



GE APPLIANCES

Service Manual

NF97U*T**R**

**96% Upflow/Horizontal Two Stage
Constant Torque Gas Furnace**



Contact GE Appliances at:

Homeowner: **GEAppliances.com**
HVAC Pro: **GEAppliancesAirandWater.com**
or
866.814.3633

Split System USAC and USHP matches:
AHRIDirectory.org

**READ CAREFULLY.
KEEP THESE INSTRUCTIONS.**

General Information

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

WARNING

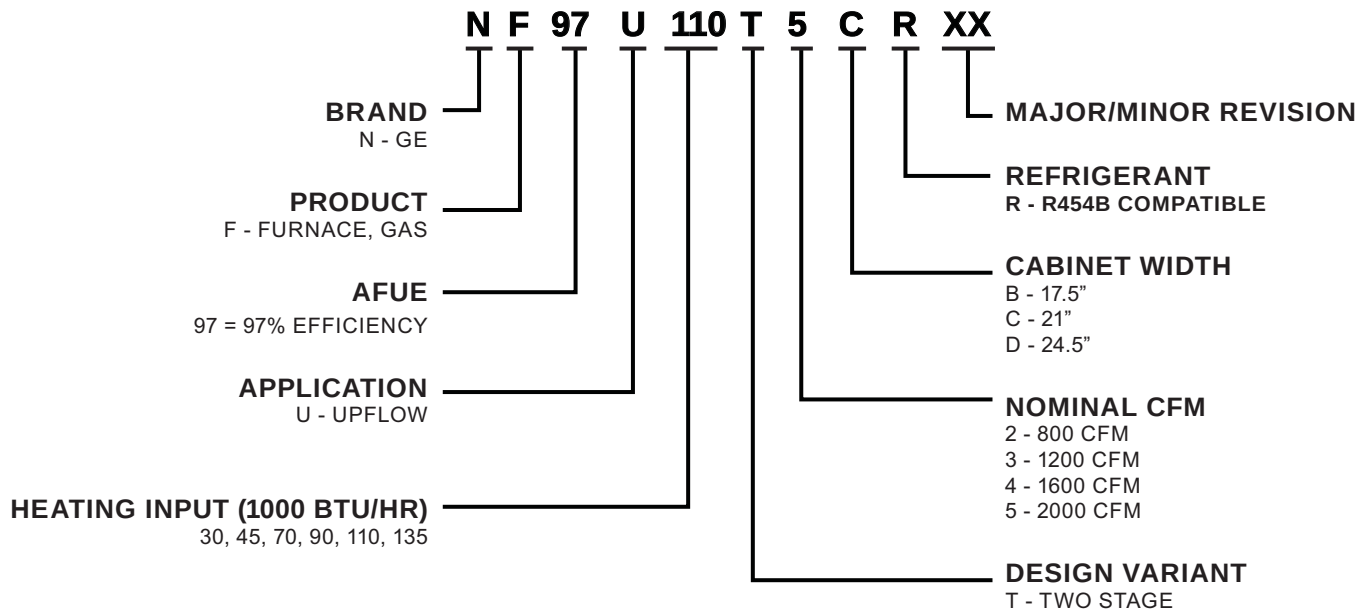
- This furnace is equipped with an ignition control factory enabled for use with A2L refrigerant systems. Disabling the refrigerant detection functionality on A2L system is prohibited by safety codes. Refer to furnace installation instructions for refrigerant system setup.
- Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a licensed professional HVAC installer or equivalent, service agency, or the gas supplier.
- 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.

CAUTION

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

Technical Specifications

MODEL NUMBER GUIDE



PHYSICAL AND ELECTRICAL DATA

	Model	1st Stage		2nd Stage		AFUE (ICS)	Nominal Cooling Capacity	Gas Inlet (in.)	Volts/ Hz/ Phase	Min. Time Delay Breaker or Fuse	Nominal F.L.A.	Trans. (V.A.)	Approx. Shipping Weight (lbs.)
		Input (Btuh)	Output* (Btuh)	Input (Btuh)	Output* (Btuh)								
Upflow / Horizontal	NF97U030T2BR	19,500	19,000	30,000	29,000	97.0	2	1/2	120-60-1	15	6.4	40	120
	NF97U045T3BR	29,000	28,000	44,000	43,000	97.0	3	1/2	120-60-1	15	6.4	40	121
	NF97U070T3BR	43,000	42,000	66,000	65,000	97.0	3	1/2	120-60-1	15	6.4	40	129
	NF97U090T4CR	57,000	56,000	88,000	86,000	97.0	4	1/2	120-60-1	15	9.3	40	151
	NF97U110T5CR	72,000	71,000	110,000	108,000	97.0	5	1/2	120-60-1	20	12.3	40	160
	NF97U135T5CR	86,000	84,000	132,000	128,000	97.0	5	1/2	120-60-1	20	12.3	40	179

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

FILTER REQUIREMENT DATA

Airflow Descriptor	Disposable Filters	Cleanable Filters
	Minimum Area (sq. in.)	Minimum Area (sq.in.)
2	384	192
3	576	288
4	768	384
5	960	480

- The Airflow Descriptor is the two digits following the "B", "C", or "D" in the model number; e.g. 2 indicates 800 CFM or "2 tons nominal airflow".
- Areas shown for permanent filters are based on filters rated at 600 feet per minute face velocity.

Blower Data: Upflow / Horizontal

NF97U030T2BR PERFORMANCE (Less Filter)

External Static Pressure in. w.c.	Rise Range °F		Air Volume / Watts at Various Blower Speeds									
	1st Stage	2nd Stage	High		Medium-High		Medium		Medium-Low		Low	
			cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.10	15-45	30-60	1037	156	964	130	863	101	755	77	742	73
0.20			1001	164	927	137	824	111	689	82	535	55
0.30			968	177	891	147	776	117	634	88	470	59
0.40			937	185	849	157	743	125	596	98	410	66
0.50			896	196	806	167	703	134	544	104	344	72
0.60			865	207	768	173	665	145	502	109	305	79
0.70			835	213	736	184	619	151	459	117	255	84
0.80			787	224	689	193	575	159	412	123	230	88
0.90			743	231	659	199	533	166	365	130	n/a	n/a
1.00			664	221	617	207	500	173	n/a	n/a	n/a	n/a

F97U045T3B PERFORMANCE (Less Filter)

External Static Pressure in. w.c.	Rise Range °F		Air Volume / Watts at Various Blower Speeds									
	1st Stage	2nd Stage	High		Medium-High		Medium		Medium-Low		Low	
			cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.10	20-50	30-60	1395	348	1246	249	1139	198	911	111	847	96
0.20			1375	358	1206	258	1105	203	876	120	809	103
0.30			1348	367	1184	267	1079	215	839	122	768	109
0.40			1318	380	1160	278	1046	221	798	132	733	115
0.50			1294	386	1125	286	1014	230	755	139	694	124
0.60			1265	398	1097	296	987	239	710	145	652	132
0.70			1216	393	1066	304	957	247	665	156	606	136
0.80			1147	374	1043	314	923	256	624	160	569	145
0.90			1062	350	1010	320	889	267	589	166	532	151
1.00			941	314	917	301	846	271	556	177	486	156

NF97U070T3BR PERFORMANCE (Less Filter)

External Static Pressure in. w.c.	Rise Range °F		Air Volume / Watts at Various Blower Speeds									
	1st Stage	2nd Stage	High		Medium-High		Medium		Medium-Low		Low	
			cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.10	25-55	35-65	1388	292	1244	221	1131	173	925	110	884	100
0.20			1359	302	1212	230	1096	182	886	116	843	107
0.30			1331	313	1182	238	1062	190	846	123	802	114
0.40			1301	323	1151	247	1028	198	805	130	759	120
0.50			1273	333	1121	256	996	206	764	137	717	127
0.60			1245	342	1090	265	961	215	720	145	670	134
0.70			1217	352	1059	274	928	223	671	151	616	140
0.80			1187	362	1026	283	892	231	623	157	566	146
0.90			1158	371	995	292	854	240	578	163	519	151
1.00			1128	381	962	302	814	248	532	169	464	156

Blower Data : Upflow / Horizontal

NF97U090T4CR PERFORMANCE (Less Filter)

External Static Pressure in. w.c.	Rise Range °F		Air Volume / Watts at Various Blower Speeds									
	1st Stage	2nd Stage	High		Medium-High		Medium		Medium-Low		Low	
			cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.10	30-60	40-70	1714	401	1490	284	1373	217	1286	186	1165	143
0.20			1679	419	1476	292	1332	233	1250	199	1131	155
0.30			1650	435	1440	312	1305	247	1219	214	1083	168
0.40			1630	456	1403	327	1271	258	1178	222	1050	176
0.50			1601	469	1377	334	1227	270	1142	232	1006	188
0.60			1567	478	1347	346	1196	283	1110	245	968	197
0.70			1489	461	1313	361	1165	291	1068	257	930	207
0.80			1390	433	1275	372	1126	306	1035	268	894	217
0.90			1237	387	1218	373	1091	315	990	277	843	228
1.00			1115	354	1075	337	1043	324	951	287	807	235

NF97U110T5CR PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Rise Range °F		Air Volume / Watts at Different Blower Speeds																			
	1st Stage	2nd Stage	Bottom Return Air, Side Return Air with Return Air from Both Sides or Return Air from Bottom and One Side.										Single Side Return Air – Air volumes in bold (over 1800 cfm) require Optional Return Air Base and field fabricated transition to accommodate 20 x 25 x 1 in. air filter in order to maintain proper air velocity.									
			High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)		High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)	
			CFM	Watt	CFM	Watt	CFM	Watt	CFM	Watt	CFM	Watt	CFM	Watt	CFM	Watt	CFM	Watt	CFM	Watt	CFM	Watt
0.10	30-60	40-70	2140	653	1877	449	1706	349	1616	292	1419	215	2101	650	1821	449	1650	346	1558	288	1383	209
0.20			2102	669	1840	461	1670	362	1566	304	1388	223	2069	664	1795	462	1621	357	1503	301	1331	217
0.30			2061	687	1799	477	1639	375	1518	317	1326	234	2036	681	1746	479	1575	373	1466	312	1289	229
0.40			2031	702	1758	492	1590	387	1480	328	1275	244	1998	698	1708	492	1538	383	1417	326	1235	241
0.50			1999	719	1721	507	1546	399	1427	341	1229	255	1970	717	1676	509	1497	397	1377	340	1183	254
0.60			1960	735	1683	519	1505	413	1390	351	1179	266	1940	731	1641	517	1460	408	1339	349	1152	262
0.70			1908	741	1637	534	1467	424	1351	361	1128	277	1890	740	1609	533	1417	423	1293	362	1099	274
0.80			1840	721	1609	550	1423	438	1299	374	1088	284	1834	730	1560	549	1375	437	1254	374	1047	286
0.90			1744	692	1569	561	1387	447	1257	386	1036	296	1741	702	1532	561	1339	447	1219	384	1011	296
1.00			1651	655	1539	573	1347	461	1218	397	984	305	1645	665	1496	574	1298	460	1177	397	970	304

NF97U135T5CR PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Rise Range °F		Air Volume / Watts at Different Blower Speeds																			
	1st Stage	2nd Stage	Bottom Return Air, Side Return Air with Return Air from Both Sides or Return Air from Bottom and One Side.												Single Side Return Air – Air volumes in bold (over 1800 cfm) require Optional Return Air Base and field fabricated transition to accommodate 20 x 25 x 1 in. air filter in order to maintain proper air velocity.							
			High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)		High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)	
			CFM	Watt	CFM	Watt	CFM	Watt	CFM	Watt	CFM	Watt	CFM	Watt	CFM	Watt	CFM	Watt	CFM	Watt	CFM	Watt
0.10	35-65	45-75	2300	922	2125	689	1948	508	1750	368	1576	287	2274	936	2058	680	1880	509	1690	366	1524	269
0.20			2298	932	2111	703	1914	522	1706	385	1531	302	2248	957	2030	695	1852	523	1659	374	1488	282
0.30			2252	960	2074	720	1880	537	1681	398	1489	310	2214	970	1997	712	1829	537	1621	394	1446	297
0.40			2227	974	2050	737	1850	550	1629	412	1439	322	2194	990	1974	727	1799	554	1595	407	1407	308
0.50			2188	971	2015	757	1809	570	1597	421	1387	334	2153	994	1947	745	1771	567	1562	418	1356	321
0.60			2114	946	1984	770	1771	585	1553	439	1351	346	2104	980	1928	762	1742	583	1519	434	1322	333
0.70			2048	911	1944	785	1730	600	1516	451	1312	356	2044	949	1897	778	1705	596	1474	447	1277	345
0.80			1962	858	1893	797	1705	616	1485	462	1267	368	1962	907	1856	794	1671	616	1449	458	1230	356
0.90			1857	806	1838	774	1665	628	1427	477	1209	382	1873	853	1809	793	1637	629	1402	473	1189	368
1.00			1780	775	1754	739	1625	642	1387	488	1177	392	1756	801	1733	769	1594	643	1362	487	1148	381

Accessory List

Description	Catalog Number
Return Air Base	
Return Air Base 17.5 Inch	68W62
Return Air Base 21.0 Inch	68W63
Return Air Base 24.5 Inch	68W64
Concentric Vent Kit (90% Furnaces only) US Only	
1-1/2" Vent Version	71M80
2" Vent Version	69M29
3" Vent Version	60L46
Flush Mount Termination (90% Furnaces only)	
2" & 3.0" Vent - US Version	51W11
2" & 3.0" Vent - ULC S636 Compliant (Canada)	51W12
Refrigerant Detection System	
Refrigerant Detection System (RDS) Coil Sensor Kit (Upflow)	27V53
Transformer (75VA)	
Recommended when furnace is used with zoning or defrost thermostats and other 24V accessories requiring a higher VA rating	27J32
Circuit breaker (furnished) is wired in series	
Replaces the standard 40VA transformer	

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

Model	Natural to LP/ Propane	High Altitude Natural Burner Orifice Kit	High Altitude LP/ Propane Burner Orifice Kit	High Altitude Pressure Switch	
	0 - 7500 ft (0 - 2286m)	7501 - 10000 ft (2286 - 3048m)	7501 - 10000 ft (2286 - 3048m)	4501 - 7500 ft (1371 - 2286m)	7501 - 10000 ft (2286 - 3048m)
030	17H64	14C92	17H65	14A47	14A50
045	11K48	*51W01	11K47	14A51	14A53
070				14A48	14A54
090				14A54	14A53
110				25B93	14A45
135	11K51	73W37	11K36	25B94	25B95

*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).

