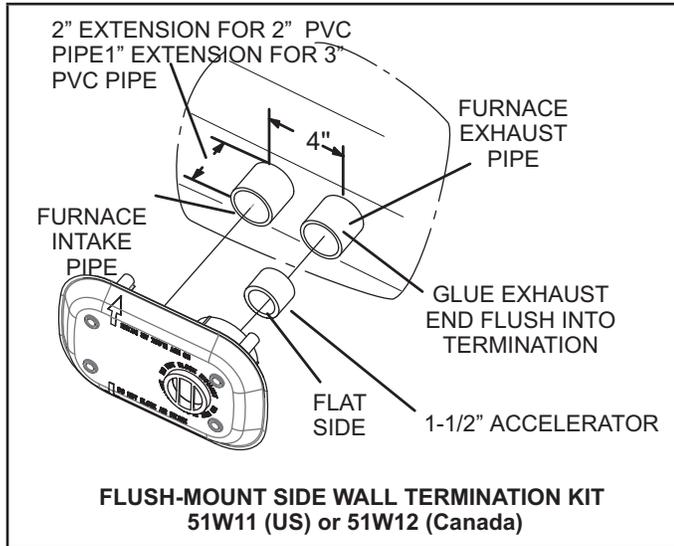
EL296UHV MODEL	Termination Pipe Size
*045 and 070	1-1/2" (38MM)
*090	2" (51MM)
110	2" (51MM)
135	2" (51MM)

\*EL296UHE-045, -070 and -090 units with the flush mount termination must use the 1-1/2" accelerator supplied with the kit.

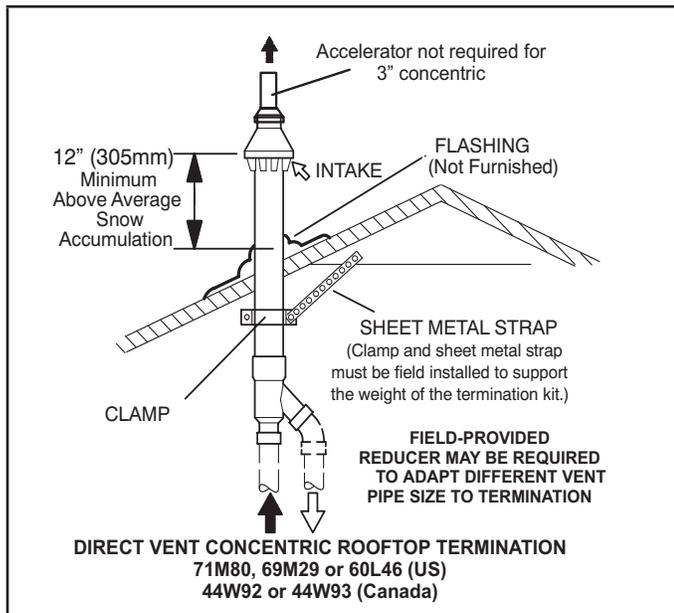
**NOTE** - Care must be taken to avoid recirculation of exhaust back into intake pipe.

- On field-supplied terminations for side wall exit, exhaust piping may extend a maximum of 12 inches (305MM) for 2" PVC and 20 inches (508MM) for 3" (76MM) PVC beyond the outside wall. Intake piping should be as short as possible. See FIGURE 39.
- On field-supplied terminations, a minimum distance between the end of the exhaust pipe and the end of the intake pipe without a termination elbow is 8" and a minimum distance of 6" with a termination elbow. See FIGURE 39.

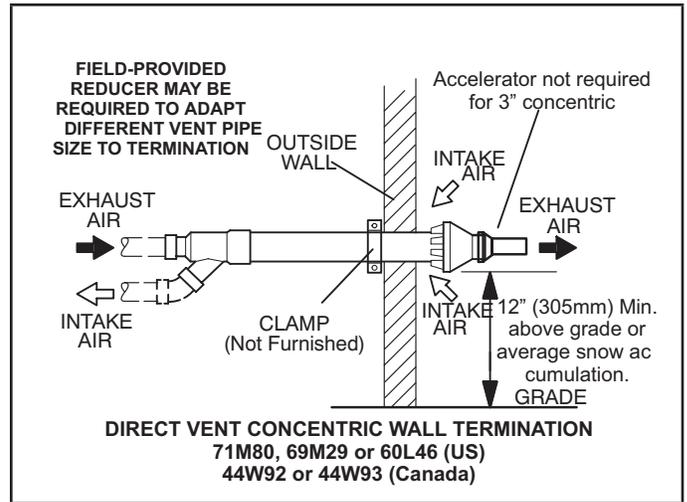
- 7 - If intake and exhaust piping must be run up a side wall to position above snow accumulation or other obstructions, piping must be supported. At least one bracket must be used within 6" from the top of the elbow and then every 24" (610mm) as shown in FIGURE 39, to prevent any movement in any direction. When exhaust and intake piping must be run up an outside wall, the exhaust piping must be terminated with pipe sized per table 20. The intake piping may be equipped with a 90° elbow turndown. Using turndown will add 5 feet (1.5m) to the equivalent length of the pipe.
- 8 - A multiple furnace installation may use a group of up to four terminations assembled together horizontally, as shown in FIGURE 37.



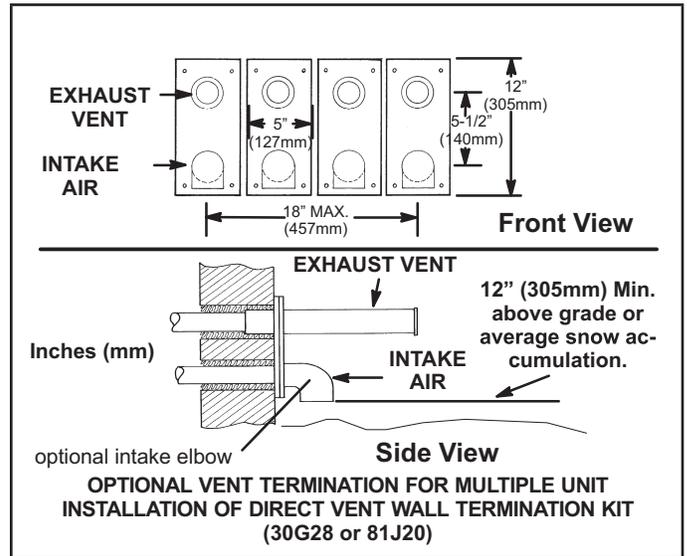
**FIGURE 34**



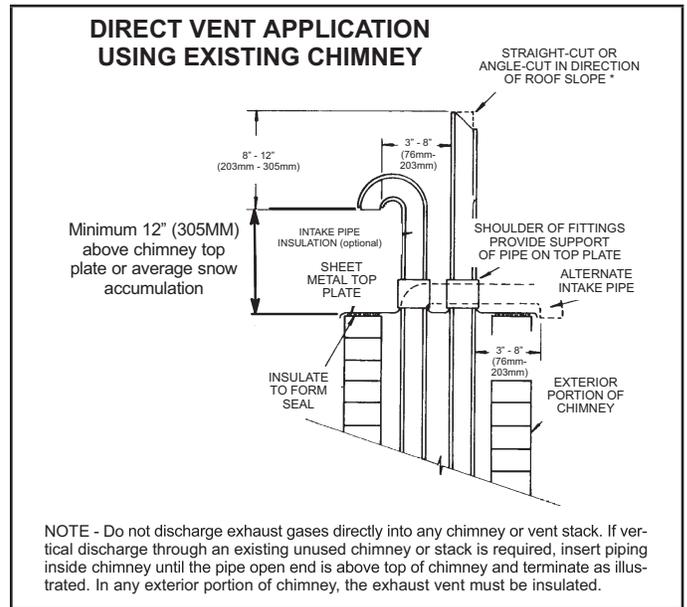
**FIGURE 35**



**FIGURE 36**



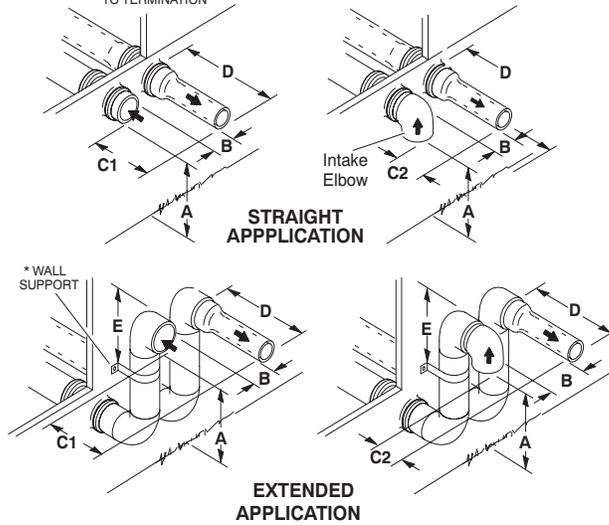
**FIGURE 37**



**FIGURE 38**

NOTE - FIELD-PROVIDED REDUCER MAY BE REQUIRED TO ADAPT LARGER VENT PIPE SIZE TO TERMINATION

### FIELD FABRICATED WALL TERMINATION



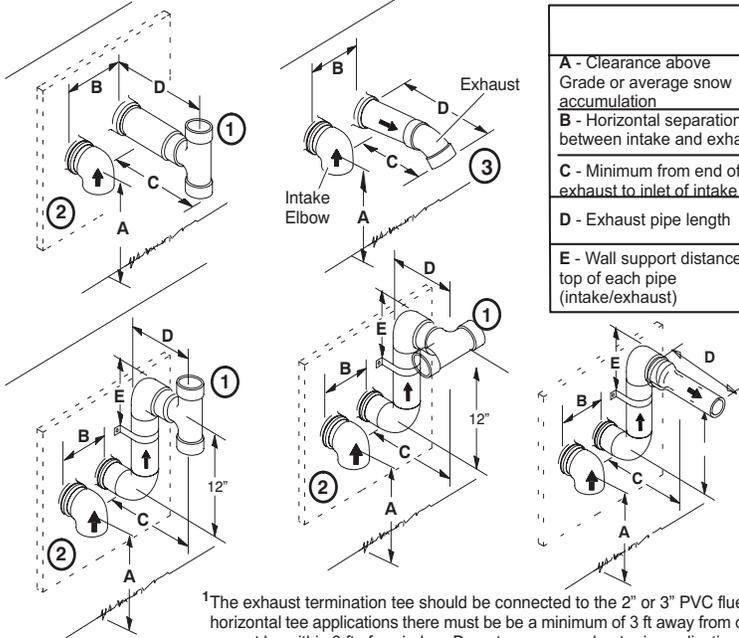
	2" (51mm) Vent Pipe	3" (76mm) Vent Pipe
<b>A</b> - Minimum clearance above grade or average snow accumulation	12" (305 mm)	12" (305 mm)
<b>B</b> - Maximum horizontal separation between intake and exhaust	6" (152 mm)	6" (152 mm)
<b>C1</b> - Minimum from end of exhaust to inlet of intake	8" (203 mm)	8" (203 mm)
<b>C2</b> - Minimum from end of exhaust to inlet of intake	6" (152 mm)	6" (152 mm)
<b>D</b> - Maximum exhaust pipe length	12" (305 mm)	20" (508 mm)
<b>E</b> - Maximum wall support distance from top of each pipe (intake/exhaust)	6" (152 mm)	6" (152 mm)

See maximum allowable venting tables for venting lengths with this arrangement.

\* Use wall support every 24" (610 mm). Use two wall supports if extension is greater than 24" (610 mm) but less than 48" (1219 mm).

NOTE - One wall support must be within 6" (152 mm) from top of each pipe (intake and exhaust) to prevent movement in any direction.

### ALTERNATE TERMINATIONS (TEE & FORTY-FIVE DEGREE ELBOWS ONLY)



	2" (51mm) Vent Pipe	3" (76mm) Vent Pipe
<b>A</b> - Clearance above Grade or average snow accumulation	12" (305 mm) Min	12" (305 mm) Min
<b>B</b> - Horizontal separation between intake and exhaust	6" (152mm)min 24" (610mm)Max	6" (152mm)min 24" (610mm)Max
<b>C</b> - Minimum from end of exhaust to inlet of intake	9" (227mm)	9" (227mm)
<b>D</b> - Exhaust pipe length	12" (305mm)min 16" (405mm)Max	12" (305mm)min 16" (405mm)Max
<b>E</b> - Wall support distance from top of each pipe (intake/exhaust)	6" (152mm) Max	6" (152mm) Max

<sup>1</sup>The exhaust termination tee should be connected to the 2" or 3" PVC flue pipe as shown in the illustration. In horizontal tee applications there must be a minimum of 3 ft away from covered patios or any living areas and cannot be within 3 ft of a window. Do not use an accelerator in applications that include an exhaust termination tee. The accelerator is not required.

<sup>2</sup>As required. Flue gas may be acidic and may adversely affect some building materials. If a side wall vent termination is used and flue gases will impinge on the building materials, a corrosion-resistant shield (24 inches square) should be used to protect the wall surface. If optional tee is used, the protective shield is recommended. The shield should be constructed using wood, sheet metal or other suitable material. All seams, joints, cracks, etc. in affected area, should be sealed using an appropriate sealant.

<sup>3</sup>Exhaust pipe 45° elbow can be rotated to the side away from the combustion air inlet to direct exhaust away from adjacent property. The exhaust must never be directed toward the combustion air inlet.

