ML193UH SERIES UNITS

ML193UH series units are high-efficiency gas furnaces manufactured with Lennox DuralokPlus™ aluminized steel clamshell-type heat exchangers, with a stainless steel condensing coil. ML193UH units are available in heating input capacities of 44,000 to 132,000 Btuh (13 to 38.6 kW) and cooling applications from 2 through 5 tons (7.0 through 17.6 kW). Refer to Engineering Handbook for proper sizing.

Units are factory equipped for use with natural gas. A kit is available for conversion to LPG operation. All ML193UH units are equipped with a hot surface ignition system. The gas valve is redundant to assure safety shut-off as required by C.S.A.

The heat exchanger, burners and manifold assembly can be removed for inspection and service. The maintenance section gives a detailed description on how this is done.

All specifications 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.

⚠WARNING

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

Table of Contents

Specifications 2
Optional Accessories 3
Blower Performance Data 4
I-Unit Components 7
II Placement and Installation 14
III-Start-Up 35
IV-Heating System Service Checks 36
V-Typical Operating Conditions 38
VI-Maintenance 39
VII-Sequence of Operation and Flow Charts 41
VIII-Integrated Control Troubleshooting 46

⚠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 installer (or equivalent), service agency or the gas supplier.

⚠ WARNING

Sharp edges.
Be careful when servicing unit to avoid sharp edges which may result in personal injury.

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SPECIFICATIONS

	Model No.	ML193UH045P36B	ML193UH070P24B	ML193UH070P36B	ML193UH090P36C
Gas Heating Performance	[1] AFUE	93%	93%	93%	93%
	Input - Btuh	44,000	66,000	66,000	88,000
	Output - Btuh	42,000	62,000	62,000	83,000
	Temperature rise range - °F	25 - 55	50 - 80	40 - 70	50 - 80
	Gas Manifold Pressure (in. w.g.) Nat. Gas / LPG/Propane	3.5 / 10.0	3.5 / 10.0	3.5 / 10.0	3.5 / 10.0
	High static - in. w.g.	0.50	0.50	0.50	0.50
Connections in.	Intake / Exhaust Pipe (PVC)	2 / 2	2 / 2	2 / 2	2 / 2
	Gas pipe size IPS	1/2	1/2	1/2	1/2
	Condensate Drain Trap (PVC pipe) - i.d.	1/2	1/2	1/2	1/2
	with field supplied (PVC coupling) - o.d.	3/4	3/4	3/4	3/4
Indoor Blower	Wheel nom. dia. x width - in.	10 x 8	10 x 8	10 x 8	10 x 8
	Motor output - hp	1/3	1/5	1/3	1/3
	Tons of add-on cooling	2.5 - 3	1.5 - 2	2.5 - 3	2 - 3
	Air Volume Range - cfm	700 - 1600	390 - 1140	660 - 1615	695 - 1620
Electrical Data	Voltage	120 volts - 60 hertz - 1 phase			
	Blower motor full load amps	6.1	3.1	6.1	6.1
	Maximum overcurrent protection	15	15	15	15
Shipping Data	lbs. - 1 package	122	125	127	143

NOTE - Filters and provisions for mounting are not furnished and must be field provided.
[1] Annual Fuel Utilization Efficiency based on DOE test procedures and according to FTC labeling regulations. Isolated combustion system rating for non-weatherized furnaces.

SPECIFICATIONS

	Model No.	ML193UH090P48C	ML193UH110P48C	ML193UH110P60C	ML193UH135P60D
Gas Heating Performance	[1] AFUE	93%	93%	93%	93%
	Input - Btuh	88,000	110,000	110,000	132,000
	Output - Btuh	83,000	103,000	103,000	123,000
	Temperature rise range - °F	40 - 70	50 - 80	40 - 70	45 - 75
	Gas Manifold Pressure (in. w.g.) Nat. Gas / LPG/Propane	3.5 / 10.0	3.5 / 10.0	3.5 / 10.0	3.5 / 10.0
	High static - in. w.g.	0.50	0.50	0.50	0.50
Connections in.	Intake / Exhaust Pipe (PVC)	2 / 2	2 / 2	2 / 2	2 / 2
	Gas pipe size IPS	1/2	1/2	1/2	1/2
	Condensate Drain Trap (PVC pipe) - i.d.	1/2	1/2	1/2	1/2
	with field supplied (PVC coupling) - o.d.	3/4	3/4	3/4	3/4
Indoor Blower	Wheel nom. dia. x width - in.	10 x 10	10 x 10	11 ½ x 10	11 ½ x 10
	Motor output - hp	1/2	1/2	1	1
	Tons of add-on cooling	3 - 4	3 - 4	4 - 5	4 - 5
	Air Volume Range - cfm	900 - 2025	850 - 2030	1210 - 2525	1340 - 2800
Electrical Data	Voltage	120 volts - 60 hertz - 1 phase			
	Blower motor full load amps	8.2	8.2	11.5	11.5
	Maximum overcurrent protection	15	15	15	15
Shipping Data	lbs. - 1 package	146	155	161	178

NOTE - Filters and provisions for mounting are not furnished and must be field provided.
[1] 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 - MUST BE ORDERED EXTRA

			"B" Width Models	"C" Width Models	"D" Width Models
CABINET ACCESSORIES					
Horizontal Suspension Kit - Horizontal only			**51W10**	**51W10**	**51W10**
Return Air Base - Upflow only			**50W98**	**50W99**	**51W00**
CONDENSATE DRAIN KITS					
Condensate Drain Heat Cable		6 ft.	**26K68**	**26K68**	**26K68**
		24 ft.	**26K69**	**26K69**	**26K69**
		50 ft.	**26K70**	**26K70**	**26K70**
Heat Cable Tape	Fiberglass - 1/2 in. x 66 ft.		**36G53**	**36G53**	**36G53**
	Aluminum foil - 2 in. x 60 ft.		**16P89**	**16P89**	**16P89**
Crawl Space Vent Drain Kit			**51W18**	**51W18**	**51W18**
CONTROLS					
Twinning Kit			**65W80**	**65W80**	**65W80**
FILTER KITS					
[1] **Air Filter and Rack Kit**	Horizontal (end)	Size of filter - in.	**87L96** - 18 x 25 x 1	**87L97** - 20 x 25 x 1	**87L98** - 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
NIGHT SERVICE KITS					
Night Service Kit			**51W03**	**51W03**	**51W03**
TERMINATION KITS					
See Installation Instructions for specific venting information.					
Termination Kits - Direct Vent Applications Only	Concentric	US - 2 in.	**71M80**	**69M29**	**- - -**
		3 in.	**- - -**	**60L46**	**60L46**
		Canada - 2 in.	**44W92**	**44W92**	**- - -**
		3 in.	**- - -**	**44W93**	**44W93**
	Flush-Mount	2, 2-1/2 or 3 in.	**51W11**	**51W11**	**51W11**
	Wall - Close Couple	US - 2 in.	**22G44**	**- - -**	**- - -**
		3 in.	**44J40**	**44J40**	**44J40**
	Wall - Close Couple WTK	Canada - 2 in.	**30G28**	**- - -**	**- - -**
		3 in.	**81J20**	**81J20**	**81J20**
Termination Kits - Direct or Non-Direct vent	Roof	2 in.	**15F75**	**15F75**	**- - -**
	Wall Ring Kit	2 in.	**15F74**	[3] **15F74**	**- - -**
Roof Termination Flashing Kit - Direct or Non-Direct Vent (2 flashings)		2 in.	**44J41**	**44J41**	**44J41**

[1] Cleanable polyurethane frame type filter.

[2] Kits contain enough parts for two, non−direct vent installations.

[3] Non−direct vent only.

NOTE - Termination Kits **44W92**, **44W93**, **30G28**, **81J20** are certified to ULC S636 standard for use in Canada only.

GAS HEAT ACCESSORIES

Input	High Altitude Pressure Switch Kit		Natural Gas to LPG/Propane Kit	LPG/Propane to Natural Gas Kit	Natural Gas High Altitude Orifice Kit
	4501 - 7500 ft.	**7501 - 10,000 ft.**	**0 - 7500 ft.**	**0 - 7500 ft.**	**7501- 10,000 ft.**
all models	**74W90**	**74W91**	**69W73**	**73W81**	**73W37**

INSTALLATION CLEARANCES - INCHES (MM)

Sides	[1] 0 inches (0 mm)
Rear	0 inches (0 mm)
Top/Plenum	1 inch (25 mm)
Front	0 inches (0 mm)
Front (service/alcove)	24 inches (610 mm)
Floor	[2] Combustible

NOTE − Air for combustion must conform to the methods outlined in the National Fuel Gas Code (NFPA 54/ANSI−Z223.1) or the National Standard of Canada CAN/CSA−B149.1 Natural Gas and Propane Installation Code".

NOTE − In the U.S. flue sizing must conform to the methods outlined in the current National Fuel Gas Code (NFPA 54/ANSI−Z223.1) or applicable provisions of local building codes. In Canada flue sizing must conform to the methods outlined in National Standard of Canada CAN/CSA−B149.1.

[1] Allow proper clearances to accommodate condensate trap and vent pipe installation.

[2] Do not install the furnace directly on carpeting, tile, or other combustible materials other than wood flooring.

BLOWER DATA

ML193UH045P36B PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds							
	High		Medium-High		Medium-Low		Low	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	1600	700	1370	590	1160	475	1005	400
0.10	1600	685	1355	565	1155	465	1015	390
0.20	1550	650	1330	540	1150	445	1000	380
0.30	1480	625	1295	515	1140	430	975	365
0.40	1425	590	1280	490	1105	415	975	350
0.50	1355	565	1190	460	1085	395	940	335
0.60	1320	545	1165	435	1030	375	900	315
0.70	1225	500	1110	425	975	355	855	310
0.80	1135	480	1050	395	920	330	780	280
0.90	1025	445	950	360	800	295	700	255

ML193UH090P36C PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds							
	High		Medium-High		Medium-Low		Low	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	1620	745	1340	620	1130	500	965	405
0.10	1610	720	1335	595	1135	490	975	395
0.20	1565	695	1335	565	1145	465	970	385
0.30	1525	665	1300	555	1135	455	970	370
0.40	1485	635	1295	520	1110	435	960	355
0.50	1431	600	1260	495	1090	405	940	345
0.60	1365	570	1210	475	1035	390	900	330
0.70	1295	535	1155	445	995	365	860	305
0.80	1200	505	1065	415	930	340	745	270
0.90	1060	460	955	375	820	305	695	260

ML193UH070P24B PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds							
	High		Medium-High		Medium-Low		Low	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	1140	455	920	365	765	295	710	265
0.10	1135	445	900	360	765	290	690	255
0.20	1125	430	895	350	755	285	680	255
0.30	1090	415	870	340	725	280	660	250
0.40	1065	405	870	325	715	270	635	245
0.50	1020	390	825	315	675	260	605	235
0.60	945	365	780	300	640	250	555	225
0.70	910	350	740	295	585	240	505	220
0.80	790	325	670	275	510	225	455	205
0.90	735	310	575	255	460	220	390	195

ML193UH090P48C PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds							
	High		Medium-High		Medium-Low		Low	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	2025	900	1690	780	1395	645	1200	540
0.10	1995	880	1705	760	1390	635	1205	525
0.20	1925	835	1675	715	1405	605	1205	505
0.30	1850	795	1640	680	1400	580	1170	490
0.40	1790	760	1575	645	1395	560	1170	475
0.50	1700	725	1540	625	1350	535	1140	450
0.60	1610	690	1455	580	1295	505	1100	430
0.70	1540	645	1365	550	1225	480	1030	405
0.80	1415	615	1265	510	1125	445	980	385
0.90	1270	565	1165	470	1060	420	900	350

ML193UH070P36B PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds							
	High		Medium-High		Medium-Low		Low	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	1615	680	1355	570	1140	480	1030	400
0.10	1565	660	1365	545	1150	465	1020	385
0.20	1535	630	1340	525	1150	440	1025	375
0.30	1440	600	1300	500	1110	420	1000	350
0.40	1405	570	1255	470	1075	400	975	345
0.50	1340	535	1200	445	1045	380	945	330
0.60	1255	500	1125	420	995	355	875	310
0.70	1165	475	1080	395	935	335	820	290
0.80	1060	455	990	365	870	315	750	265
0.90	955	425	895	345	750	285	660	245

ML193UH110P48C PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds							
	High		Medium-High		Medium-Low		Low	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	2030	905	1750	805	1425	665	1225	530
0.10	1950	865	1755	770	1430	630	1215	515
0.20	1935	840	1675	735	1455	610	1230	505
0.30	1885	810	1660	685	1410	585	1200	485
0.40	1830	780	1585	645	1385	570	1190	470
0.50	1750	740	1565	630	1320	535	1165	455
0.60	1660	695	1485	585	1280	505	1105	425
0.70	1540	665	1380	555	1230	485	1060	405
0.80	1420	615	1290	520	1140	445	945	375
0.90	1290	575	1175	470	1045	410	850	350

ML193UH110P60C PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Different Blower Speeds															
	Bottom Return Air, Side Return Air with Optional Return Air Base, Return Air from Both Sides or Return Air from Bottom and One Side.								**Single Side Return Air** − Air volumes in **bold** require field fabricated transition to accommodate 20 x 25 x 1 in. air filter in order to maintain proper air velocity.							
	High		**Medium-High**		**Medium-Low**		**Low**		**High**		**Medium-High**		**Medium-Low**		**Low**	
	cfm	**Watts**	**cfm**	**Watts**	**cfm**	**Watts**	**cfm**	**Watts**	**cfm**	**Watts**	**cfm**	**Watts**	**cfm**	**Watts**	**cfm**	**Watts**
0.00	2525	1560	2175	1165	1820	905	1465	725	**2520**	**1545**	**2135**	**1150**	1750	905	1445	720
0.10	2585	1545	2200	1135	1860	900	1475	710	**2555**	**1545**	**2135**	**1115**	1775	890	1470	715
0.20	2515	1505	2150	1110	1840	890	1490	705	**2465**	**1480**	**2105**	**1085**	1775	875	1465	705
0.30	2445	1445	2135	1065	1790	870	1500	690	**2370**	**1430**	**2045**	**1055**	1750	855	1460	690
0.40	2340	1385	2065	1035	1770	845	1500	675	**2275**	**1375**	**1990**	**1010**	1730	830	1460	680
0.50	2230	1350	1985	985	1755	810	1470	665	**2185**	**1345**	**1930**	**970**	1690	800	1460	655
0.60	2130	1295	1920	950	1685	785	1425	640	**2060**	**1290**	**1850**	**935**	1650	780	1420	635
0.70	2030	1250	1815	905	1640	760	1405	625	**1930**	**1230**	1760	900	1580	750	1355	610
0.80	1920	1190	1735	865	1560	725	1350	605	**1825**	**1180**	1660	855	1505	710	1290	585
0.90	1735	1135	1620	830	1450	685	1270	575	1665	1130	1520	810	1415	675	1210	560

ML193UH135P60D PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Different Blower Speeds															
	Bottom Return Air, Side Return Air with Optional Return Air Base, Return Air from Both Sides or Return Air from Bottom and One Side.								**Single Side Return Air** − Air volumes in **bold** require field fabricated transition to accommodate 20 x 25 x 1 in. air filter in order to maintain proper air velocity.							
	High		**Medium-High**		**Medium-Low**		**Low**		**High**		**Medium-High**		**Medium-Low**		**Low**	
	cfm	**Watts**	**cfm**	**Watts**	**cfm**	**Watts**	**cfm**	**Watts**	**cfm**	**Watts**	**cfm**	**Watts**	**cfm**	**Watts**	**cfm**	**Watts**
0.00	2800	1715	2155	1160	1730	900	1375	695	**2720**	**1685**	**2110**	**1135**	1670	905	1355	705
0.10	2770	1665	2170	1145	1740	895	1415	700	**2660**	**1650**	**2110**	**1115**	1725	895	1390	700
0.20	2690	1635	2150	1110	1770	890	1450	700	**2600**	**1585**	**2125**	**1090**	1750	885	1450	695
0.30	2590	1560	2140	1080	1785	870	1455	695	**2535**	**1525**	**2075**	**1065**	1750	865	1465	685
0.40	2500	1535	2105	1055	1785	855	1475	690	**2400**	**1490**	**2055**	**1030**	1715	845	1460	680
0.50	2420	1465	2050	1025	1770	835	1465	665	**2335**	**1420**	**2000**	**1005**	1725	825	1455	660
0.60	2330	1410	2015	995	1720	810	1460	655	**2270**	**1385**	**1950**	**970**	1720	800	1445	650
0.70	2225	1370	1965	960	1690	785	1450	650	**2175**	**1335**	**1895**	**950**	1665	780	1430	635
0.80	2150	1335	1875	925	1655	755	1435	630	**2075**	**1295**	**1840**	**910**	1605	745	1400	620
0.90	2025	1290	1830	890	1575	720	1375	605	**1975**	**1255**	1755	875	1540	725	1340	590

ML193UH PARTS IDENTIFICATION

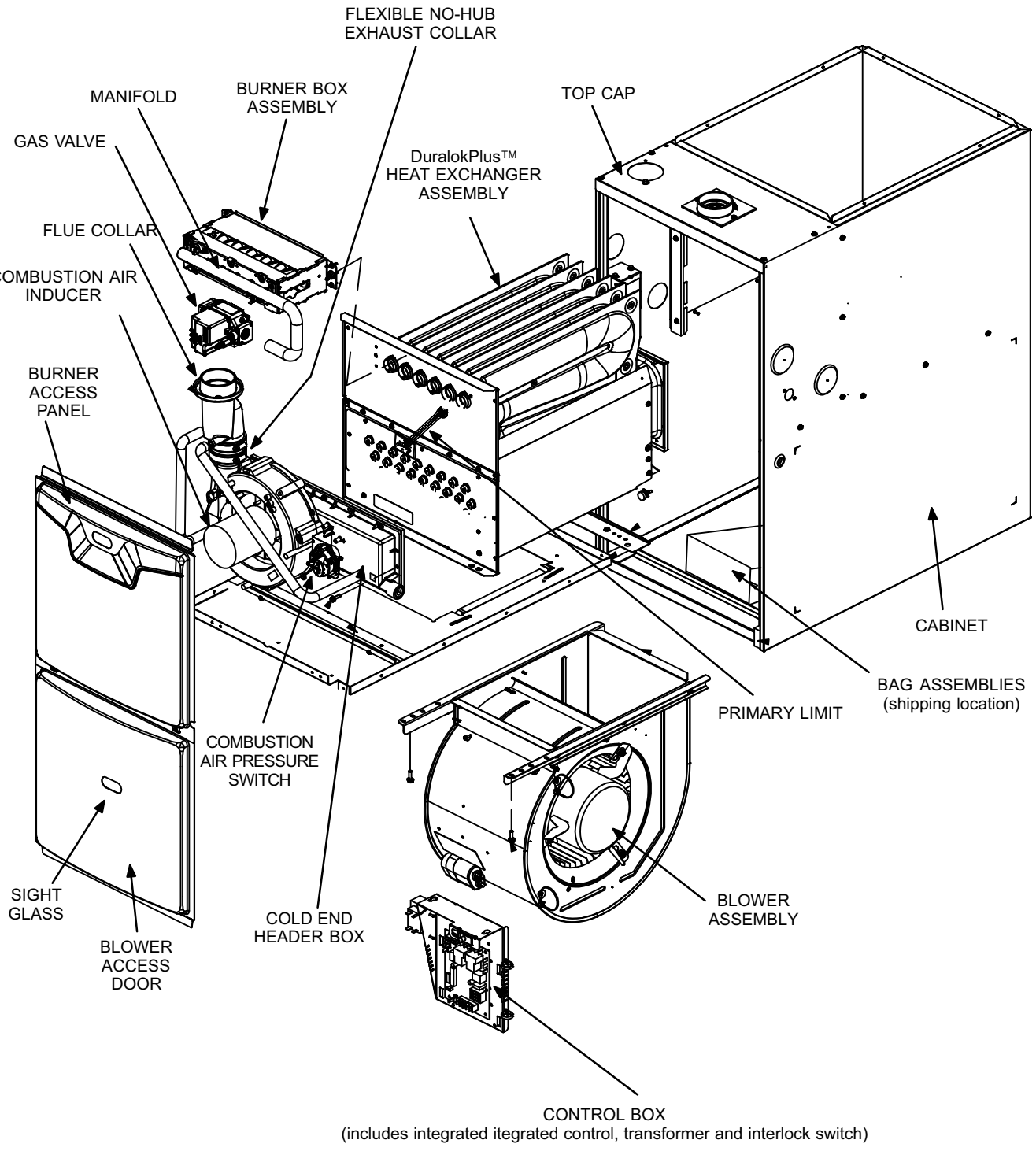


FIGURE 1

I-UNIT COMPONENTS

ML193UH unit components are shown in figure 1. The combustion air inducer, gas valve and burners can be accessed by removing the burner access panel. The blower and control box can be accessed by removing the blower access door.

A-Control Box Components (Figure 2)

Unit transformer (T1) and integrated ignition control (A92) are located in the control box. In addition, a door interlock switch (S51) is located in the control box.

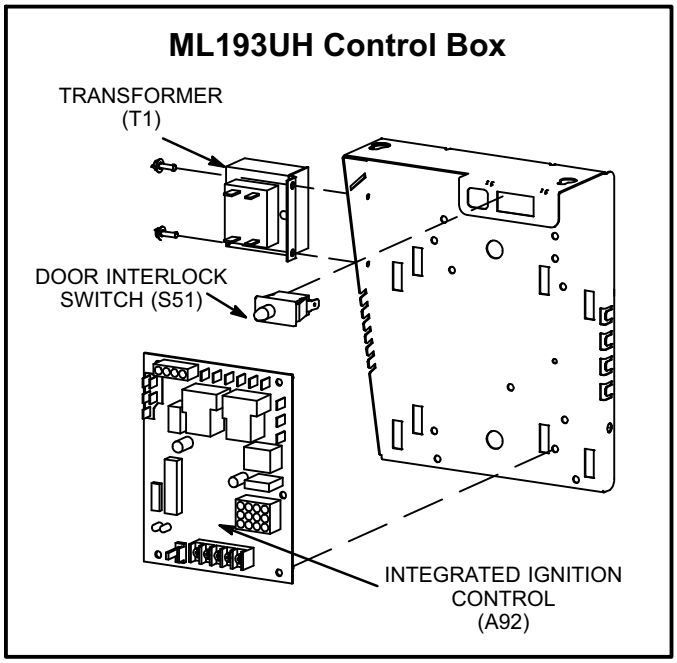


FIGURE 2

1. Transformer (T1)

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

2. Door Interlock Switch (S51)

A door interlock switch rated 14A at 120VAC is located on the control box. The switch is wired in series with line voltage. When the blower door is removed the unit will shut down.