Parts Arrangement

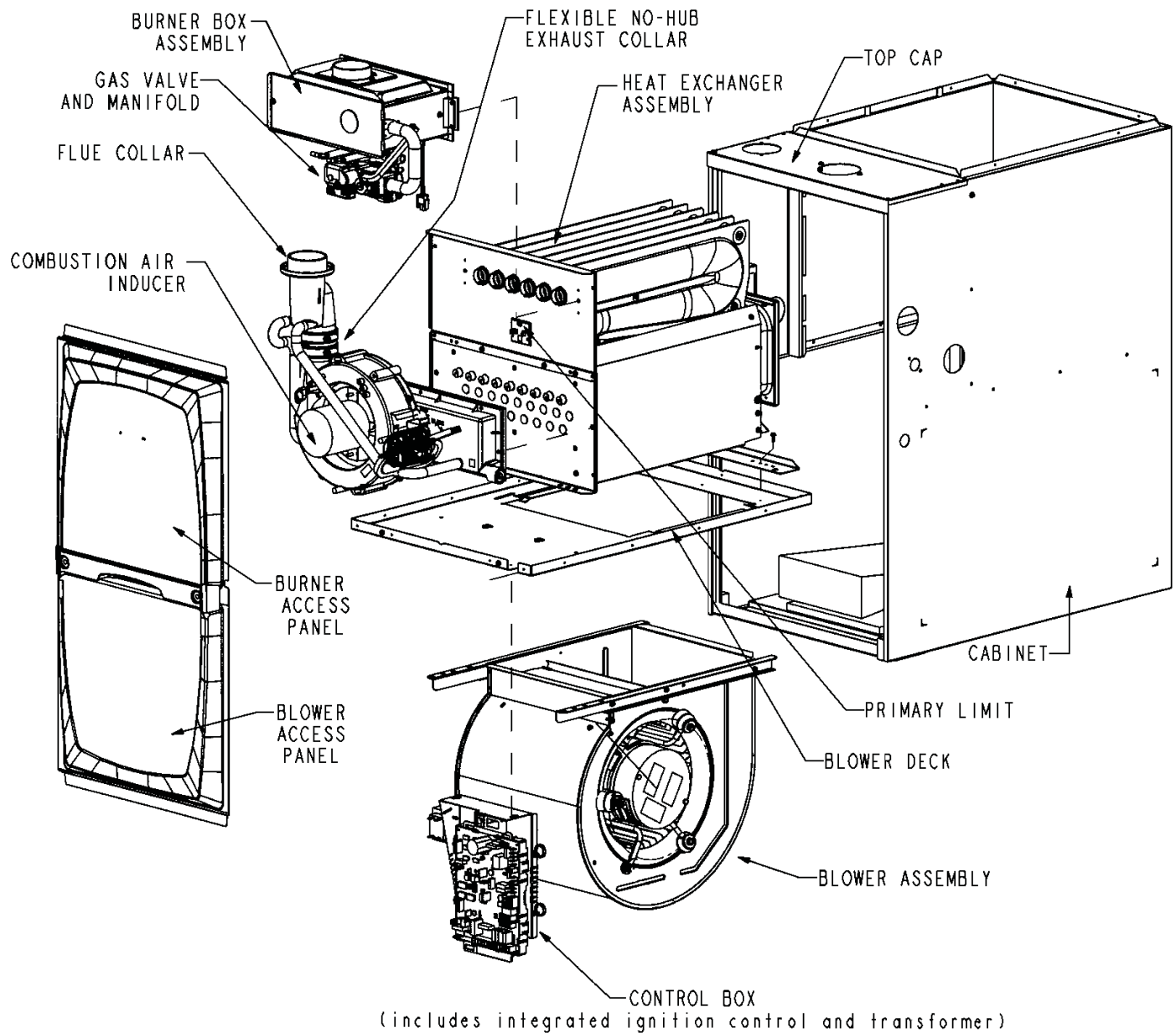


Figure 1.

Service Information

ELECTRICAL

ELECTROSTATIC DISCHARGE (ESD) Precautions and Procedures

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

NF97U***T**R unit components are shown in **Figure 1**. The gas valve, combustion air inducer and burners can be accessed by removing the upper access panel. Electrical components are in the control box (**Figure 2**) found in the blower section.

NF97U***T**R units are factory equipped with a bottom return air panel in place. The panel is designed to be field removed as required for bottom air return. Markings are provided for side return air and may be cut out in the field.

Control Box Components

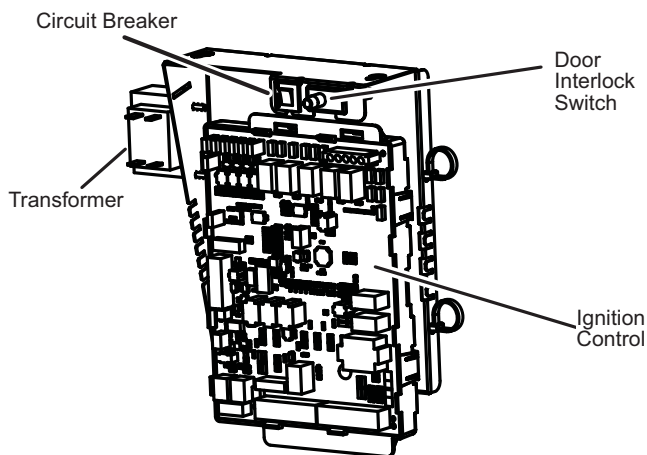


Figure 2. Control Box

Transformer (T1)

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

Door Interlock Switch (S51)

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

Circuit Breaker (CB8)

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

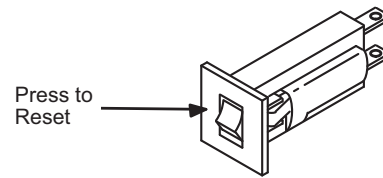


Figure 3. Circuit Breaker (CB8)

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.

Units are equipped with an two-stage, integrated control. The system consists of a ignition / blower control (**Figure 4** and **Figure 5**) with control pin designations in **Table 1** and ignitor (**Figure 12**). The control and ignitor work in combination to ensure furnace ignition and ignitor durability. The control provides gas ignition, safety checks and indoor blower control with two-stage gas heating. The furnace combustion air inducer, gas valve and indoor blower are controlled in response to various system inputs such as thermostat signal, pressure and limit switch signal and flame signal. The control features a seven-segment LED display, indicating furnace status and error codes. The LED flashes in single digits. For example, using **Table 4** under LIMIT CODE, an "E" followed by "2" followed by "5" followed by "0", the limit switch circuit is open. The control also has two unpowered (dry) 1/4" contacts for a humidifier and a 120 volt accessory terminal. Both rated at (1) one amp each.

Service Information

ELECTRICAL (Cont.)

1/4" Quick Connect Terminals	
120V HUM	Power for Humidifier (120VAC)
LINE	Incoming Power Line (120VAC)
XFMR	Transformer Primary (120VAC)
CIRC	Indoor Blower Motor (120VAC)
ACC	Accessory (120VAC)
24V HUM	Humidifier (24VAC)
NEUTRALS	Neutral (5)
3/16" Quick Connect Terminals	
LO COOL	Cool Speed Tap from Indoor Blower Motor (24VAC)
HI COOL	Cool Speed Tap from Indoor Blower Motor (24VAC)
LO HEAT	Heat Speed Tap from Indoor Blower Motor (24 VAC)
HI HEAT	Heat Speed Tap from Indoor Blower Motor (24 VAC)
FAN	Continuous Fan Speed Tap from Indoor Blower Motor (24 VAC)
FLAME SENSE	Flame Sensor Electrode (120 VAC)
COMMON	Common (24VAC)
PARK	3 Terminals to Park Unused Motor Speed Taps

Table 1. 5-Pin Terminal Designations

⚠ WARNING

Electric Shock Hazard.

Can cause injury or death. Unit must be properly grounded in accordance with national and local codes.

⚠ WARNING

Fire Hazard.

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

Electronic Ignition

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

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

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

Two Stage Operation / Thermostat Selection DIP Switch

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

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

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

Service Information

ELECTRICAL (Cont.)

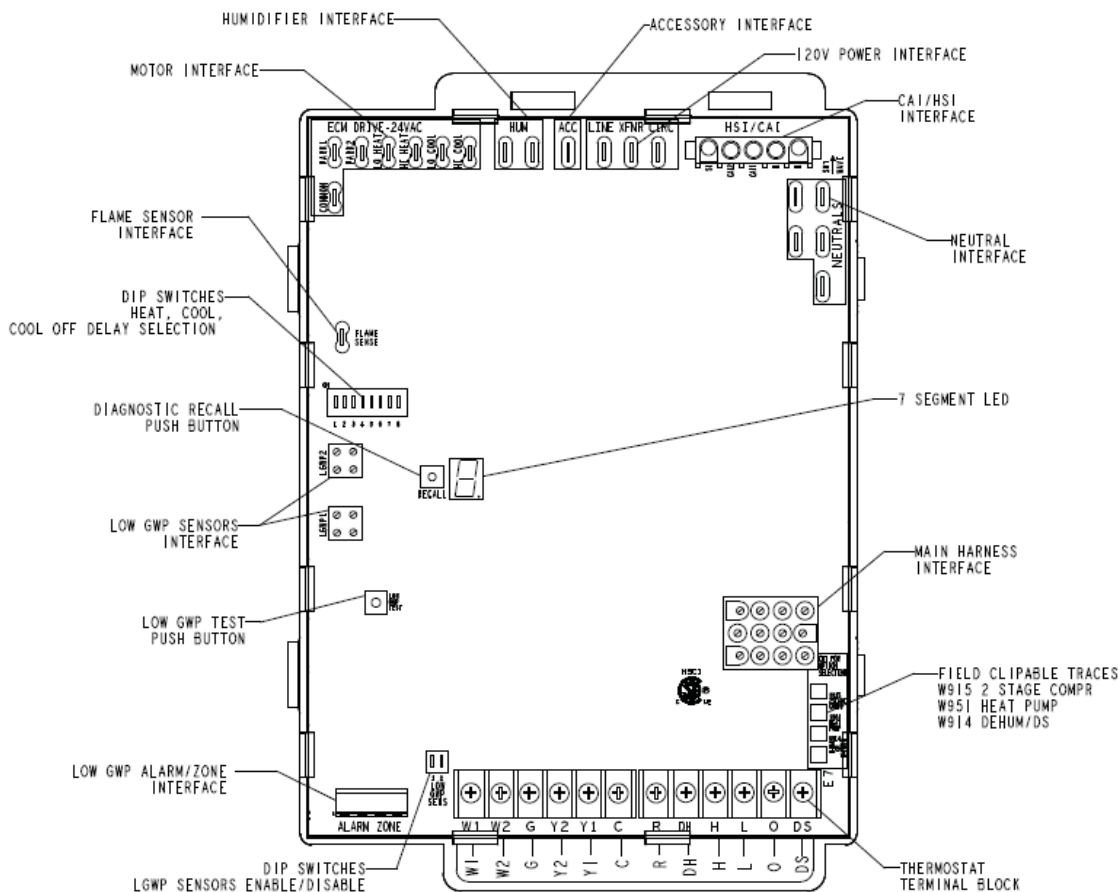


Figure 4. Integrated Control

Thermostat Input Terminals	
W1	Low Stage Heat
W2	High Stage Heat
G	Fan
Y1	Low Stage Cool (When W915 is Clipped)
Y2	High Stage Cool
C	Thermostat Common / Ground
R	24 Vac To The Thermostat
DH	Dehumidification (Unused)
H	24 Vac Humidifier (Unused)
L	LSOM (Unused)
O	Heat Pump Reversing Valve (When W951 is Clipped)
DS	Dehum / Harmony (When W914 is Clipped)

Table 2.

Low GWP Interface	
LGWP1	Low GWP Sensor #1 Interface
LGWP2	Low GWP Sensor #2 Interface
ALARM	Interface to Low GWP Leak Audible Alarm (Dry Contact)
ZONE	Interface to Zoning Control (Dry Contact)
LGWP TEST	Push Button to Test Low GWP Functionality

Table 3.

Service Information

DIAGNOSTIC CODES / STATUS OF FURNACE	CODE
Idle Mode (Decimal Blinks At 1 Hertz -- 0.5 Seconds on, 0.5 Seconds Off)	-
Indoor Blower Operation: Continuous Fan Mode (Constant Torque Only) Indoor Blower Operation: Followed by cfm Setting for Indoor Blower (1 Second on, 0.5 Second Off) / cfm Setting For Mode Displayed (Variable Speed Only)	A
Cooling Stage (1 Second On, 0.5 Second Off) 1 Or 2 Displayed / Pause / Repeat Codes. Variable Speed Only	C
Gas Heat (1 Second On, 0.5 Second Off) Pause / Cfm Displayed / Pause / Repeat Codes Blinking - Ignition	H
Heat Pump Stage (1 Second On, 0.5 Second Off) 1 Or 2 Displayed / Pause / cfm Setting Displayed / Pause / Repeat Codes	h
Defrost Mode	dF
ERROR/FAULT CONDITION	CODE
No Error in the Memory	E000
Electrical Faults (Wait For Recovery)	
AC Line Voltage Low	E110
Twin Communication Fault (Constant Torque Only)	E106
Line Voltage Polarity Reversed	E111
Earth Ground Not Detected	E112
Ac Line Voltage High	E113
Line Voltage Frequency Out of Range	E114
Low 24v - Control Will Restart if the Error Recovers	E115
Hardware Fault (5 Minutes Lockout)	
Control Hardware (Include A/D Electronics and Flame Test) Failure	E125
Hard Lockout Fault	
Rollout Open or Previously Opened	E200
Gas Valve/Pressure Switch/Limit Faults (Wait For Recovery)	
Gas Valve Relay (1st Or 2nd Stage) Problem	E204
Low Pressure Sw Failed to Close (Stuck Open	E223
Low Pressure Sw Failed to Open (Stuck Closed)	E224
High Pressure Sw Failed to Close (Stuck Open)	E225
High Pressure Sw Failed to Open (Stuck Closed)	E226
Low Pressure Switch Opened in Run or TFI	E227
Flame Sense Out of Sequence-Still Present	E241
Primary Limit Switch Opened	E250

Table 4.

Service Information

DIAGNOSTIC CODES / STATUS OF FURNACE (Cont.)	CODE
Soft Lockout Faults (60 Minutes) Code	
Gas Valve Relay (1st or 2nd Stage) Contact Shorted	E205
Hot Surface Ignitor (HSI) Sensed Open	E207
Soft Lockout-Flame Failure on Ignition, Ignition Retry>Max, Last Failed Retry Due to Flame Failure	E270
Soft Lockout-Pressure Switch Open, Ignition Retry>Max, Last Failed Retry Due to LPSW Open	E271
Soft Lockout-Pressure Switch Open, in Run Mode Heating Recycles>Max, Last Failed Retry Due To Lpsw Open	E272
Soft Lockout-Flame Failure in Run Mode, Heating Recycles>Max, Last Failed Retry Due to Loss of Flame	E273
Soft Lockout-Limit Open > 3 Minutes	E274
Soft Lockout-Flame Out of Sequence and is Gone	E275
Ignitor Circuit Fault-Failed Ignitor or Triggering Circuitry	E290
Performance Warning	
Poor Ground Detected	E117
Ignition on High Fire	E229
Low Flame Current in Heating Mode	E240
Low GWP Refrigerant Faults	
Refrigerant Leak Detected, Thermostat Lockout	E150
Refrigerant Leak Detector Sensor #1 Fault	E151
Refrigerant Leak Detector Sensor #2 Fault	E152
Refrigerant Leak Detector Sensor #1 Comm. Lost	E154
Refrigerant Leak Detector Sensor #2 Comm. Lost	E155
Refrigerant Leak Detector Sensor #2 Comm. Lost	E155
Refrigerant Leak Detector Sensor #1 Type Incorrect	E160
Refrigerant Leak Detector Sensor #2 Type Incorrect	E161
Refrigerant Leak Detector Control Failure	E163
Low GWP Test	E164
Low GWP Relay Stuck	E390

Table 4. (Cont.)