FIGURE 39

## Details of Exhaust Piping Terminations for Non-Direct Vent Applications

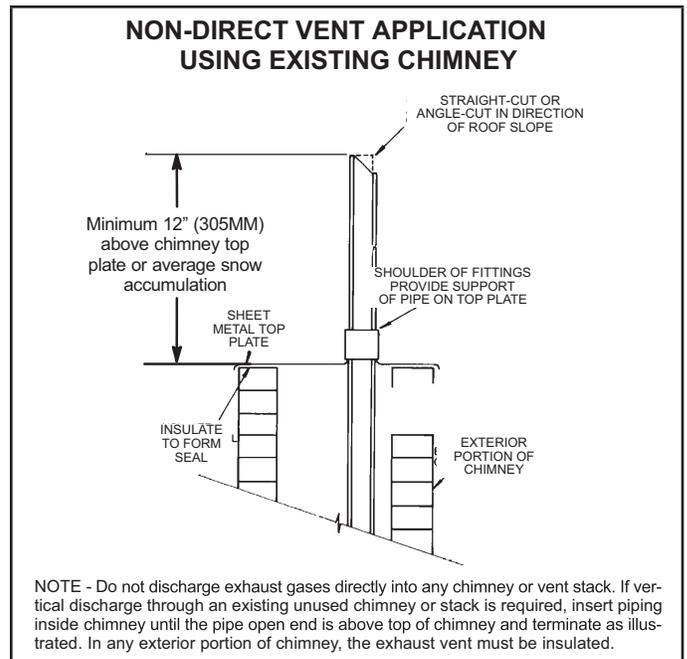
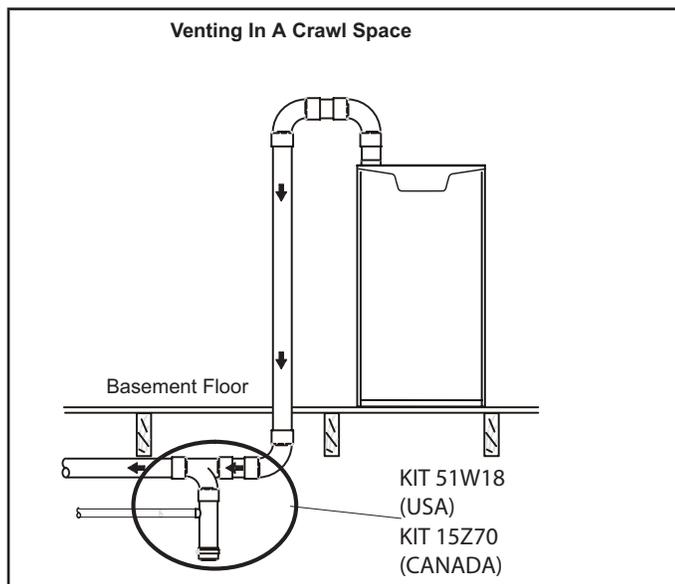
Exhaust pipes may be routed either horizontally through an outside wall or vertically through the roof. In attic or closet installations, vertical termination through the roof is preferred. FIGURE 40 and FIGURE 41 show typical terminations.

- 1 - Exhaust piping must terminate straight out or up as shown. The termination pipe must be sized as listed in TABLE 20. The specified pipe size ensures proper velocity required to move the exhaust gases away from the building.
- 2 - On field supplied terminations for side wall exit, exhaust piping may extend a maximum of 12 inches (305MM) for 2" PVC and 20 inches (508MM) for 3" (76MM) PVC beyond the outside wall.
- 3 - If exhaust piping must be run up a side wall to position above snow accumulation or other obstructions, piping must be supported every 24 inches (610MM). When exhaust piping must be run up an outside wall, any reduction in exhaust pipe size must be done after the final elbow.
- 4 - Distance between exhaust pipe terminations on multiple furnaces must meet local codes.

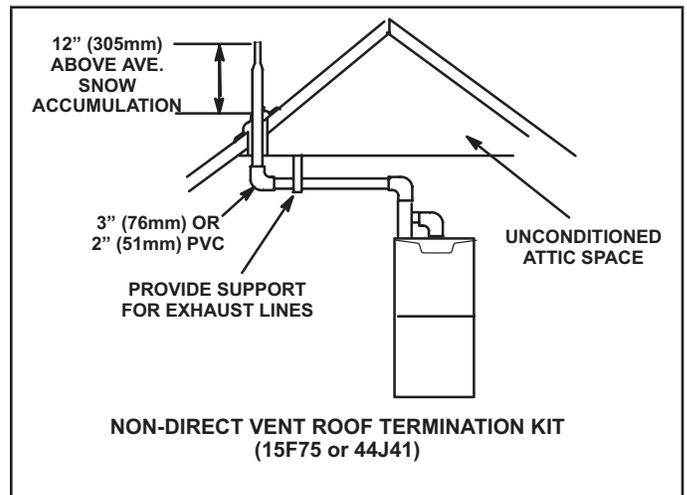
### Crawl Space and Extended Horizontal Venting

Lennox provides kit 51W18 (USA) and kit 15Z70 (Canada) to install 2" or 3" PVC exhaust piping through the floor joists and into the the crawl space. See figure below.

This kit can also be used as a supplemental drain for installations with condensate run back in the vent pipe (ie. long horizontal runs, unconditioned spaces, etc.)



**FIGURE 40**



**FIGURE 41**

## Condensate Piping

This unit is designed for either right- or left-side exit of condensate piping in upflow applications. In horizontal applications, the condensate trap must extend below the unit. An 8" service clearance is required for the condensate trap. Refer to FIGURE 42 for condensate trap locations. FIGURE 50 shows trap assembly using 1/2" PVC or 3/4" PVC.

**NOTE** - If necessary the condensate trap may be installed up to 5' away from the furnace. Use PVC pipe to connect trap to furnace condensate outlet. Piping from furnace must slope down a minimum of 1/4" per ft. toward trap.

- 1 - Determine which side condensate piping will exit the unit, location of trap, field-provided fittings and length of PVC pipe required to reach available drain.
- 2 - Use a large flat head screw driver or a 1/2" drive socket extension and remove plug. Install provided 3/4 NPT street elbow fitting into cold end header box. Use Teflon tape or appropriate pipe dope.
- 3 - Install the cap over the clean out opening at the base of the trap. Secure with clamp. See figure 49.
- 4 - Install drain trap using appropriate PVC fittings, glue all joints. Glue the provided drain trap as shown in FIGURE 50. Route the condensate line to an open drain. Condensate line must maintain a 1/4" downward slope from the furnace to the drain.

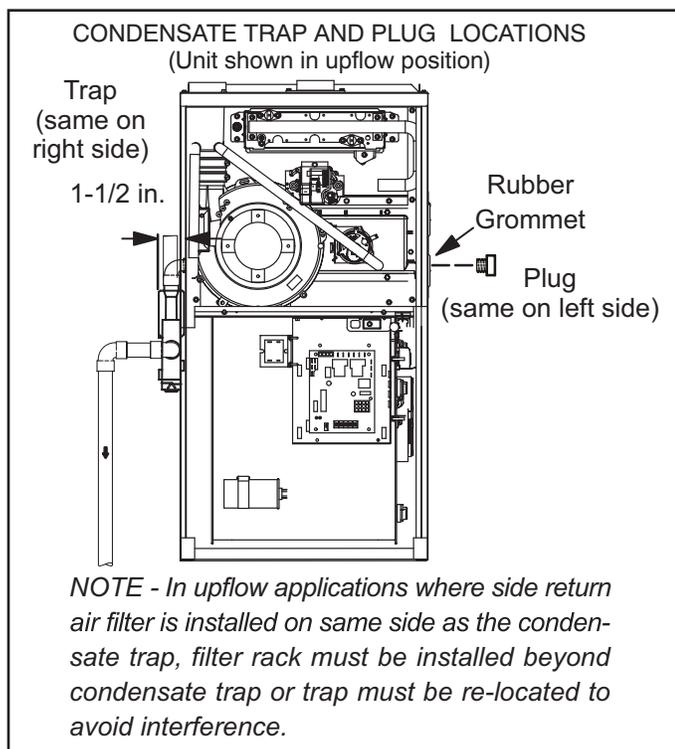


FIGURE 42

- 5 - FIGURE 45 and FIGURE 47 show the furnace and evaporator coil using a separate drain. If necessary the condensate line from the furnace and evaporator coil can drain together. See FIGURE 48 and FIGURE 49.

**Upflow furnace (FIGURE 48)** - In upflow furnace applications the field provided vent must be a minimum 1" to a maximum 2" length above the condensate drain outlet connection. Any length above 2" may result in a flooded heat exchanger if the combined primary drain line were to become restricted.

**Horizontal furnace (FIGURE 49)** - In horizontal furnace applications the field provided vent must be a minimum 4" to a maximum 5" length above the condensate drain outlet connection. Any length above 5" may result in a flooded heat exchanger if the combined primary drain line were to become restricted.

**NOTE** - In horizontal applications it is recommended to install a secondary drain pan underneath the unit and trap assembly.

**NOTE** - Appropriately sized tubing and barbed fitting may be used for condensate drain. Attach to the drain on the trap using a hose clamp. See FIGURE 43.

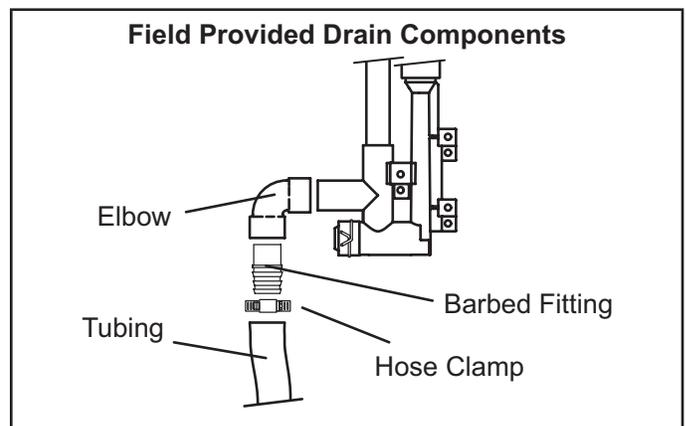


FIGURE 43

## CAUTION

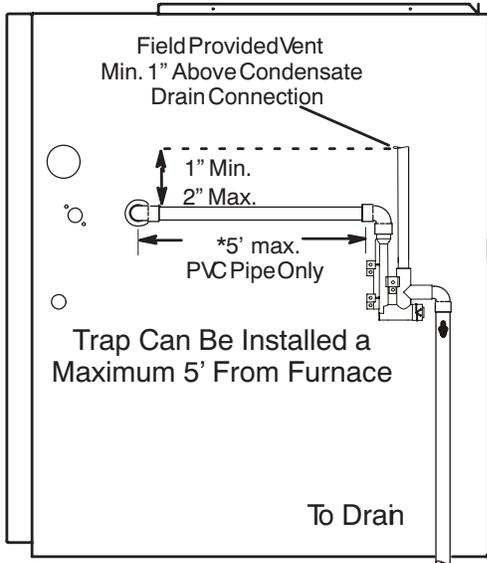
Do not use copper tubing or existing copper condensate lines for drain line.

- 6 - If unit will be started immediately upon completion of installation, prime trap per procedure outlined in Unit Start-Up section.

Condensate line must slope downward away from the trap to drain. If drain level is above condensate trap, condensate pump must be used. Condensate drain line should be routed within the conditioned space to avoid freezing of condensate and blockage of drain line. If this is not possible, a heat cable kit may be used on the condensate trap and line. Heating cable kit is available from Lennox in various lengths; 6 ft. (1.8m) - kit no. 26K68 and 24 ft. (7.3m) - kit no. 26K69.

### CONDENSATE TRAP LOCATIONS

(Unit shown in upflow position with remote trap)



\*Piping from furnace must slope down a minimum 1/4" per ft. toward trap

FIGURE 44

### Condensate Trap With Optional Overflow Switch

From Evaporator Coil

Field-Provided Vent  
(Upflow/Furnace 1" Min. to 2" Max.  
Horizontal Furnace 4" Min. to 5" Max. above  
condensate drain connection)