3. Integrated Ignition Control (A92)

⚠ WARNING

Shock hazard.
Disconnect power before servicing. Control is not field repairable. If control is inoperable, simply replace entire control.
Can cause injury or death. Unsafe operation will result if repair is attempted.

The ignition control system consists of an integrated control (figure 4) ignitor (figure 6) and flame sensor (figure 6). The integrated control and ignitor work in combination to ensure furnace ignition and ignitor durability. The integrated control, controls all major furnace operations. The integrated control also features two LED lights (DS1 red and DS2 green) for troubleshooting and two accessory terminals rated at (1) one amp. The integrated control also features a (3) amp fuse for overcurrent protection. Tables 1 and 2 show jack plug terminal designations. See table 3 for troubleshooting diagnostic codes. The mini-nitride ignitor is made from a non-porous, high strength proprietary ceramic material that provides long life and trouble free maintenance. The integrated control continuously monitors line voltage and maintains the ignitor power at a consistent level to provide proper lighting and maximum ignitor life.

TABLE 1

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

TABLE 2

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

Electronic Ignition (See Figure 5)

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

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

The integrated control has an added feature of ignitor power regulation to maintain consistent lighting and longer ignitor life under all line voltage conditions.

Fan Control

The fan on time of 30 seconds is not adjustable. The fan off delay (amount of time that the blower operates after the heat demand has been satisfied) may be adjusted by changing the jumper position across the five pins on the integrated control. The unit is shipped with a factory fan off setting of 90 seconds. The fan off delay affects comfort and is adjustable to satisfy individual applications. Adjust the fan off delay to achieve a supply air temperature between 90° and 110°F at the moment that the blower is de-energized. Longer off delay settings provide lower return air temperatures; shorter settings provide higher return air temperatures. See figure 3.

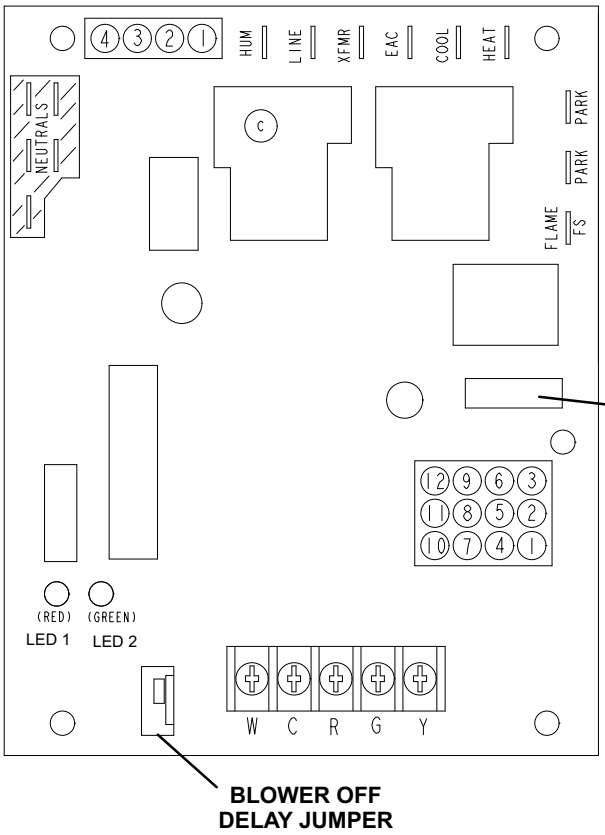
FAN-OFF TIME IN SECONDS

JUMPER POSITION		HEAT OFF DELAY
PIN1	PIN2	60
PIN2	PIN3	90
PIN3	PIN4	120
PIN4	PIN5	180
NO JUMPER		180

To adjust fan-off timing, reposition jumper across pins to achieve desired setting.

FIGURE 3

INTEGRATED CONTROL
(Automatic Hot Surface Ignition System)



TERMINAL DESIGNATIONS	
HUM	Humidifier (120VAC)
LINE	Input (120VAC)
XFMR	Transformer (120VAC)
EAC	Electronic Air Cleaner (120VAC)
COOL	Blower - Cooling Speed (120VAC)
HEAT	Blower - Heating Speed (120VAC)
PARK	Dead terminals to park alternate spd taps
FLAME	Flame sensor
NEUTRALS	Neutral terminals (120VAC)

FIGURE 4

The integrated control is equipped with two LED lights for troubleshooting. The diagnostic codes are listed below in table 3.

TABLE 3

DIAGNOSTIC CODES **Make sure to Identify LED'S Correctly.**		
LED #1 (Red)	**LED #2 (Green)**	**DESCRIPTION**
SIMULTANEOUS SLOW FLASH	SIMULTANEOUS SLOW FLASH	Power on - Normal operation. Also signaled during cooling and continuous fan.
SIMULTANEOUS FAST FLASH	SIMULTANEOUS FAST FLASH	Normal operation - signaled when heating demand initiated at thermostat.
SLOW FLASH	ON	Primary or secondary limit switch open. Limit must close within 3 minutes or unit goes into 1 hour Watchguard.
OFF	SLOW FLASH	Pressure prove switch open. OR: Blocked inlet/exhaust vent; OR: Pressure switch closed prior to activation of combustion air inducer.
ALTERNATING SLOW FLASH	ALTERNATING SLOW FLASH	Watchguard 1 hour -- burners failed to ignite or lost flame 5 times during single heating demand.
SLOW FLASH	OFF	Flame sensed without gas valve energized.
ON	SLOW FLASH	Rollout switch open. OR: 12-pin connector improperly attached.
ON ON OFF	ON OFF ON	Circuit board failure or control wired incorrectly.
FAST FLASH	SLOW FLASH	Main power polarity reversed. Switch line and neutral.
SLOW FLASH	FAST FLASH	Low flame signal. Measures below 1.5 microamps. Replace flame sense rod.
ALTERNATING FAST FLASH	ALTERNATING FAST FLASH	Improper main ground. OR: Line voltage below 90 volts.

NOTE *- Slow flash rate equals 1 Hz (one flash per second). Fast flash rate equals 3 Hz (three flashes per second). Minimum flame sense current = 0.5 microAmps.*

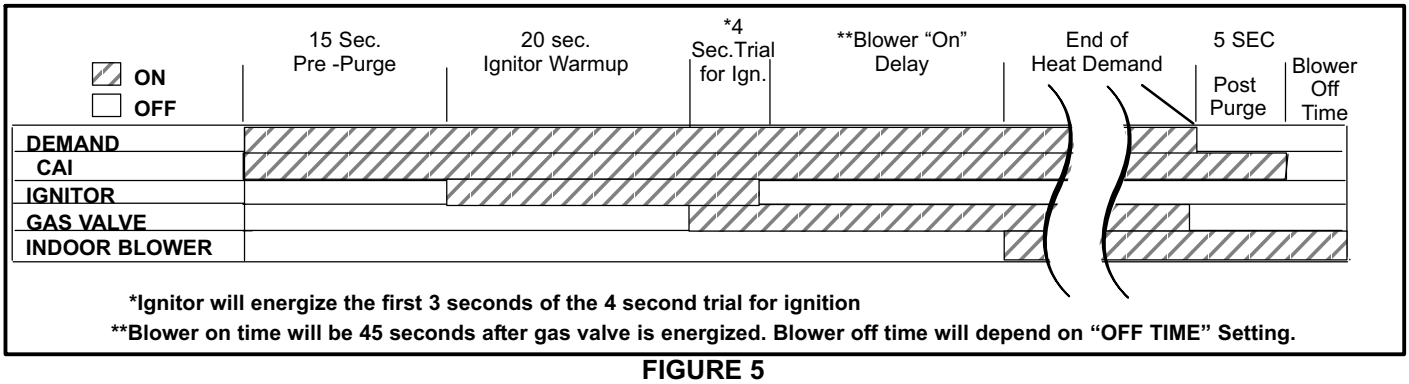


FIGURE 5

B-Heating Components

Combustion air inducer (B6), primary limit control (S10), SureLight ignitor, burners, flame rollout switch (S47), gas valve (GV1), combustion air prove switch (S18), and clam-shell heat exchangers are located in the heating compartment. The heating compartment can be accessed by removing the burner access panel.

1. Ignitor (Figure 6)

ML193UH units use a mini-nitride ignitor made from a proprietary ceramic material. Ignitor longevity is enhanced by controlling the voltage to the ignitor. Due to this feature of the integrated control, voltage cannot be measured. To check ignitor, measure its resistance. A value of 50 to 450 ohms indicates a good ignitor.

2. Flame Sensor (Figure 6)

A flame sensor is located on the left side of the burner support. The sensor is mounted on the front burner box plate and the 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 ignition control allows the gas valve to remain open as long as flame signal is sensed.

NOTE - The ML193UH furnace contains electronic components that are polarity sensitive. Make sure that the furnace is wired correctly and is properly grounded.

3. Flame Rollout Switches (Figure 6)

Flame rollout switches S47 are SPST N.C. high temperature limits located on the top left and bottom right of the front buner box plate. S47 is wired to the burner ignition control A92. When either of the switches sense flame rollout (indicating a blockage in the combustion passages), the flame rollout switch trips, and the ignition control immediately closes the gas valve. Switch S47 in all ML193UH units is factory preset to open at 210°F ± 12°F (99°C ± 6.7°C) on a temperature rise. All flame rollout switches are manual reset.

ML193UH Burner Box Assembly

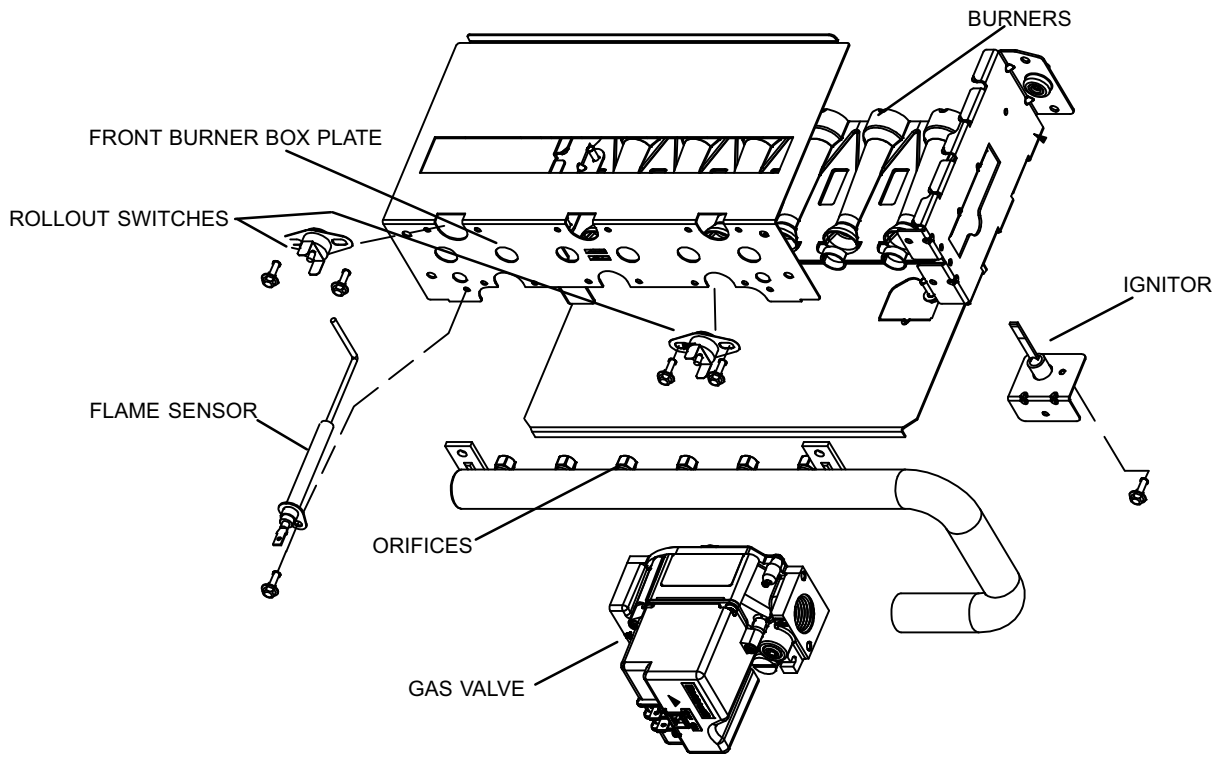


FIGURE 6

4. Primary Limit Control (Figure 7)

Primary limit (S10) used on ML193UH units is located in the heating vestibule panel. When excess heat is sensed in the heat exchanger, the limit will open. Once the limit opens, the furnace control energizes the supply air blower and de-energizes the gas valve. The limit automatically resets when unit temperature returns to normal. The switch is factory set and cannot be adjusted. For limit replacement remove wires from limit terminals, remove mounting screws, rotate limit switch 90 degrees and slowly remove from the vestibule panel. Install replacement limit with same care.

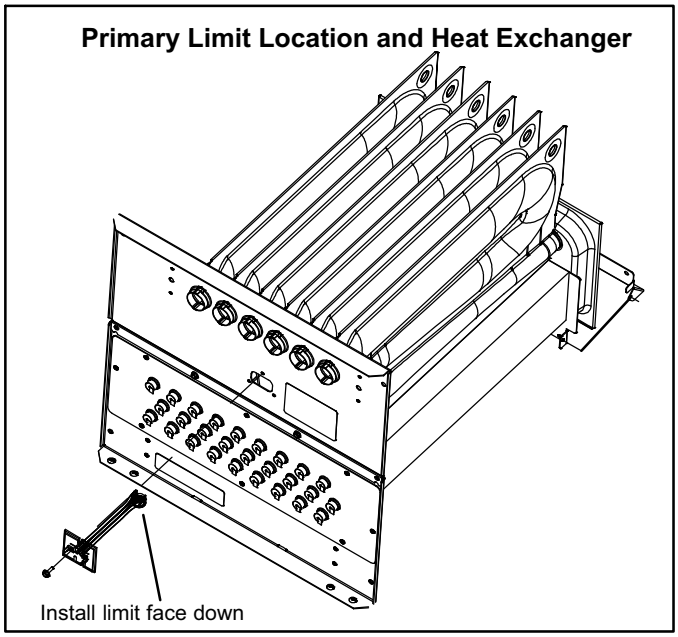


FIGURE 7

5. Heat Exchanger (Figure 7)

ML193UH units use an aluminized steel primary and stainless steel secondary heat exchanger assembly. Heat is transferred to the air stream from all surfaces of the heat exchanger. The shape of the heat exchanger ensures maximum efficiency.

The combustion air inducer pulls fresh air through the burner box. This air is mixed with gas in the burners. The gas / air mixture is then burned at the entrance of each clamshell. Combustion gases are then pulled through the primary and secondary heat exchangers and exhausted out the exhaust vent pipe.

6. Burners (Figure 8)

All units use inshot burners. Burners are factory set and do not require adjustment. Burners can be removed as an assembly for service. Burner maintenance and service is detailed in the MAINTENANCE section of this manual. Each burner uses an orifice which is precisely matched to the burner input. See table 4 for orifice size. The burner is supported by the orifice and will easily slide off for service. A flame retention ring in the end of each burner maintains correct flame length and shape and keeps the flame from lifting off the burner head.

TABLE 4
Gas Orifice Size

Unit	Fuel	Orifice Size
All	Natural	0.0625
All	L.P./Propane	0.0340

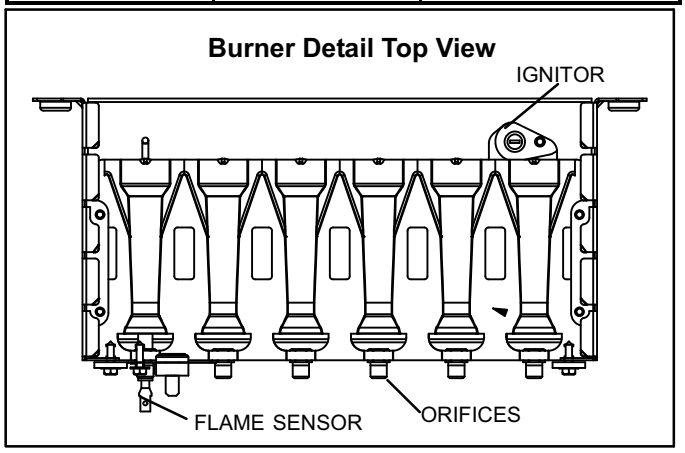


FIGURE 8

7. Gas Valve (GV1)

The ML193UH uses an internally redundant valve to assure safety shut-off. If the gas valve must be replaced, the same type valve must be used.

24VAC terminals and gas control switch are located on top of the valve. All terminals on the gas valve are connected to wires from the ignition control. 24V applied to the terminals opens the valve.

Inlet and outlet pressure taps are located on the valve. A manifold adjustment screw is also located on the valve. An LPG changeover kit is available.

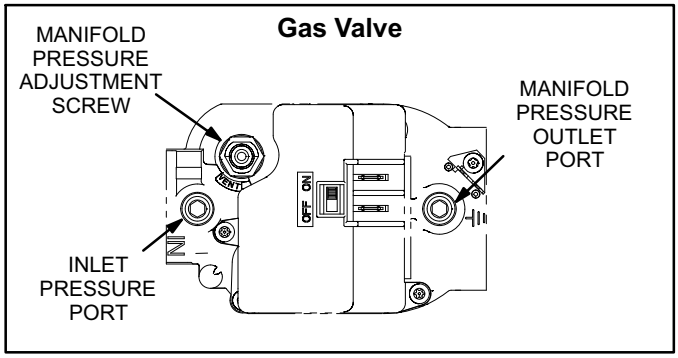


FIGURE 9

8. Combustion Air Inducer (B6) & Cold End Header Box

All ML193UH units use a combustion air inducer to move air through the burners and heat exchanger during heating operation. The blower uses a shaded pole 120VAC motor. The motor operates during all heating operation and is controlled by integrated control A3. Blower operates continuously while there is a call for heat. The integrated control will not proceed with the ignition sequence until combustion air inducer operation is sensed by the proving switches.

The combustion air inducer is installed on the cold end header box. 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 across the combustion air inducer 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.**

TABLE 5

ML193UH Unit	Combustion Air Inducer Orifice Size
-045	0.563
-070	0.844
-090	1.00
-110	1.22
-135	1.30

9. Combustion Air Pressure Switch (Figure 10)

ML193UH series units are equipped with a differential pressure switch located on the cold end header box. The switch monitors across the combustion air inducer orifice to insure proper flow through the heat exchanger.

The switch is a SPST N.O. prove switch electrically connected to the integrated control. The purpose of the switch is to prevent burner operation if the combustion air inducer is not moving enough air for proper combustion.

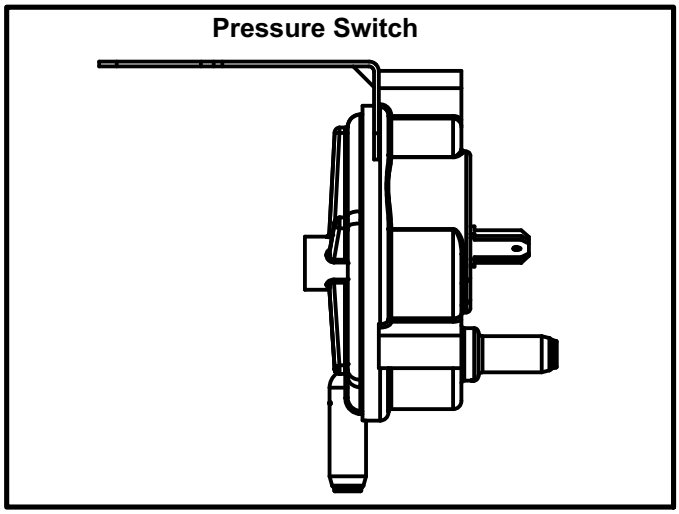


FIGURE 10

On start-up, the switch monitors whether the combustion air inducer is operating. It closes a circuit to the integrated control when the difference in pressure across the combustion air inducer orifice exceeds a non-adjustable factory setting. If the switch does not successfully sense the required differential, the switch cannot close and the furnace cannot operate. If the flue or air inlet become obstructed during operation, the switch senses a loss of pressure differential and opens the circuit to the integrated control. If the condensate line is blocked, water will back up into the header box and reduce the pressure differential across the switch. The prove switch opens if the differential drops below the set point. See table 6.

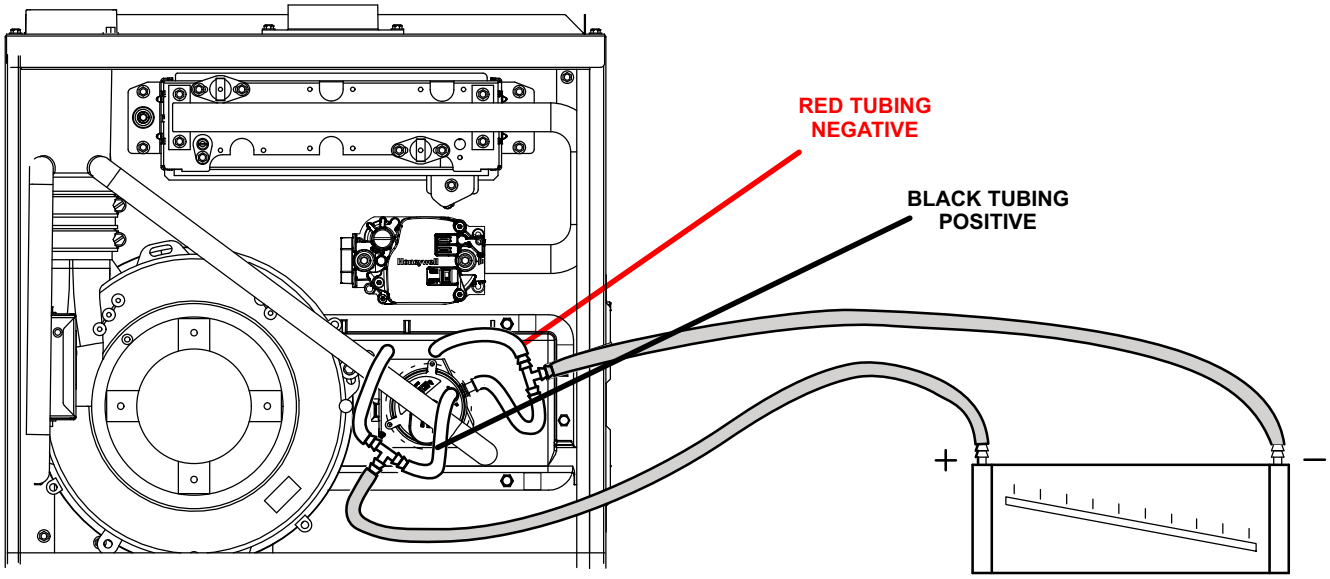
Checks of pressure differential can aid in troubleshooting. When measuring the pressure differential, readings should be taken at the pressure switch. See figure 11. Lack of differential usually indicates problems in the intake or exhaust piping, but may indicate problems in the heat exchanger, condensing coil, header boxes, combustion inducer or other components.