Service Information

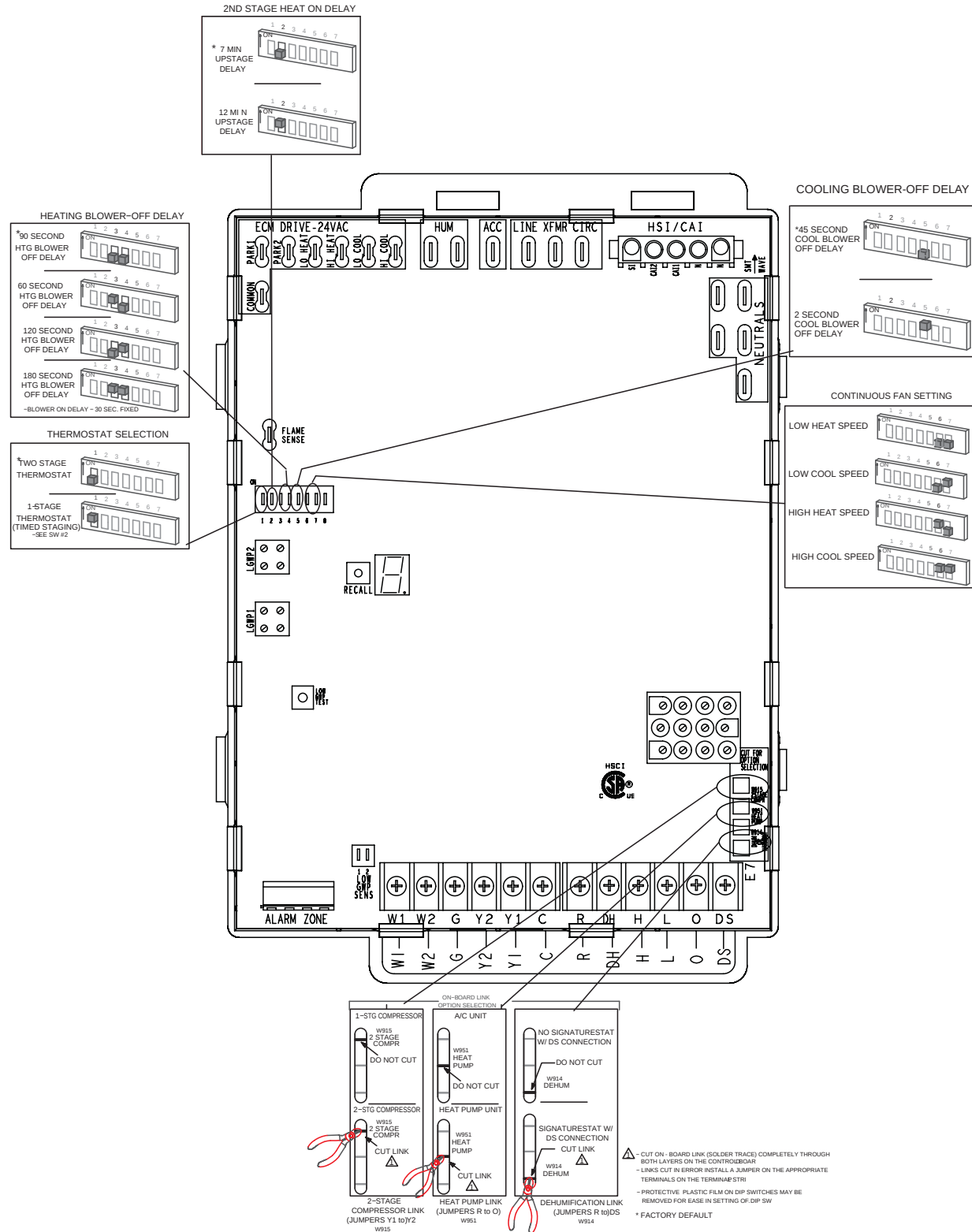


Figure 5. Integrated Control Configuration Guide

Service Information

Display	Action (when button released)
No change (idle)*	Remain in idle mode
Solid "E"	Enter diagnostic recal mode
Solid "F"	Enter flame signal mode
* No change implies the display will continue to show whatever is currently being displayed for normal operation (blinking decimal, active error code, heat state, etc.)	

Table 5A. Integrated Control Diagnostic Modes

Code	Diagnostic Codes/Status of Equipment	Action Required to Clear and Recover
.	Idle mode (Decimal blinks at 1 Hertz -- 0.5 second ON, 0.5 second OFF).	
C	Cooling stage (1 second ON, 0.5 second OFF) 1 or 2 displayed / Pause / Repeat codes.	
d	Dehumidification mode (1 second ON, 1 second OFF) / Pause / Repeat Codes).	
H	Gas Heat Stage (1 second ON, 0.5 second OFF) 1 or 2 displayed / Pause / Repeat codes. Blinking during ignition.	
h	Heat pump stage.	
E110	Low line voltage.	Line Voltage Low (Voltage lower than nameplate rating). Check power line voltage and correct. Alarm clears 5 seconds after fault recovered.
E111	Line voltage polarity reversed.	Reverse line power voltage wiring. System resumes normal operation 5 seconds after fault recovered.
E112	Ground not detected.	System shuts down. Provide proper earth ground. System resumes normal operation 5 seconds after fault recovered.
E113	High line voltage.	Line Voltage High (Voltage higher than nameplate rating). Provide power voltage within proper range. System resumes normal operation 5 seconds after fault recovered.
E114	Line voltage frequency out-of-range.	No 60 Hertz Power. Check voltage and line power frequency. Correct voltage and frequency problems. System resumes normal operation 5 seconds after fault recovered.
E115	Low 24V - Control will restart if the error recovers.	24-Volt Power Low (Range is 18 to 30 volts). Check and correct voltage. Check for additional power-robbing equipment connected to system. May require installation of larger VA transformer to be installed in furnace / air handler. Clears after fault recovered.
E117	Poor ground detected (Warning only).	Provide proper grounding for unit. Check for proper earth ground to the system. Warning only will clear 30 seconds after fault recovered.
E125	Control failed self-check, internal error, failed hardware. Will restart if error recovers. Integrated control not communicating. Covers hardware errors (flame sense circuit faults, pin shorts, etc.).	Hardware problem on the control. Cycle power on control. Replace if problem prevents service and is persistent. Critical alert. Cleared 300 seconds after fault recovered.
E200	Hard lockout - Rollout circuit open or previously open.	Correct cause of rollout trip, or replace flame rollout switch. Test furnace operation. Cleared after fault recovered.
E204	Gas valve mis-wired.	Check gas valve operation and wiring. Clears when repaired.
E205	Gas valve control relay contact shorted	Check wiring on control and gas valve. If wiring is correct, replace control.
E206	Gas valve second-stage relay failure.	Furnace will operate on 1st stage for remainder of the heating demand, Will clear after fault recovered. If unable to operate 2nd stage, replace control.
E207	Hot surface ignitor sensed open.	Measure resistance of hot surface ignitor, Replace if open or not within specified range found in IOM. Resumes normal operation after fault is cleared.

Table 5B. Integrated Diagnostic Codes/Status of Equipment

Service Information

Code	Diagnostic Codes/Status of Equipment	Action Required to Clear and Recover
E223	Low pressure switch failed open.	Check pressure (inches w.c.) of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E224	Low pressure switch failed closed.	Check operation of low pressure switch to see if it stuck closed on heat call. longer than 150 seconds. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E225	High pressure switch failed open.	Check pressure (inches w.c.) of high pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E226	High pressure switch failed closed.	Check operation of high pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E227	Low pressure switch open during trial for ignition or run mode.	Check pressure (inches w.c.) of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E229	Ignition on High Fire - Information Only.	Codes is displayed if 1) low pressure switch fails to close, then furnace will switch to high speed inducer to close both low and high pressure switches, then furnace lights on high fire, or 2) if continuous fan is active, furnace lights on high fire for 60 seconds to improve heat exchanger warm up time.
E240	Low flame current - Run mode.	Check micro-amperes of flame sensor using control diagnostics or field-installed mode. Clean or replace sensor. Measure voltage of neutral to ground to ensure good unit ground. Alert clears after current heat call has been completed.
E241	Flame sensed out of sequence - Flame still present.	Shut off gas. Check for gas valve leak. Replace, if necessary. Alert clears when fault is recovered.
E250	Limit switch circuit open.	Check for proper firing rate on furnace. Ensure there is no blockage in heater. Check for proper air flow. If limit not closed within 3 minutes, unit will go into 1-hour soft lockout. Resumes normal operation after fault is cleared.
E270	Soft lockout - Exceeded maximum number of retries. No flame current sensed.	Check for proper gas flow. Ensure that ignitor is lighting burner. Check flame sensor current. Clears when heat call finishes successfully.
E271	Soft lockout - Exceeded maximum number of retries. Last retry failed due to the pressure switch opening.	Check pressure (inches w.c.) of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Clears when heat call finishes successfully.
E272	Soft lockout - Exceeded maximum number of recycles. Last recycle due to the pressure switch opening.	Check operation of low pressure switch to see if it is stuck closed on heat call. Check pressure (inches w.c.) of high pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Clears when heat call finishes successfully.
E273	Soft lockout - Exceeded maximum number of recycles. Last recycle due to flame failure.	Check micro-amperes of flame sensor using control diagnostics or field-installed mode. Clean or replace sensor. Measure voltage of neutral to ground to ensure good unit ground. Clears when heat call finishes successfully.
E274	Soft lockout - Exceeded maximum number of recycles. Last recycle failed due to the limit circuit opening or limit remained open longer than 3 minutes.	Shut down system. 1-hour soft lockout. Check firing rate and air flow. Check for blockage. Clears when heat call finishes successfully.
E275	Soft lockout - Flame sensed out of sequence. Flame signal is gone.	Shut off gas. Check for gas valve leak. 1-hour soft lockout. Clears when flame has been proven stable.

Table 5B. Integrated Diagnostic Codes/Status of Equipment (Cont.)

Service Information

Code	Diagnostic Codes/Status of Equipment	Action Required to Clear and Recover
E290	Ignitor circuit fault - Failed ignitor or triggering circuitry.	Measure resistance of hot surface ignitor, Replace if open or not within specifications, 1-hour soft lockout. Clears when flame has been proven stable.
E150	Refrigerant Leak detected	This may indicate the presence of a leak at or in the indoor unit coil of the equipment, that will need to be repaired for proper and safe system operation. Additionally, it may indicate that proper refrigerant charge will need to be verified. This fault cannot be cleared while the refrigerant detection system sensor is reporting the presence of a leak.
E151	Refrigerant Leak Detector Sensor #1 fault	The refrigerant detection sensor #1 in the unit is reporting an issue that prevents it from functioning properly, and replacement of the sensor may be necessary. This fault clears when the sensor no longer reports the presence of a fault condition. E152 Refrigerant Leak Detector Sensor #2 fault The refrigerant detection sensor #2 in the unit is reporting an issue that prevents it from functioning properly, and replacement of the sensor may be necessary. This fault clears when the sensor no longer reports the presence of a fault condition.
E154	Refrigerant Leak Detector Sensor #1 Communication lost or invalid sensor dip switch configuration (ON/OFF)	There may be an issue with the wiring harness connecting the sensor #1 to the furnace control board, either with the wiring itself or with the connector. Check the wiring and the connector for damage or improper connectivity. Check the sensor for damage or obstruction on the harness plug. This fault clears when communications with the sensor has been reestablished, but blower latches for a minimum of 5 minutes. Retest of the presence of fault can be effected by pressing the Low GWP test button on the furnace unit control board. This may also indicate incorrect Low GWP dip switch settings. Please refer to installation instructions.
E155	Refrigerant Leak Detector Sensor #2 Communication lost	There may be an issue with the wiring harness connecting the sensor #2 to the furnace control board, either with the wiring itself or with the connector. Check the wiring and the connector for damage or improper connectivity. Check the sensor for damage or obstruction on the harness plug. This fault clears when communications with the sensor has been reestablished, but blower latches for a minimum of 5 minutes. Retest of the presence of fault can be effected by pressing the Low GWP test button on the furnace unit control board
E160	Refrigerant Leak Detector Sensor #1 type incorrect	The sensor #1 is of a type not suitable for use in the application. Replace the sensor with a GE Appliances approved replacement part. This fault clears when a sensor suitable for the application is detected by the furnace control board, but blower will latch for a minimum of 5 minutes. Retest of the presence of the fault can be effected by pressing the Low GWP test button on the furnace unit control board.
E161	Refrigerant Leak Detector Sensor #2 type incorrect	The sensor #2 is of a type not suitable for use in the application. Replace the sensor with a GE Appliances approved replacement part. This fault clears when a sensor suitable for the application is detected by the furnace control board, but blower will latch for a minimum of 5 minutes. Retest of the presence of the fault can be effected by pressing the Low GWP test button on the furnace unit control board.
E163	Furnace Control Board Failure	There is an issue with the furnace control board, preventing the furnace from operating properly. This may require the replacement of the indoor unit control board. This fault clears when the furnace controller operates normally.
E164	Low GWP Test	Low GWP Test mode activates by manually engaging Low GWP test button. Normal operations resumes and code clears automatically after 1-minute.
E390	Low GWP Relay Stuck	This indicates an issue with the Low GWP relay in the furnace control. This may require the replacement of the indoor unit control board. This fault clears when the relay operates normally.

Table 5B. Integrated Diagnostic Codes/Status of Equipment (Cont.)

Service Information

ELECTRICAL (Cont.)

Diagnostic LED (Figure 4)

The seven-segment diagnostic LED displays operating status, error codes and other information. **Table 4** lists diagnostic LED codes.

Diagnostic Push Button (Figure 4)

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

Error Code Recall Mode

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

Flame Signal Mode

Select "F" from the menu to access the flame signal mode. The integrated control will display the flame current on seven-segment LED in micro amps (uA).

Flame signal mode is exited after any of the following:

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

Integrated Control DIP Switches

NF97U***T**R units are equipped with a two-stage integrated control. This control manages ignition timing, heating mode fan off delays and indoor blower speeds based on selections made using the control dip switches and jumpers. The control includes an internal feature which automatically resets the ignition control when it has been locked out. After one hour of continuous thermostat demand for heat, the feature will break and remake thermostat demand to the furnace and automatically reset the control to relight the furnace.

Heating Operation DIP Switch Settings

Switch 1 -- Thermostat Selection -- This unit may be used with either a single-stage or two-stage thermostat.

Heating Operation DIP Switch Settings

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

- a. Select "OFF" for two-stage heating operation controlled by a two-stage heating thermostat (factory setting);
- b. Select "ON" for two-stage heating operation controlled by a single-stage heating thermostat.

This setting provides a timed delay before secondstage heat is initiated.

Switch 2 --- Second Stage Delay (Used with Single-Stage Thermostat Only) --

This switch is used to determine the second stage on delay when a single-stage thermostat is being used. The switch is factory-set in the OFF position, which provides a 7-minute delay before second-stage heat is initiated. If the switch is toggled to the ON position, it will provide a 12-minute delay before second-stage heat is initiated. This switch is only activated when the thermostat selector jumper is positioned for single-stage thermostat use.

Indoor Blower Operation DIP Switch Settings

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

-- The blower-on delay of 30 seconds is not adjustable. The blower-off delay (time that the blower operates after the heating demand has been satisfied) can be adjusted by moving switches 3 and 4 on the integrated control. The unit is shipped from the factory with a blower-off delay of 120 seconds. The blower off delay affects comfort and is adjustable to satisfy individual applications. Adjust the blower off delay to achieve a supply air temperature between 90° and 110°F at the exact moment that the blower is de-energized. Longer off delay settings provide lower supply air temperatures; shorter settings provide higher supply air temperatures. **Table 6** provides the blower off timings that will result from different switch settings.

Blower Off Delay (seconds)	Switch 3	Switch 4
90	On	Off
120 (Factory)	Off	Off
180	Off	On
210	On	On

Table 6. Blower Off Heating Mode Delay Switch Settings

Service Information

ELECTRICAL (Cont.)

Switch 5 -- Cooling Mode Blower-Off Delay -- The unit is shipped from the factory with the dip switch positioned OFF for a 45 second delay. **Table 7** provides the cooling mode off delay settings.

Blower Off Delay (seconds)	Switch 5
45 (Factory)	Off
2	On

Table 7. Blower Off Cooling Mode Delay Switch Settings

Switches 6 and 7 -- Continuous Fan Mode -- Continuous fan speed can be controlled by changing DIP switch positions. **Table 8** provides DIP switch settings for continuous fan mode.

Continuous Fan Mode	Switch 6	Switch 7
Low Heat Speed (Factory)	Off	Off
Low Cool Speed	Off	On
High Heat Speed	On	Off
High Cool Speed	On	On

Table 8. Continuous Fan Mode Settings

ONBOARD LINKS

W914 Dehum

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

W951 Heat Pump (R to O)

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

W915 2 Stage Compr (Y1 to Y2)

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

⚠ IMPORTANT

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

BLOWER COMPARTMENT

⚠ IMPORTANT

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

NF97U***T**R units are equipped with a constant torque ECM motor. It has a DC motor coupled to an electronic control module both contained in the same motor housing. The motor is programmed to provide constant torque at each of the five selectable speed taps. Each tap requires 24 volts to energize.