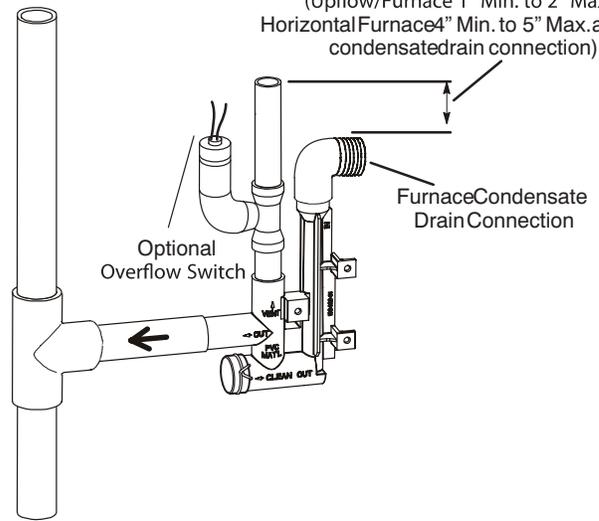


FIGURE 46

### Furnace With Evaporator Coil Using A Separate Drain

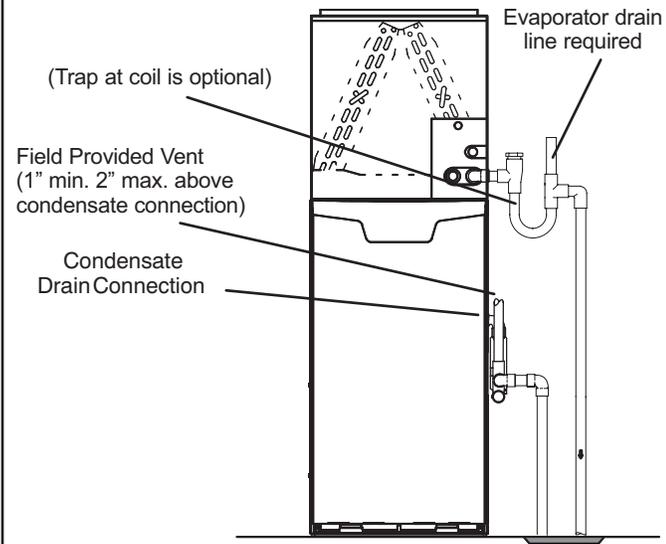
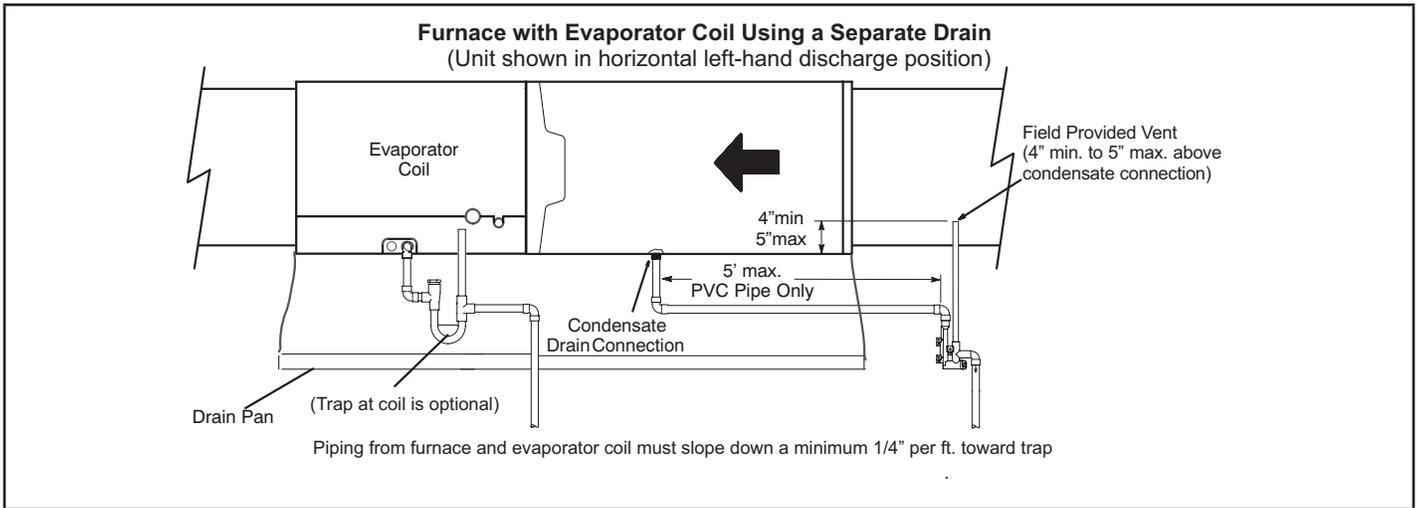
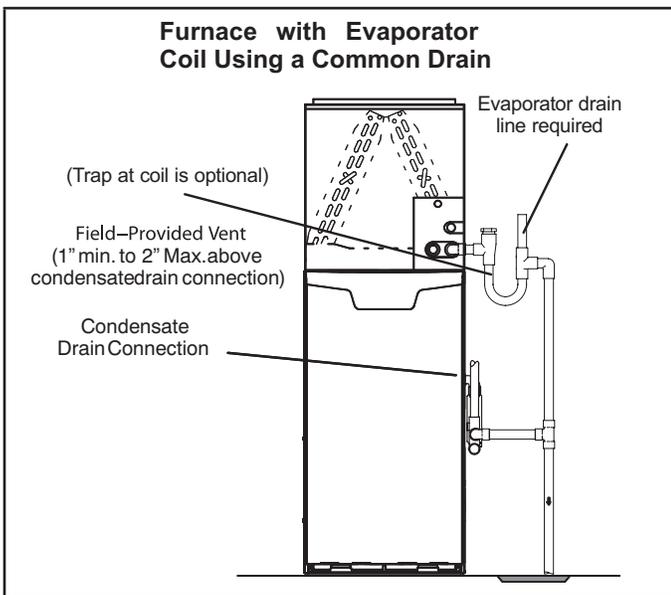


FIGURE 45



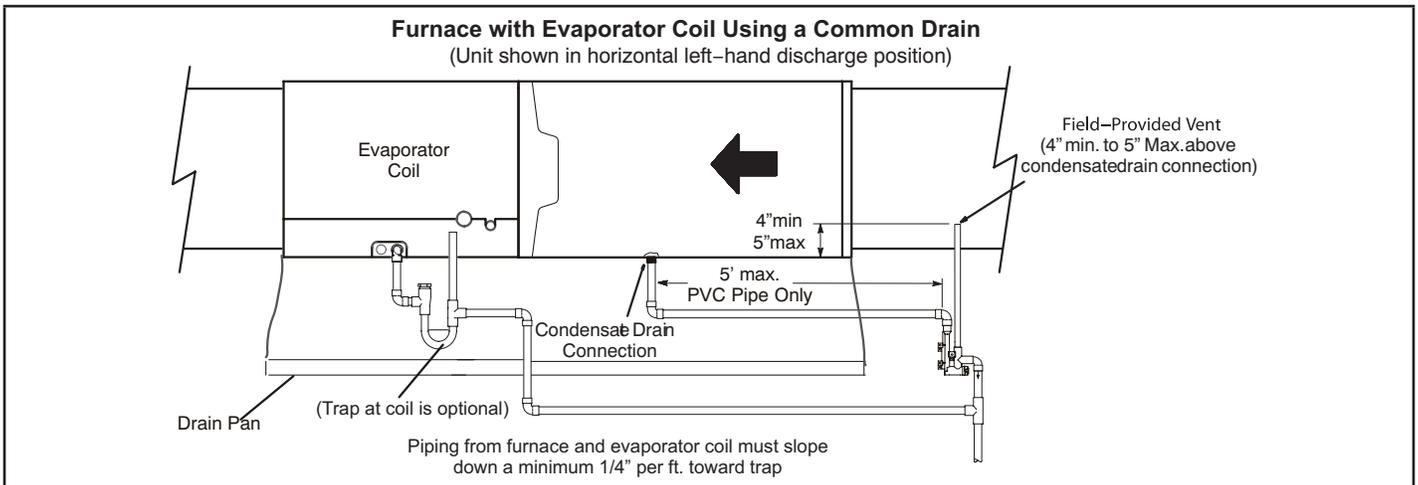
**FIGURE 47**



**FIGURE 48**

**⚠ IMPORTANT**

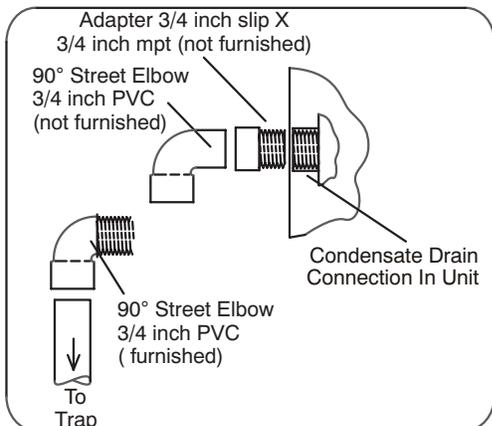
**When combining the furnace and evaporator coil drains together, the A/C condensate drain outlet must be vented to relieve pressure in order for the furnace pressure switch to operate properly.**



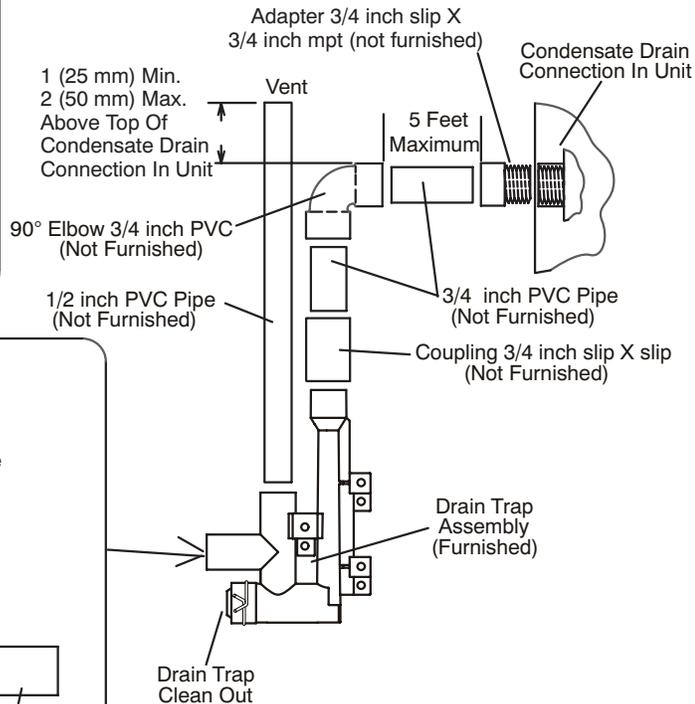
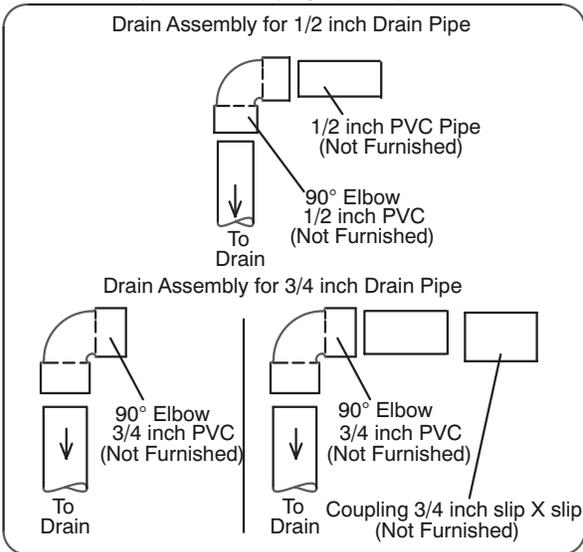
**FIGURE 49**

**TRAP / DRAIN ASSEMBLY USING 1/2" PVC OR 3/4" PVC**

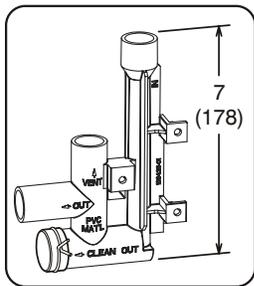
Optional Condensate Drain Connection



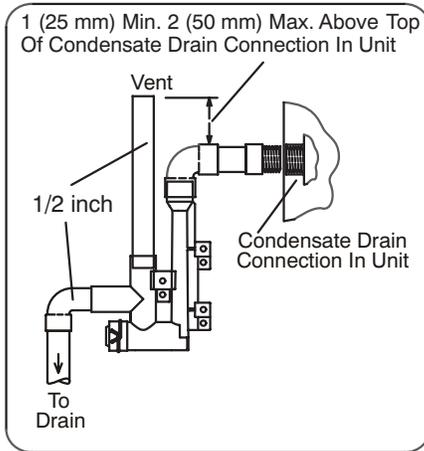
Optional Drain Piping From Trap



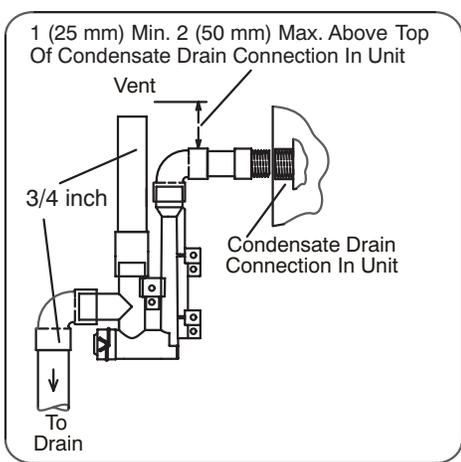
Drain Trap Assembly (Furnished)



Drain Trap Assembly with 1/2 inch Piping



Drain Trap Assembly with 3/4 inch Piping



**FIGURE 50**

### III-START-UP

#### A-Preliminary and Seasonal Checks

- 1 - Inspect electrical wiring, both field and factory installed for loose connections. Tighten as required.
- 2 - Check voltage at disconnect switch. Voltage must be within range listed on the nameplate. If not, consult the power company and have voltage condition corrected before starting unit.
- 3 - Inspect condition of condensate traps and drain assembly. Disassemble and clean seasonally.

#### B-Heating Start-Up

BEFORE LIGHTING the unit, smell all around the furnace area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor. The gas valve on the EL296UHE is equipped with a gas control switch. Use only your hand to move the switch. Never use tools. If the the switch will not move by hand, replace the valve. Do not try to repair it. Force or attempted repair may result in a fire or explosion.

#### Placing the furnace into operation:

EL296UHE units are equipped with a SureLight® ignition system. Do not attempt to manually light burners on this furnace. Each time the thermostat calls for heat, the burners will automatically light. The ignitor does not get hot when there is no call for heat on units with SureLight ignition system.

#### Priming Condensate Trap

The condensate trap should be primed with water prior to start-up to ensure proper condensate drainage. Either pour 10 fl. oz. (300 ml) of water into the trap, or follow these steps to prime the trap:

- 1 - Follow the lighting instructions to place the unit into operation.
- 2 - Set the thermostat to initiate a heating demand.
- 3 - Allow the burners to fire for approximately 3 minutes.
- 4 - Adjust the thermostat to deactivate the heating demand.
- 5 - Wait for the combustion air inducer to stop. Set the thermostat to initiate a heating demand and again allow the burners to fire for approximately 3 minutes.
- 6 - Adjust the thermostat to deactivate the heating demand and again wait for the combustion air inducer to stop. At this point, the trap should be primed with sufficient water to ensure proper condensate drain operation.

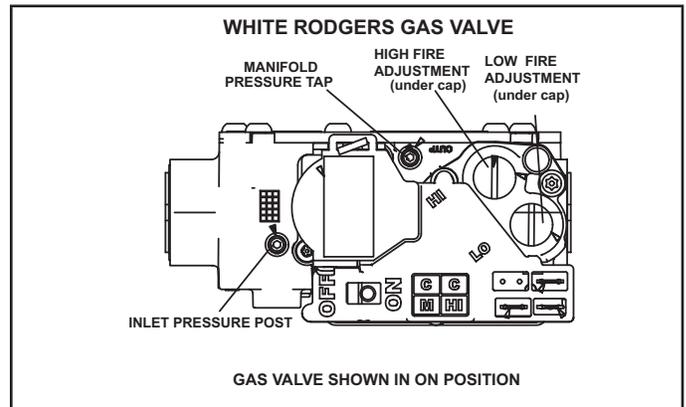
## **⚠ WARNING**

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

#### Gas Valve Operation (FIGURE 51)

- 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**. See FIGURE 51.
- 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**. See FIGURE 51.