TABLE 6

Unit	Altitude ft.		
	0 - 4500	4501 - 7500	7501 - 10000
	Set Point "w.c.	Set Point "w.c	Set Point "w.c.
-045	-0.65	-0.60	-0.055
-070			
-090			
-110			
-135			

**Set point is factory set and non-adjustable*

Measuring Pressure Differential



1 - Remove thermostat demand and allow unit to cycle off.

2 - Install a tee in the negative (-) line (red tubing) and a tee in the positive (+) line (black tubing) running from the pressure switch to the cold end header box.

3 - Install a manometer with hose from the negative (-) side of the manometer to the tee installed in the negative (-) line and with hose from the positive (+) side of the manometer to the tee in the positive (+) line.

NOTE - Both sides of the cold end header box are negative. However the (+) port reads less negative pressure than the (-) port.

4 - Operate unit and observe manometer reading. *Readings will change as heat exchanger warms.*
a. Take one reading immediately after start-up.
b. Take a second reading after unit has reached steady state (approximately 5 minutes). This will be the pressure differential.
The pressure differential should be greater than those listed in table 6.

5 - Remove thermostat demand and allow to cycle off.

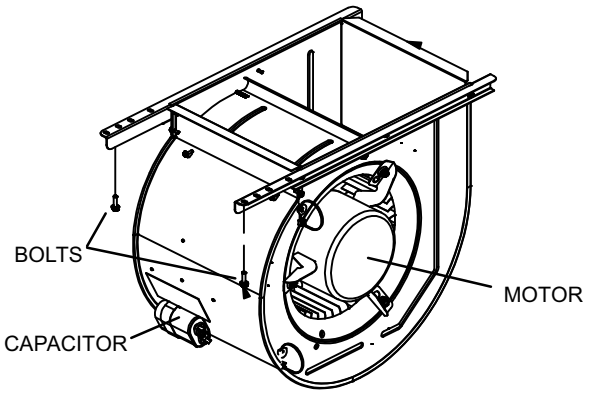
6 - Remove manometer and tee's. Reinstall combustion air sensing hoses to the pressure switch.

FIGURE 11

C- Blower Compartment

Blower motor (B3) and capacitor (C4), are located in the blower compartment. The blower compartment can be accessed by removing the blower access panel.

Blower Motor Housing



To Remove Blower From Unit: Disconnect Power, Remove Control Box, Remove Bolts and Unplug Motor Wires From Control. Then Slide Out Front of Unit.

FIGURE 12

1. Blower Motor (B3) and Capacitor (C4)

All ML193UH units use single-phase direct-drive blower motors. All motors are 120V permanent split capacitor motors to ensure maximum efficiency. See SPECIFICATIONS table at the front of this manual for more detail. See motor nameplate for capacitor ratings.

II-PLACEMENT AND INSTALLATION

Combustion, Dilution & Ventilation Air

If the ML193UH is installed as a Non-Direct Vent Furnace, follow the guidelines in this section.

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

In the past, there was no problem in bringing in sufficient outdoor air for combustion. Infiltration provided all the air that was needed. In today's homes, tight construction practices make it necessary to bring in air from outside for combustion. Take into account that exhaust fans, appliance vents, chimneys, and fireplaces force additional air that could be used for combustion out of the house. Unless outside air is brought into the house for combustion, negative pressure (outside pressure is greater than inside pressure) will build to the point that a downdraft can occur in the furnace vent pipe or chimney. As a result, combustion gases enter the living space creating a potentially dangerous situation.

In the absence of local codes concerning air for combustion and ventilation, use the guidelines and procedures in this section to install ML193UH furnaces to ensure efficient and safe operation. You must consider combustion air needs and requirements for exhaust vents and gas piping. A portion of this information has been reprinted with permission from the National Fuel Gas Code (ANSI-Z223.1/NFPA 54). This reprinted material is not the complete and official position of the ANSI on the referenced subject, which is represented only by the standard in its entirety.

In Canada, refer to the CSA B149 installation codes.

⚠ CAUTION

Do not install the furnace in a corrosive or contaminated atmosphere. Meet all combustion and ventilation air requirements, as well as all local codes.

All gas-fired appliances require air for the combustion process. If sufficient combustion air is not available, the furnace or other appliance will operate inefficiently and unsafely. Enough air must be provided to meet the needs of all fuel-burning appliances and appliances such as exhaust fans which force air out of the house. When fireplaces, exhaust fans, or clothes dryers are used at the same time as the furnace, much more air is required to ensure proper combustion and to prevent a downdraft. Insufficient air causes incomplete combustion which can result in carbon monoxide.

In addition to providing combustion air, fresh outdoor air dilutes contaminants in the indoor air. These contaminants may include bleaches, adhesives, detergents, solvents and other contaminants which can corrode furnace components.

The requirements for providing air for combustion and ventilation depend largely on whether the furnace is installed in an unconfined or a confined space.

Unconfined Space

An unconfined space is an area such as a basement or large equipment room with a volume greater than 50 cubic feet (1.42 m^3) per 1,000 Btu (.29 kW) per hour of the combined input rating of all appliances installed in that space. This space also includes adjacent rooms which are not separated by a door. Though an area may appear to be unconfined, it might be necessary to bring in outdoor air for combustion if the structure does not provide enough air by infiltration. If the furnace is located in a building of tight construction with weather stripping and caulking around the windows and doors, follow the procedures in the Air from Outside section.

Confined Space

A confined space is an area with a volume less than 50 cubic feet (1.42 m^3) per 1,000 Btu (.29 kW) per hour of the combined input rating of all appliances installed in that space. This definition includes furnace closets or small equipment rooms.

When the furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air ***must be*** handled by ducts which are sealed to the furnace casing and which terminate outside the space containing the furnace. This is especially important when the furnace is mounted on a platform in a confined space such as a closet or small equipment room. Even a small leak around the base of the unit at the platform or at the return air duct connection can cause a potentially dangerous negative pressure condition. Air for combustion and ventilation can be brought into the confined space either from inside the building or from outside.

Air from Inside

If the confined space that houses the furnace adjoins a space categorized as unconfined, air can be brought in by providing two permanent openings between the two spaces. Each opening must have a minimum free area of 1 square inch (645 mm^2) per 1,000 Btu (.29 kW) per hour of total input rating of all gas-fired equipment in the confined space. Each opening must be at least 100 square inches (64516 mm^2). One opening shall be within 12 inches (305 mm) of the top of the enclosure and one opening within 12 inches (305 mm) of the bottom. See figure 13.

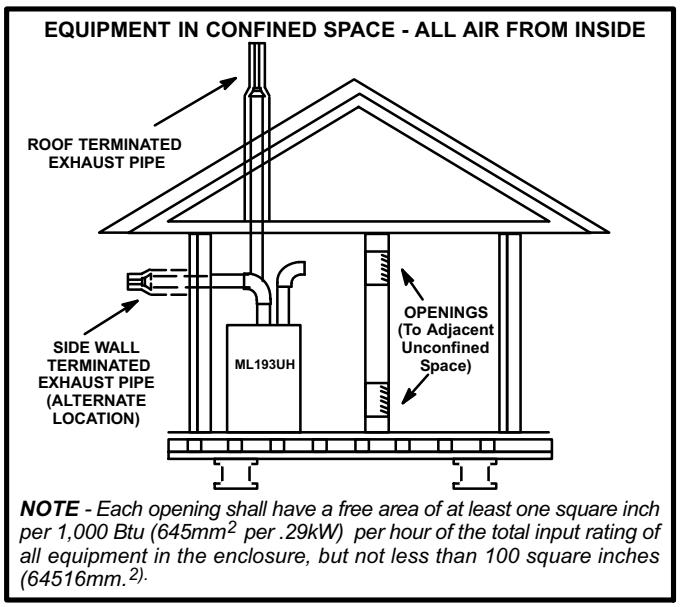


FIGURE 13

Air from Outside

If air from outside is brought in for combustion and ventilation, the confined space shall be provided with two permanent openings. One opening shall be within 12” (305mm) of the top of the enclosure and one within 12” (305mm) of the bottom. These openings must communicate directly or by ducts with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors or indirectly through vertical ducts. Each opening shall have a minimum free area of 1 square inch per 4,000 Btu (645mm^2 per 1.17kW) per hour of total input rating of all equipment in the enclosure. When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 square inch per 2,000 Btu (645mm^2 per .59kW) per total input rating of all equipment in the enclosure (See figure 14).

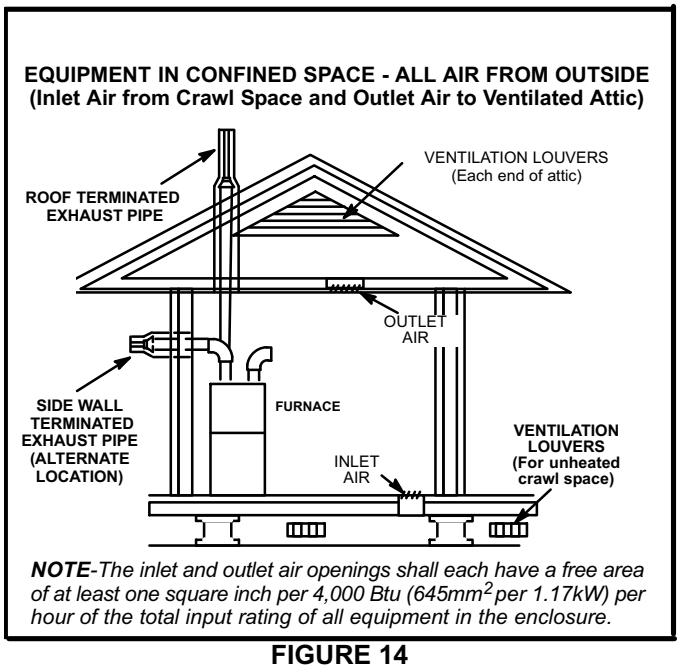


FIGURE 14

If air from outside is brought in for combustion and ventilation, the confined space must have two permanent openings. One opening shall be within 12 inches (305 mm) of the top of the enclosure and one opening within 12 inches (305 mm) of the bottom. These openings must communicate directly or by ducts with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors or indirectly through vertical ducts. Each opening shall have a minimum free area of 1 square inch (645 mm^2) per 4,000 Btu (1.17 kW) per hour of total input rating of all equipment in the enclosure. See figures 14 and 15. When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 square inch (645 mm^2) per 2,000 Btu (.56 kW) per total input rating of all equipment in the enclosure. See figure 16.

When ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall be no less than 3 inches (75 mm). In calculating free area, the blocking effect of louvers, grilles, or screens must be considered. If the design and free area of protective covering is not known for calculating the size opening required, it may be assumed that wood louvers will have 20 to 25 percent free area and metal louvers and grilles will have 60 to 75 percent free area. Louvers and grilles must be fixed in the open position or interlocked with the equipment so that they are opened automatically during equipment operation.

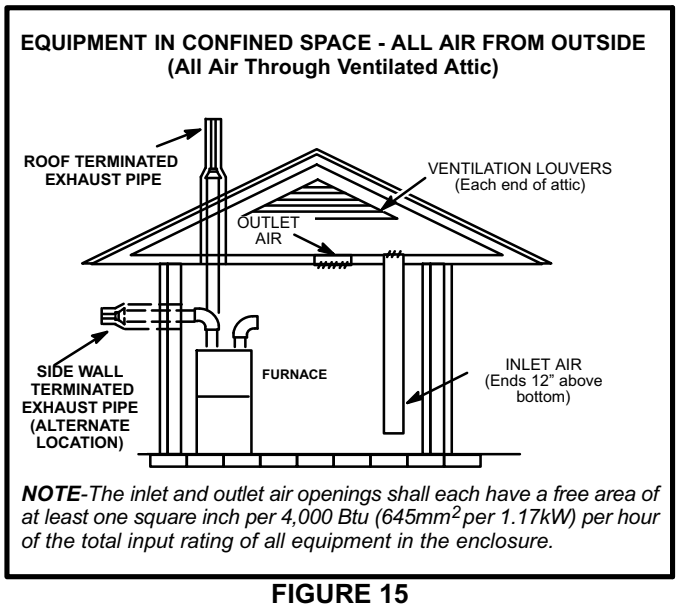
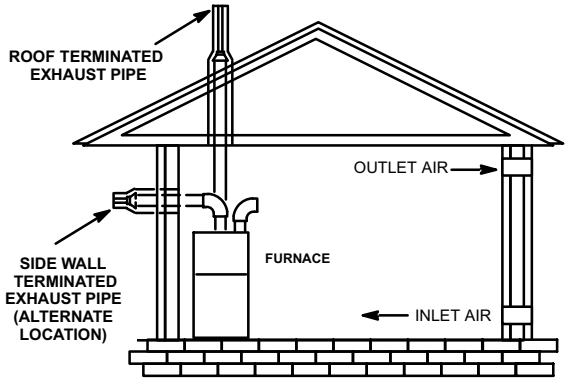


FIGURE 15



***NOTE**-Each air duct opening shall have a free area of at least one square inch per 2,000 Btu (645mm^2 per .59kW) per hour of the total input rating of all equipment in the enclosure. If the equipment room is located against an outside wall and the air openings communicate directly with the outdoors, each opening shall have a free area of at least 1 square inch per 4,000 Btu (645mm^2 per 1.17kW) per hour of the total input rating of all other equipment in the enclosure.*

FIGURE 16

Pipe & Fittings Specifications

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 7 below for approved piping and fitting materials.

⚠ IMPORTANT

ML193UH exhaust and intake connections are made of PVC. Use PVC primer and solvent cement when using PVC vent pipe. When using ABS vent pipe, use transitional solvent cement to make connections to the PVC fittings in the unit.

⚠ 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 7. 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.

TABLE 7
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
PRIMER & SOLVENT CEMENT	**ASTM SPECIFICATION**
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	D3138
CANADA PIPE & FITTING & SOLVENT CEMENT	**MARKING**
PVC & CPVC Pipe and Fittings	ULCS636
PVC & CPVC Solvent Cement	
ABS to PVC or CPVC Transition Cement	

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. When bonding the vent system to the furnace, use ULC S636 approved One-Step Transition Cement to bond the pipe to the flue collar, or to bond the 90° elbow or reducing 90° elbow to the flue collar. In addition, the first three feet of vent pipe from the furnace flue collar must be accessible for inspection.*

TABLE 8
OUTDOOR TERMINATION KITS USAGE

ML193 UNIT	VENT PIPE DIA. (in.)	STANDARD						CONCENTRIC		
		Outdoor Exhaust Accelerator (Dia. X Length)	Outdoor Exhaust Accelerator (Dia. X Length)	2" Wall Plate Kit	3" Wall Plate Kit	2" Wall Ring Kit	Flush-Mount Kit	1-1/2" Concentric Kit	2" Concentric Kit	3" Concentric Kit
		1-1/2" X 12"	2" X 12"	22G44 or 30G28†	44J40 or 81J20†	15F74	51W11**	71M80 or †44W92††	69M29 or †44W92††	60L46 or 44W93†
045	2	YES		YES	YES*	YES	YES	YES		
	2-1/2	YES		YES	YES*	YES	YES	YES		
	3	YES		YES	YES*	YES	YES	YES		
070	2	YES		YES	YES*	YES	YES	YES		
	2-1/2	YES		YES	YES*	YES	YES	YES		
	3	YES		YES	YES*	YES	YES	YES		
090	2		YES		YES	YES	YES		YES	YES
	2-1/2		YES		YES	YES	YES		YES	YES
	3		YES		YES	YES	YES		YES	YES
110	2		YES		YES	YES	YES		YES	YES
	2-1/2		YES		YES	YES	YES		YES	YES
	3		YES		YES	YES	YES		YES	YES
135	3		YES				YES			YES

**Requires field-provided and installed 1-1/2" exhaust accelerator.*
*** Kit 51W11 is provided with a 1-1/2" accelerator which must be used for all ML193UH-045, -070 and -090 installations.*
† Termination kits 44W92, 44W93, 30G28 and 81J20 approved for use in Canadian installations to meet CSAB149.
†† The 44W92 Concentric kit is provided with a 1-1/2" accelerator which must be installed on the exhaust outlet when this kit is used with the ML193UH045P36B, ML193UH070P24B and ML193UH070P36B furnaces.

Joint Cementing Procedure

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

⚠ 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.

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.

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.

***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.

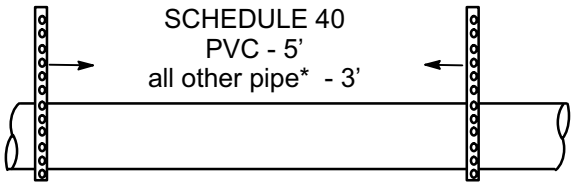
***NOTE** - Assembly should be completed within 20 seconds after last application of cement. Hammer blows should not be used when inserting pipe.*

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

Piping Suspension Guidelines



** See table 7 for allowable pipe.*

***NOTE** - Isolate piping at the point where it exits the outside wall or roof in order to prevent transmission of vibration to the structure.*

Wall Thickness Guidelines

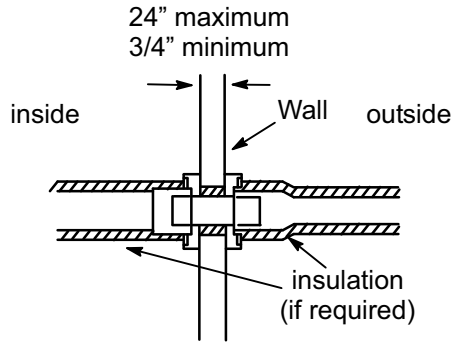
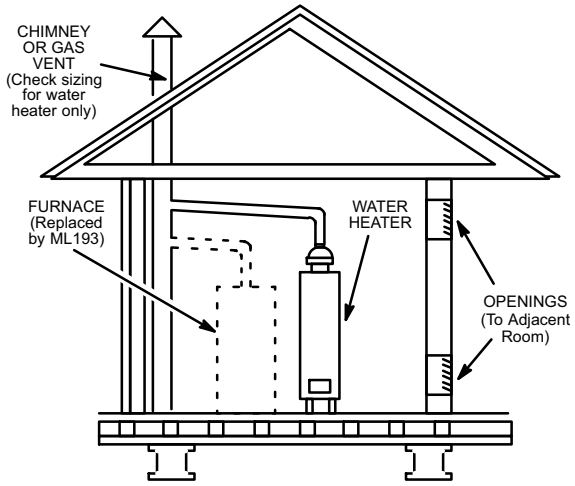


FIGURE 17

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.

REPLACING FURNACE THAT WAS PART OF A COMMON VENT SYSTEM



If an ML193UH furnace replaces a furnace which was commonly vented with another gas appliance, the size of the existing vent pipe for that gas appliance must be checked. Without the heat of the original furnace flue products, the existing vent pipe is probably oversized for the single water heater or other appliance. The vent should be checked for proper draw with the remaining appliance.

FIGURE 18

Exhaust Piping (Figures 21 and 22)

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

The ML193UH can be installed as either a Non-Direct Vent or a Direct Vent gas central furnace.

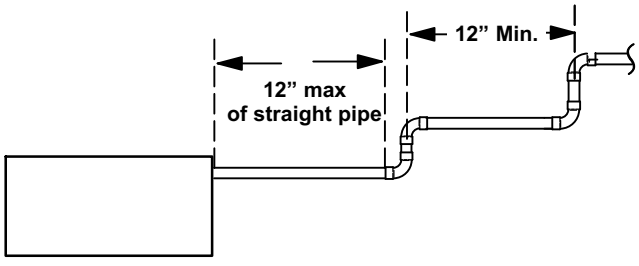
NOTE *- In Non-Direct Vent installations, combustion air is taken from indoors and flue gases are discharged outdoors. In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged outdoors.*

Intake and exhaust pipe sizing -- Size pipe according to tables 9 and 10. Table 9 lists the *minimum* vent pipe lengths permitted. Table 10 lists the *maximum* pipe lengths permitted.

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 11.

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. When vent pipe which is larger than 2" must be used in an upflow application, a transition must be applied at the exhaust collar in order to properly step to the larger diameter vent pipe. Contact the Application Department for more information concerning sizing of vent systems which include multiple pipe sizes.*



Horizontal Application

NOTE - *All horizontal runs of exhaust pipe must slope back toward unit. A minimum of 1/4" (6mm) drop for each 12" (305mm) of horizontal run is mandatory for drainage.*

NOTE *- Exhaust pipe MUST be glued to furnace exhaust fittings.*

NOTE *- Exhaust piping should be checked carefully to make sure there are no sags or low spots.*

FIGURE 19

TABLE 9
MINIMUM VENT PIPE LENGTHS

ML193UH MODEL	MIN. VENT LENGTH*
045, 070, 090, 110	15 ft. or 5 ft plus 2 elbows or 10 ft plus 1 elbow
135**	

**Any approved termination may be added to the minimum length listed.*

***ML193UH135P60D must have 3" to 2" reducing ell (supplied or field replacement Canadian kit) installed directly into unit flue collar.*

Use the following steps to correctly size vent pipe diameter.