Input Voltage Requirements

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

Troubleshooting the Motor

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

1. Shut off power to unit.
2. Remove input plugs P48 and P49 from motor. See **Figure 10** for troubleshooting procedure.

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

If replacing the indoor blower motor or blower wheel is necessary, placement is critical. The blower wheel must be centered in the blower housing as shown in **Figure 6**. When replacing the indoor blower motor the set screw must be aligned and tightened with the motor shaft as shown in **Figure 7**.

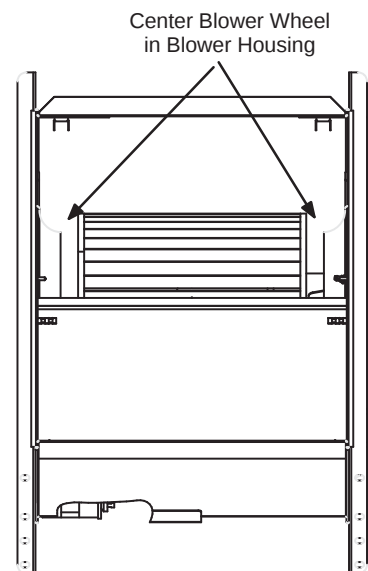


Figure 6. Blower Wheel Replacement

Service Information

ELECTRICAL (Cont.)

BLOWER COMPARTMENT(Cont.)

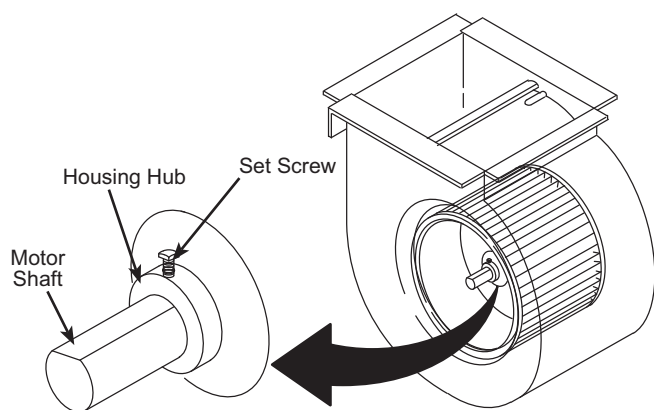


Figure 7.

Testing the Motor (Figure 8)

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

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



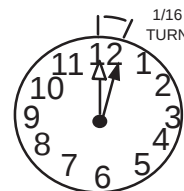
Figure 8. Motor Test

Scale	Measurement Range in Words	ohms
2 M	two megohms - two million ohms	0 - 2,000,000
200 K	two hundred kil-ohms - two hundred thousand ohms	0 - 200,000
20 K	twenty kilo-ohms - twenty thousand ohms	0 - 20,000
2 K	two kilo-ohms - two-thousand ohms	0 - 2,000
200	two hundred ohms	0 - 200

Motor Module Installation

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

1. Verify electrical power to unit is disconnected.
2. Connect three-wire harness from motor to control module.
3. Mount new motor control module to motor using two hex head bolts. Torque bolts to 22 inch pounds or 1/16th clock turn as exemplified to the right.
4. Reconnect the two harnesses to the motor control module.



5. The electrical connectors of the motor should be facing down to form a drip loop (Figure 9). This will direct moisture away from the motor and its electric connections on the motor.

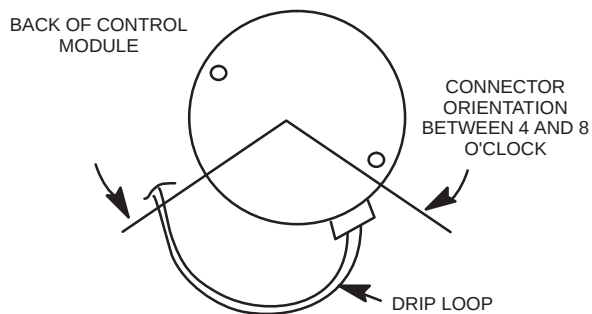
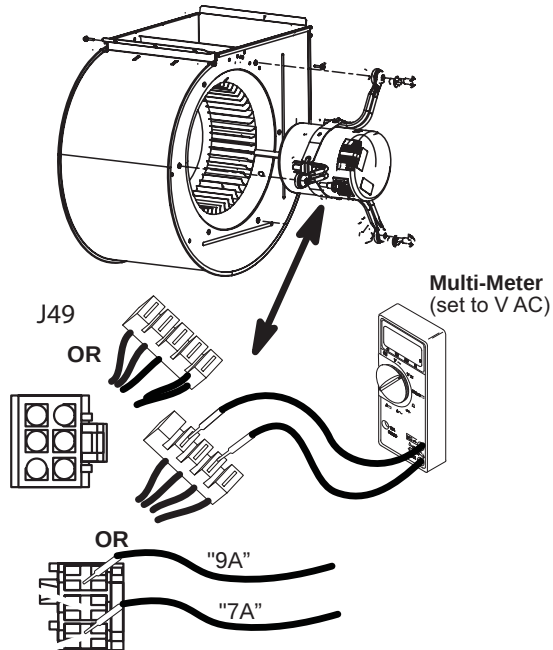


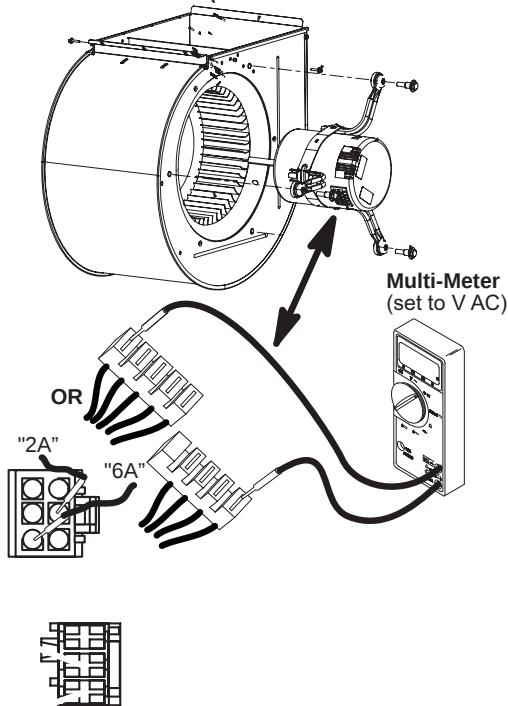
Figure 9. Drip Loop

Service Information

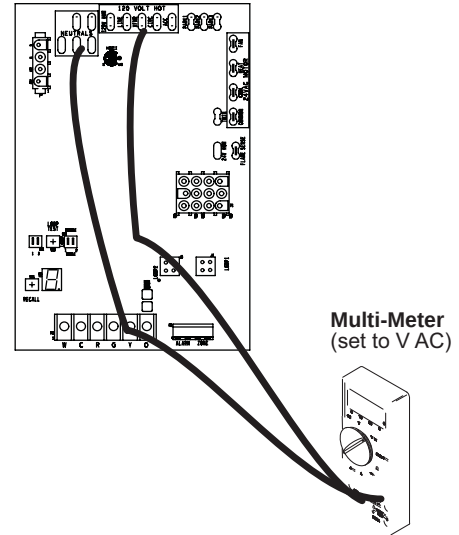


Test 1 - Turn power on to unit. Check for 120 volts across terminals “L” and “N” or terminals “7A” and “9A” of connector J48. If voltage is present continue to test 2. If voltage is not present, problem may be upstream of J48. Proceed to **Test 3**.

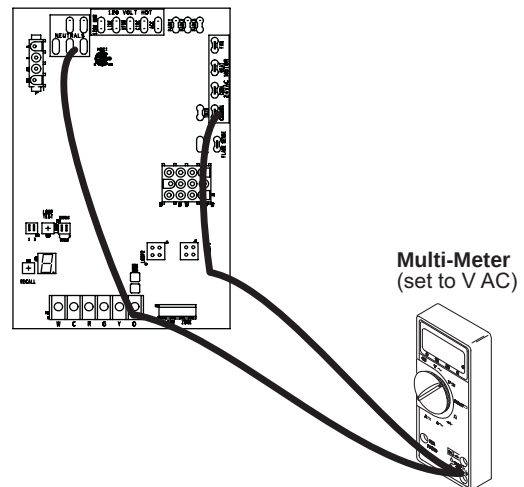
OR



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



Test 3 (if necessary) - **NOTE** - Ignition control illustration is typical. Check for 120 volts across terminals “L1” and “Neutrals” on the integrated control. If voltage is present, problem is with the harness. If voltage is not present problem may be may be with the integrated control.



Test 4 (if necessary) - **NOTE** - Ignition control illustration is typical. Check for 24 volts across terminals “24 COM” and the “active speed tap” on the integrated control. If voltage is present, problem is with the harness. If voltage is not present problem may be may be with the integrated control.

Figure 10.

Service Information

ELECTRICAL (Cont.)

Heating Components

Ignitor

The ignitor is made of durable silicon nitride. The integrated control provides 120 volts to the ignitor for a consistent ignition and long ignitor life. Ohm value should be 39 to 70. See **Figure 12** for ignitor location and **Figure 13** for ignitor check out.

NOTE: The NF97U***T**R furnace contains electronic components that are polarity sensitive. Make sure that the furnace is wired correctly and is properly grounded.

Flame Sensor

A flame sensor is located on the left side of the burner support. See **Figure 12**. The sensor tip protrudes into the flame envelope of the left-most burner. The sensor can be removed for service without removing any part of the burners. During operation, flame is sensed by current passed through the flame and sensing electrode. The control allows the gas valve to remain open as long as flame signal is sensed. To check flame sense signal use the push-button found on the integrated control and go to Field Test Mode. The menu will display the flame signal. See **Table 9** for flame signal.

Normal	Low	Drop Out
2.6 or greater	2.5 or less	0.6

Table 9. Flame Signal in Microamps

Gas Valve

The valve (**Figure 12**) is internally redundant to assure safety shut-off. If the gas valve must be replaced, the same type valve must be used.

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

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

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

Flame Rollout Switches (S47)

Flame rollout switch is a high temperature limit located on top of the burner box, one on each side. See **Figure 12**. The limit is a N.C. SPST manual-reset limit. When S47 senses rollout, the circuit breaks and the ignition control immediately stops ignition and closes the gas valve. Rollout can be caused by a blocked exchanger, flue or lack of combustion air. The switch is factory set to trip (open) at 210°F and cannot be adjusted. The switch can be manually reset. To manually reset a tripped switch, push the reset button located on the control.

Burners

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

Primary Limit Control (S10)

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

The switch may have a different set point for each unit model number. When removing switch make note of orientation. When replacing switch make sure the three mounting holes are lined up with the screw holes in the vestibule for correct orientation.

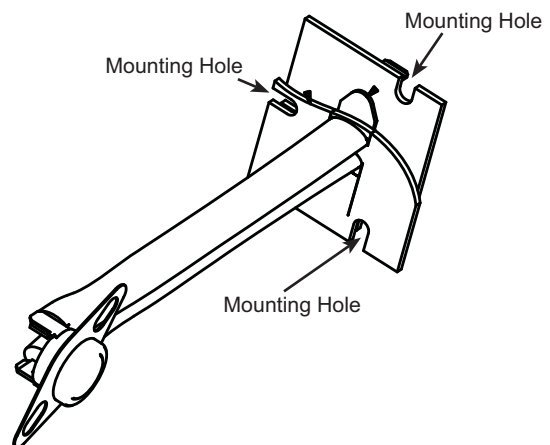


Figure 11. Primary Limit Control (S10)

Service Information

ELECTRICAL (Cont.)

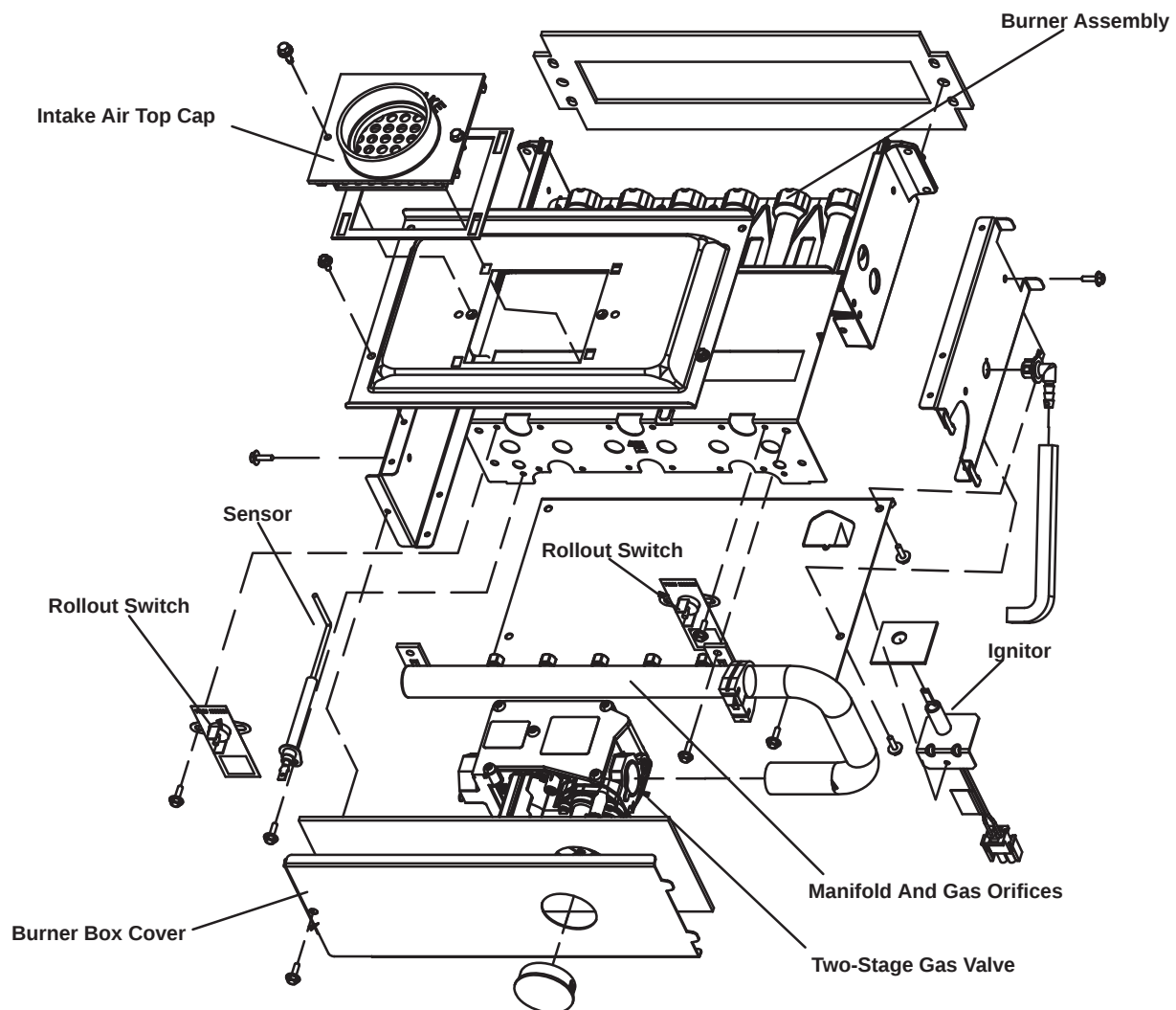


Figure 12. Heating Components

Service Information

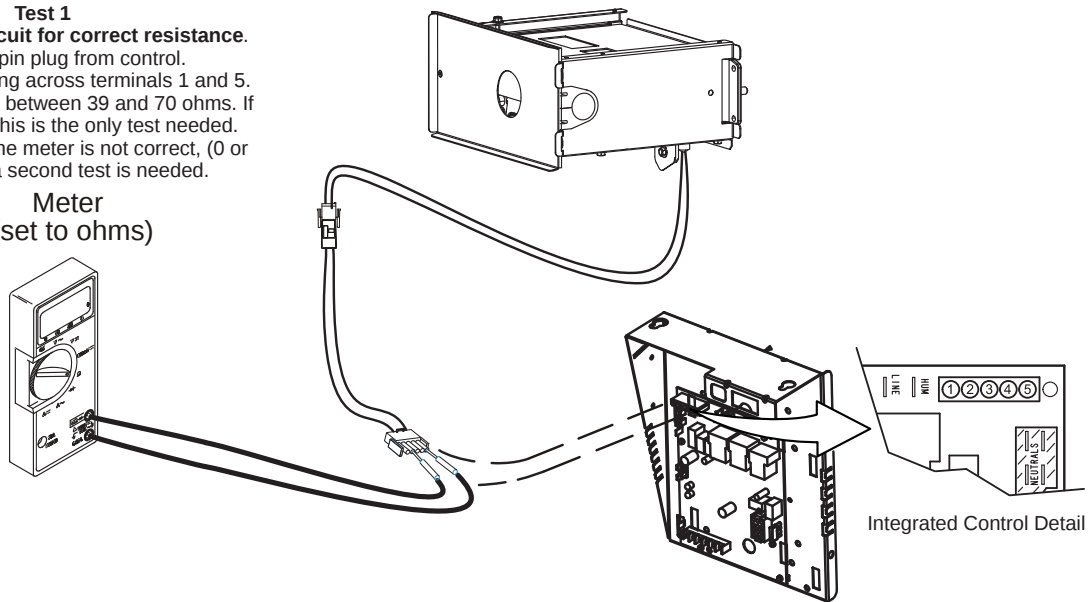
ELECTRICAL (Cont.)