**FIGURE 51**

- 9 - Replace the upper access panel.
  - 10 - Turn on all electrical power to the unit.
  - 11 - Set the thermostat to desired setting.
- NOTE** - When unit is initially started, steps 1 through 11 may need to be repeated to purge air from gas line.

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

#### Turning Off Gas to Unit

- 1 - Set the thermostat to the lowest setting.
- 2 - Turn off all electrical power to the unit if service is to be performed.
- 3 - Remove the upper access panel.
- 4 - Move gas valve switch to OFF.
- 5 - Replace the upper access panel.

#### Failure To Operate

If the unit fails to operate, check the following:

- 1 - Is the thermostat calling for heat?
- 2 - Are access panels securely in place?
- 3 - Is the main disconnect switch closed?
- 4 - Is there a blown fuse or tripped breaker?
- 5 - Is the filter dirty or plugged? Dirty or plugged filters will cause the limit control to shut the unit off.
- 6 - Is gas turned on at the meter?
- 7 - Is the manual main shut-off valve open?
- 8 - Is the internal manual shut-off valve open?
- 9 - Is the unit ignition system in lockout? If the unit locks out again, inspect the unit for blockages.

## IV-HEATING SYSTEM SERVICE CHECKS

### A-CSA Certification

All units are CSA design certified without modifications. Refer to the EL296UHE Installation Instruction.

### B-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. The flexible connector can then be added between the black iron pipe and the gas supply line.

#### **⚠ WARNING**

Do not over torque (800 in-lbs) or under torque (350 in-lbs) when attaching the gas piping to the gas valve.

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

#### **⚠ 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.

When pressure testing gas lines, the gas valve must be disconnected and isolated. Gas valves can be damaged if subjected to more than 0.5 psig (14" W.C.). See FIGURE 52. If the pressure is greater than 0.5psig (14"W.C.), use the manual shut-off valve before pressure testing to isolate furnace from gas supply.

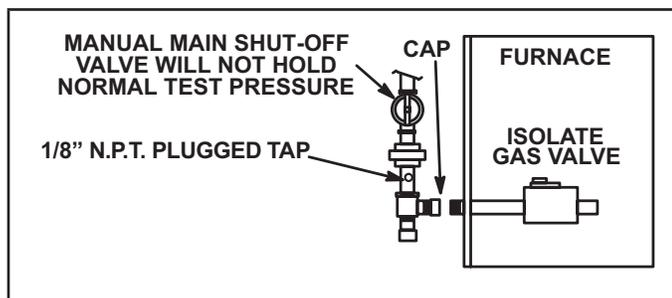


FIGURE 52

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-Testing Gas Supply Pressure

An inlet post located on the gas valve provides access to the supply pressure. See FIGURE 51. Back out the 3/32 hex screw one turn, connect a piece of 5/16 tubing and connect to a manometer to measure supply pressure. See TABLE 23 for supply line pressure.

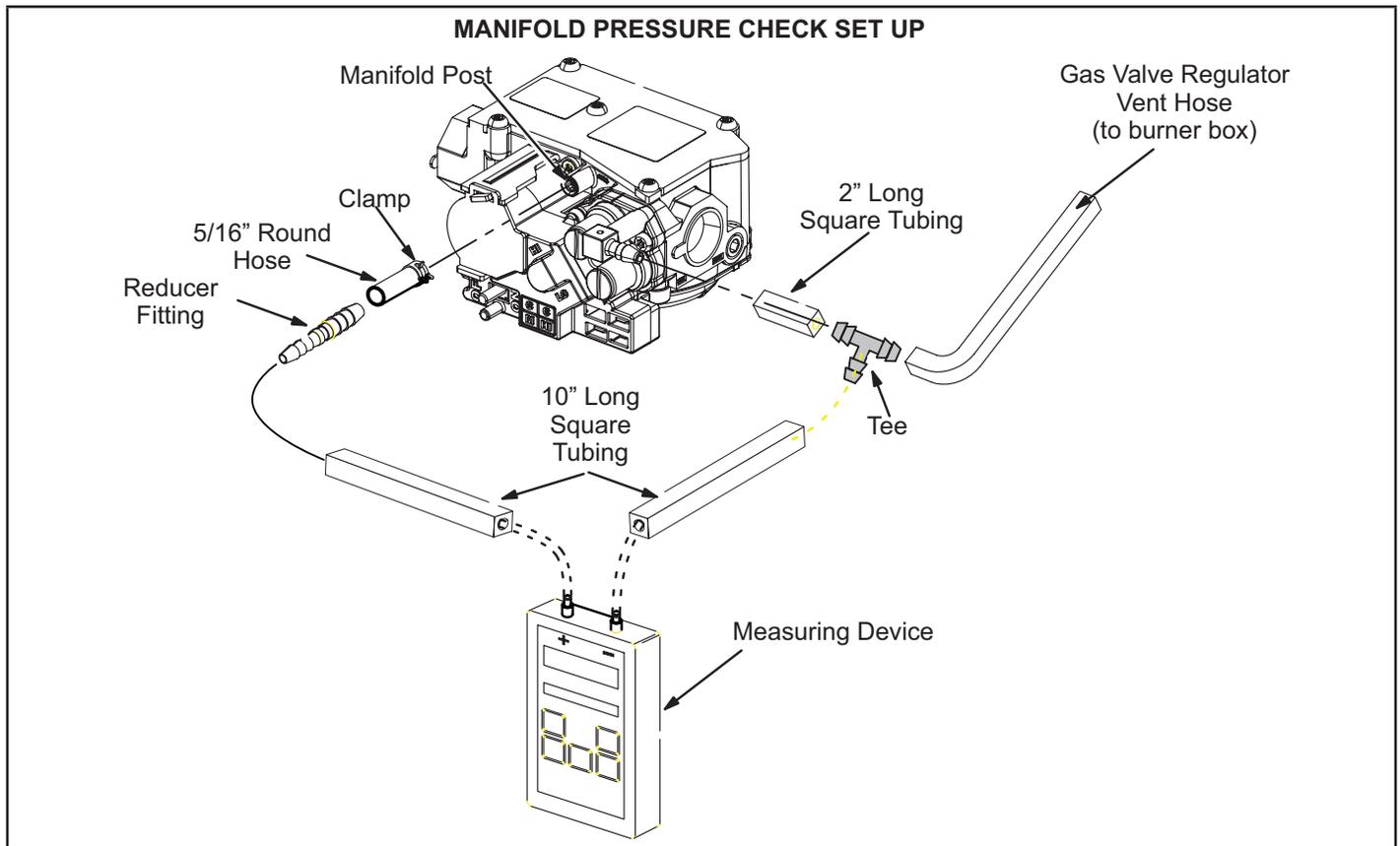
### E-Check Manifold Pressure

A manifold pressure post located on the gas valve provides access to the manifold pressure. See FIGURE 51. Back out the 3/32 hex screw one turn. Follow the steps below and use FIGURE 53 as a reference. Gas manifold Kit 10L34 provides additional components if needed

- 1 - Connect the 5/16" round tubing to the manifold post. Secure with the clamp.
- 2 - Connect the reducer fitting to the 5/16" round tubing followed by a piece of 10" length square tubing.
- 3 - Connect the other end of the square tubing to the "+" positive side of the measuring device.
- 4 - Take the 2" length square tubing, tee, 10" length of square tubing and tee into the gas valve regulator vent hose. Connect to the measuring device negative "-" side.
- 5 - Ignite unit on low fire and let run for 5 minutes to allow for steady state conditions.
- 6 - After allowing unit to stabilize for 5 minutes, record manifold pressure and compare to value given in TABLE 23 or TABLE 24.
- 7 - If necessary, make adjustments. FIGURE 51 shows location of high fire and low fire adjustment screws.
- 8 - Repeat steps 5, 6 and 7 on high fire. See values in TABLE 23 or TABLE 24.
- 9 - Shut unit off and remove manometer as soon as an accurate reading has been obtained.
- 10 - Start unit and perform leak check. Seal leaks if found.

#### **⚠ IMPORTANT**

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



**FIGURE 53**

**F- Proper Gas Flow (Approximate)**

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 21. If manifold pressure matches TABLE 21 and rate is incorrect, check gas orifices for proper size and restriction.

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

**TABLE 21**

<b>GAS METER CLOCKING CHART</b>				
<b>EL296 Unit</b>	<b>Seconds for One Revolution</b>			
	<b>Natural</b>		<b>LP</b>	
	<b>1 cu ft Dial</b>	<b>2 cu ft Dial</b>	<b>1 cu ft Dial</b>	<b>2 cu ft Dial</b>
-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				

**G- Proper Combustion**

Furnace should operate minimum 15 minutes with correct manifold pressure and gas flow rate before checking combustion. See sections E- and F-. Take combustion sample beyond the flue outlet. TABLE 22 shows acceptable combustions. The maximum carbon monoxide reading should not exceed 100 ppm.

**TABLE 22**

<b>EL296 Model</b>	<b>CO<sub>2</sub>% For Nat</b>		<b>CO<sub>2</sub>% For L.P</b>	
	<b>Low Fire</b>	<b>High Fire</b>	<b>Low Fire</b>	<b>High Fire</b>
045	5.4 - 6.4	7.5 - 8.5	6.4 - 7.4	8.8 - 9.8
070	5.3 - 6.3	7.4 - 8.4	6.3 - 7.3	8.7 - 9.7
090	5.8 - 6.8	7.6 - 8.6	6.8 - 7.8	8.9 - 9.9
110	6.1 - 7.1	8.0 - 9.0	7.1 - 8.1	9.3 - 10.3
135	6.1 - 7.1	7.8 - 8.8	7.1 - 8.2	9.1 - 10.1
The maximum carbon monoxide reading should not exceed 100ppm.				

**H- High Altitude**

The manifold pressure, gas orifice and pressure switch may require adjustment or replacement to ensure proper operation at higher altitudes. See TABLE 23 or TABLE 24 for manifold pressures and TABLE 25 for gas conversion and pressure switch kits.

**TABLE 23**

**Manifold and Supply Line Pressure 0-10,000ft. For -1 Units**

EL296 Unit	Gas	Manifold Pressure in wc		Supply Line Pressure in wc	
		Low Fire	High Fire	Min	Max
All Sizes	Natural	1.7	3.5	4.5	13.0
	LP/Propane	4.5	10.0	11.0	13.0

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.

**TABLE 24**

**Manifold and Supply Line Pressure 0-10,000ft. For -2 Units and Later**

EL296 Model	Gas	Manifold Pressure in. wg.										Supply Line Pressure in. w.g 0 - 10,000 ft.	
		0 - 4500 ft		4501 - 5500 ft.		5501 - 6500 ft		6501 - 7500 ft		7501 - 10,000 ft		Min	Max
		Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire		
All Sizes	Natural	1.7	3.5	1.6	3.3	1.5	3.2	1.5	3.1	1.7	3.5	4.5	13.0
	LP/Propane	4.5	10.0	4.2	9.4	4.0	9.1	3.9	8.9	4.5	10.0	11.0	13.0

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.

**TABLE 25**

**LP/Propane Conversion Kit and Pressure Switch Requirements at Varying Altitudes**

EL296 Model	Natural to LP/Propane	High Altitude Natural Burner Orifice Kit	High Altitude LP/Propane Burner Orifice Kit	High Altitude Pressure Switch	
	0 - 7500 ft	7501 - 10,000 ft	7501 - 10,000 ft	4501 - 7500 ft	7501 - 10,000 ft
045	*11K51	73W37	*11K46	14A47	14A50
070-1, -2				93W80	93W85
070-3 and later				14A54	14A53
090				14A57	14A54
110				14A46	14A51
135				14A49	14A51

\* Conversion requires installation of a gas valve manifold spring which is provided with the gas conversion kit. Pressure switch is factory set. No adjustment necessary. All models use the factory-installed pressure switch from 0-4500 feet (0-1370 m).