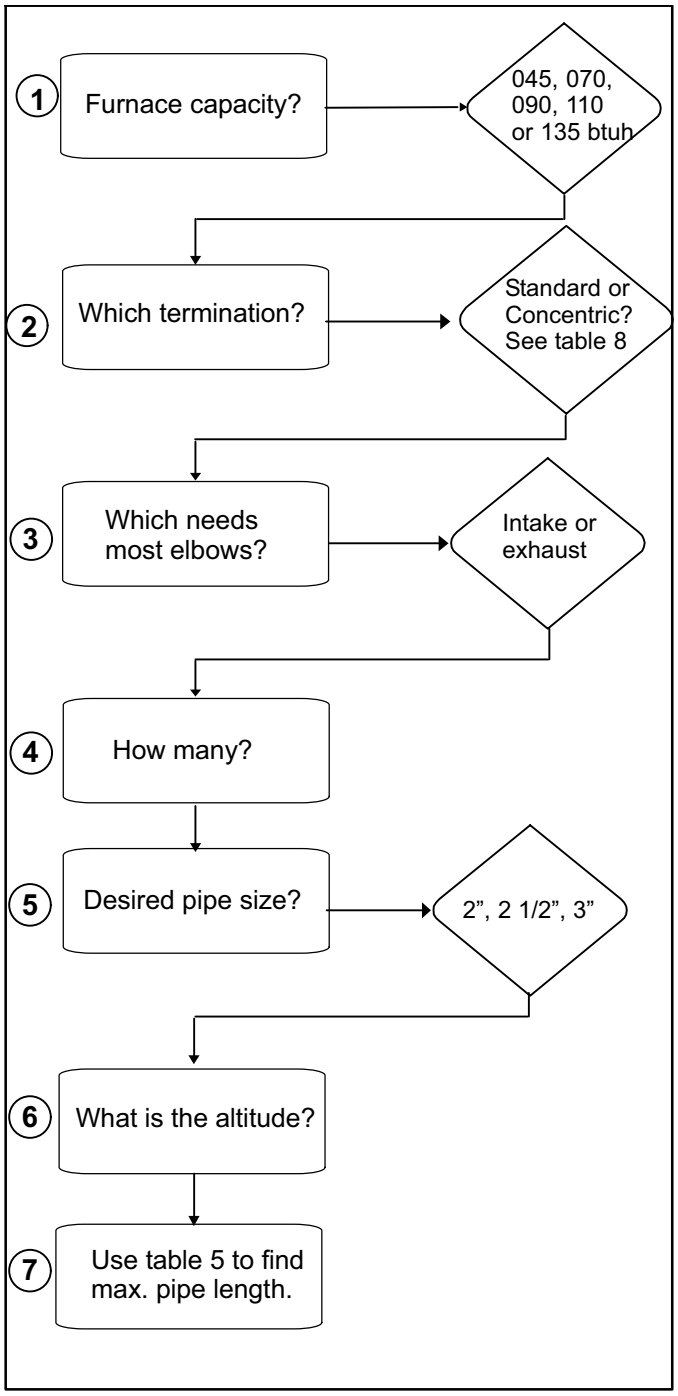


FIGURE 20

⚠ 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 10
Maximum Allowable Vent Length in Feet

Standard Termination at Elevation 0 - 10,000 ft.																
Number Of 90° Ebows Used	Pipe Size	2”					2-1/2”					3”				
	Model	045	070	090	110	135	045	070	090	110	135	045	070	090	110	135
	1	81	66	44	24	n/a	115	100	68	43	n/a	137	137	118	118	114
	2	76	61	39	19		110	95	63	38		132	132	113	113	109
	3	71	56	34	14		105	90	58	33		127	127	108	108	104
	4	66	51	29	n/a		100	85	53	28		122	122	103	103	99
	5	61	46	24			95	80	48	23		117	117	98	98	94
	6	56	41	19			90	75	43	18		112	112	93	93	89
	7	51	36	14			85	70	38	13		107	107	88	88	84
	8	46	31	n/a			80	65	33	n/a		102	102	83	83	79
	9	41	26				75	60	28			97	97	78	78	74
	10	36	21				70	55	23			92	92	73	73	69
Concentric Termination Elevation 0 - 10,000 ft.																
Number Of 90° Ebows Used	Pipe Size	2”					2-1/2”					3”				
	Model	045	070	090	110	135	045	070	090	110	135	045	070	090	110	135
	1	73	58	42	22	n/a	105	90	64	39	n/a	121	121	114	114	105
	2	68	53	37	17		100	85	59	34		116	116	109	109	100
	3	63	48	32	12		95	80	54	29		111	111	104	104	95
	4	58	43	27	n/a		90	75	49	24		106	106	99	99	90
	5	53	38	22			85	70	44	19		101	101	94	94	85
	6	48	33	17			80	65	39	14		96	96	89	89	80
	7	43	28	12			75	60	34	n/a		91	91	84	84	75
	8	38	23	n/a			70	55	29			86	86	79	79	70
	9	33	18				65	50	24			81	81	74	74	65
	10	28	13				60	45	19			76	76	69	69	60

TYPICAL *EXHAUST* PIPE CONNECTIONS AND CONDENSATE TRAP INSTALLATION IN UPFLOW DIRECT OR NON-DIRECT VENT APPLICATIONS

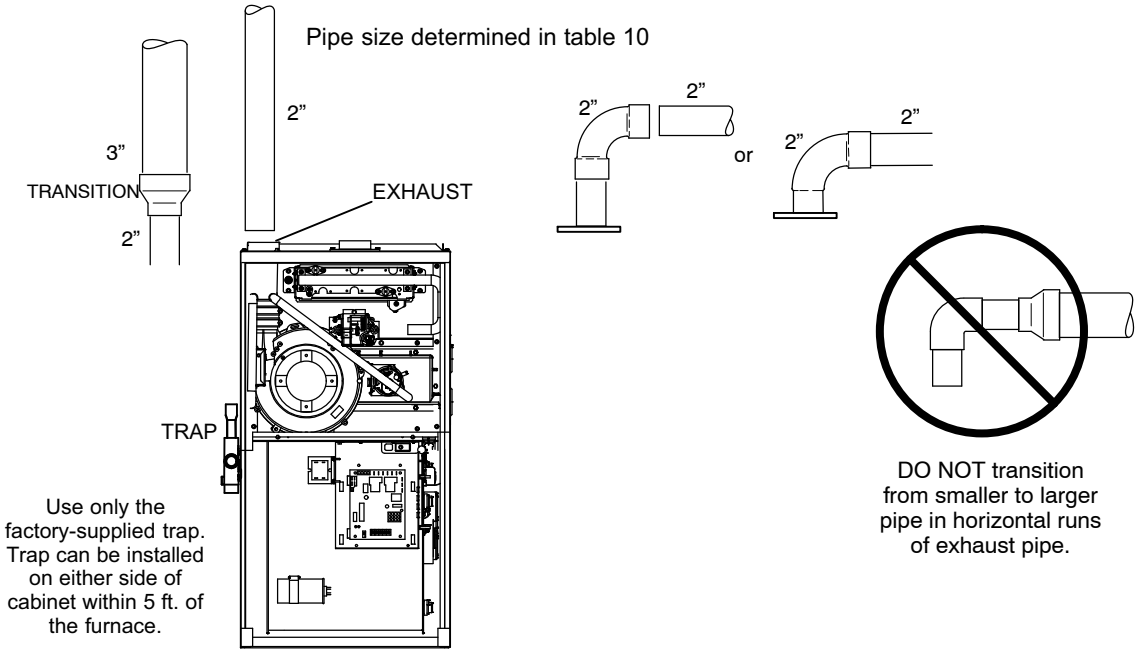


FIGURE 21

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

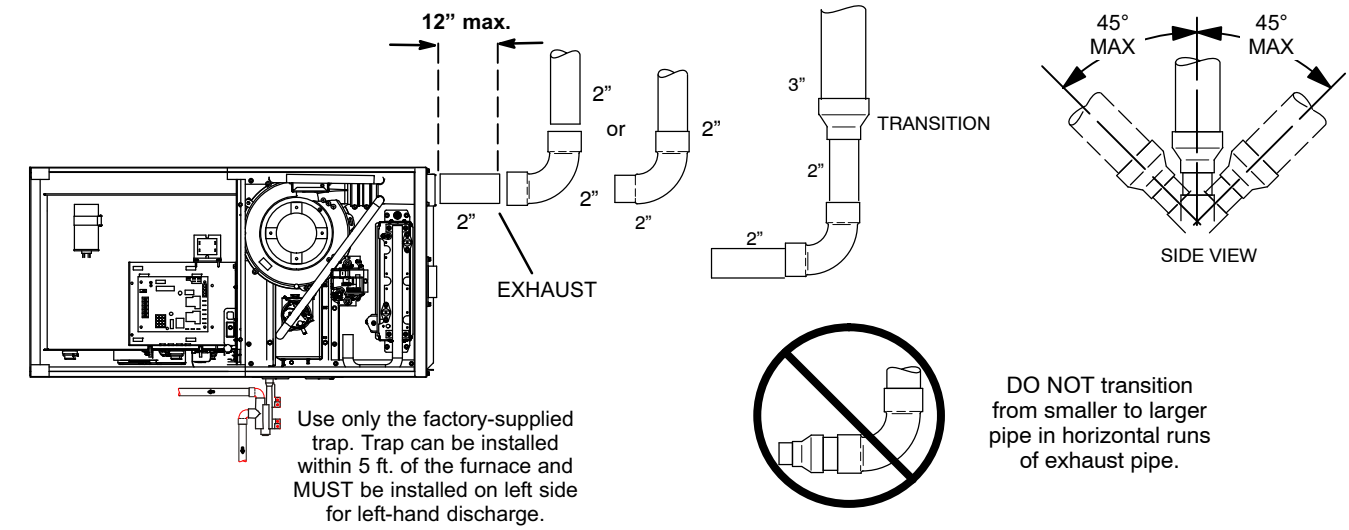


FIGURE 22

TYPICAL AIR *INTAKE* PIPE CONNECTIONS IN UPFLOW DIRECT VENT APPLICATIONS

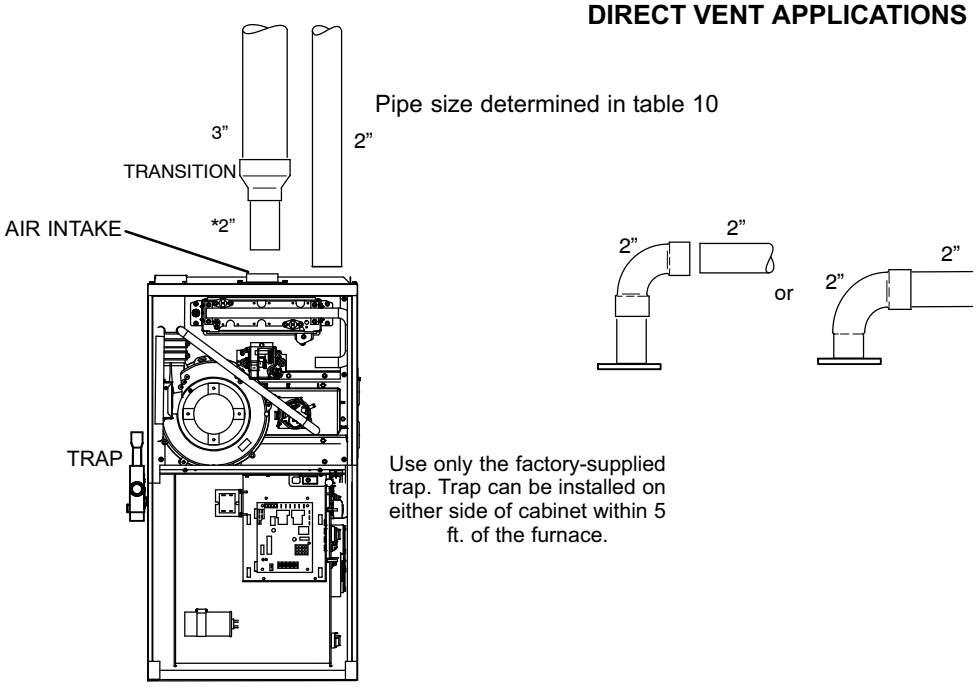


FIGURE 23

TYPICAL AIR *INTAKE* PIPE CONNECTIONS IN HORIZONTAL DIRECT VENT APPLICATIONS
(RIGHT HAND DISCHARGE SHOWN)

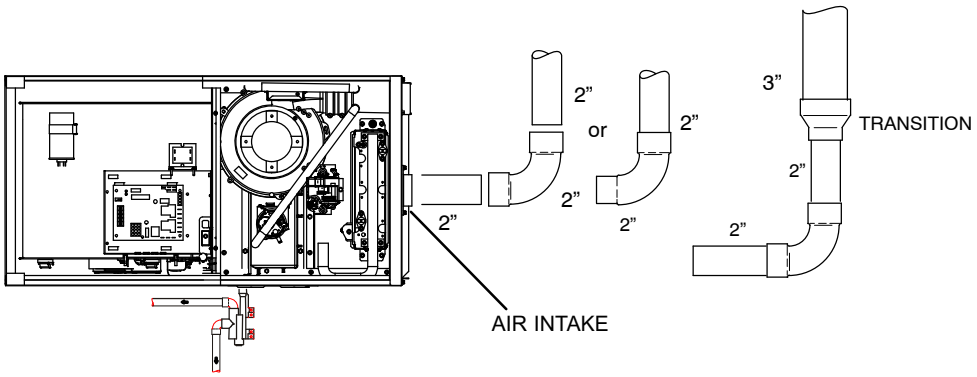


FIGURE 24

Intake Piping

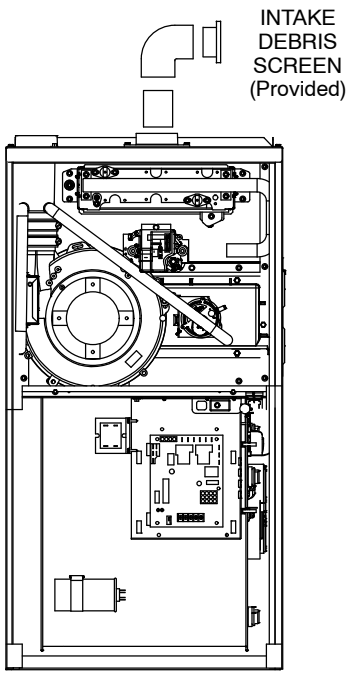
The ML193UH furnace may be installed in either **direct vent** or **non-direct vent** applications. In non-direct vent applications, when intake air will be drawn into the furnace from the surrounding space, the indoor air quality must be considered and guidelines listed in Combustion, Dilution and Ventilation 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 guide lines for piping terminations and intake and exhaust piping terminations for direct vent sections. Refer to table 10 for pipe sizes.

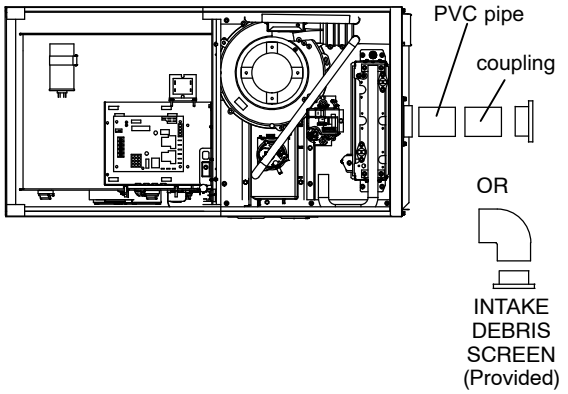
TYPICAL AIR INTAKE PIPE CONNECTIONS
UPFLOW NON–DIRECT
VENT APPLICATIONS



NOTE *- Debris screen and elbow may be rotated, so that screen may be positioned to face forward or to either side.*

FIGURE 25

TYPICAL AIR INTAKE PIPE CONNECTIONS
HORIZONTAL NON–DIRECT VENT APPLICATIONS
(Horizontal Right–Hand Air Discharge Application Shown)



NOTE *- Debris screen may be positioned straight out (preferred) or with an elbow rotated to face down.*

FIGURE 26

Follow the next two steps when installing the unit in **Non-Direct Vent applications** where combustion air is taken from indoors 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 25 or 26. 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 - Use a sheet metal screw to secure the intake pipe to the connector, if desired.

General Guidelines for Vent Terminations

In Non-Direct Vent applications, combustion air is taken from indoors and the flue gases are discharged to the outdoors. The ML193UH 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 ML193UH 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 27 or 28. 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** - If winter design temperature is below 32°F (0°C), exhaust piping should be insulated with 1/2" (13mm), Armaflex or equivalent when run through unheated space. Do not leave any surface area of exhaust pipe open to outside air; exterior 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 on outside runs of exhaust pipe must be painted or wrapped to protect insulation from deterioration. Exhaust pipe insulation may not be necessary in some specific applications.*

***NOTE** - During extremely cold temperatures, below approximately 20°F (6.7°C), units with long runs of vent pipe through unconditioned space, even when insulated, may form ice in the exhaust termination that prevents the unit from operating properly. Longer run times of at least 5 minutes will alleviate most icing problems. Also, a heating cable may be installed on exhaust piping and termination to prevent freeze-ups. Heating cable installation kit is available from Lennox. See Condensate Piping section for part numbers.*

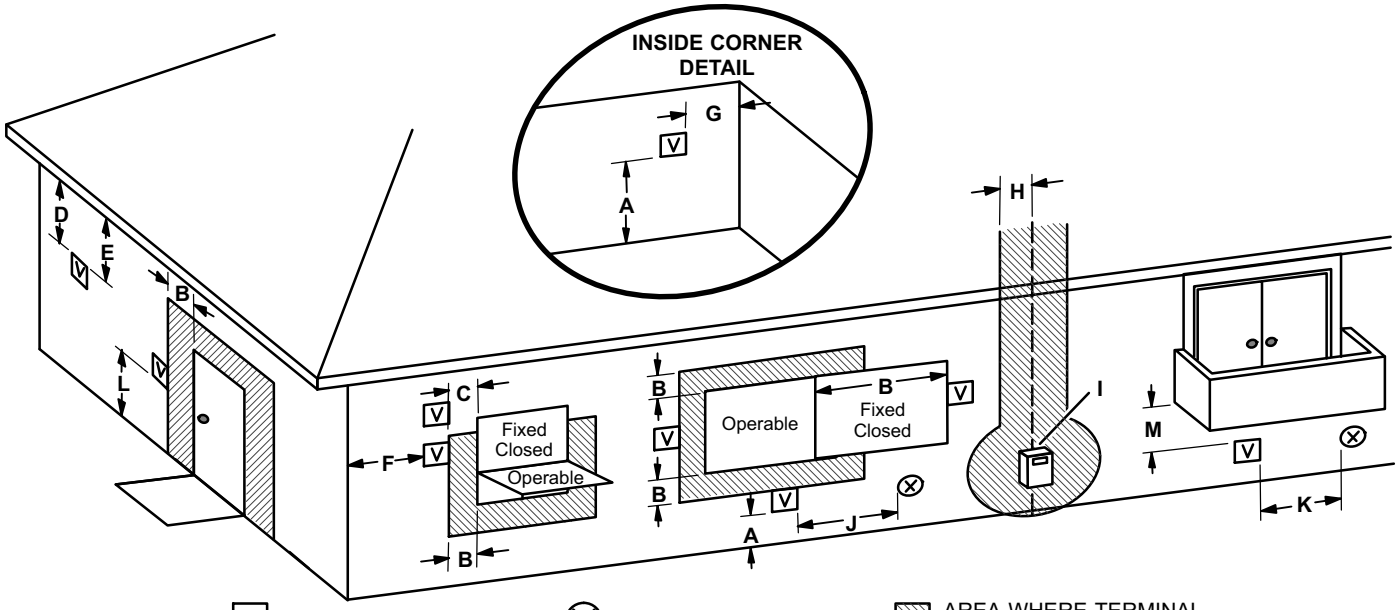
⚠ IMPORTANT

Do not use screens or perforated metal in exhaust 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).

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



V VENT TERMINAL ⊗ AIR SUPPLY INLET AREA WHERE TERMINAL IS NOT PERMITTED

		US Installations[1]	Canadian Installations[2]
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	4 feet (1.2 m) below or to side of opening; 1 foot (30 cm) above opening	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 (mm) 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	* 3 feet (.9m)	* 3 feet (.9m)
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	4 feet (1.2 m) below or to side of opening; 1 foot (30 cm) above opening	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)‡

[1] In accordance with the current ANSI Z223.1/NFPA 54 Natural Fuel Gas Code

[2] In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

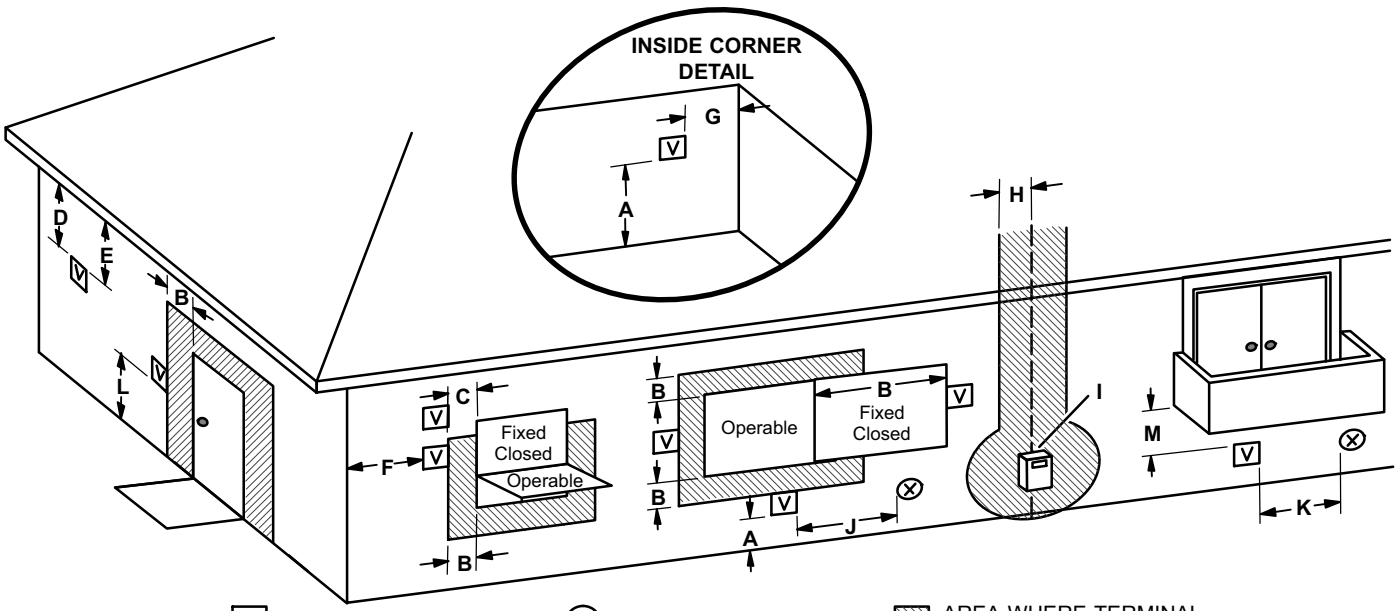
† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

‡ 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.”

FIGURE 27

VENT TERMINATION CLEARANCES
FOR DIRECT VENT INSTALLATIONS IN THE USA AND CANADA



V VENT TERMINAL ⊗ AIR SUPPLY INLET AREA WHERE TERMINAL IS NOT PERMITTED

		US Installations[1]	Canadian Installations[2]
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 (mm) 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 (mm) 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	* 3 feet (.9m)	* 3 feet (.9m)
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 (mm) 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)‡

[1] In accordance with the current ANSI Z223.1/NFPA 54 Natural Fuel Gas Code

[2] 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.”