Test 1

Check ignitor circuit for correct resistance.

Remove 4-pin plug from control.
Check ohms reading across terminals 1 and 5.
Reading should be between 39 and 70 ohms. If value is correct, this is the only test needed.
If the reading on the meter is not correct, (0 or infinity) then a second test is needed.

Meter
(set to ohms)

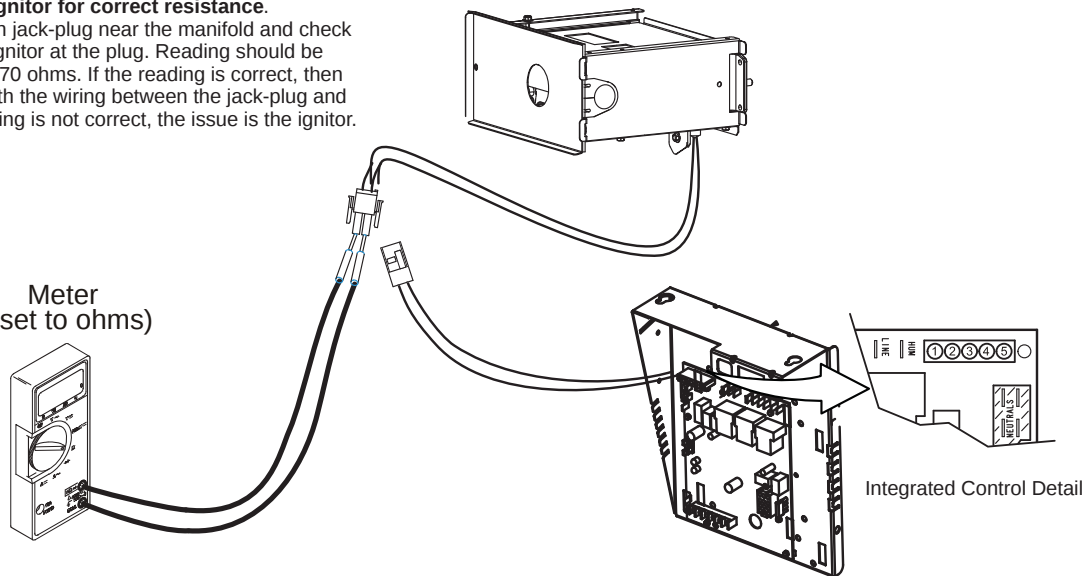


Test 2

Check ignitor for correct resistance.

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

Meter
(set to ohms)



Test 3

Check ignitor for correct voltage

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

Meter
(set to AC volts)

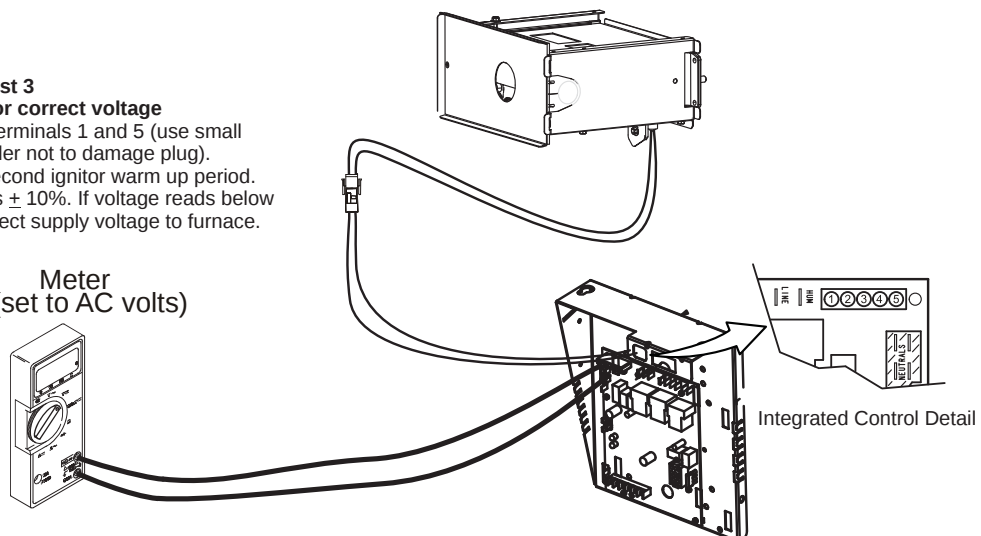


Figure 13. Ignitor Check

Service Information

ELECTRICAL (Cont.)

Heating Components (Cont.)

Combustion Air Inducer (B6) and Cold End Header Box

All NF97U***T**R units use a two-speed combustion air inducer to move air through the burners and heat exchanger during heating operation. The blower uses a 120VAC motor. The motor operates during all heating operation and is controlled by integrated control A92. The inducer also operates for 15 seconds before burner ignition (pre-purge) and for 5 seconds after the gas valve closes (post-purge). The inducer operates on low speed during first-stage heat, then switches to high speed for second stage heat.

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

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

Combustion Air Inducer Pressure Switch (S18) (Figure 14)

NF97U***T**R series units are equipped with a dual combustion air pressure switch (first and second stage) located on the CEHB. The switch is connected to the cold end header box by means of flexible silicone hoses. It monitors negative differential pressure across the cold end header box orifice.

The switches are a single-pole single-throw pressure switches electrically connected to the integrated control. The purpose of the switches is to prevent burner operation if the combustion air inducer is not operating, the inlet or exhaust pipes or heat exchanger are restricted.

On heat demand (first or second stage) the switch senses that the combustion air inducer is operating. It closes a circuit to the integrated control when pressure across the CEHB orifice becomes greater than the switch set point. Set points vary depending on unit size. See **Table 10**. Both pressures sensed by the switches are negative relative to atmospheric pressure. If the inlet or exhaust pipes, or the heat exchanger become obstructed, the switch senses the loss of differential pressure and opens the circuit to the furnace integrated control and gas valve. A bleed port on

the switch allows relatively dry air in the vestibule to purge switch tubing, to prevent condensate build up.

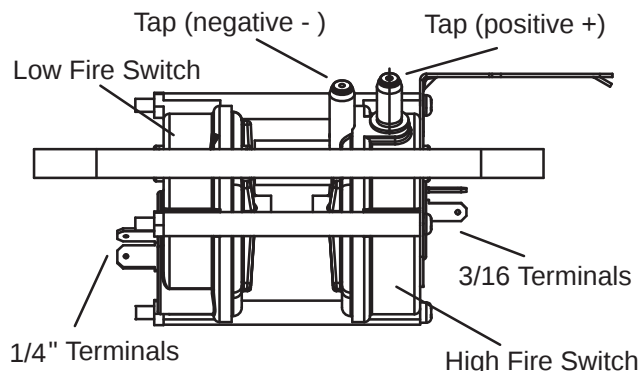


Figure 14. Combustion Air Inducer Pressure Switch

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

Table 10A. 0 - 4500'

Unit	Set Point High Heat	Set Point Low Heat
-045	0.80	0.50
-070	0.95	0.55
-090	0.90	0.50
-110	1.00	0.55
-135	0.85	0.45

Table 10B. 4501' - 7500'

Unit	Set Point High Heat	Set Point Low Heat
-045	0.74	0.41
-070	0.85	0.50
-090	0.75	0.45
-110	0.95	0.55
-135	0.80	0.40

Table 10C. 7501' - 10,000'

Unit	Set Point High Heat	Set Point Low Heat
-045	0.70	0.40
-070	0.75	0.45
-090	0.70	0.40
-110	0.90	0.50
-135	0.75	0.35

Service Information

PLACEMENT AND INSTALLATION

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 **Table 11** for approved piping and fitting materials.

⚠ 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.

⚠ IMPORTANT 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.

Use PVC primer and solvent cement or ABS solvent cement meeting ASTM specifications, refer to **Table 11**. As an alternate, use all purpose cement, to bond ABS, PVC, or CPVC pipe when using fittings and pipe made of the same materials. Use transition solvent cement when bonding ABS to either PVC or CPVC.

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

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

PIPING AND FITTINGS SPECIFICATIONS	
Schedule 40 PVC (Pipe)	D1785
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 (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	
POLYPROPYLENE VENTING SYSTEM	
PolyPro® by Duravent	
InnoFlue® by Centrotherm	ULCS636
ECCO Polypropylene VentTM	

Table 11.

Service Information

PLACEMENT AND INSTALLATION (Cont.)

Model	Vent Pipe Dia. (in.)	STANDARD			CONCENTRIC		
		Outdoor Exhaust Accelerator (Dia. X Length)	Outdoor Exhaust Accelerator (Dia. X Length)	Flush Mount Kit	1-1/2" Concentric Kit	2" Concentric Kit	3" Concentric Kit
		1-1/2" x12"	2" x12"	51W11	71M80	69M29	60L46
030 045	¹ 1-1/2			YES	YES		
	2	YES		YES	YES		
	2-1/2"	YES		YES	YES		
	3	YES		YES	YES		
70	¹ 1-1/2			YES	YES		
	2	YES		YES	YES		
	2-1/2	YES		YES	YES		
	3	YES		YES	YES		
90	2		YES	YES		YES	YES
	2-1/2		YES	YES		YES	YES
	3		YES	YES		YES	YES
110	2		YES	YES		YES	YES
	2-1/2		YES	YES		YES	YES
	3		YES	YES		YES	YES
135	3		YES	YES			YES

¹ 2 in. to 1-1/2 in. reducer required, must be field provided.
 * Requires field provided end installed 1-1/2 in. exhaust accelerator.
 ** Kit 51W11 is provided with a 1-1/2 in. accelerator, which must be used for all 2 and 2-1/2 in. PVC installations. When using 1-1/2 in. piping, the pipe must be transitioned to 2 in. pipe when used with the Flush Mount Kit.
NOTE: When using 1-1/2 in. piping, the pipe must be transitioned to 2 in. pipe when used with the Concentric Kit.

Table 12. Outdoor Termination Kits Usage

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.

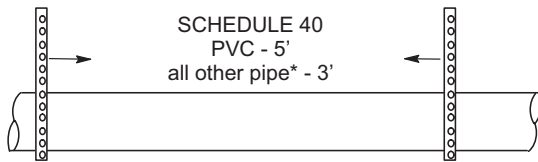
1. Measure and cut vent pipe to desired length.
2. Debur and chamfer end of pipe, removing any ridges or rough edges. If end is not chamfered, edge of pipe may remove cement from fitting socket and result in a leaking joint.
NOTE: Check the inside of vent pipe thoroughly for any obstruction that may alter furnace operation.
3. Clean and dry surfaces to be joined.
4. Test fit joint and mark depth of fitting on outside of pipe.
5. Uniformly apply a liberal coat of PVC primer for PVC or use a clean dry cloth for ABS to clean inside socket surface of fitting and male end of pipe to depth of fitting socket.

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 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.

Service Information

VENTING PRACTICES



* See Piping and Fittings Specifications table

NOTE: Vertical support guidelines: Recommend following the guidelines in the International Plumbing code for PVC.

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

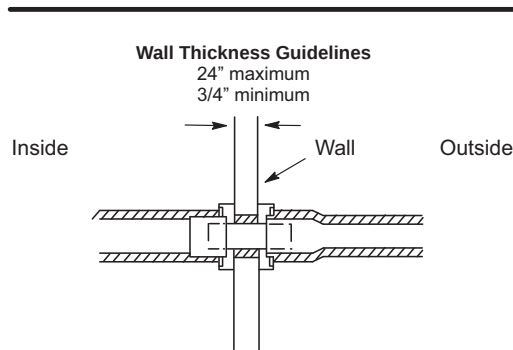


Figure 15. Piping Suspension Guidelines

- 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.
- When furnace is installed in a residence where unit is shut down for an extended period of time, such as a vacation home, make provisions for draining condensate collection trap and lines.

Removal of the Furnace from Common Vent

In the event that an existing furnace is removed from a venting system commonly run with separate gas appliances, the venting system is likely to be too large to properly vent the remaining attached appliances.

Conduct the following test while each appliance is operating and the other appliances (which are not operating) remain connected to the common venting system. If the venting system has been installed improperly, you must correct the system as indicated in the general venting requirements section.

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

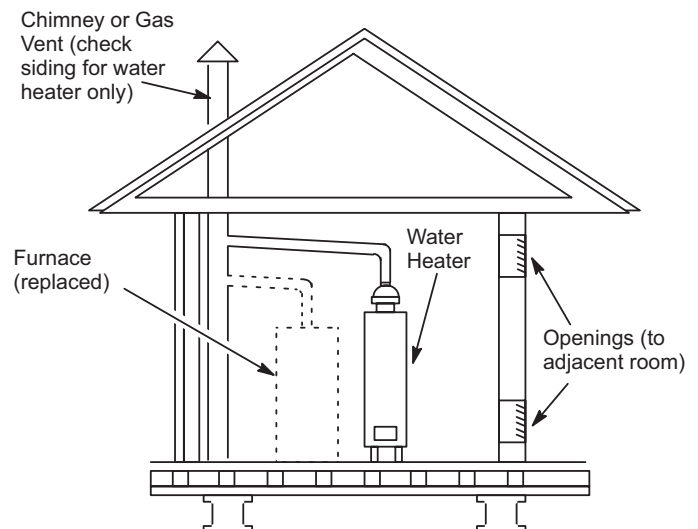
⚠ WARNING

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

1. Seal any unused openings in the common venting system.

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

Resize the common venting system to the minimum vent pipe size determined by using the appropriate tables in Appendix G (these are in the current standards of the National Fuel Gas Code ANSI Z223.1).



If replacing 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 16.

Service Information

VENTING PRACTICES (Cont.)

Exhaust Piping (Figure 17, Figure 19, Figure 20)

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

⚠ CAUTION

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

⚠ CAUTION

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

VENT PIPING GUIDELINES

NOTE: GE Appliances has approved the use of DuraVent® and Centrotherm manufactured vent pipe and terminations as an option to PVC. When using the PolyPro® by DuraVent or InnoFlue® by Centrotherm venting system the vent pipe requirements stated in the unit installation instruction – minimum & maximum vent lengths, termination clearances, etc. – apply and must be followed. Follow the instructions provided with PolyPro by DuraVent and InnoFlue by Centrotherm venting system for assembly or if requirements are more restrictive. The PolyPro by DuraVent and InnoFlue by Centrotherm venting system must also follow the uninsulated and unconditioned space criteria listed in **Table 14**.