## I- Proper Ground and Voltage

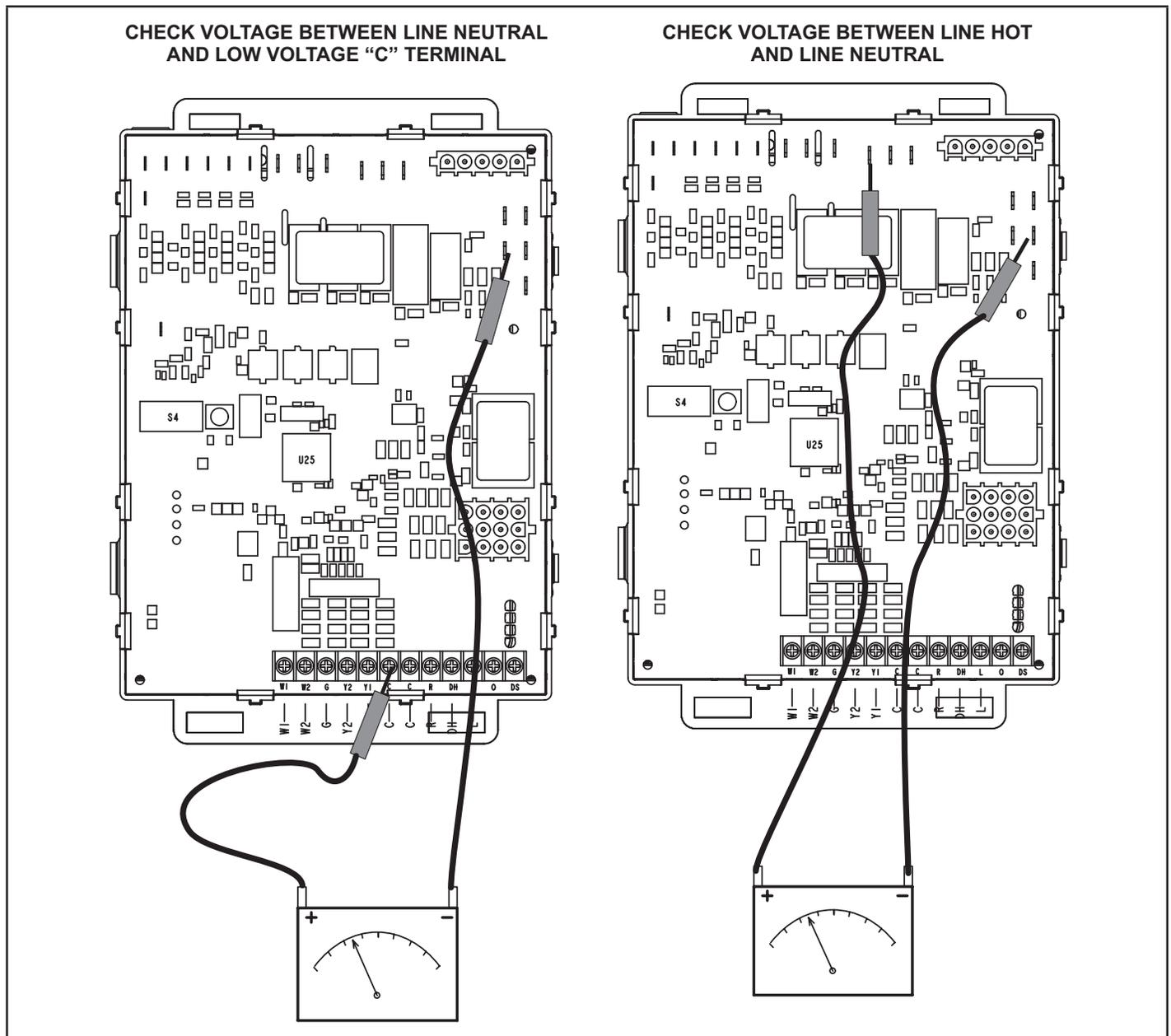
Furnace must be properly grounded for proper performance. Use the following procedure to check for ground and voltage to the integrated control.

- 1 - Measure the AC voltage between Line Neutral (spade terminals) and "C" terminal (low voltage terminal block) on the integrated control. See FIGURE 54. 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 26, 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 54. This voltage should be in the range of 97 to 132 Vac.

**TABLE 26**

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 54**

## V-TYPICAL OPERATING CHARACTERISTICS

### A-Blower Operation and Adjustment

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

### B-Temperature Rise (FIGURE 55)

Temperature rise for EL296UHE 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.

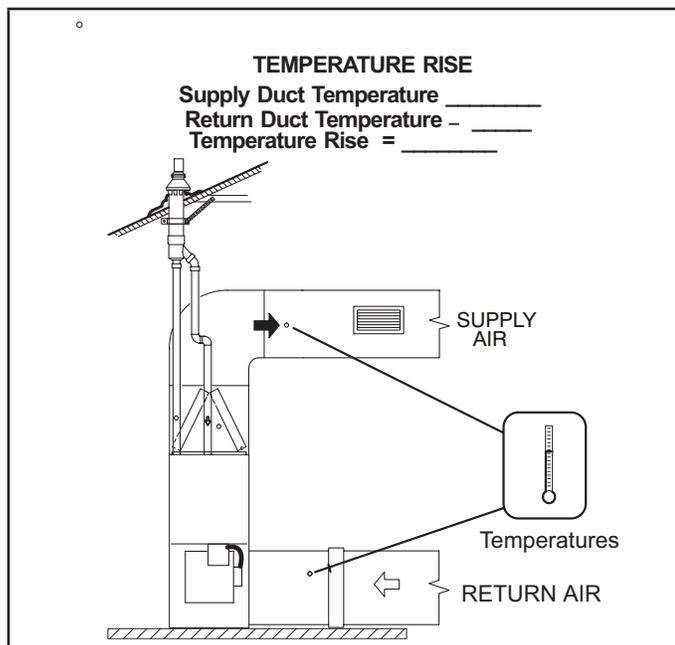


FIGURE 55

### C-External Static Pressure

- 1 - Tap locations shown in FIGURE 56.
- 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 (second stage heat speed) external static pressure drop must not be more than 0.5" W.C. For cooling speed (second stage cool speed) external static pressure drop must not be more than 0.5" W.C.
- 4 - Seal the hole when the check is complete.

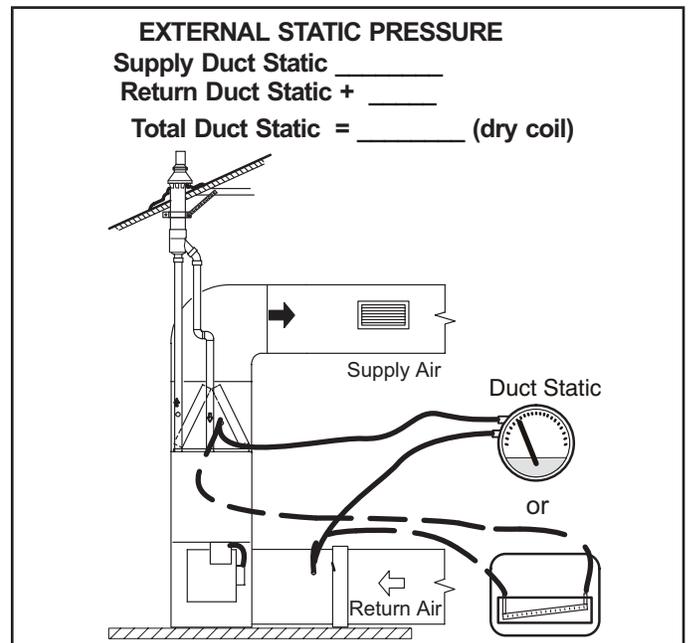


FIGURE 56

TABLE 27

**⚠ WARNING**  
**ELECTRICAL SHOCK, FIRE, OR EXPLOSION HAZARD.**  
 Failure to follow safety warnings exactly could result in dangerous operation, serious injury, death or property damage.  
 Improper servicing could result in dangerous operation, serious injury, death, or property damage. Before servicing, disconnect all electrical power to furnace.  
 When servicing controls, label all wires prior to disconnecting. Take care to reconnect wires correctly. Verify proper operation after servicing.

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

**Blower**

Check the blower wheel for debris and clean if necessary. The blower motors are prelubricated for extended bearing life. No further lubrication is needed.

**⚠ WARNING**  
 The blower access panel must be securely in place when the blower and burners are operating. Gas fumes, which could contain carbon monoxide, can be drawn into living space resulting in personal injury or death.

**Filters**

All air filters are installed external to the unit. Filters should be inspected monthly. Clean or replace the filters when necessary to ensure proper furnace operation. TABLE 27 lists recommended filter sizes.

**⚠ 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).

Cabinet Width	Filter Size	
	Side Return	Bottom Return
17-1/2"	16 x 25 x 1(1)	16 x 25 x 1(1)
21"	16 x 25 x 1(1)	20 x 25 x 1 (1)
24-1/2"	16 x 25 x 1(2)	24 x 25 x 1 (1)

**Exhaust and air intake pipes**

Check the exhaust and air intake pipes and all connections for tightness and to make sure there is no blockage.

**NOTE** - After any heavy snow, ice or frozen fog event the furnace vent pipes may become restricted. Always check the vent system and remove any snow or ice that may be obstructing the plastic intake or exhaust pipes.

**Electrical**

**⚠ CAUTION**  
 Failure to use properly sized wiring and circuit breaker may result in property damage. Size wiring and circuit breaker(s) per Product Specifications bulletin (EHB) and unit rating plate.

- 1 - Check all wiring for loose connections.
- 2 - Check for the correct voltage at the furnace (furnace operating).
- 3 - Check amp-draw on the blower motor.  
 Motor Nameplate \_\_\_\_\_ Actual \_\_\_\_\_

**Winterizing and Condensate Trap Care**

- 1 - Turn off power to the furnace.
- 2 - Have a shallow pan ready to empty condensate water.
- 3 - Remove the clean out cap from the condensate trap and empty water. Inspect the trap then reinstall the clean out cap.

**Condensate Hose Screens (FIGURE 57)**

Check the condensate hose screens for blockage and clean if necessary.

- 1 - Turn off power to the unit.
- 2 - Remove hoses from cold end header box. Twist and pull screens to remove.
- 3 - Inspect screens and rinse with tap water if needed.
- 4 - Reinstall screens, reconnect hoses and turn on power to unit.

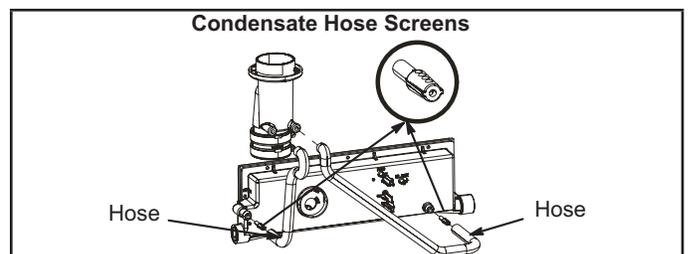


FIGURE 57

## Cleaning Heat Exchanger

If cleaning the heat exchanger becomes necessary, follow the below procedures and refer to figure 1 when disassembling unit. Use papers or protective covering in front of furnace while removing heat exchanger assembly.

- 1 - Turn off electrical and gas supplies to the furnace.
- 2 - Remove the furnace access panels.
- 3 - Disconnect the wires from the gas valve.
- 4 - Remove gas supply line connected to gas valve. Remove the burner box cover (if equipped) and remove gas valve/manifold assembly.
- 5 - Remove sensor wire from sensor. Disconnect 2-pin plug from the ignitor.
- 6 - Disconnect wires from flame roll-out switches.
- 7 - Disconnect combustion air intake pipe. It may be necessary to cut the existing pipe to remove burner box assembly.
- 8 - Remove four burner box screws at the vestibule panel and remove burner box. Set burner box assembly aside.

**NOTE** - *If necessary, clean burners at this time. Follow procedures outlined in Burner Cleaning section on the next page.*

- 9 - Loosen the clamps to the flexible exhaust coupling.
- 10 - 10 - Disconnect condensate drain line from the cold end header box.
- 11 - Disconnect condensate drain tubing from flue collar. Remove screws that secures the flue collar into place. Remove flue collar. It may be necessary to cut the exiting exhaust pipe for removal of the fitting.
- 12 - Mark and disconnect all combustion air pressure tubing from cold end header collector box.
- 13 - Mark and remove wires from pressure switch assembly. Remove the assembly. Keep tubing attached to pressure switches.
- 14 - Disconnect the plug from the combustion air inducer. Remove two screws which secure combustion air inducer to collector box. Remove combustion air inducer assembly. Remove ground wire from vest panel.
- 15 - Disconnect the condensate drain line.
- 16 - Remove cold end header box
- 17 - . Remove electrical junction box from the side of the furnace.
- 18 - Mark and disconnect any remaining wiring to heating compartment components. Disengage strain relief bushing and pull wiring and bushing through the hole in the blower deck.
- 19 - Remove the primary limit from the vestibule panel.
- 20 - Remove two screws from the front cabinet flange at the blower deck. Spread cabinet sides slightly to allow clearance for removal of heat exchanger.

- 21 - Remove screws along vestibule sides and bottom which secure vestibule panel and heat exchanger assembly to cabinet. Remove two screws from blower rail which secure bottom heat exchanger flange. Remove heat exchanger from furnace cabinet.
- 22 - Back wash heat exchanger with soapy water solution or steam. **If steam is used it must be below 275°F (135°C) .**
- 23 - Thoroughly rinse and drain the heat exchanger. Soap solutions can be corrosive. Take care to rinse entire assembly.
- 24 - Reinstall heat exchanger into cabinet making sure that the clamshells of the heat exchanger assembly is engaged properly into the support bracket on the blower deck. Remove the indoor blower to view this area through the blower opening.
- 25 - Re-secure the supporting screws along the vestibule sides and bottom to the cabinet.
- 26 - Reinstall cabinet screws on front flange at blower deck.
- 27 - Reinstall the primary limit on the vestibule panel.
- 28 - Route heating component wiring through hole in blower deck and reinsert strain relief bushing.
- 29 - Reinstall electrical junction box.
- 30 - Reinstall the cold end header box.
- 31 - Reinstall the combustion air inducer. Reconnect the plug to the wire harness.
- 32 - Reinstall pressure switches and reconnect pressure switch wiring.
- 33 - Carefully connect combustion air pressure switch tubing from pressure switches to proper ports on cold end header collector box.
- 34 - Reconnect condensate drain line to the cold end header box.
- 35 - Use securing screws to reinstall flue collar to the top cap on the furnace. Reconnect exhaust piping and exhaust drain tubing.
- 36 - Replace flexible exhaust adapter on combustion air inducer and flue collar. Secure using two existing hose clamps.
- 37 - Reinstall burner box assembly in vestibule area. Secure burner box assembly to vestibule panel using four existing screws. Make sure burners line up in center of burner ports
- 38 - Reconnect flame roll-out switch wires.
- 39 - Reconnect sensor wire and reconnect 2-pin plug from ignitor.
- 40 - Reinstall gas valve manifold assembly. Reconnect gas supply line to gas valve.
- 41 - Reconnect the combustion air intake pipe.
- 42 - Reinstall burner box cover.
- 43 - Reconnect wires to gas valve.
- 44 - Replace the blower compartment access panel.

- 45 - Reconnect gas supply piping. Turn on power and gas supply to unit.
- 46 - Follow lighting instructions on unit nameplate to light and operate furnace for 5 minutes to ensure the furnace is operating properly.
- 47 - Check all piping connections, factory and field, for gas leaks. Use a leak detecting solution or other preferred means.
- 48 - Replace heating compartment access panel.