FIGURE 28

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.*

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. Figures 29 through 40 show typical terminations.

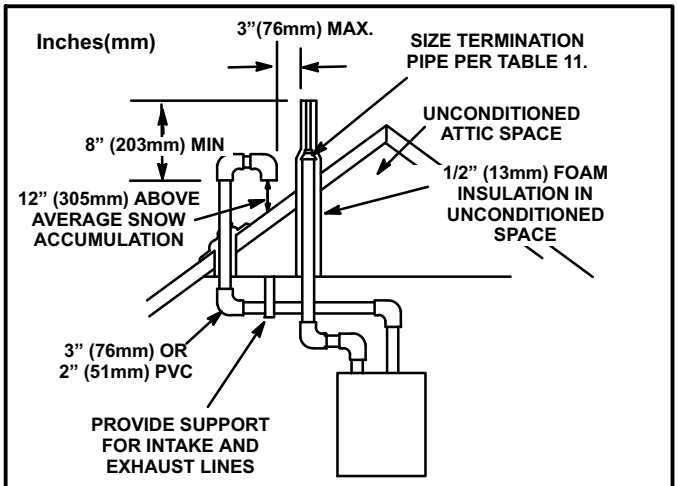
1. Exhaust and intake exits must be in same pressure zone. Do not exit one through the roof and one on the side. Also, do not exit the intake on one side and the exhaust on another side of the house or structure.
2. Intake and exhaust pipes should be placed as close together as possible at termination end (refer to illustrations). Maximum separation is 3" (76mm) on roof terminations and 6" (152mm) on side wall terminations.
3. On roof terminations, the intake piping should terminate straight down using two 90° elbows (See figure 29).
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 11.

TABLE 11
EXHAUST PIPE TERMINATION SIZE REDUCTION

ML193UH MODEL	Exhaust Pipe Size	Termination Pipe Size
*045 and 070	2" (51mm), 2-1/2" (64mm), 3" (76mm)	1-1/2" (38mm)
*090		2" (51mm)
110		2" (51mm)
135	3" (76mm)	2" (51mm)

**ML193UH-045, -070 and -090 units with the flush mount termination must use the 1 1/2"accelerator supplied with the kit.*

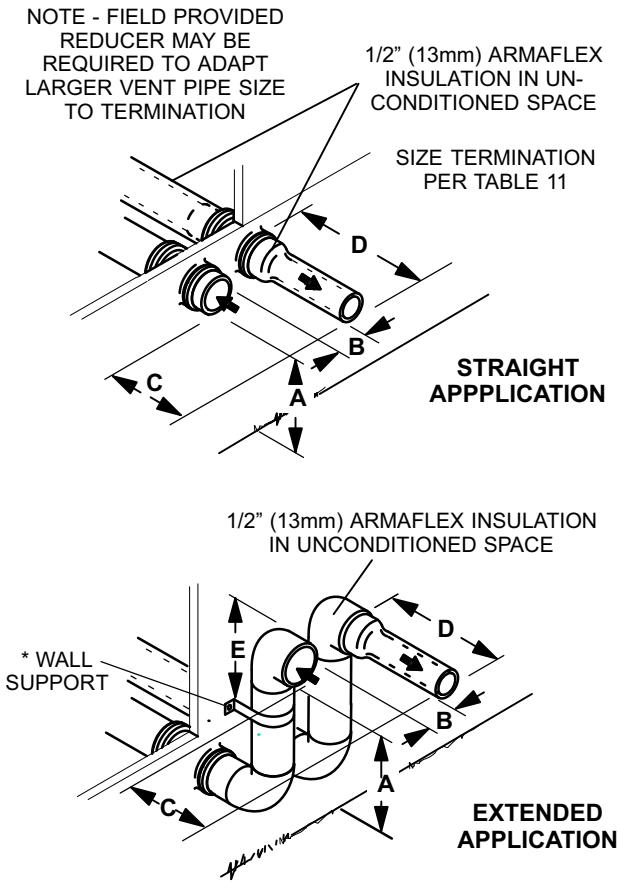
***NOTE** - Care must be taken to avoid recirculation of exhaust back into intake pipe.*



DIRECT VENT ROOF TERMINATION KIT (15F75 or 44J41)

FIGURE 29

FIELD SUPPLIED WALL TERMINATION OR (15F74) WALL RING TERMINATION KIT



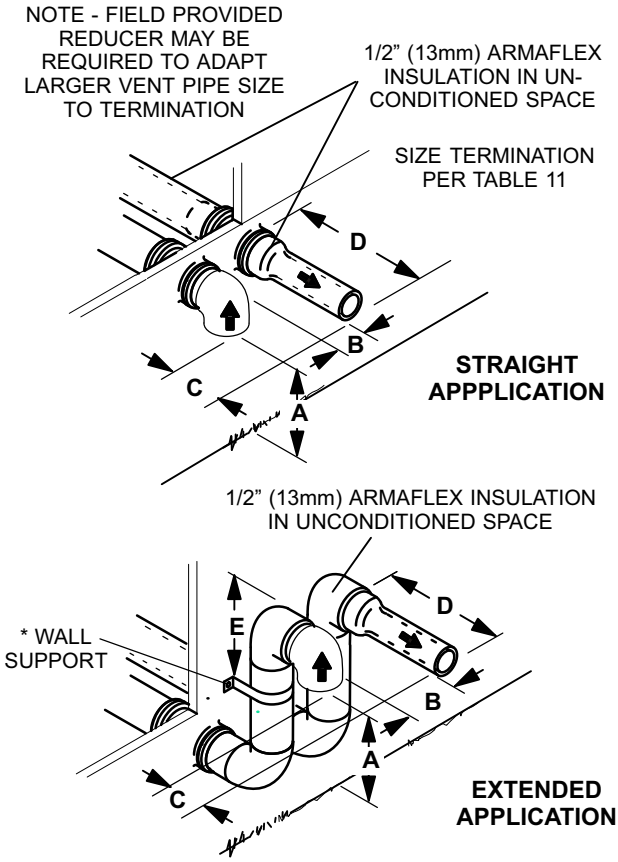
See venting table 10 for maximum venting lengths with this arrangement.

* 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 6" (152 mm) from top of each pipe (intake and exhaust)

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

FIGURE 30

FIELD SUPPLIED WALL TERMINATION OR (15F74) WALL RING TERMINATION KIT With INTAKE ELBOW



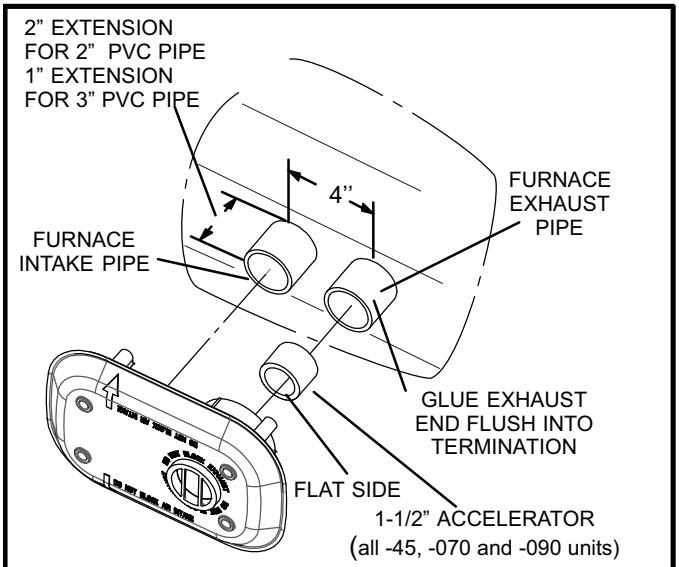
See venting table 10 for maximum venting lengths with this arrangement.

* 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 6" (152 mm) from top of each pipe (intake and exhaust)

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

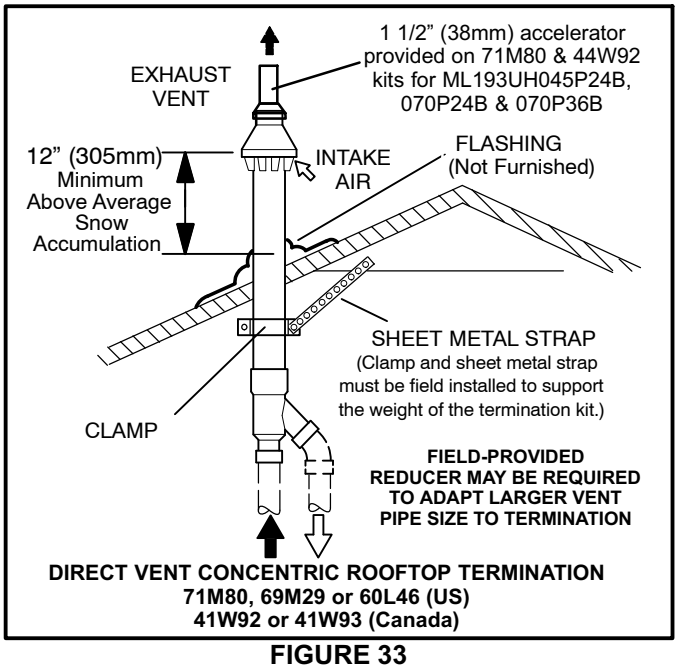
FIGURE 31

5. 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 figures 30 and 31.
6. 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 figures 30 and 31.
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 every 24" (610mm) as shown in figures 30 and 31. In addition, close coupled wall termination kits must be extended for use in this application. See figures 38 and 39. When exhaust and intake piping must be run up an outside wall, the exhaust piping must be terminated with pipe sized per table 11.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 35.



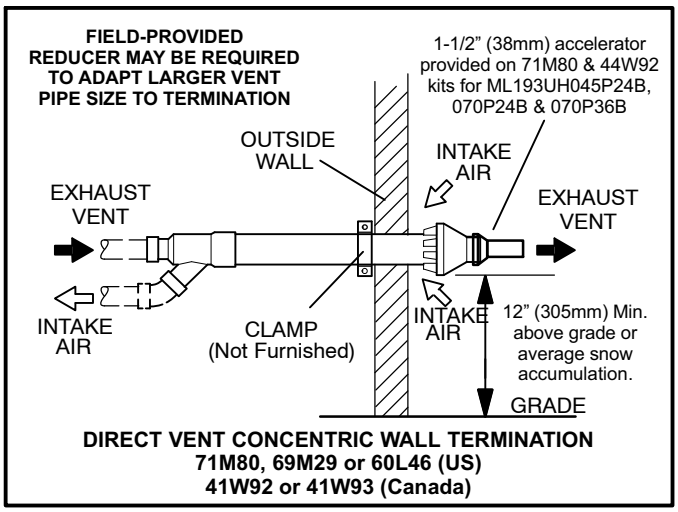
FLUSH-MOUNT SIDE WALL TERMINATION 51W11

FIGURE 32



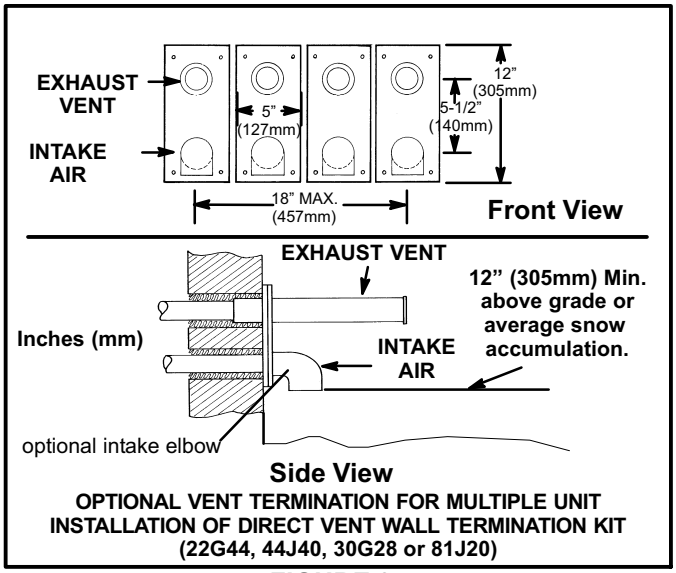
DIRECT VENT CONCENTRIC ROOFTOP TERMINATION
71M80, 69M29 or 60L46 (US)
41W92 or 41W93 (Canada)

FIGURE 33



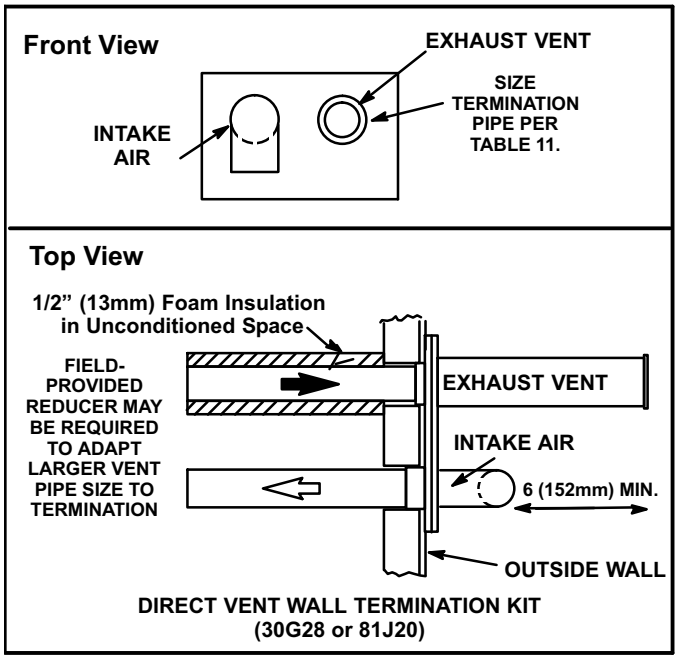
DIRECT VENT CONCENTRIC WALL TERMINATION
71M80, 69M29 or 60L46 (US)
41W92 or 41W93 (Canada)

FIGURE 34



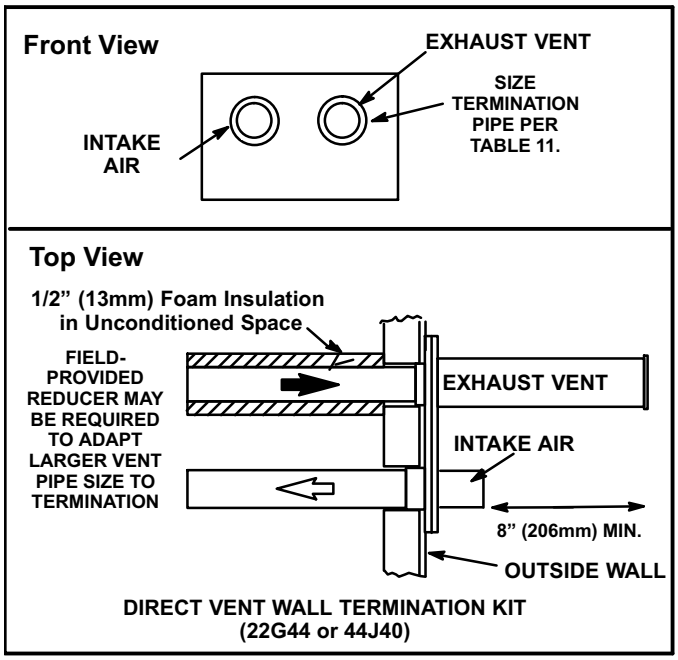
OPTIONAL VENT TERMINATION FOR MULTIPLE UNIT INSTALLATION OF DIRECT VENT WALL TERMINATION KIT
(22G44, 44J40, 30G28 or 81J20)

FIGURE 35



DIRECT VENT WALL TERMINATION KIT
(30G28 or 81J20)

FIGURE 36



DIRECT VENT WALL TERMINATION KIT
(22G44 or 44J40)

FIGURE 37

WALL TERMINATION KITS (CLOSE−COUPLE)
EXTENDED VENT FOR GRADE CLEARANCE
2 inch (51 mm) 22G44 (US)
3 inch (76 mm) 44J40 (US)

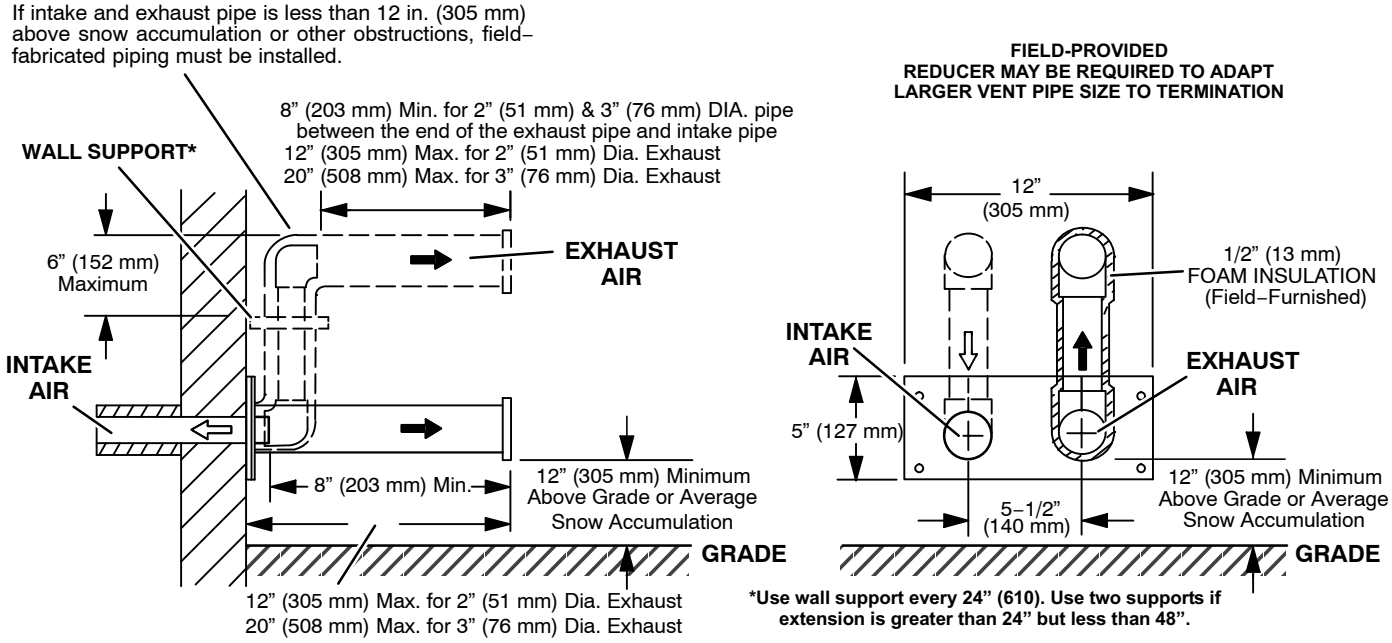


FIGURE 38

WALL TERMINATION KITS (CLOSE−COUPLE)
EXTENDED VENT FOR GRADE CLEARANCE
2 inch (51 mm) 30G28 (WTK Canada)
3 inch (76 mm) 81J20 (WTK Canada)
See Installation Instructions for additional information.

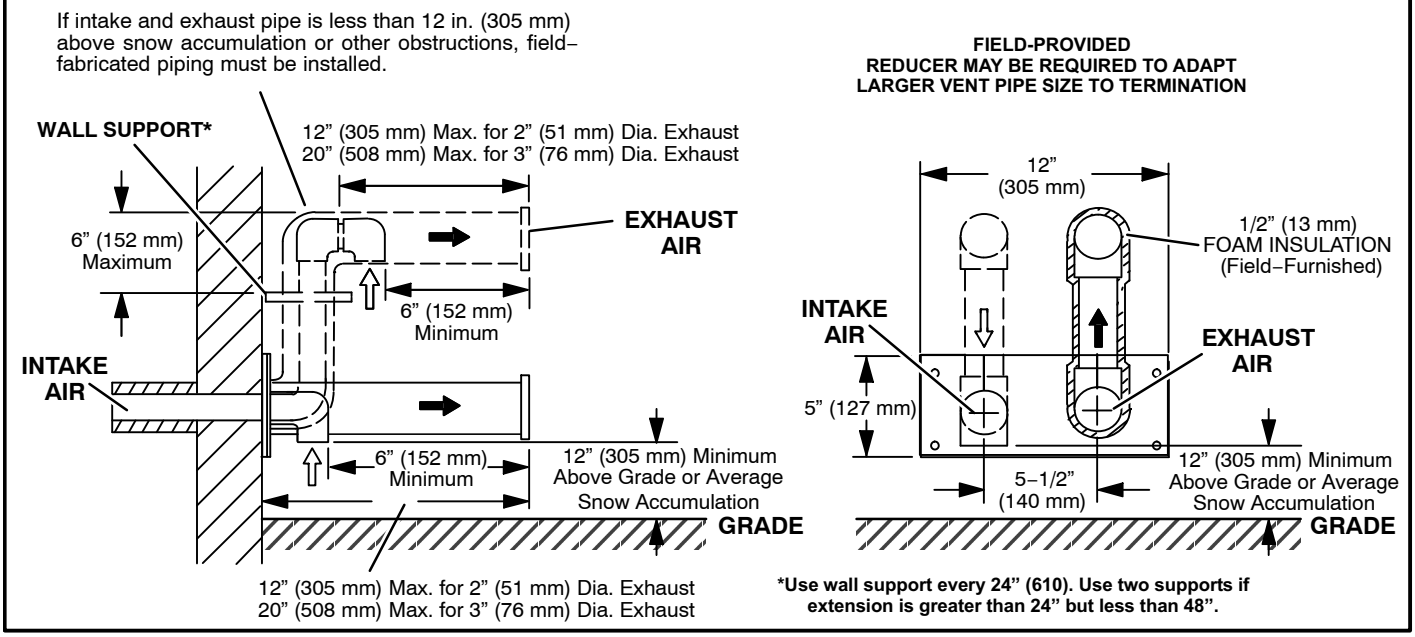


FIGURE 39

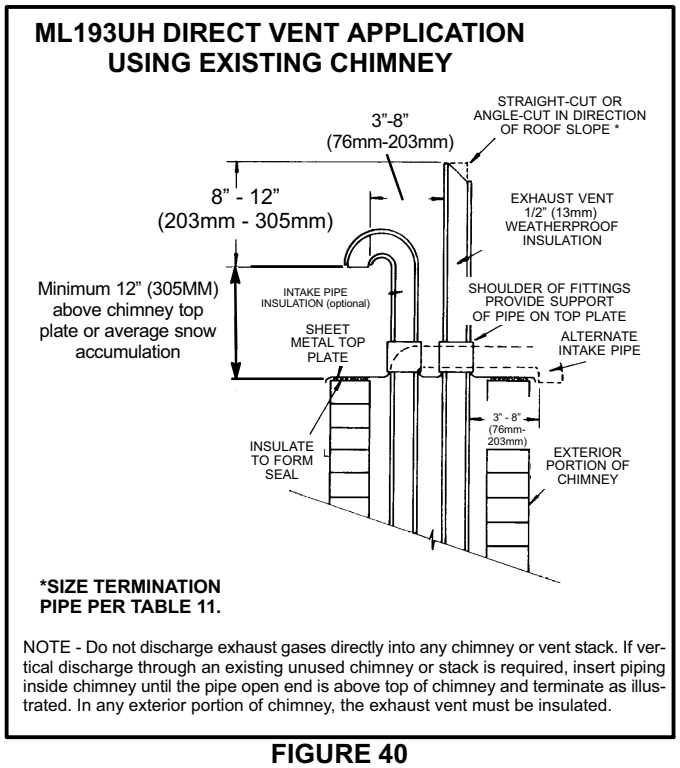


FIGURE 40

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. Figures 41 through 44 show typical terminations.