The NF97U*T**R can be installed as either a Non-Direct Vent or a Direct Vent gas central furnace.**

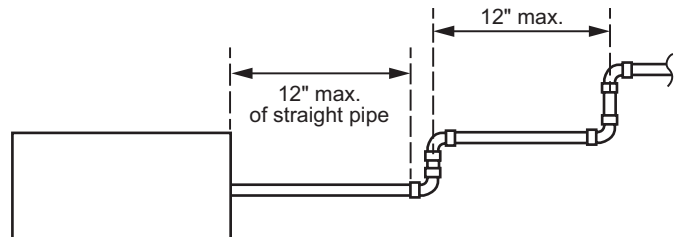
NOTE: In Non-Direct Vent installations, combustion air is taken from indoors and flue gases are discharged outdoors. In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged outdoors.

Intake and exhaust pipe sizing -- Size pipe according to **Table 13** and **Table 14A** through **Table 14C**. Count all elbows in side and outside the home. **Table 12** lists the minimum vent pipe lengths permitted. **Table 13A** through **Table 13C** 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 15**.

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

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



Horizontal Application

NOTE: All horizontal runs of exhaust pipe must slope back toward unit. A minimum of 1/4" (6 mm) drop for each 12" (305 mm) 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 17. Exhaust Pipe

Model	Min. Vent Length*
030, 045, 070, 090, 110, 135	15 ft. or 5 ft. plus 2 elbows or 10 ft. plus 1 elbow
* Any approved termination may be added to the minimum length listed.	
** This gas furnace must have 3" to 2" reducing elbow (supplied or field replacement Canadian kit) installed directly.	

Table 13. Minimum Vent Pipe Lengths

⚠ IMPORTANT

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

Service Information

VENT PIPING GUIDELINES (Cont.)

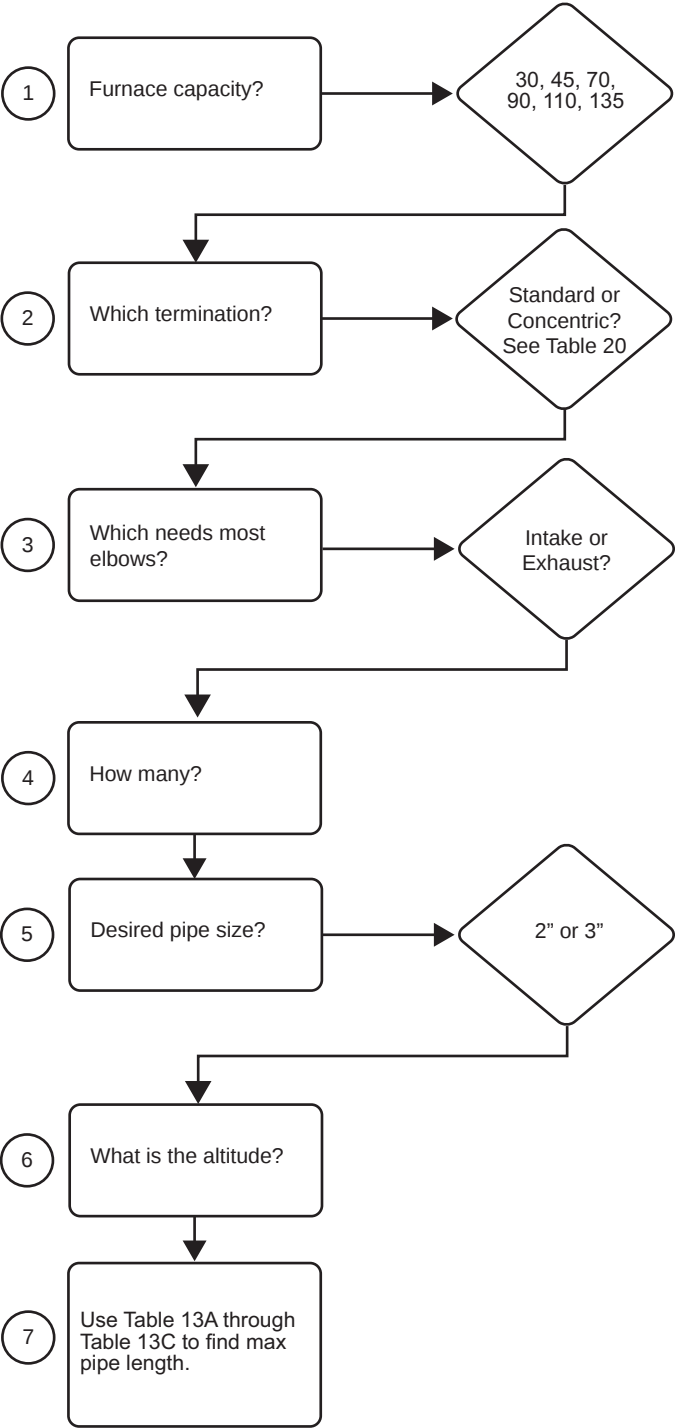


Figure 18. Vent Pipe Diameter Sizing

Service Information

VENT PIPING GUIDELINES (Cont.)

Standard Termination at Elevation 0 - 4,500ft																									
No. Of 90° Elbows Used	1-1/2" Pipe					2" Pipe					2-1/2" Pipe					3" Pipe									
	Model					Model					Model					Model									
	030 045	070	090	110	135	045	070	090	110	135	030 045	070	090	110	135	030 045	070	090	110	135					
1	25	20	n/a	n/a	n/a	76	61	39	19	n/a	110	110	88	53	n/a	133	132	113	113	114					
2	20	15				71	56	34	14		105	105	83	48		128	127	108	108	109					
3	15	10				66	51	29	9		100	100	78	43		123	122	103	103	104					
4	10	n/a				n/a	n/a	61	46		24	n/a	n/a	95		95	73	38	n/a	118	117	98	98	99	
5	n/a							56	41		19			90		90	68	33		113	112	93	93	94	
6								51	36		14			85		85	63	28		108	107	88	88	89	
7								46	31		9			80		80	58	23		103	102	83	83	84	
8								41	26		n/a			75		75	53	18		98	97	78	78	79	
9								36	21					70		70	48	13		93	92	73	73	74	
10								31	16					65		65	43	8		89	87	68	68	69	
Standard Termination at Elevation 4,501 - 10,000 ft																									
No. Of 90° Elbows Used	2" Pipe					2-1/2" Pipe										3" Pipe									
	Model					Model										Model									
	030 045	070	090	110	135	030 045	070	090	110	135	030 045	070	090	110	135	030 045	070	090	110	135					
1	25	20	n/a	n/a	n/a	76	61	39	n/a	n/a	110	110	88	53	n/a	133	132	113	113	114					
2	20	15				71	56	34			105	105	83	48		128	127	108	108	109					
3	15	10				66	51	29			100	100	78	43		123	122	103	103	104					
4	10	n/a				n/a	n/a	61			46	24	n/a	n/a		95	95	73	38	n/a	118	117	98	98	99
5	n/a							56			41	19				90	90	68	33		113	112	93	93	94
6								51			36	14				85	85	63	28		108	107	88	88	89
7								46			31	9				80	80	58	23		103	102	83	83	84
8								41			26	n/a				75	75	53	18		98	97	78	78	79
9								36			21					70	70	48	13		93	92	73	73	74
10								31			16					65	65	43	8		89	87	68	68	69
*Size intake and exhaust pipe length separately. Values in table are for intake or exhaust, not combined total. Both intake and exhaust must be the same pipe size.																									

Table 14A. Maximum Allowable Intake or Exhaust Vent Length in Feet

Service Information

VENT PIPING GUIDELINES (Cont.)

Concentric Termination at Elevation 0 - 4,500 ft																				
No. Of 90° Elbows	1-1/2" Pipe					2" Pipe					2-1/2" Pipe					3" Pipe				
	Model					Model					Model					Model				
	030 045	070	090	110	135	030 045	070	090	110	135	030 045	070	090	110	135	030 045	070	090	110	135
1	20	15	n/a	n/a	n/a	68	53	37	17		100	100	84	49	n/a	116	116	109	109	105
2	15	10				63	48	32	12		95	95	79	44		111	111	104	104	100
3	10	n/a				58	43	27	7		90	90	74	39		106	106	99	99	95
4	n/a					53	38	22	n/a		85	85	69	34		101	101	94	94	90
5						48	33	17			80	80	64	29		96	96	89	89	85
6						43	28	12			75	75	59	24		91	91	84	84	80
7						38	23	7			70	70	54	19		86	86	79	79	75
8						33	18	n/a			65	65	49	14		81	81	74	74	70
9						28	13				60	60	44	9		76	76	69	69	65
10						23	8				55	55	39	n/a		71	71	64	64	60
Concentric Termination at Elevation 4,501 - 10,000 ft																				
No. Of 90° Elbows	1-1/2" Pipe					2" Pipe					2-1/2" Pipe					3" Pipe				
	Model					Model					Model					Model				
	030 045	070	090	110	135	030 045	070	090	110	135	030 045	070	090	110	135	030 045	070	090	110	135
1	20	15	n/a	n/a	n/a	68	53	37	n/a	n/a	100	100	84	49	n/a	116	116	109	109	105
2	15	10				63	48	32			95	95	79	44		111	111	104	104	100
3	10	n/a				58	43	27			90	90	74	39		106	106	99	99	95
4	n/a					53	38	22			85	85	69	34		101	101	94	94	90
5						48	33	17			80	80	64	29		96	96	89	89	85
6						43	28	12			75	75	59	24		91	91	84	84	80
7						38	23	7			70	70	54	19		86	86	79	79	75
8						33	18	n/a			65	65	49	14		81	81	74	74	70
9						28	13				60	60	44	9		76	76	69	69	65
10						23	8				55	55	39	n/a		71	71	64	64	60
*Size intake and exhaust pipe length separately. Values in table are for intake or exhaust, not combined total. Both Intake and Exhaust must be same pipe size.																				

Table 14B. Maximum Allowable Intake or Exhaust Vent Length in Feet

Service Information

VENT PIPING GUIDELINES (Cont.)

Concentric Termination at Elevation 0 - 4,500 ft																				
No. Of 90° Elbows	1-1/2" Pipe					2" Pipe					2-1/2" Pipe					3" Pipe				
	Model					Model					Model					Model				
	030 045	070	090	110	135	030 045	070	090	110	135	030 045	070	090	110	135	030 045	070	090	110	135
1	20	15	n/a	n/a	n/a	66	51	29	9	n/a	95	95	73	38	n/a	113	112	93	93	94
2	15	10				61	46	24	4		90	90	68	33		108	107	88	88	89
3	10	n/a				56	41	19	n/a		85	85	63	28		103	102	83	83	84
4	n/a					51	36	14			80	80	58	23		98	97	78	78	79
5						46	31	9			75	75	53	18		93	92	73	73	74
6						41	26	4			70	70	48	13		88	87	68	68	69
7						36	21	n/a			65	65	43	8		83	82	63	63	64
8						31	16				60	60	38	3		78	77	58	58	59
9						26	11				55	55	33	n/a		73	72	53	53	54
10						21	6				50	50	28			68	67	48	48	49
Standard Termination at Elevation 4,501 - 10,000 ft																				
No. Of 90° Elbows	1-1/2" Pipe					2" Pipe					2-1/2" Pipe					3" Pipe				
	Model					Model					Model					Model				
	030 045	070	090	110	135	030 045	070	090	110	135	030 045	070	090	110	135	030 045	070	090	110	135
1	20	15	n/a	n/a	n/a	66	51	29	n/a	n/a	95	95	73	38	n/a	113	112	93	93	94
2	15	10				61	46	24			90	90	68	33		108	107	88	88	89
3	10	n/a				56	41	19			85	85	63	28		103	102	83	83	84
4	n/a					51	36	14			80	80	58	23		98	97	78	78	79
5						46	31	9			75	75	53	18		93	92	73	73	74
6						41	26	4			70	70	48	13		88	87	68	68	69
7						36	21	n/a			65	65	43	8		83	82	63	63	64
8						31	16				60	60	38	3		78	77	58	58	59
9						26	11				55	55	33	n/a		73	72	53	53	54
10						21	6				50	50	28			68	67	48	48	49
NOTE: Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation.																				

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

Table 14C. Maximum Allowable Exhaust Vent Lengths with Furnace Installed in a Closet or Basement Using Ventilated Attic or Crawl Space for Intake Air in Feet

Service Information

VENT PIPING GUIDELINES (Cont.)

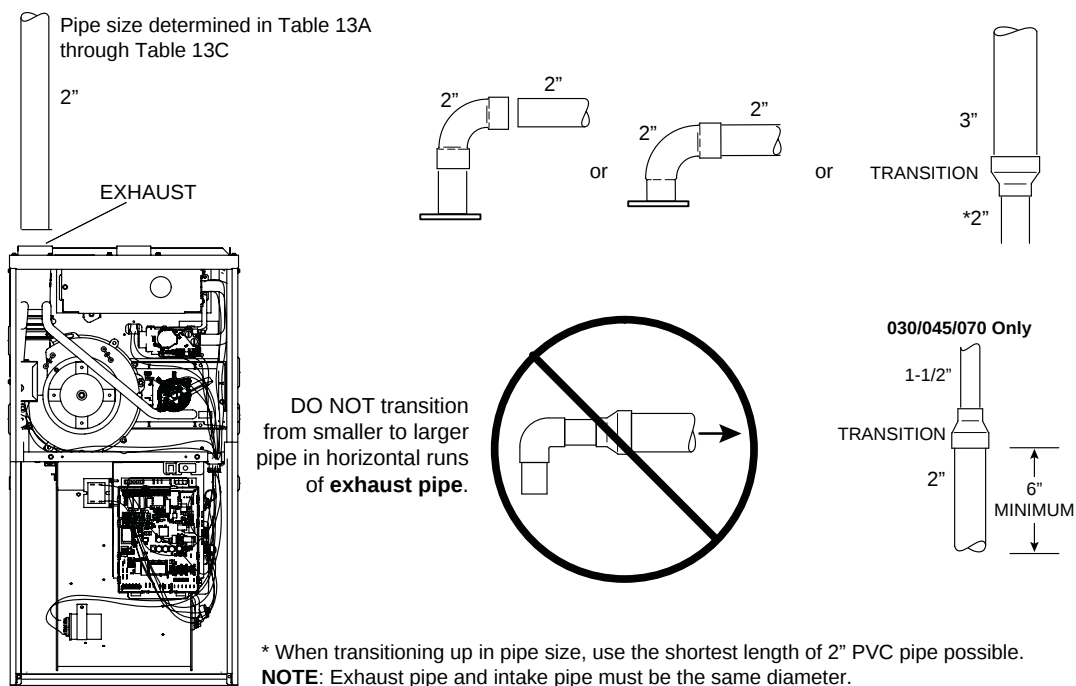


Figure 19. Typical Exhaust Pipe Connections in Upflow Direct or Non-Direct Vent Applications