## 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.**

### **Cleaning the Burner Assembly (if needed)**

- 1 - 1 - Turn off electrical and gas power supplies to furnace. Remove upper and lower furnace access panels.
- 2 - Disconnect the wires from the gas valve.
- 3 - Remove the burner box cover (if equipped).
- 4 - Disconnect the gas supply line from the gas valve. Remove gas valve/manifold assembly.
- 5 - Mark and disconnect sensor wire from the sensor. Disconnect wires from flame rollout switches.

- 6 - Disconnect combustion air intake pipe. It may be necessary to cut the existing pipe to remove burner box assembly.
- 7 - Remove four screws which secure burner box assembly to vest panel. Remove burner box from the unit.
- 8 - Use the soft brush attachment on a vacuum cleaner to gently clean the face of the burners. Visually inspect the inside of the burners and crossovers for any blockage caused by foreign matter. Remove any blockage.
- 9 - Reinstall the burner box assembly using the existing four screws. Make sure that the burners line up in the center of the burner ports.
- 10 - Reconnect the sensor wire and reconnect the 2-pin plug to the ignitor wiring harness. Reconnect wires to flame rollout switches.
- 11 - Reinstall the gas valve manifold assembly. Reconnect the gas supply line to the gas valve. Reinstall the burner box cover.
- 12 - Reconnect wires to gas valve.
- 13 - Replace the blower compartment access panel.
- 14 - Refer to instruction on verifying gas and electrical connections when re-establishing supplies.
- 15 - Follow lighting instructions to light and operate furnace for 5 minutes to ensure that heat exchanger is clean and dry and that furnace is operating properly.
- 16 - Replace heating compartment access panel.





## Electronic Ignition

The two-stage, variable speed integrated control used in EL296UHE units has an added feature of an internal Watchguard control. The feature serves as an automatic reset device for ignition control lockout caused by ignition failure. After one hour of continuous thermostat demand for heat, the Watchguard will break and remake thermostat demand to the furnace and automatically reset the control to begin the ignition sequence.

**NOTE** - The ignition control thermostat selection DIP switch is factory-set in the "TWO-STAGE" position.

### Applications Using a Two-Stage Thermostat

See FIGURE 58 for ignition control sequence

#### A - Heating Sequence -- Integrated Control Thermostat Selection DIP Switch 1 OFF in "Two-Stage" Position

##### (Factory Setting)

- 1 - On a call for heat, thermostat first-stage contacts close sending a signal to the integrated control. The integrated control runs a self-diagnostic program and checks high temperature limit switches for normally closed contacts and pressure switches for normally open contacts. The combustion air inducer is energized at low speed.
- 2 - Once the control receives a signal that the low pressure switch has closed, the combustion air inducer begins a 15-second pre-purge in low speed.  
**NOTE** - If the low fire pressure switch does not close the combustion air inducer will switch to high fire. After a 15 second pre-purge the high fire pressure switch will close and the unit will begin operation on high fire. After 10 to 20 seconds of high fire operation the unit will switch to low fire.
- 3 - After the pre-purge is complete, a 20-second initial ignitor warm-up period begins. The combustion air inducer continues to operate at low speed.
- 4 - After the 20-second warm-up period has ended, the gas valve is energized on low fire (first stage) and ignition occurs. At the same time, the control module sends a signal to begin an indoor blower 30-second ON-delay.

When the delay ends, the indoor blower motor is energized on the low fire heating speed, the HUM contacts close energizing the humidifier and 120V ACC terminal is energized. The furnace will continue this operation as long as the thermostat has a first-stage heating demand.

**NOTE** - If the indoor thermostat is set on CONTINUOUS FAN ON mode, the furnace will light on high fire (second-stage) for 60 seconds to improve heat exchanger warm up. After 60 second warm-up period, furnace will switch to low fire (first-stage).

- 5 - If second-stage heat is required, the thermostat second-stage heat contacts close and send a signal to the integrated control. The integrated control initiates a 30-second second-stage recognition delay.
- 6 - At the end of the recognition delay, the integrated control energizes the combustion air inducer at high speed. The control also checks the high fire (second stage) pressure switch to make sure it is closed. The high fire (second stage) gas valve is energized and the indoor blower motor is energized for operation at the high fire heating speed.
- 7 - When the demand for high fire (second stage) heat is satisfied, the combustion air inducer is switched to the low-fire heating speed and the high-fire (second stage) gas valve is de-energized. The low-fire (first stage) gas valve continues operation. The indoor blower motor is switched to the low-fire heating speed.
- 8 - When the thermostat demand for low-fire (first stage) heat is satisfied, the gas valve is de-energized and the field-selected indoor blower off delay begins. The combustion air inducer begins a 5-second post-purge period.
- 9 - When the combustion air post-purge period is complete, the inducer and the HUM contacts are de-energized. The indoor blower is de-energized at the end of the off delay as well as the 120V ACC terminal.

## Applications Using A Single-Stage Thermostat

See FIGURE 59 for ignition control sequence

### B - Heating Sequence -- Integrated Control Thermostat Selection DIP Switch 1 ON in "Single-Stage" Position

**NOTE** - In these applications, two-stage heat will be initiated by the integrated control if heating demand has not been satisfied after the field adjustable period (7 or 12 minutes).

1 - On a call for heat, thermostat first-stage contacts close sending a signal to the integrated control. The integrated control runs a self-diagnostic program and checks high temperature limit switches for normally closed contacts and pressure switches for normally open contacts. The combustion air inducer is energized at low speed.

2 - Once the control receives a signal that the low pressure switch has closed, the combustion air inducer begins a 15-second pre-purge in low speed.

**NOTE** - If the low fire pressure switch does not close the combustion air inducer will switch to high fire. After a 15 second pre-purge the high fire pressure switch will close and the unit will begin operation on high fire. After 10 to 20 seconds of high fire operation the unit will switch to low fire.

3 - After the pre-purge is complete, a 20-second initial ignitor warm-up period begins. The combustion air inducer continues to operate at low speed.

4 - After the 20-second warm-up period has ended, the gas valve is energized on low fire (first stage) and ignition occurs. At the same time, the control module sends a signal to begin an indoor blower 30-second ON-delay. When the delay ends, the indoor blower motor is energized on the low fire heating speed and the HUM contacts are energized. The integrated control also initiates a second-stage on delay (factory-set at 7 minutes; adjustable to 12 minutes).

5 - If the heating demand continues beyond the secondstage on delay, the integrated control energizes the combustion air inducer at high speed. The control also checks the high fire (second stage) pressure switch to make sure it is closed. The high fire (second stage) gas valve is energized and the indoor blower motor is energized for operation at the high fire heating speed.

6 - When the thermostat heating demand is satisfied, the combustion air inducer begins a 5-second low speed post-purge. The field-selected indoor blower off delay begins. The indoor blower operates at the low-fire heating speed.

7 - When the combustion air post-purge period is complete, the inducer and the HUM contacts are de-energized. The indoor blower is de-energized at the end of the off delay as well as the 120V ACC terminal.

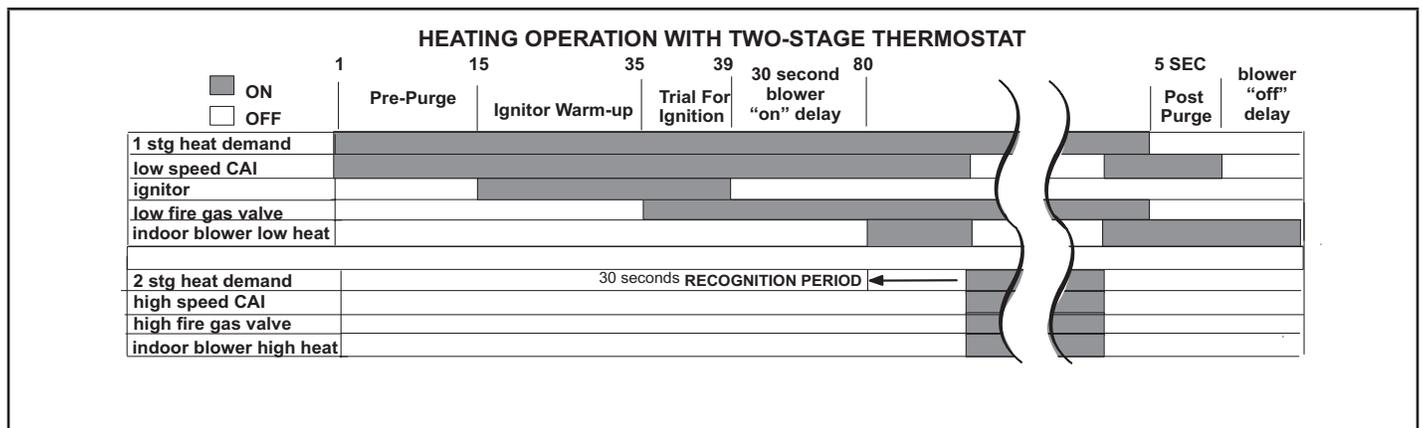


FIGURE 58

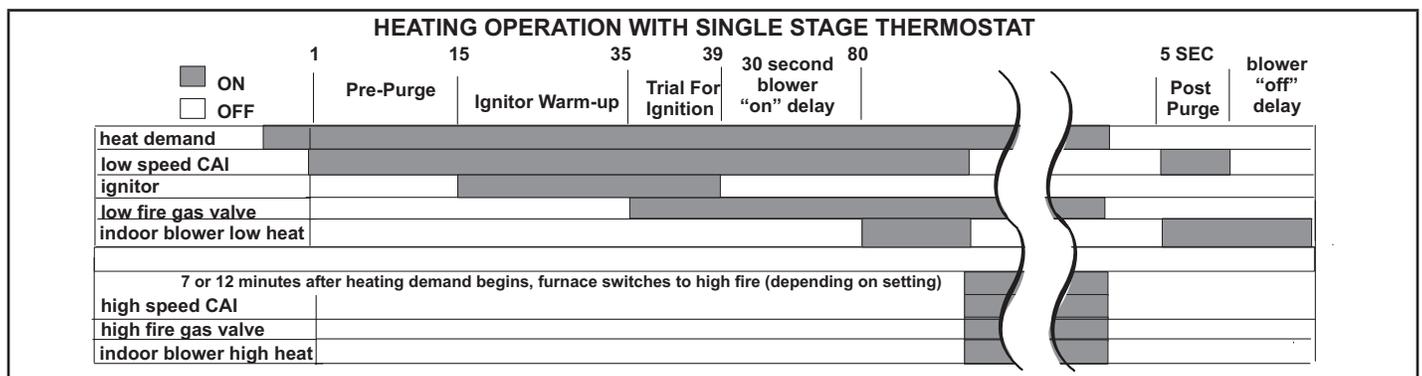


FIGURE 59

VIII- EL296UHE Field Wiring Applications

**TABLE 28**  
**EL296 Field Wiring Applications**

Thermostat	DIP Switch Settings and On-Board Links		Wiring Connections																														
	DIP Switch 1 Thermostat Heating Stages	On Board Links Must Be Cut To Select System Options																															
1 Heat / 1 Cool <i>NOTE - Use DIP switch 2 to set second-stage heat ON delay. OFF-7 minutes. ON-12 minutes.</i>	ON	DO NOT CUT ANY ON-BOARD LINKS 	<table border="0"> <tr> <td>S1 T'STAT</td> <td>FURNACE TERM. STRIP</td> <td>OUTDOOR UNIT</td> </tr> <tr> <td></td> <td>(D8)</td> <td></td> </tr> <tr> <td>(W2)</td> <td>(W2)</td> <td></td> </tr> <tr> <td>(W1) -----</td> <td>(W1)</td> <td></td> </tr> <tr> <td>(R) -----</td> <td>(R) ----- *</td> <td>(R)</td> </tr> <tr> <td>(G) -----</td> <td>(G)</td> <td></td> </tr> <tr> <td>(C) -----</td> <td>(C) -----</td> <td>(C)</td> </tr> <tr> <td></td> <td>(Y2)</td> <td></td> </tr> <tr> <td>(Y) -----</td> <td>(Y1) -----</td> <td>(Y1)</td> </tr> <tr> <td></td> <td>(O)</td> <td></td> </tr> </table>	S1 T'STAT	FURNACE TERM. STRIP	OUTDOOR UNIT		(D8)		(W2)	(W2)		(W1) -----	(W1)		(R) -----	(R) ----- *	(R)	(G) -----	(G)		(C) -----	(C) -----	(C)		(Y2)		(Y) -----	(Y1) -----	(Y1)		(O)	
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(Y) -----	(Y1) -----	(Y1)																															
	(O)																																
1 Heat / 2 Cool <i>NOTE - Use DIP switch 2 to set second-stage heat ON delay. OFF-7 minutes. ON-12 minutes.</i>	ON	CUT ON-BOARD LINK W915 2 STAGE COMPR 	<table border="0"> <tr> <td>S1 T'STAT</td> <td>FURNACE TERM. STRIP</td> <td>OUTDOOR UNIT</td> </tr> <tr> <td></td> <td>(D8)</td> <td></td> </tr> <tr> <td></td> <td>(W2)</td> <td></td> </tr> <tr> <td>(W) -----</td> <td>(W1)</td> <td></td> </tr> <tr> <td>(R) -----</td> <td>(R) ----- *</td> <td>(R)</td> </tr> <tr> <td>(G) -----</td> <td>(G)</td> <td></td> </tr> <tr> <td>(C) -----</td> <td>(C) -----</td> <td>(C)</td> </tr> <tr> <td>(Y2) -----</td> <td>(Y2)</td> <td>(Y2)</td> </tr> <tr> <td>(Y1) -----</td> <td>(Y1)</td> <td>(Y1)</td> </tr> <tr> <td></td> <td>(O)</td> <td></td> </tr> </table>	S1 T'STAT	FURNACE TERM. STRIP	OUTDOOR UNIT		(D8)			(W2)		(W) -----	(W1)		(R) -----	(R) ----- *	(R)	(G) -----	(G)		(C) -----	(C) -----	(C)	(Y2) -----	(Y2)	(Y2)	(Y1) -----	(Y1)	(Y1)		(O)	
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1 Heat / 2 Cool with t'stat with humidity control <i>NOTE - Use DIP switch 2 to set second-stage heat ON delay. OFF-7 minutes. ON-12 minutes.</i>	ON	CUT ON-BOARD LINK W915 2 STAGE COMPR  CUT ON-BOARD LINK W914 DEHUM OR HARMONY 	<table border="0"> <tr> <td>S1 T'STAT</td> <td>FURNACE TERM. STRIP</td> <td>OUTDOOR UNIT</td> </tr> <tr> <td>(D8) -----</td> <td>(D8)</td> <td></td> </tr> <tr> <td></td> <td>(W2)</td> <td></td> </tr> <tr> <td>(W1) -----</td> <td>(W1)</td> <td></td> </tr> <tr> <td>(R) -----</td> <td>(R) ----- *</td> <td>(R)</td> </tr> <tr> <td>(G) -----</td> <td>(G)</td> <td></td> </tr> <tr> <td>(C) -----</td> <td>(C) -----</td> <td>(C)</td> </tr> <tr> <td>(Y2) -----</td> <td>(Y2)</td> <td>(Y2)</td> </tr> <tr> <td>(Y1) -----</td> <td>(Y1)</td> <td>(Y1)</td> </tr> <tr> <td></td> <td>(O)</td> <td></td> </tr> </table>	S1 T'STAT	FURNACE TERM. STRIP	OUTDOOR UNIT	(D8) -----	(D8)			(W2)		(W1) -----	(W1)		(R) -----	(R) ----- *	(R)	(G) -----	(G)		(C) -----	(C) -----	(C)	(Y2) -----	(Y2)	(Y2)	(Y1) -----	(Y1)	(Y1)		(O)	
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\* Not required on all units.