1. Exhaust piping must terminate straight out or up as shown. The termination pipe must be sized as listed in table 11.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. See figure 42.

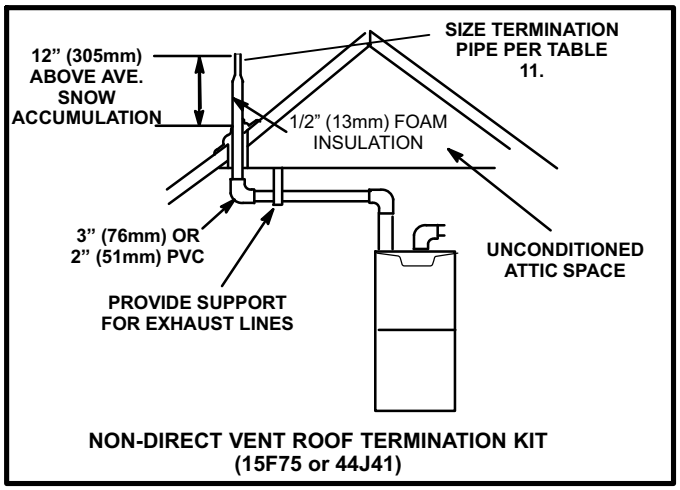


FIGURE 41

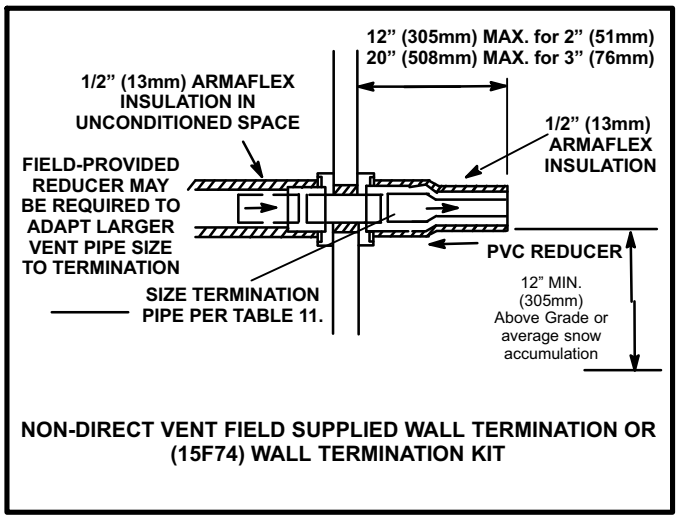


FIGURE 42

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) as shown in figure 43. When exhaust piping must be run up an outside wall, any reduction in exhaust pipe size must be done after the final elbow.

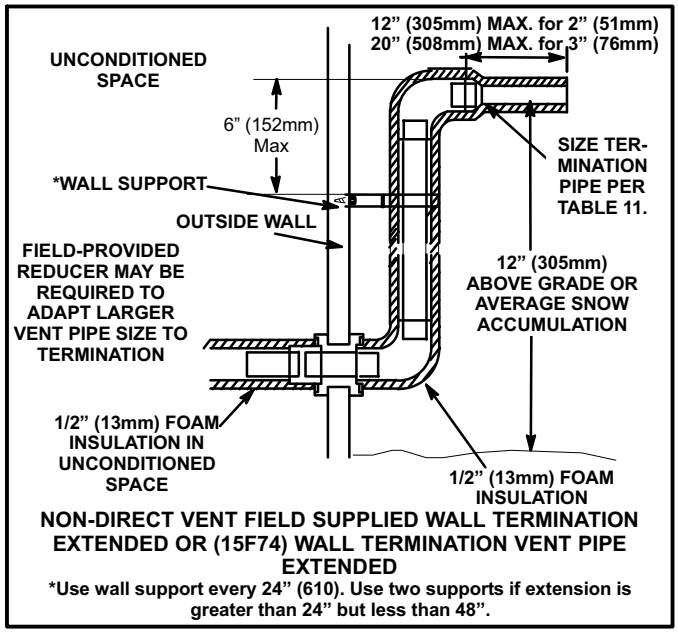
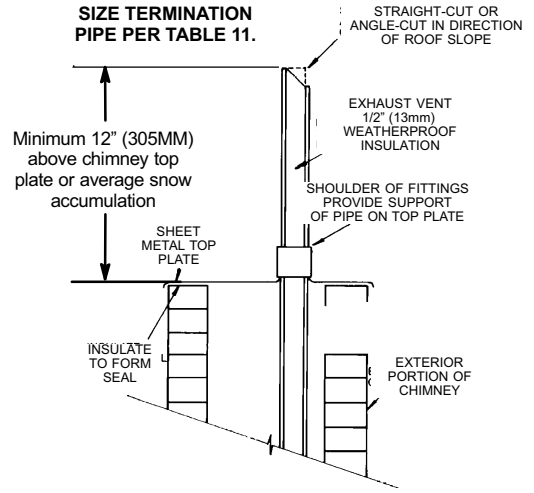


FIGURE 43

ML193UH NON-DIRECT VENT APPLICATION USING EXISTING CHIMNEY



NOTE - Do not discharge exhaust gases directly into any chimney or vent stack. If vertical discharge through an existing unused chimney or stack is required, insert piping inside chimney until the pipe open end is above top of chimney and terminate as illustrated. In any exterior portion of chimney, the exhaust vent must be insulated.

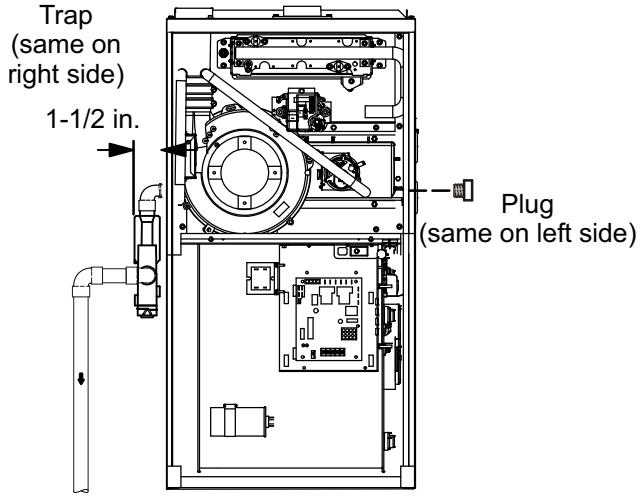
FIGURE 44

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 45 for condensate trap locations.

***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.*

CONDENSATE TRAP AND PLUG LOCATIONS
(Unit shown in upflow position)



NOTE - In upflow applications where side return air filter is installed on same side as the condensate trap, filter rack must be installed beyond condensate trap or trap must be re-located to avoid interference.

FIGURE 45

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 - Remove plug (figure 45) from the cold end header box at the appropriate location on the side of the unit. Install field-provided 1/2 NPT male 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 49. Route the condensate line to an open drain. *Condensate line must maintain a 1/4" downward slope from the furnace to the drain.*

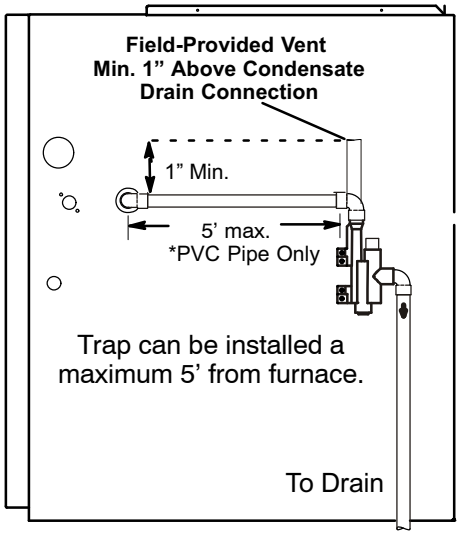
⚠ CAUTION

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

5 - 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; 24 ft. (7.3m) - kit no. 26K69; and 50 ft. (15.2m) - kit no. 26K70.

CONDENSATE TRAP LOCATIONS
(Unit shown in upflow position with remote trap)



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

FIGURE 46

⚠ CAUTION

A separate drain line must be run to the drain from the condensate trap. DO NOT connect the condensate trap drain into the drain line from the evaporator coil.

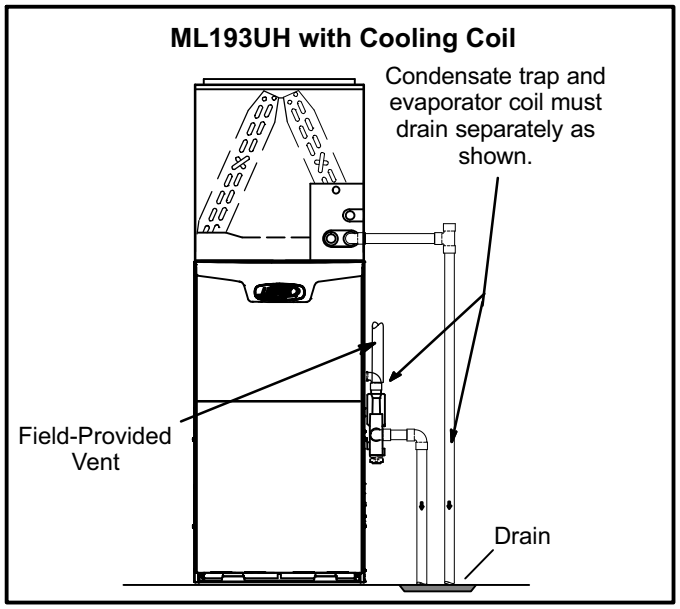


FIGURE 47

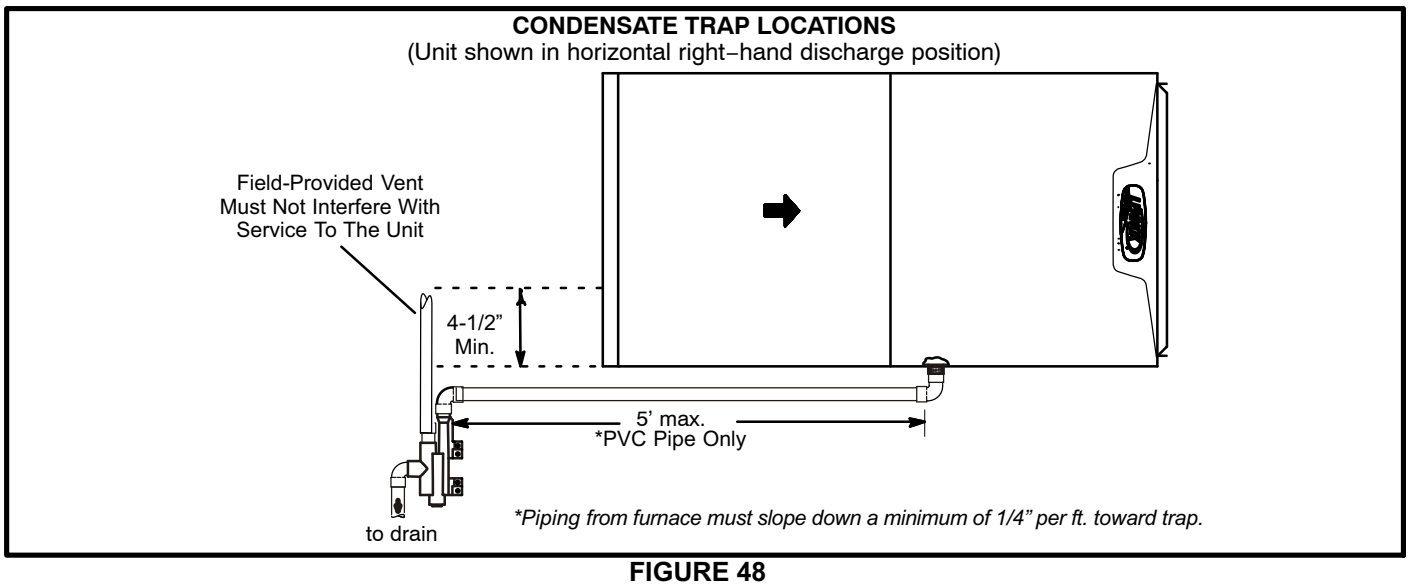


FIGURE 48

TRAP / DRAIN ASSEMBLY USING 1/2” PVC OR 3/4” PVC

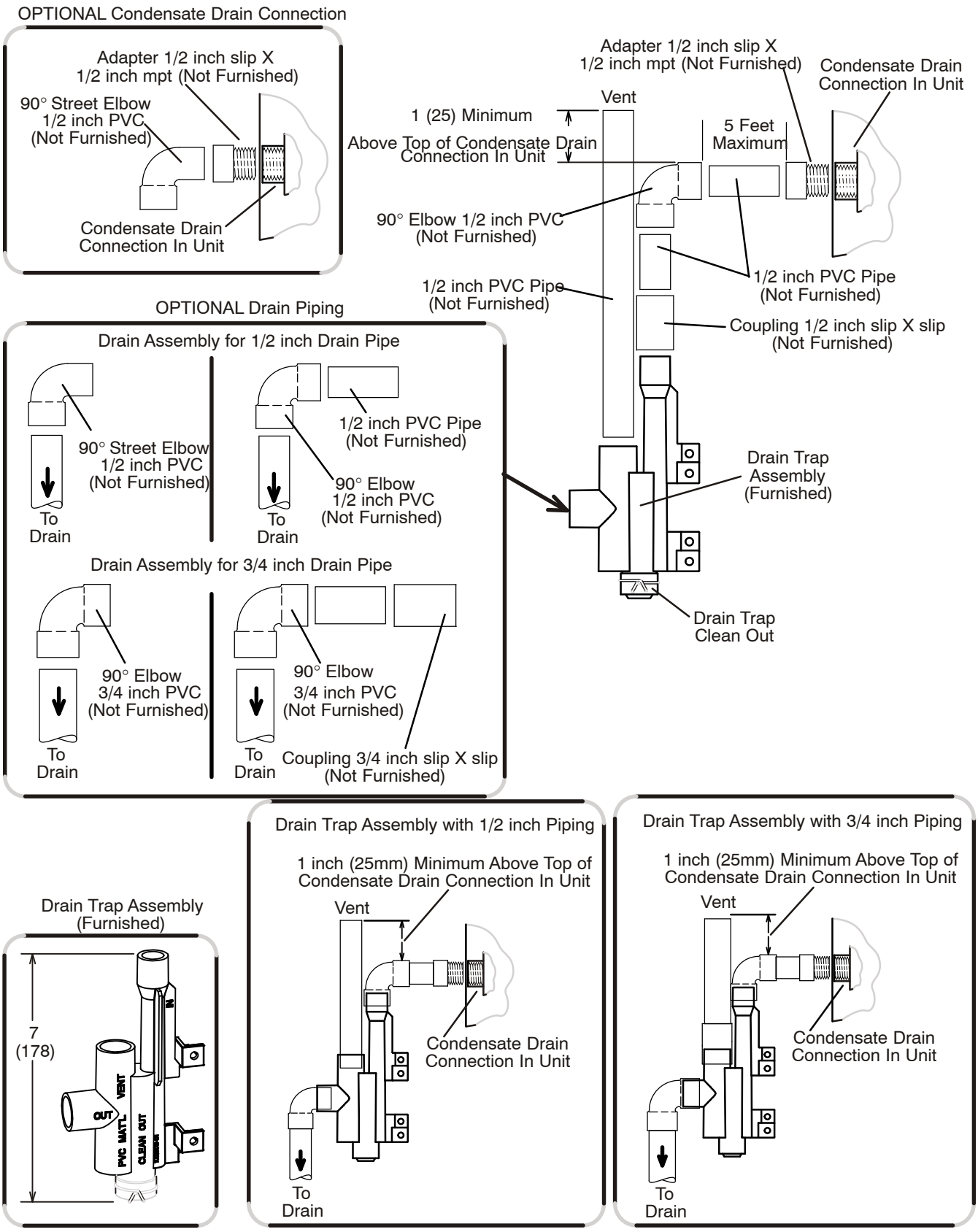


FIGURE 49

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 ML193UH 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:

ML193UH 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 50)

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 50.

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 50.

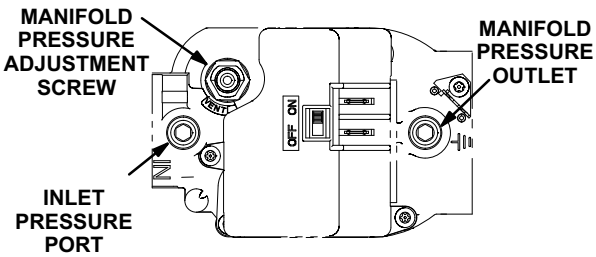


FIGURE 50

9 - Replace the upper access panel.

10- Turn on all electrical power to to the unit.

11- Set the thermostat to desired setting.

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

12- If the appliance will not operate, follow the instructions "Turning Off Gas to Unit" and call 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-C.S.A. Certification

All units are C.S.A. design certified without modifications. Refer to the ML193UH Operation and Installation Instruction Manual Information.

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.

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 0.5psig (14" W.C.). See figure 51.

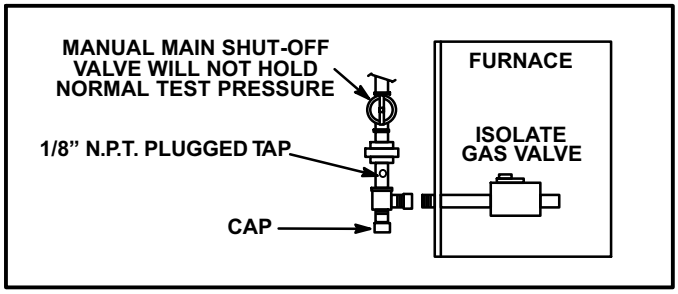


FIGURE 51

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.

⚠ WARNING

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

D-Testing Gas Supply Pressure

Gas Flow (Approximate)

TABLE 12

GAS METER CLOCKING CHART				
ML193 Unit	Seconds for One Revolution			
	Natural		LP	
	1 cu ft Dial	2 cu ft Dial	1 cu ft Dial	2 cu ft DIAL
-045	80	160	200	400
-070	55	110	136	272
-090	41	82	102	204
-110	33	66	82	164
-135	27	54	68	136
Natural-1000 btu/cu ft LP-2500 btu/cu ft				

Furnace should operate at least 5 minutes before checking gas flow. Determine time in seconds for **two** revolutions of gas through the meter. (Two revolutions assures a more accurate time.) **Divide by two** and compare to time in table 12 below. If manifold pressure matches table 13 and rate is incorrect, check gas orifices for proper size and restriction. Remove temporary gas meter if installed.

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

Supply Pressure Measurement

When testing supply gas pressure, use the 1/8" N.P.T. plugged tap or pressure post located on the gas valve to facilitate test gauge connection. See figure 50. Check gas line pressure with unit firing at maximum rate. Low pressure may result in erratic operation or underfire. High pressure can result in permanent damage to gas valve or overfire.

On multiple unit installations, each unit should be checked separately, with and without units operating. Supply pressure must fall within range listed in table 13.

Manifold Pressure Measurement

1 - Remove the threaded plug from the outlet side of the gas valve and install a field-provided barbed fitting. Connect to a manometer to measure manifold pressure.

2 - Start unit and allow 5 minutes for unit to reach steady state.

3 - While waiting for the unit to stabilize, observe the flame. Flame should be stable and should not lift from burner. Natural gas should burn blue.

4 - After allowing unit to stabilize for 5 minutes, record manifold pressure and compare to value given in table 13.

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

TABLE 13
Supply Line and Manifold Pressure (inches w.c.)

Unit	Fuel	Manifold Pressure	Line Pressure
All	Nat. Gas	3.5	4.5 - 10.4
All	L.P. Gas	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.*

E-Proper Combustion

Furnace should operate minimum 15 minutes with correct manifold pressure and gas flow rate before checking combustion. Take combustion sample beyond the flue outlet and compare to the tables below.

TABLE 14

ML193 Unit	CO_2% For Nat	CO_2% For L.P.
-045	7.2 - 7.9	8.6 - 9.3
-070		
-090		
-110		
-135		
The maximum carbon monoxide reading should not exceed 50 ppm.		

F-High Altitude

***NOTE** - In Canada, certification for installations at elevations over 4500 feet (1372 m) is the jurisdiction of local authorities.*

ML193UH units require no manifold pressure adjustments for operation at altitudes up to 10,000 feet (3048 m) above sea level. Units installed at altitude of 4501 - 10,000 feet (1373 to 3048m) require a pressure switch change which can be ordered separately. Table 15 lists conversion kit and pressure switch requirements at varying altitudes.

The combustion air pressure switch is factory-set and requires no adjustment.

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

TABLE 15
Conversion Kit and Pressure Switch Requirements at Varying Altitudes

ML193 Unit	Natural to LP/Propane	High Altitude Natural Burner Orifice Kit	LP/Propane to Natural	High Altitude Pressure Switch	
	0 - 7500 ft (0 - 2286m)	7501 - 10,000 ft (2286 - 3038m)	0 - 7500 ft (0 - 2286m)	4501 - 7500 ft (1373 - 2286m)	7501 -10,000 ft (2286 - 3048m)
-045	*69W73	73W37	*73W81	74W90	74W91
-070					
-090					
-110					
-135					

* 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).

G-Flame Signal

A transducer (Part #78H5401 available from Lennox Repair Parts) is required to measure flame signal if meter used will not read a low micro amp signal. See figure 52. The transducer converts microamps to volts on a 1:1 conversion. Flame signal is shown in table 16. A digital readout meter must be used. The transducer plugs into most meters.

TABLE 16

Normal Flame Signal	$\geq$ 1.50 Microamps
Low Flame Signal	$\leq$ 1.40 Microamps
Drop Out Signal	= 0.50 Microamps

To Measure Flame Signal:

1 - Set the volt meter to the DC voltage scale. Insert transducer into the VDC and common inputs. Observe correct polarities. Failure to do so results in negative (-) values.