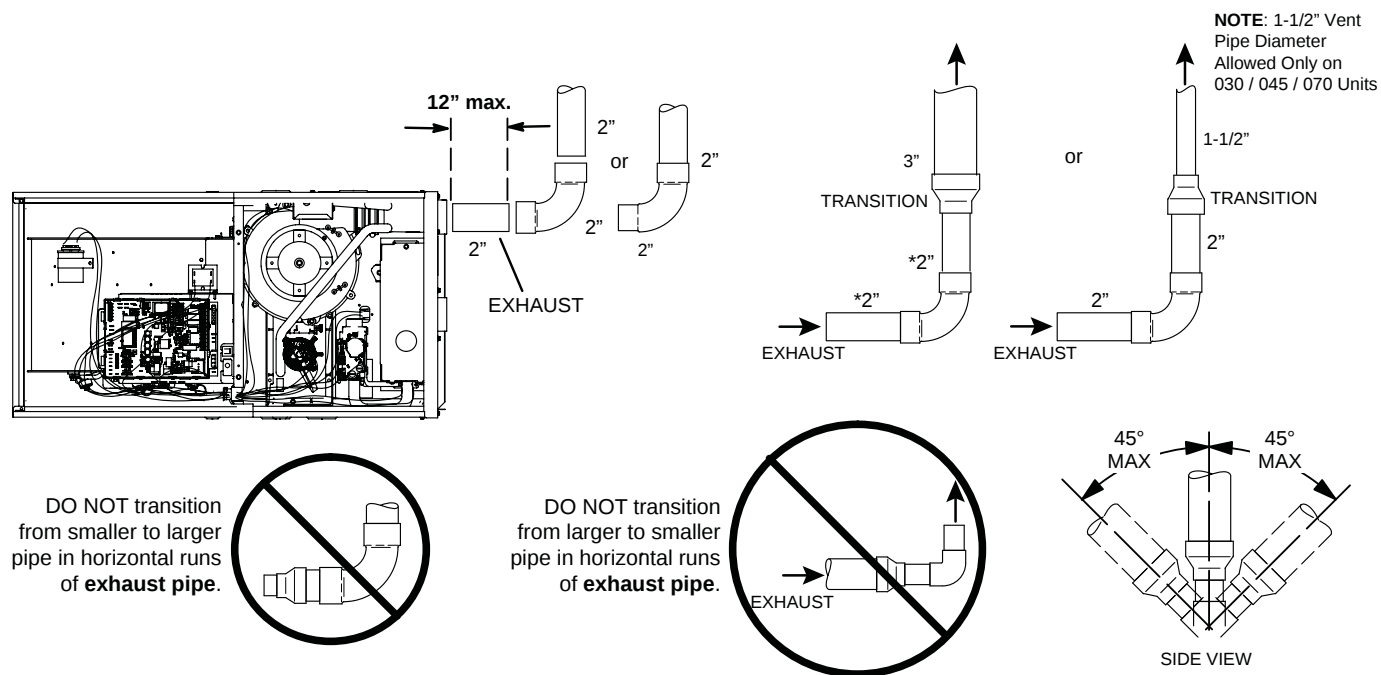


Figure 20. Typical Exhaust Pipe Connections in Horizontal Direct or Non-Direct Vent Applications (Right-Hand Discharge Shown)

Service Information

VENT PIPING GUIDELINES (Cont.)

Intake Piping

The NF97U***T**R furnace may be installed in either direct vent or non-direct vent applications. In non-direct vent applications, when intake air will be drawn into the furnace from the surrounding space, the indoor air quality must be considered and guidelines listed in Combustion, Dilution and Ventilation Air section must be followed.

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

1. Use transition solvent cement or a sheet metal screw to secure the intake pipe to the inlet air connector.
2. Route piping to outside of structure. Continue with installation following instructions given in general guidelines for piping terminations and intake and exhaust piping terminations for direct vent sections. Refer to **Table 13A** through **Table 13C** for pipe sizes.

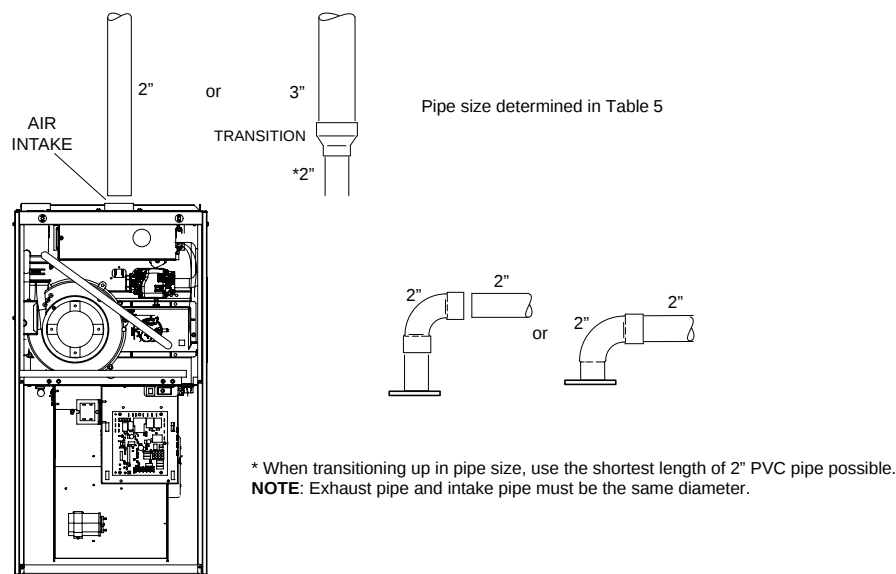


Figure 21. Typical Intake Pipe Connections in Upflow Direct or Non-Direct Vent Applications

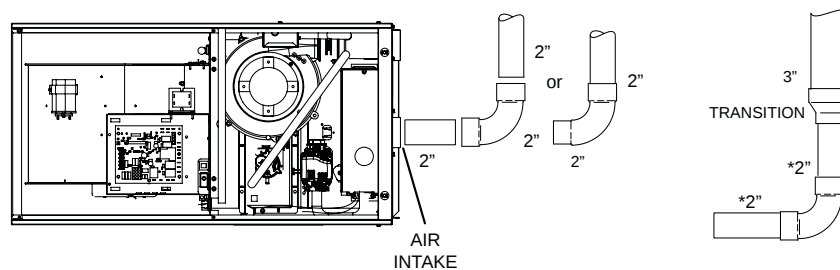


Figure 22. Typical Intake Pipe Connections in Horizontal Direct or Non-Direct Vent Application (Right-Hand Discharge Shown)

Service Information

VENT PIPING GUIDELINES (Cont.)

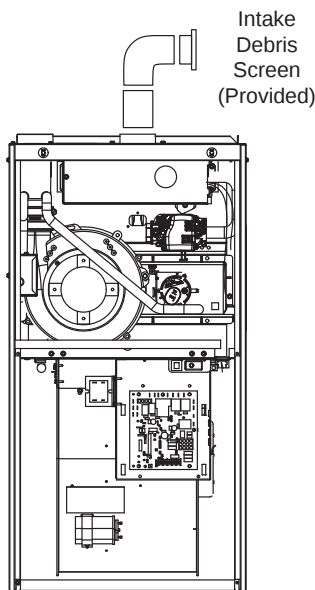
Intake Piping (Cont.)

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 23** or **Figure 24**. Maintain a minimum clearance of 3" (76mm) around the air intake opening. The air intake opening (with the protective screen) should always be directed forward or to either side in the upflow position, and either straight out or downward in the horizontal position.

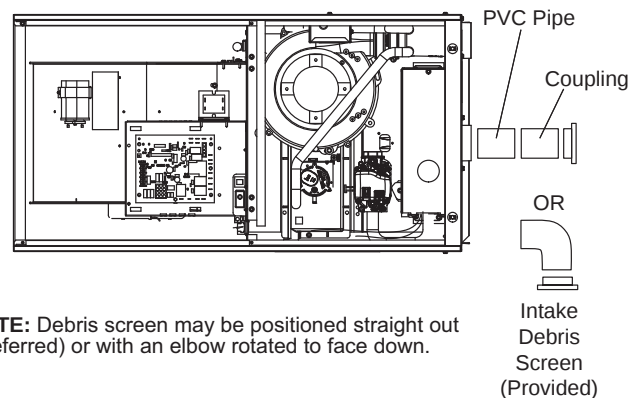
The air intake piping must not terminate too close to the flooring or a platform. Ensure that the intake air inlet will not be obstructed by loose insulation or other items that may clog the debris screen.

2. If intake air is drawn from a ventilated attic (**Figure 25**) or ventilated crawlspace (**Figure 26**) the exhaust vent length must not exceed those listed in **Table 13C**. If 3" diameter pipe is used, reduce to 2" diameter pipe at the termination point to accommodate the debris screen.
3. Use a sheet metal screw to secure the intake pipe to the connector, if desired.



NOTE: Debris screen and elbow may be rotated so that the screen may be positioned to face forward or to either side.

Figure 23. Typical Air Intake Pipe Connections Upflow Non-Direct Vent Applications

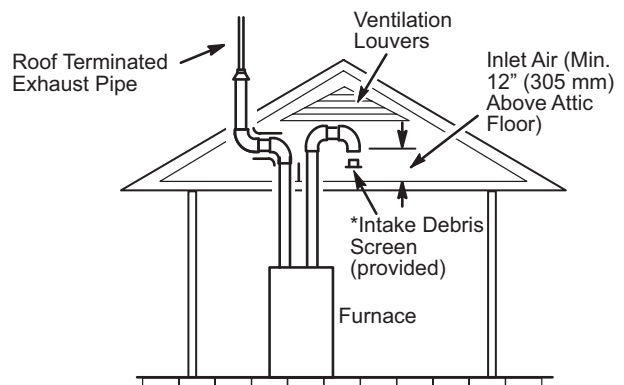


NOTE: Debris screen may be positioned straight out (preferred) or with an elbow rotated to face down.

Figure 24. Typical Air Intake Pipe Connections Horizontal Non-Direct Vent Applications (Horizontal Right-Hand Air Discharge Application Shown)

CAUTION

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



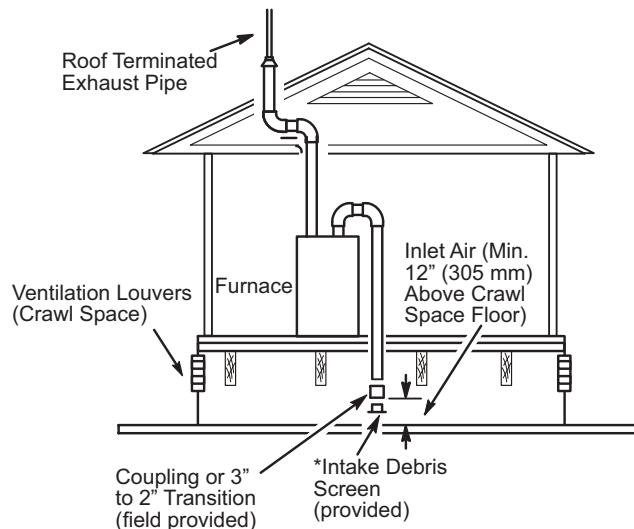
NOTE: The inlet and outlet air openings shall each have a free area of at least one square inch per 4,000 Btu (645mm² per 1.17kW) per hour of the total input rating of all equipment in the enclosure.

Figure 25. Equipment in Confined Space (Inlet Air from Ventilated Attic and Outlet Air to Outside)

Service Information

VENT PIPING GUIDELINES (Cont.)

Intake Piping (Cont.)



NOTE: The inlet and outlet air openings shall each have a free area of at least one square inch per 4,000 Btu (645mm² per 1.17kW) per hour of the total input rating of all equipment in the enclosure.

**Figure 26. Equipment in Confined Space
(Inlet Air from Ventilated Crawl Space and Outlet Air to Outside)**

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 **NF97U***T**R** 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 **NF97U***T**R** 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 28** or **Figure 37**. In addition, position termination so it is free from any obstructions and 12" above the average snow accumulation.

At vent termination, care must be taken to maintain protective coatings over building materials (prolonged exposure to exhaust condensate can destroy protective coatings). It is recommended that the exhaust outlet not be located within 6 feet (1.8m) of a condensing unit because the condensate can damage the painted coating. **NOTE:** See **Table 14** for maximum allowed exhaust pipe length without insulation in unconditioned space during winter design temperatures below 32°F (0°C). If required exhaust pipe should be insulated with 1/2" (13mm) Armaflex or equivalent. In extreme cold climate areas, 3/4" (19mm) Armaflex or equivalent may be necessary. Insulation must be protected from deterioration. Armaflex with UV protection is permissible. Basements or other enclosed areas that are not exposed to the outdoor ambient temperature and are above 32 degrees F (0°C) are to be considered conditioned spaces.

⚠ IMPORTANT Do not use screens or perforated metal in exhaust 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 in. (305mm).

Service Information

VENT PIPING GUIDELINES (Cont.)

General Guidelines for Vent Terminations (Cont.)

Winter Design Temp ¹ °F (°C)	Vent Pipe Diam	Unit Input Size											
		030		045		070		090		110		135	
		PVC	² PP	PVC	² PP	PVC	² PP	PVC	² PP	PVC	² PP	PVC	² PP
32 to 21 (0 to -6)	1-1/2 in	N/A	N/A	22	N/A	20	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2 in	13	12	21	18	33	30	46	42	30	30	N/A	N/A
	2-1/2 in	10	N/A	16	N/A	26	N/A	37	N/A	36	N/A	N/A	N/A
	3 in	6	6	12	12	21	21	30	30	29	29	42	42
20 to 1 (-7 to -17)	1-1/2 in	N/A	N/A	12	N/A	20	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2 in	6	4	11	9	19	17	28	25	27	24	N/A	N/A
	2-1/2 in	N/A	N/A	7	N/A	14	N/A	21	N/A	20	N/A	N/A	N/A
	3 in	N/A	N/A	N/A	N/A	9	9	16	16	14	14	23	23
0 to -20 (-18 to -29)	1-1/2 in	N/A	N/A	8	N/A	13	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2 in	N/A	N/A	6	4	12	10	19	16	18	15	N/A	N/A
	2-1/2 in	N/A	N/A	N/A	N/A	7	N/A	13	N/A	12	N/A	N/A	N/A
	3 in	N/A	N/A	N/A	N/A	N/A	N/A	8	8	7	7	13	13

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

² Poly-Propylene vent pipe (PP) by Duravent and Centrotherm.

³ Vent length in the table is equivalent length. Each elbow is equivalent to 5ft of straight pipe and should be included when measuring total length.

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

NOTE: Maximum uninsulated vent lengths listed may include the termination (vent pipe exterior to the structure) and cannot exceed 5 linear feet or the maximum allowable intake or exhaust vent length listed in table **Table 13A** through **Table 13C**.

NOTE: If insulation is required in an unconditioned space, it must be located on the pipe closest to the furnace. See **Figure 27**.