**TABLE 28**  
**EL296 Field Wiring Applications (Continued)**

Thermostat	DIP Switch Settings and On-Board Links		Wiring Connections																														
	DIP Switch 1 Thermostat Heating Stages	On Board Links Must Be Cut To Select System Options																															
2 Heat / 2 Cool	OFF	<p>CUT ON-BOARD LINK W915 2 STAGE COMPR</p>	<table border="0"> <tr> <td>S1 T'STAT</td> <td>FURNACE TERM. STRIP</td> <td>OUTDOOR UNIT</td> </tr> <tr> <td>(W2) --- (W2)</td> <td>(DS)</td> <td></td> </tr> <tr> <td>(W1) --- (W1)</td> <td>(W2)</td> <td></td> </tr> <tr> <td>(R) --- (R) --- *</td> <td>(R)</td> <td>(R)</td> </tr> <tr> <td>(G) --- (G)</td> <td>(G)</td> <td></td> </tr> <tr> <td>(C) --- (C) --- (C)</td> <td>(C)</td> <td>(C)</td> </tr> <tr> <td>(Y2) --- (Y2) --- (Y2)</td> <td>(Y2)</td> <td>(Y2)</td> </tr> <tr> <td>(Y1) --- (Y1) --- (Y1)</td> <td>(Y1)</td> <td>(Y1)</td> </tr> <tr> <td></td> <td>(O)</td> <td></td> </tr> </table>	S1 T'STAT	FURNACE TERM. STRIP	OUTDOOR UNIT	(W2) --- (W2)	(DS)		(W1) --- (W1)	(W2)		(R) --- (R) --- *	(R)	(R)	(G) --- (G)	(G)		(C) --- (C) --- (C)	(C)	(C)	(Y2) --- (Y2) --- (Y2)	(Y2)	(Y2)	(Y1) --- (Y1) --- (Y1)	(Y1)	(Y1)		(O)				
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2 Heat / 2 Cool with t'stat with humidity control	OFF	<p>CUT ON-BOARD LINK W915 2 STAGE COMPR</p> <p>CUT ON-BOARD LINK W914 DEHUM OR HARMONY</p>	<table border="0"> <tr> <td>S1 T'STAT</td> <td>FURNACE TERM. STRIP</td> <td>OUTDOOR UNIT</td> </tr> <tr> <td>(DS) --- (DS)</td> <td>(DS)</td> <td></td> </tr> <tr> <td>(W2) --- (W2)</td> <td>(W2)</td> <td></td> </tr> <tr> <td>(W1) --- (W1)</td> <td>(W1)</td> <td></td> </tr> <tr> <td>(R) --- (R) --- *</td> <td>(R)</td> <td>(R)</td> </tr> <tr> <td>(G) --- (G)</td> <td>(G)</td> <td></td> </tr> <tr> <td>(C) --- (C) --- (C)</td> <td>(C)</td> <td>(C)</td> </tr> <tr> <td>(Y2) --- (Y2) --- (Y2)</td> <td>(Y2)</td> <td>(Y2)</td> </tr> <tr> <td>(Y1) --- (Y1) --- (Y1)</td> <td>(Y1)</td> <td>(Y1)</td> </tr> <tr> <td></td> <td>(O)</td> <td></td> </tr> </table>	S1 T'STAT	FURNACE TERM. STRIP	OUTDOOR UNIT	(DS) --- (DS)	(DS)		(W2) --- (W2)	(W2)		(W1) --- (W1)	(W1)		(R) --- (R) --- *	(R)	(R)	(G) --- (G)	(G)		(C) --- (C) --- (C)	(C)	(C)	(Y2) --- (Y2) --- (Y2)	(Y2)	(Y2)	(Y1) --- (Y1) --- (Y1)	(Y1)	(Y1)		(O)	
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2 Heat / 1 Cool	OFF	<p>DO NOT CUT ANY ON-BOARD LINKS</p>	<table border="0"> <tr> <td>S1 T'STAT</td> <td>FURNACE TERM. STRIP</td> <td>OUTDOOR UNIT</td> </tr> <tr> <td>(W2) --- (W2)</td> <td>(DS)</td> <td></td> </tr> <tr> <td>(W1) --- (W1)</td> <td>(W2)</td> <td></td> </tr> <tr> <td>(R) --- (R) --- *</td> <td>(R)</td> <td>(R)</td> </tr> <tr> <td>(G) --- (G)</td> <td>(G)</td> <td></td> </tr> <tr> <td>(C) --- (C) --- (C)</td> <td>(C)</td> <td>(C)</td> </tr> <tr> <td>(Y2) --- (Y2)</td> <td>(Y2)</td> <td></td> </tr> <tr> <td>(Y) --- (Y1) --- (Y1)</td> <td>(Y1)</td> <td>(Y1)</td> </tr> <tr> <td></td> <td>(O)</td> <td></td> </tr> </table>	S1 T'STAT	FURNACE TERM. STRIP	OUTDOOR UNIT	(W2) --- (W2)	(DS)		(W1) --- (W1)	(W2)		(R) --- (R) --- *	(R)	(R)	(G) --- (G)	(G)		(C) --- (C) --- (C)	(C)	(C)	(Y2) --- (Y2)	(Y2)		(Y) --- (Y1) --- (Y1)	(Y1)	(Y1)		(O)				
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	(O)																																

\* Not required on all units.

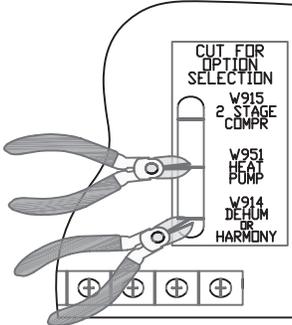
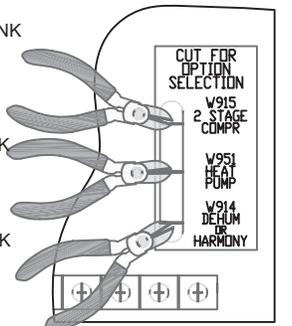
**TABLE 28**  
**EL296 Field Wiring Applications (Continued)**

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\* Connect W1 to W1 ONLY if using defrost tempering kit 67M41

NOTE - **Do NOT** make a wire connection between the room thermostat L terminal and the L terminal of the furnace integrated control.

**TABLE 28**  
**EL296 Field Wiring Applications (Continued)**

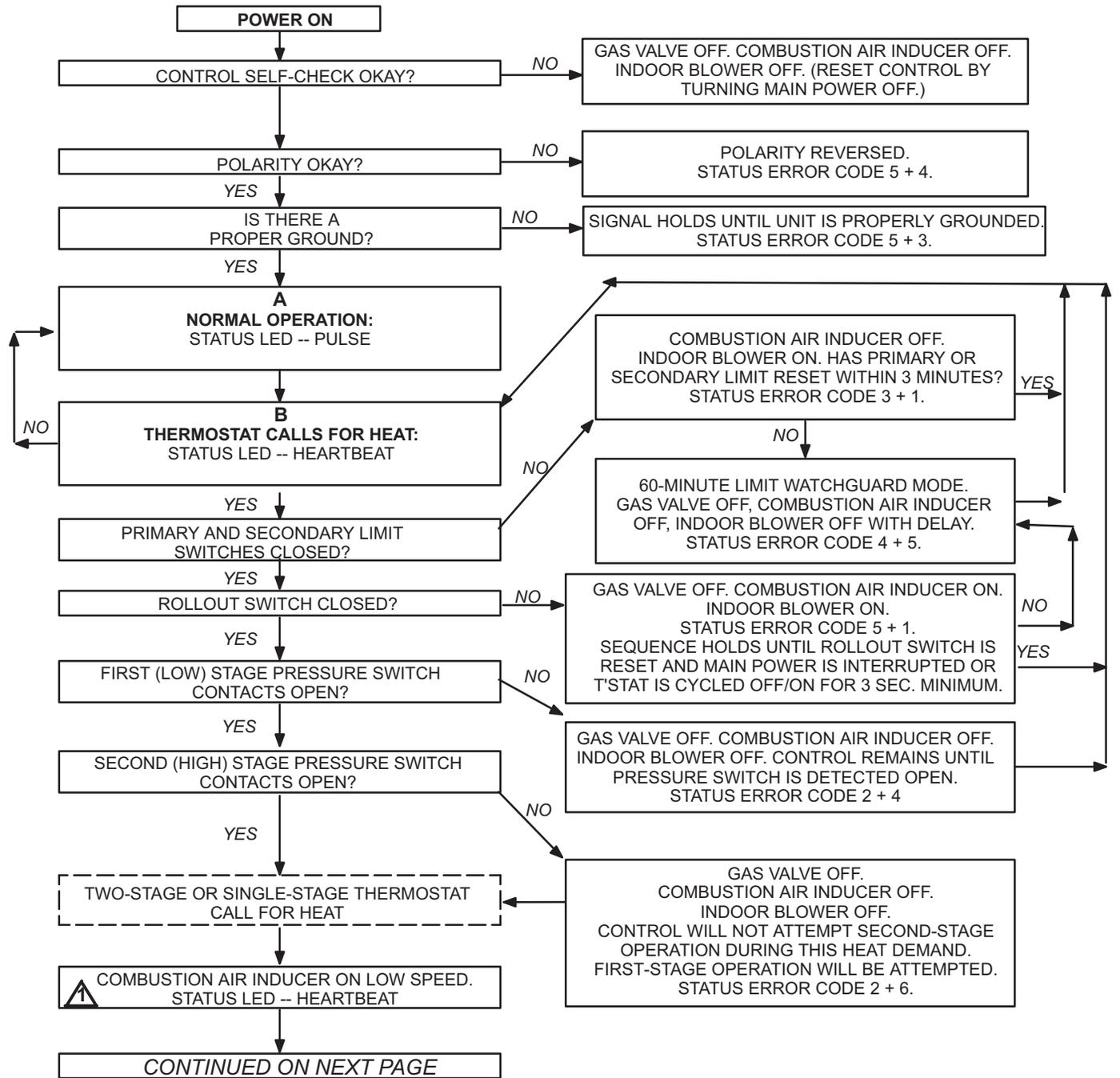
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\* Connect W1 to W1 ONLY if using defrost tempering kit 67M41

NOTE - **Do NOT** make a wire connection between the room thermostat L terminal and the L terminal of the furnace integrated control.