2 - Turn off supply voltage to control.

3 - Disconnect integrated control flame sensor wire from the flame sensor.

4 - Connect (-) lead of the transducer to flame sensor.

5 - Connect (+) lead of transducer to the integrated control sensor wire.

6 - Turn supply voltage on and close thermostat contacts to cycle system.

7 - When main burners are in operation for two minutes, take reading. Remember 1 DC volt = 1 DC microamp.

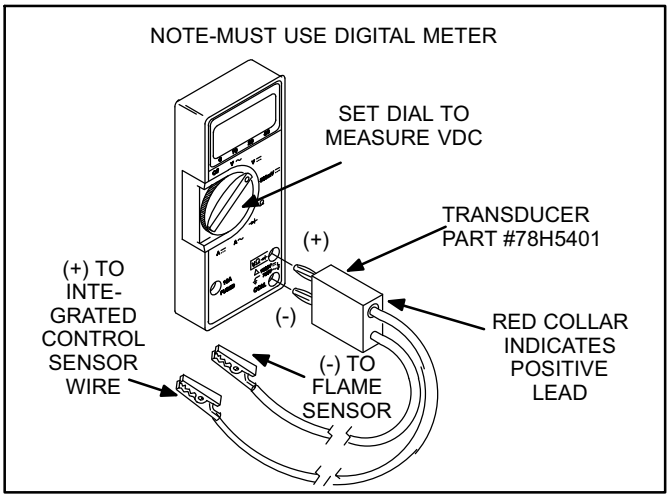


FIGURE 52

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

Temperature rise 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.

To Measure Temperature Rise:

1 - Place plenum thermometers in the supply and return air plenums. Locate supply air thermometer in the first horizontal run of the plenum where it will not pick up radiant heat from the heat exchanger.

2 - Set thermostat for heat call.

3 - After plenum thermometers have reached their highest and steadiest readings, subtract the two readings. The difference should be in the range listed on the unit rating plate. If the temperature is too low, decrease blower speed. If temperature is too high, first check the firing rate. Provided the firing rate is acceptable, increase blower speed to reduce temperature.

To change existing heat tap, turn off power then switch out speed tap with tap connected to "PARK" . See unit diagram for blower motor tap colors for each speed.

C-External Static Pressure

1 - Tap locations shown in figure 53.

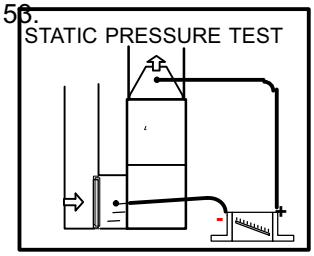


FIGURE 53

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.

4 - External static pressure drop must not be more than 0.5" W.C. in the heating mode and must not exceed 0.6" W.C in the cooling mode.

5 - Seal the hole when the check is complete.

VI-MAINTENANCE

⚠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 17 lists recommended filter sizes.

TABLE 17

Furnace 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

1 - Check all wiring for loose connections.
2 - Check for the correct voltage at the furnace (furnace operating). Correct voltage is 120VAC ± 10%
3 - Check amp-draw on the blower motor with blower access panel in place.
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.

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 burner access panel.
3 - Mark all gas valve wires and disconnect them from valve.
4 - Remove gas supply line connected to gas valve.
5 - Remove sensor wire from flame sensor. Disconnect 2-pin plug from the ignitor.
6 - Disconnect wires from flame roll-out switches.
7 - Remove four burner assembly screws at the vestibule panel and remove gas valve /manifold and burner box as a single unit.
***NOTE** - If necessary, clean burners at this time. Follow procedures outlined in Burner Cleaning section.*
9 - Remove the clean-out cap on trap and drain. Replace cap.
10 - Disconnect condensate drain line from the condensate trap. Remove condensate trap (it may be necessary to cut drain pipe). Remove the 1/2” NPT fitting from the cold end header box. Disconnect drain tubes from cold end header collector box.
11 - Disconnect condensate drain tubes from flue collar. Remove screws that secures flue collar in place. Remove flue collar. It may be necessary to cut the exiting exhaust pipe for removal of the fitting.
12 - Loosen two clamps from flexible no-hub exhaust collar.
13 - Disconnect the 2-pin plug from the combustion air inducer. Remove screws which secure combustion air inducer to collector box. Remove combustion air inducer assembly. Remove ground wire.
14 - Mark and disconnect all combustion air pressure tubing from cold end header collector box.
15 - Mark and remove wires from pressure switch. Remove pressure switch. Keep tubing attached to pressure switch.
16 - Remove electrical junction box from the side of the furnace.
17 - Remove blower access panel.
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 top cap screws to allow top cap to be tilted upward to allow clearance for removing heat exchanger.

21 - Remove two screws from the front cabinet flange at the blower deck. Spread cabinet sides slightly to allow clearance for removal of heat exchanger.

22 - Remove screws along vestibule sides and bottom which secure vestibule panel and heat exchanger assembly to cabinet. Remove two screws from blower rails which secure bottom heat exchanger flange. Remove heat exchanger from furnace cabinet.

23 - Back wash heat exchanger with soapy water solution or steam. **If steam is used it must be below 275°F (135°C) .**

24 - Thoroughly rinse and drain the heat exchanger. Soap solutions can be corrosive. Take care to rinse entire assembly.

25 - Reinstall heat exchanger into cabinet making sure that the rear baffle of the heat exchanger assembly is nested under the support located at the rear of the cabinet. Remove the indoor blower to view this area through the blower opening.

26 - Re-secure the supporting screws along the vestibule sides.

27 - Reinstall blower assembly and reinstall two screws through rails.

28 - Reinstall cabinet screws on front flange at blower deck.

29 - Reinstall screws securing top cap.

30 - Reinstall the primary limit on the vestibule panel.

31 - Route heating component wiring through hole in blower deck and reinsert strain relief bushing.

32 - Reinstall pressure switch and reconnect pressure switch wiring.

33 - Carefully connect combustion air pressure switch hosing from pressure switch to proper stubs on cold end header collector box.

34 - Reinstall 1/2” NPT (if removed) in the cold end header box. Reconnect drain tubing to collector box.

35 - Reinstall condensate trap pipe. Reconnect condensate drain line to the condensate trap.

36 - Reinstall electrical junction box.

37- Reinstall the combustion air inducer and flexible no hub connector. Reconnect the 2-pin plug to the wire harness.

39 - Reconnect drain tubes between flue collar and cold end header box.

40 - Secure burner assembly to vestibule panel using four existing screws. **Burners are self aligning to center of clam shells.**

41 - Reconnect gas supply line to gas valve.

42 - Reconnect flame roll-out switch wires.

43 - Reconnect sensor wire and reconnect 2-pin plug from ignitor.

44 - Reconnect wires to gas valve.

45 - Replace the blower compartment access panel.

46 - Refer to instruction on verifying gas and electrical connections when re-establishing supplies.

47 - 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.

48 - Replace heating compartment access panel.

Cleaning the Burner Assembly

1 - Turn off gas and electrical power to the furnace. Remove heating compartment access panel.

2 - Disconnect the gas supply line from the gas valve.

3 - Disconnect and label wires from gas valve.

4 - Disconnect ignitor wiring at 2 circuit plug.

5 - Disconnect and label wires from rollout switch.

6 - Disconnect and label flame sensor wire.

7 - Disconnect and label ground wire from burner/manifold assembly.

8 - Remove four screws that secures burner/manifold assembly to vestibule. Remove the assembly and make note not to allow ignitor plate to dislodge from the assembly.

9 - Gently clean the face of the burners using the soft brush attachment on a vacuum cleaner. Visually inspect the inside of the burners and crossovers for any blockage caused by foreign matter. Remove any blockage

10 - Reinstall the burner/manifold assembly using the existing four screws. **Burners are self aligning to center of clam shells.**

11 - Reconnect ground wire.

12 - Reconnect flame sensor wire.

13 - Reconnect rollout switch wires.

14 - Reconnect ignitor wires.

15 - Reconnect gas valve wires.

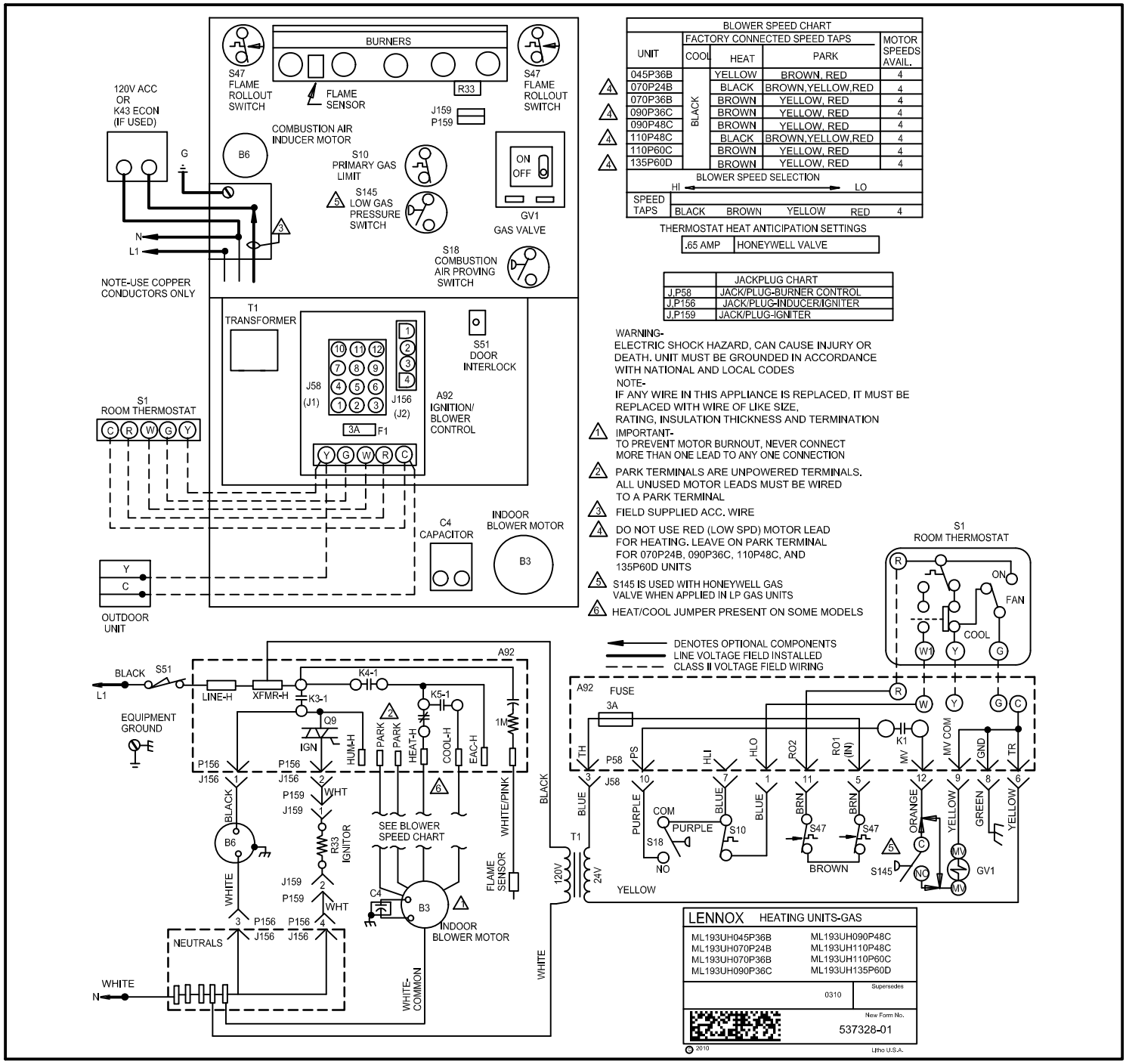
16 - Reconnect gas supply line to gas valve.

17 - Refer to instructions on verifying gas and electrical connections when re-establishing supplies.

18 - Follow instructions to place furnace in operation. Run furnace 5 minutes to ensure burners are clean and operating correctly.

19 - Replace heating compartment access panel.

VII-WIRING DIAGRAM AND SEQUENCE OF OPERATION



BLOWER SPEED CHART				
UNIT	FACTORY CONNECTED SPEED TAPS COOL	HEAT	PARK	MOTOR SPEEDS AVAIL.
045P36B	BLACK	YELLOW	BROWN, RED	4
070P24B		BLACK	BROWN,YELLOW,RED	4
070P36B		BROWN	YELLOW, RED	4
090P36C		BROWN	YELLOW, RED	4
090P48C		BROWN	YELLOW, RED	4
110P48C		BLACK	BROWN,YELLOW,RED	4
110P60C		BROWN	YELLOW, RED	4
135P60D		BROWN	YELLOW, RED	4
BLOWER SPEED SELECTION HI ← → LO				
SPEED TAPS	BLACK	BROWN	YELLOW	RED 4

THERMOSTAT HEAT ANTICIPATION SETTINGS	
.65 AMP	HONEYWELL VALVE

JACKPLUG CHART	
J,P58	JACK/PLUG-BURNER CONTROL
J,P156	JACK/PLUG-INDUCER/IGNITER
J,P159	JACK/PLUG-IGNITER

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

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

1. IMPORTANT- TO PREVENT MOTOR BURNOUT, NEVER CONNECT MORE THAN ONE LEAD TO ANY ONE CONNECTION
2. PARK TERMINALS ARE UNPOWERED TERMINALS. ALL UNUSED MOTOR LEADS MUST BE WIRED TO A PARK TERMINAL
3. FIELD SUPPLIED ACC. WIRE
4. DO NOT USE RED (LOW SPD) MOTOR LEAD FOR HEATING. LEAVE ON PARK TERMINAL FOR 070P24B, 090P36C, 110P48C, AND 135P60D UNITS
5. S145 IS USED WITH HONEYWELL GAS VALVE WHEN APPLIED IN LP GAS UNITS
6. HEAT/COOL JUMPER PRESENT ON SOME MODELS

LENNOX HEATING UNITS-GAS

ML193UH045P36B	ML193UH090P48C
ML193UH070P24B	ML193UH110P48C
ML193UH070P36B	ML193UH110P60C
ML193UH090P36C	ML193UH135P60D

0310 Supersedes
New Form No. 537328-01
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1 - When there is a call for heat, W1 of the thermostat energizes W of the furnace control with 24VAC.

2 - S10 primary limit switch and S47 rollout switch are closed. Call for heat can continue.

3 - The integrated control (A92) energizes combustion air inducer B6. Combustion air inducer runs until S18 combustion air prove switch closes (switch must close within 2-1/2 minutes or control goes into 5 minute Watchguard Pressure Switch delay). Once S18 closes, a 15-second pre-purge follows.

4 - The integrated control (A92) energizes ignitor. A 20-second warm-up period begins.

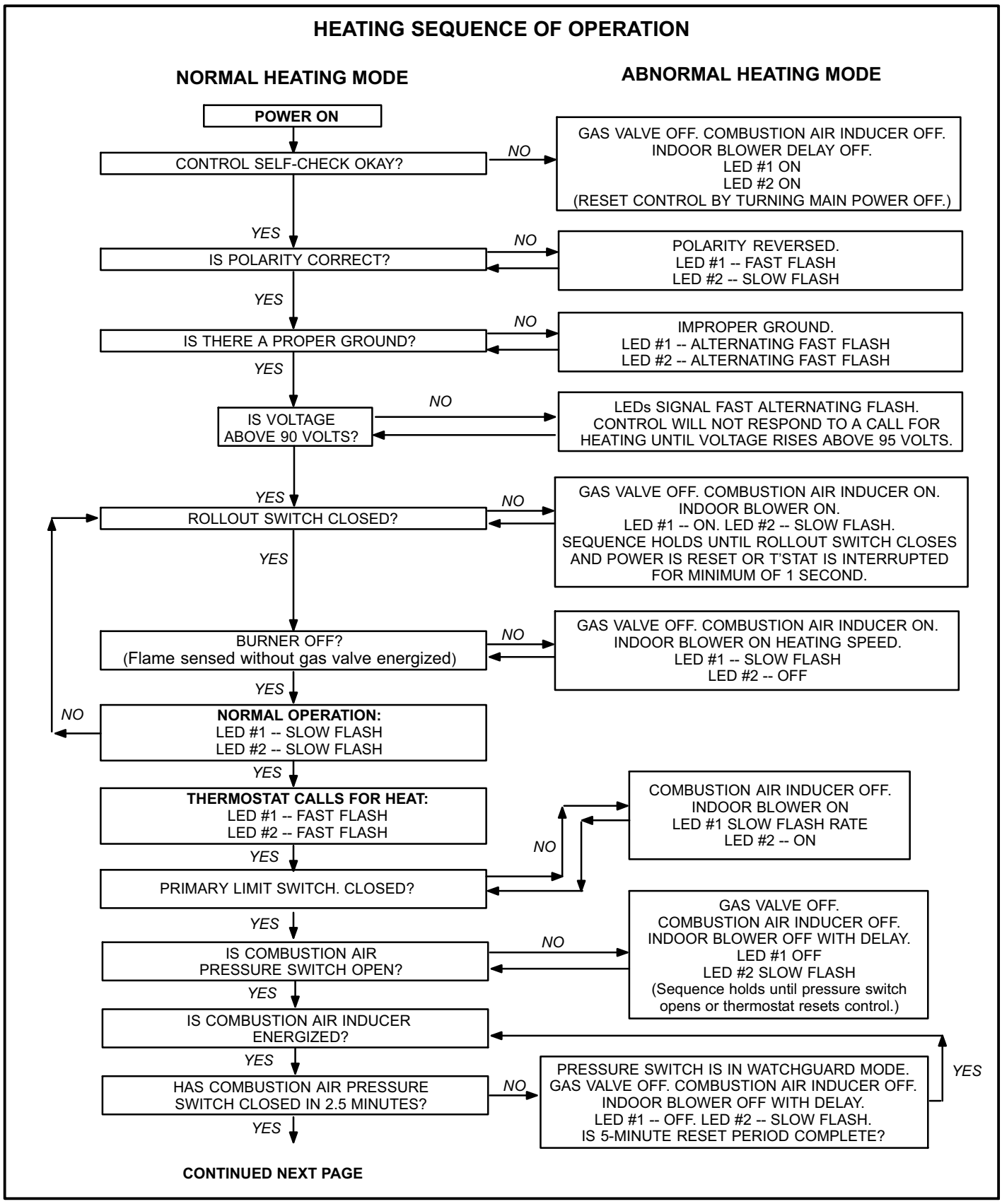
5 - Gas valve opens for a 4-second trial for ignition

6 - Flame is sensed, gas valve remains open for the heat call.

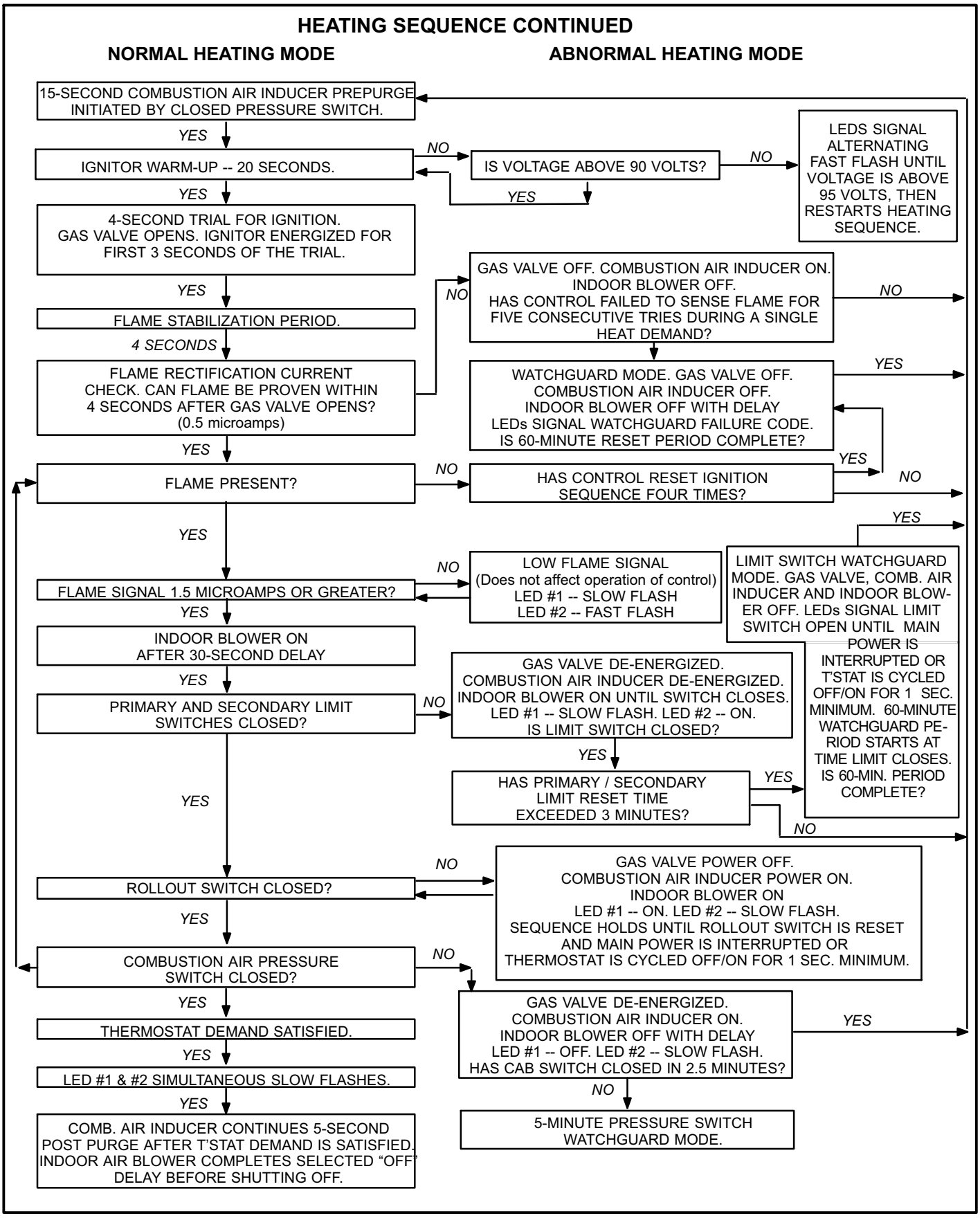
7 - After 45-second delay, the integrated control (A92) energizes indoor blower B3.

8 - When heat demand is satisfied, W1 of the indoor thermostat de-energizes W of the integrated control which de-energizes the gas valve. Combustion air inducer B6 continues a 5-second post-purge period, and indoor blower B3 completes a selected OFF time delay.

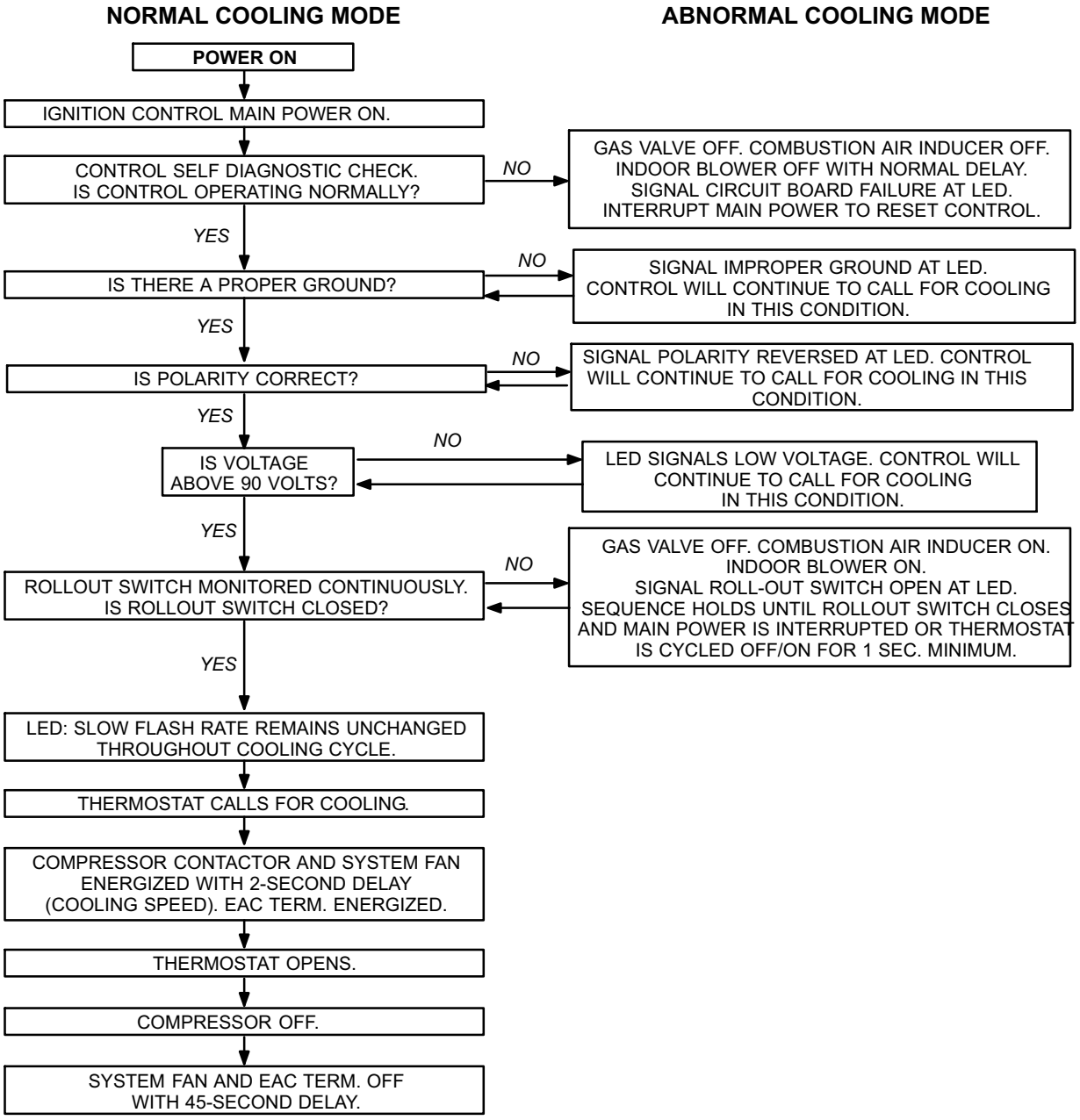
Sequence of Operation Flow Chart



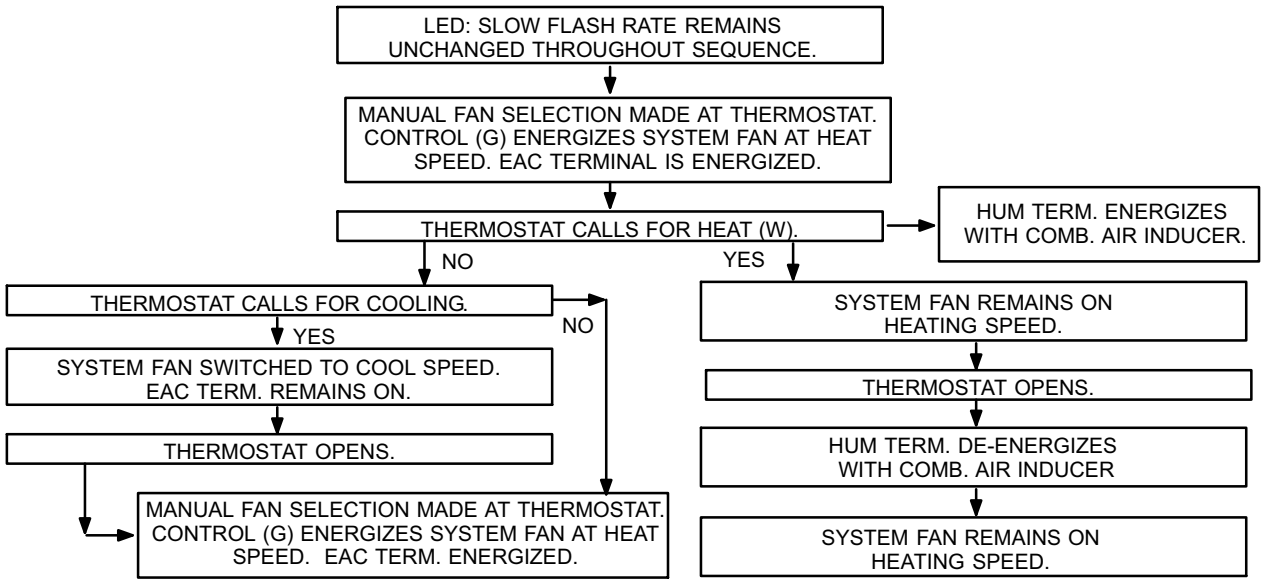
HEATING SEQUENCE CONTINUED



COOLING SEQUENCE OF OPERATION



CONTINUOUS HEAT SPEED FAN SEQUENCE OF OPERATION



VIII-Integrated Control Troubleshooting Chart

UPON INITIAL POWER UP, REMOVE ALL THERMOSTAT DEMANDS TO THE UNIT

PROBLEM: 1 UNIT FAILS TO OPERATE IN THE COOLING, HEATING, OR CONTINUOUS FAN MODE		
Condition	**Possible Cause**	**Corrective Action / Comments**
1.1 **-** Both diagnostic lights fail to light up. LED#1-Off LED#2-Off	**1.1.1** Main voltage 120V not supplied to unit.	**ACTION 1 -** Check 120V main voltage. Determine cause of main power failure.
	1.1.2 Miswiring of furnace or improper connections.	**ACTION 1 -** Check for correct wiring of 120V to power make up box and transformer. **ACTION 2** - Check 24V wiring to control.
	1.1.3 Blown fuse	**ACTION 1 -** Replace fuse. **ACTION 2 -** If fuse still blows, check for short.
	1.1.4 Door interlock switch failure.	**ACTION 1 -** Check that door switch is activated when door is closed. **ACTION 2 -** Check wire connections to switch, replace loose connectors. **ACTION 3 -** Check continuity of switch in closed position. Replace if defective.
	1.1.5 Transformer Failure.	**ACTION 1 -** Check that transformer output is 24V. Replace if defective.
	1.1.6 Failed control.	**ACTION 1 -** If all the above items have been checked, replace control.
1.2 **-** Diagnostic lights flash the roll-out . code. LED#1-On, LED#2-Slow Flash	**1.2.1** Roll-out switch open.	**ACTION 1 -** Manually reset the roll-out switch by pushing the top button. **ACTION 2 -** Determine the cause of the roll-out switch activation before leaving furnace.
	1.2.2 Roll-out switch failure.	**ACTION 1 -** Check continuity across roll-out switch. Replace roll-out switch if switch is reset but does not have continuity.
	1.2.3 Miswiring or improper connections at roll-out switch.	**ACTION 1 -** Check wiring connections to switch.
	1.2.4 12 pin connector failure	**ACTION 1 -** Check 12-pin connector for proper connection to control. **ACTION 2 -** Check continuity of the multi plug pin.
1.3 **-** Both diagnostic lights the polarity code. LED#1-Fast Flash, LED#2-Slow Flash.	**1.3.1** 120V main power polarity reversed.	**ACTION 1 -** Check the 120V has line and neutral correctly input into control. **ACTION 2 -** Reverse the line and neutral at the 120V field connection.
1.4 LED#1-Slow Flash LED#2-Slow Flash	**1.4.1** Open combustion air inducer motor circuit.	**ACTION 1 -** Check for 120V to combustion air inducer. If no power, check wire and connections.
	1.4.2 Failed combustion air inducer motor.	**ACTION 1 -** If power is present at blower, replace blower.

PROBLEM 1: UNIT FAILS TO OPERATE IN THE COOLING, HEATING, OR CONTINUOUS FAN MODE		
Condition	**Possible Cause**	**Corrective Action / Comments**
1.5 **-** Diagnostic lights flash the improper main ground. LED#1-Alternating Fast Flash* LED#2-Alternating Fast Flash*	**1.5.1** Improper ground to the unit.	**ACTION 1 -** Check that the unit is properly ground. **ACTION 2 -** Install a proper main ground to the unit
	1.5.2 4-Pin connector is improperly attached to the circuit board.	**ACTION 1 -** Check 4-pin connector for proper installation. Correctly insert connector into control.
	1.5.3 Line voltage is below 90V	**ACTION 1 -** Check that the line voltage is correct. Determine cause of voltage drop and supply correct voltage to the control.
PROBLEM 2: UNIT FAILS TO FIRE IN THE HEATING MODE, COMBUSTION AIR BLOWER DOES NOT ENERGIZE		
Condition	**Possible Cause**	**Corrective Action / Comments**
2.1 **-** Unit operates with a cooling or continuous fan demand. **-** Combustion air inducer will not start with a Heating demand. - Diagnostic lights flash the limit failure mode. LED#1-Slow Flash, LED#2-On	**2.1.1** Primary or secondary (if equipped) limit open.	**ACTION 1 -** Check continuity across switch(es). Switches reset automatically upon cool down. **ACTION 2 -** Check for restrictions on blower inlet air (including filter) and outlet air. Determine cause for limit activation before placing unit back in operation.
	2.1.2 Miswiring of furnace or improper connections at limit switch(es).	**ACTION 1 -** Check for correct wiring and loose connections. Correct wiring and/or replace any loose connections.
2.2 - Unit operates with a cooling and continuous fan demand. - Combustion air inducer will not start with a Heating demand. **-** Diagnostic lights flash the pressure switch failure code. LED#1-Off, LED#2-Slow Flash	**2.2.1** Miswiring of furnace or improper connections to combustion air inducer.	**ACTION 1 -** Check for correct wiring and loose connections. Correct wiring and/or replace any loose connections.
	2.2.2 Pressure switch stuck closed.	**ACTION 1 -** Check that the pressure switch is open without the combustion air inducer operating. Replace if defective.

PROBLEM 2: UNIT FAILS TO FIRE IN THE HEATING MODE, COMBUSTION AIR INDUCER DOES NOT ENERGIZE (CONT.).		
Condition	**Possible Cause**	**Corrective Action/Comments**
2.3 - Unit operates with a cooling and continuous fan demand. - Combustion air inducer will not start with a Heating demand. - Diagnostic lights flash the pressure switch failure code 2.5 minutes after heating demand. LED#1-Off, LED#2-Slow Flash	**2.3.1** Miswiring of furnace or improper connections to combustion air inducer.	**ACTION 1 -** Check for correct wiring and loose connections. Correct wiring and/or replace any loose connections.
	2.3.2 Combustion air inducer failure.	**ACTION 1 -** If there is 120V to combustion air inducer and it does not operate, replace combustion air inducer.
PROBLEM 3: UNIT FAILS TO FIRE IN THE HEATING MODE, COMBUSTION AIR INDUCER ENERGIZES, IGNITOR IS NOT ENERGIZED.		
Condition	**Possible Cause**	**Corrective Action/Comments**
3.1 - Unit operates with a cooling and continuous fan demand. - Combustion air inducer energizes with a heating demand. - Diagnostic lights flash the pressure switch failure code 2.5 minutes after heating demand. LED#1-Off LED#2-Slow Flash	**3.1.1** Pressure switch does not close due to incorrect routing of the pressure switch lines.	**ACTION 1 -** Check that the pressure switch lines are correctly routed. Correctly route pressure switch lines.
	3.1.2 Pressure switch does not close due to obstructions in the pressure lines.	**ACTION 1 -** Remove any obstructions from the the pressure lines and/or taps.
	3.1.3 Pressure switch lines damaged	**ACTION 1 -** Check pressure switch lines for leaks. Replace any broken lines.
	3.1.4 Condensate in pressure switch line.	**ACTION 1 -** Check pressure switch lines for condensate. Remove condensate from lines.
	3.1.5 Pressure switch does not close due to a low differential pressure across the pressure switch.	**ACTION 1 -** Check the differential pressure across the pressure switch. This pressure should exceed the set point listed on the switch. **ACTION 2 -** Check for restricted inlet vent. Remove all blockage. **ACTION 3 -** Check for proper vent sizing and run length.
	3.1.6 Wrong pressure switch installed in the unit, or pressure switch is out of calibration.	**ACTION 1 -** Check that the proper pressure switch is installed in the unit. Replace pressure switch if necessary.
	3.1.7 Miswiring of furnace or improper connections at pressure switch.	**ACTION 1 -** Check for correct wiring and loose connections. Correct wiring and/or replace any loose connections.
	3.1.8 Pressure switch failure.	**ACTION 1 -** If all the above modes of failure have been checked, the pressure switch may have failed. Replace pressure switch and determine if unit will operate.

PROBLEM 4: UNIT FAILS TO FIRE IN THE HEATING MODE, COMBUSTION AIR BLOWER ENERGIZES, IGNITOR IS ENERGIZED.		
Condition	**Possible Cause**	**Corrective Action/Comments**
4.1 - Unit operates with a cooling and continuous fan demand. - Combustion air inducer energizes with Heating demand. - Ignitor is energized but unit fails to light. LED#1-Alternating Slow Flash LED#2-Alternating Slow Flash	**4.1.1** Check that gas is being supplied to the unit.	**ACTION 1 -** Check line pressure at the gas valve. Pressure should not exceed 13" WC for both natural and propane. Line pressure should read a minimum 4.5" WC for natural and 11.0"WC for propane.
	4.1.2 Miswiring of gas valve or loose connections at multi-pin control amp plugs or valve.	**ACTION 1 -** Check for correct wiring and loose connections. Correct wiring and/or replace any loose connections.
	4.1.3 Defective gas valve or ignition control.	**ACTION 1 -** Check that 24V is supplied to the gas valve approximately 35 seconds after heat demand is initiated. **ACTION 2 -** Replace the valve if 24V is supplied but valve does not open. **ACTION 3 -** Replace the control if 24V is not supplied to valve.
PROBLEM 5: BURNERS LIGHT WITH A HEATING DEMAND BUT UNIT SHUTS DOWN PREMATURELY		
Condition	**Possible Cause**	**Corrective Action/Comments**
5.1 - Burners fire with a heating demand. - Burners light but unit shuts off prior to satisfying T-stat demand. - Diagnostic lights flash the pressure switch code. LED#1-Off LED#2-Slow Flash	**5.1.1** Low pressure differential at the pressure switch.	**ACTION 1 -** Check for restricted intake/exhaust vent. Remove all blockage. **ACTION 2:** Check for proper vent sizing. See installation instructions.
	5.1.2 Wrong concentric vent kit used for terminating the unit.	**ACTION 1 -** Check vent termination kit installed. See Placement and Installation section.
	5.1.3 Condensate drain line is not draining properly.	**ACTION 1 -** Check condensate line for proper vent slope, and any blockage. Condensate should flow freely during operation of furnace. Repair or replace any improperly installed condensate lines.
5.2 - Combustion air inducer energizes with a heating demand. - Burners light but fail to stay lit. - After 5 tries the control diagnostics flash the watchguard burners failed to ignite code. LED#1-Alternating Slow Flash LED#2-Alternating Slow Flash	**5.2.1** Sensor or sense wire is improperly installed.	**ACTION 1 -** Check that sensor is properly located and that the sense wire is properly attached to both the sensor and the control.
	5.2.2 Sensor or sense wire is broken.	**ACTION 1 -** Check for a broken sensor. **ACTION 2 -** Test continuity across the sense wire. If wire or sensor are damaged replace the component.
	5.2.3 Sensor or sensor wire is grounded to the unit.	**ACTION 1 -** Check for resistance between the sensor rod and the unit ground. **ACTION 2 -** Check for resistance between the sensor wire and the unit ground. **ACTION 3 -** Correct any shorts found in circuit.
	5.2.4 Control does not sense flame.	**ACTION 1 -** Check the microamp signal from the burner flame. If the microamp signal is below normal, check the sense rod for proper location or contamination. **ACTION 2 -** Replace, clean, or relocate flame sense rod. If rod is to be cleaned, use steel wool or replace sensor. DO NOT CLEAN ROD WITH SAND PAPER. SAND PAPER WILL CONTRIBUTE TO THE CONTAMINATION PROBLEM. **NOTE:** Do not attempt to bend sense rod.

PROBLEM 5: BURNERS LIGHT WITH HEATING DEMAND BUT UNIT SHUTS DOWN PREMATURELY (CONT.)		
Condition	**Possible Cause**	**Corrective Action/Comments**
5.3 - Combustion air inducer energizes with a heating demand. - Burners light. - Roll-out switch trips during the heating demand. - Diagnostic lights flash roll-out failure. LED#1-On LED#2-Slow Flash	**5.3.1** Unit is firing above 100% of the nameplate input.	**ACTION 1 -** Check that the manifold pressure matches value listed on nameplate. See installation instructions for proper procedure. **ACTION 2 -** Verify that the installed orifice size match the size listed on the nameplate or installation instructions. **ACTION 3 -** Check gas valve sensing hose to insure no leaks are present. **ACTION 4 -** Check the input rate to verify rate matches value listed on nameplate.
	5.3.2 Gas orifices leak at the manifold connection.	**ACTION 1 -** Tighten orifice until leak is sealed. **NOTE:** Be careful not to strip orifice threads. **ACTION 2 -** Check for gas leakage at the threaded orifice connection. Use approved method for leak detection (see unit instructions).
	5.3.3 Air leakage at the connections between the primary heat exchanger, secondary heat exchanger, and combustion air blower.	**ACTION 1 -** Check for air leakage at all joints in the heat exchanger assembly. Condition will cause high CO2 with high CO. **ACTION 2 -** Seal leakage if possible, replace heat exchanger if necessary, tag and return heat exchanger to proper Lennox personnel.
	5.3.4 Insufficient flow through the heat exchanger caused by a sooted or restricted heat exchanger.	**ACTION 1 -** Check for sooting deposits or other restrictions in the heat exchanger assembly. Clean assembly as outlined in instruction manual. **ACTION 2 -** Check for proper combustion.
	5.3.5 Burners are not properly located in the burner box.	**ACTION 1 -** Check that the burners are firing into the center of the heat exchanger openings. Correct the location of the burners if necessary.
5.4 **-** Combustion air inducer energizes with a heating demand. - Burners light roughly and the unit fails to stay lit. - Diagnostic lights flash watchguard flame failure. LED#1-Alternating Slow Flash LED#2-Alternating Slow Flash	**5.4.1** Recirculation of flue gases. This condition causes rough ignitions and operation. Problem is characterized by nuisance flame failures.	**ACTION 1 -** Check for proper flow of exhaust gases away from intake vent. Remove any obstacles in front of the intake and exhaust vent which would cause recirculation. **ACTION 2 -** Check for correct intake and exhaust vent installation. See instructions
	5.4.2 Improper burner cross-overs	**ACTION 1 -** Remove burner and inspect the cross-overs for burrs, or any restriction or if crossover is warped. Remove restriction or replace burners.
	5.4.3 Pressure Switch opens 5 times during a single demand	**ACTION 1 -** Inspect vent pipe installation and for any restriction. Remove restriction. **ACTION 2 -** Check pressure switch reliability.

PROBLEM 6: CONTROL SIGNALS LOW FLAME SENSE DURING HEATING MODE		
Condition	**Possible Cause**	**Corrective Action/Comments**
6.0 - Unit operates correctly but the diagnostic lights flash low flame sense code. LED#1-Slow Flash LED#2-Fast Flash	**6.1.1** Sensor rod is improperly located on the burner.	**ACTION 1 -** Check the sensor rod for proper location on the burner. Properly locate the sensor rod or replace if rod cannot be located correctly.
	6.1.2 Sensor rod is contaminated.	**ACTION 1 -** Check sensor rod for contamination or coated surface. Clean the sensor rod with steel wool or replace sensor. DO NOT USE SAND PAPER TO CLEAN ROD. SAND PAPER WILL CONTRIBUTE TO THE CONTAMINATION PROBLEM.
PROBLEM 7: INDOOR BLOWER FAILS TO OPERATE IN COOLING, HEATING, OR CONTINUOUS FAN MODE		
Condition	**Possible Cause**	**Corrective Action/Comments**
7.0 - Indoor blower fails to operate in continuous fan, cooling, or heating mode.	**7.1.1** Miswiring of furnace or improper connections at control or indoor blower motor.	**ACTION 1-** Correct wiring and/or replace any loose connections. Check for correct wiring and loose connections.
	7.1.2 120V is not being supplied to the indoor air blower or blower motor failure.	**ACTION 1 -** Check for 120V at the various calls for indoor blower by energizing ”Y”, ”G”, and ”W” individually on the low voltage terminal strip. Note that when ”W” is energized, the blower is delayed 45 seconds. If there is 120V to each motor tap but the blower does not operate, replace the motor.
	7.1.3 Defective control	**ACTION 1 -** If there is not 120V when ”Y”, ”G”, or ”W” is energized, replace the control.
	7.1.4 Defective run capacitor	**ACTION 1 -** Replace capacitor
PROBLEM 8: RF STATIC DURING TIME FOR IGNITION		
Condition	**Possible Cause**	**Corrective Action/Comments**
8.0 - AM radio interference.	**8.1.2** Ignitor operation	**ACTION 1 -** Call Technical Support, Dallas.