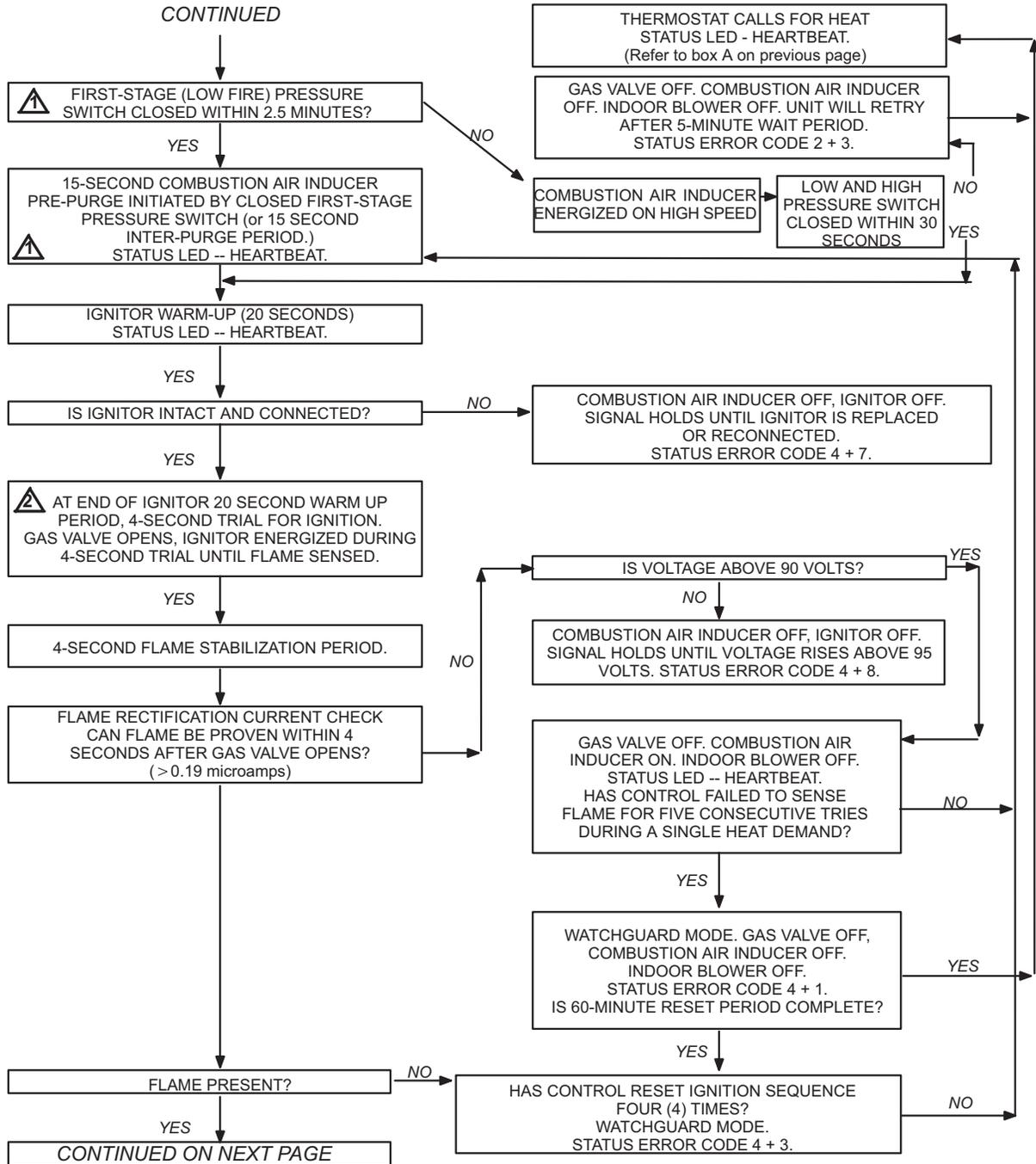
IX- Troubleshooting

**HEATING SEQUENCE OF OPERATION  
NORMAL AND ABNORMAL HEATING MODE**



**⚠** If the furnace is operating on continuous fan mode (terminals "R" and "G" are energized), the combustion air inducer will energize on high speed, the gas valve will energize on second-stage heat and the furnace will operate on high fire. Furnace will stay on high fire 60 seconds then switch to low fire.

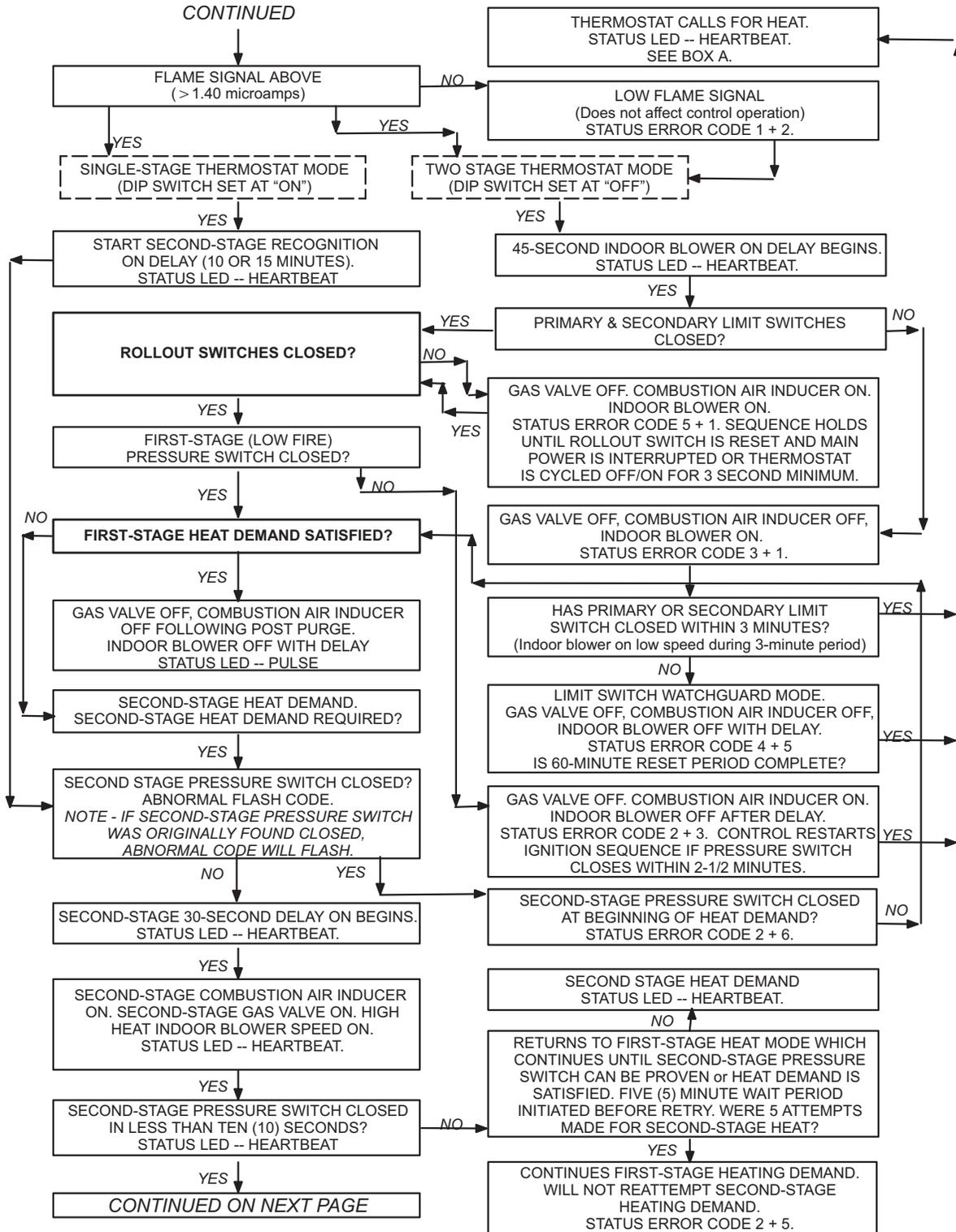
## HEATING SEQUENCE OF OPERATION



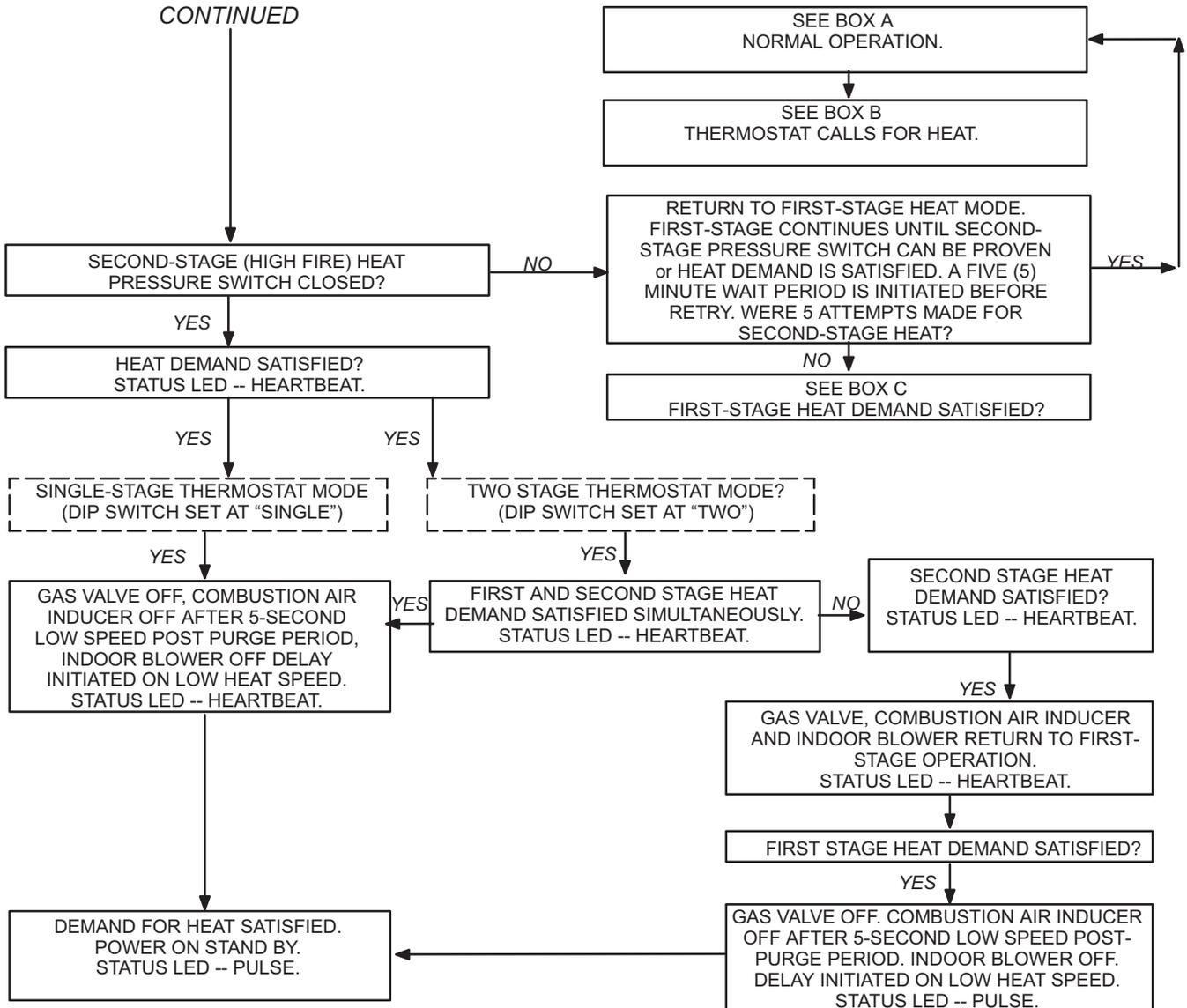
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**⚠** If combustion air inducer is operating on high speed and gas valve is energized on second-stage heat, 20 seconds after flame is sensed furnace will switch to low fire.

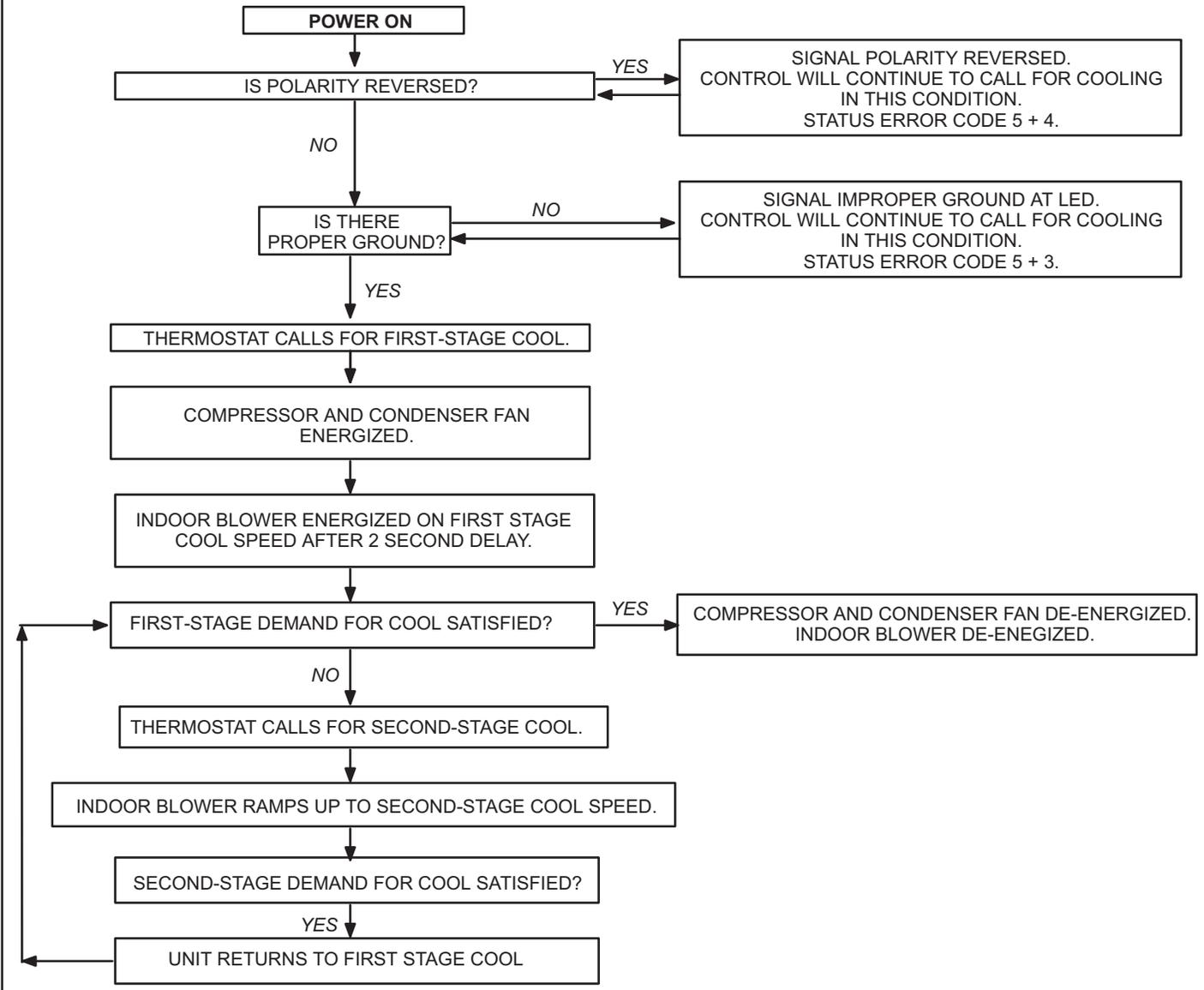
## HEATING SEQUENCE OF OPERATION



## HEATING SEQUENCE OF OPERATION



## COOLING SEQUENCE OF OPERATION



## CONTINUOUS LOW SPEED FAN SEQUENCE OF OPERATION