Table 15. Maximum Allowable Exhaust Vent Pipe Length ³ (in ft.) without Insulation in Unconditioned Space for Winter Design Temperatures

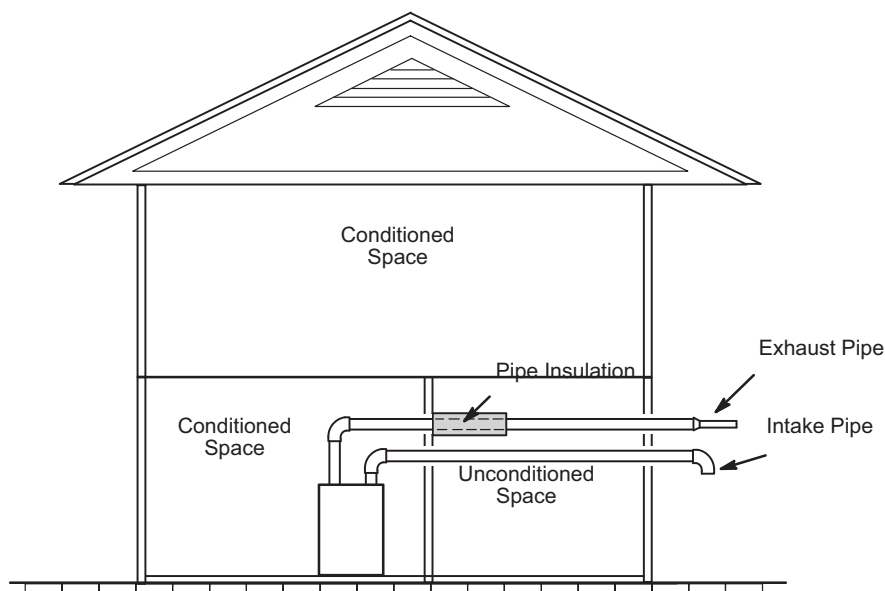


Figure 27. Insulating Exhaust Pipe in an Unconditioned Space

Service Information

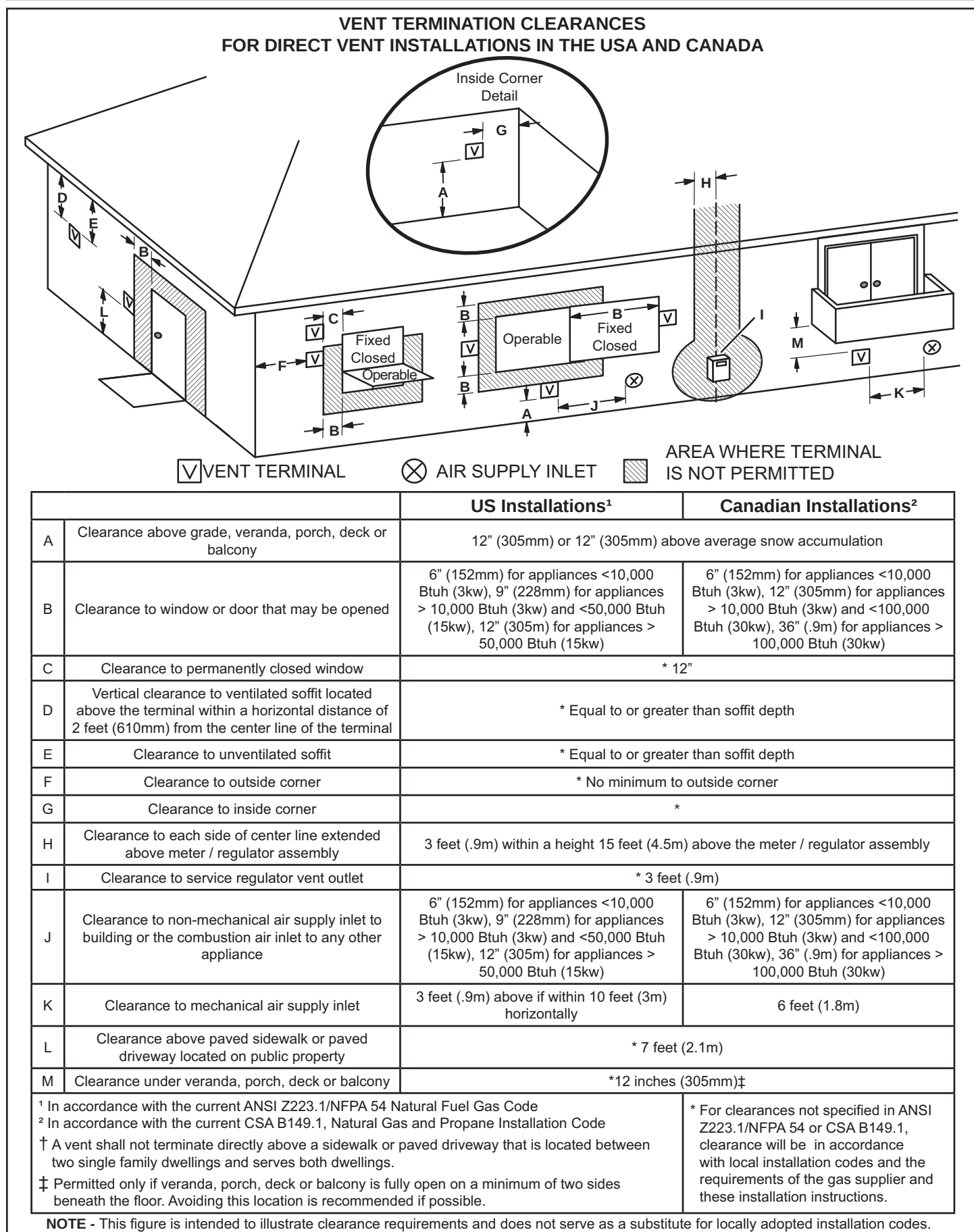


Figure 28. Vent Termination Clearances for Direct Installations

Service Information

VENT PIPING GUIDELINES (Cont.)

Details of Intake and Exhaust Piping Terminations for Direct Vent Installations

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

NOTE: Flue gas may be slightly acidic and may adversely affect some building materials. If any vent termination is used and the flue gases may impinge on the building material, a corrosion-resistant shield (minimum 24 in. square) must be used to protect the wall surface. If the optional tee is used, the protective shield is required. The shield should be constructed using wood, plastic, sheet metal or other suitable material. All seams, joints, cracks, etc. in the affected area should be sealed using an appropriate sealant. See **Figure 40**. Intake and exhaust pipes may be routed either horizontally through and outside wall or vertically through the roof. In attic or closet installations, vertical termination through the roof is preferred. **Figure 29** through **Figure 33** show typical terminations.

1. Intake and exhaust terminations are not required to be in the same pressure zone. You may exit the intake on one side of the structure and the exhaust on another side (**Figure 30**). You may exit the exhaust out the roof and the intake out the side of the structure (**Figure 31**).
2. Intake and exhaust pipes should be placed as close together as possible at termination end (refer to illustrations). Minimum separation is 3 in. (76 mm) on roof terminations and 6" (152 mm) on sidewall 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 16**.

Capacity	Termination Pipe Size
030, 045, 070*	1-1/2" (38mm)
90*	2" (51mm)
110, 135	

* -030, -045, -070 and -090 units with the flush mount termination must use the 1-1/2" accelerator supplied with the kit.

Table 16. Exhaust Pipe Termination Size Reduction

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

5. On field supplied terminations for sidewall exit, exhaust piping may extend a maximum of 12 in.(305 mm) for 2 in. PVC and 20 in. (508 mm) for 3 in. (76 mm) PVC beyond the outside wall. Intake piping should be as short as possible. See **Figure 40**.

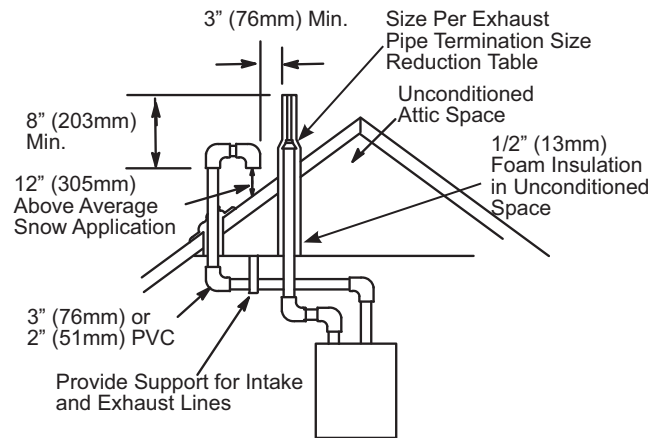


Figure 29. Direct Vent Roof Termination Kit

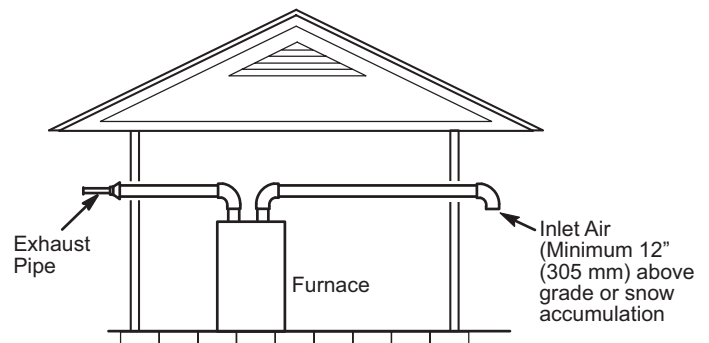


Figure 30. Exiting Exhaust and Intake Vent (No Common Pressure Zone)

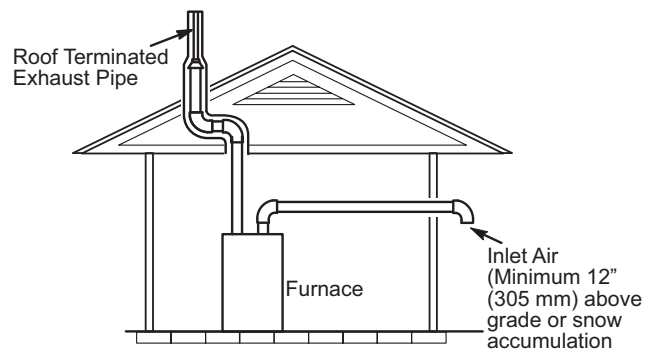


Figure 31. Existing Exhaust and Intake Vent (No Common Pressure Zone)

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 **Figure 40**.

Service Information

VENT PIPING GUIDELINES (Cont.)

Details of Intake and Exhaust Piping Terminations for Direct Vent Installations (Cont.)

- If intake and exhaust piping must be run up a side wall to position above snow accumulation or other obstructions, piping must be supported. At least one bracket must be used within 6" from the top of the elbow and then every 24 in. (610mm) as shown in **Figure 40**, to prevent any movement in any direction. When exhaust and intake piping must be run up an outside wall, the exhaust piping must be terminated with pipe sized per **Table 15**. The intake piping may be equipped with a 90° elbow turndown. Using turndown will add 5 ft. (1.5m) to the equivalent length of the pipe.
- A multiple furnace installation may use a group of up to four terminations assembled together horizontally, as shown in **Figure 36**.

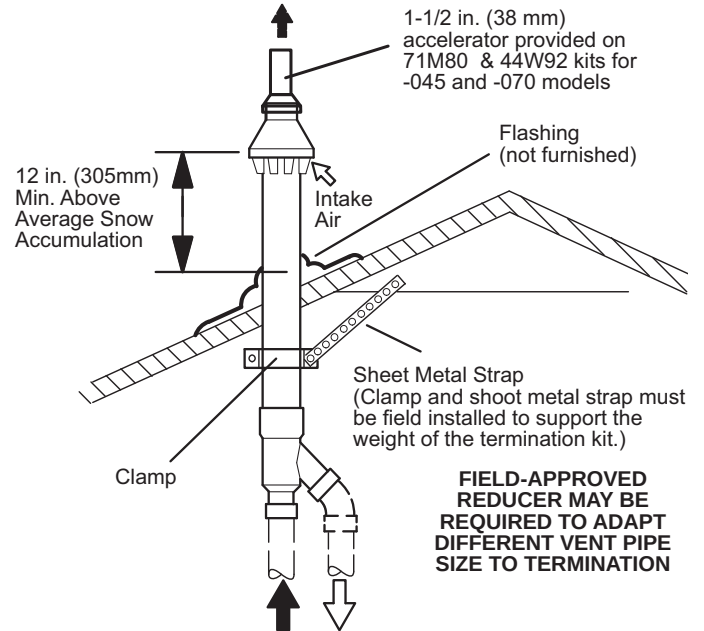


Figure 34. Direct Vent Concentric Wall Termination

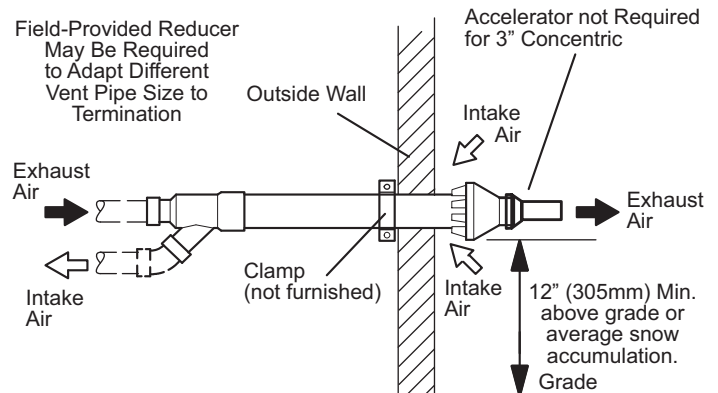


Figure 35. Direct Vent Concentric Wall Termination

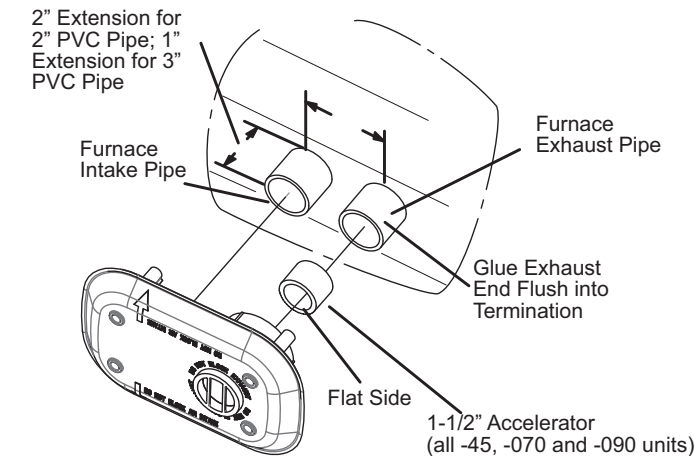


Figure 32. Flush-Mount Side Wall Termination

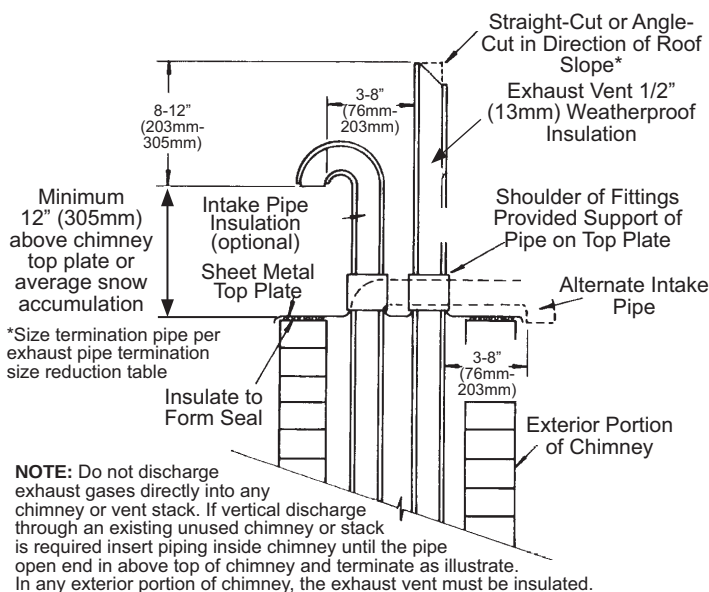


Figure 33. Direct Vent Application Using Existing Chimney

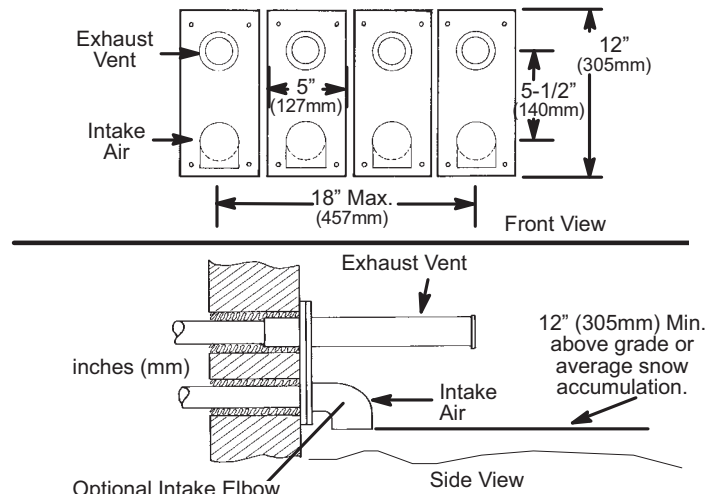


Figure 36. Optional Vent Termination for Multiple Unit Installation of Direct Vent Wall Termination Kit

Service Information

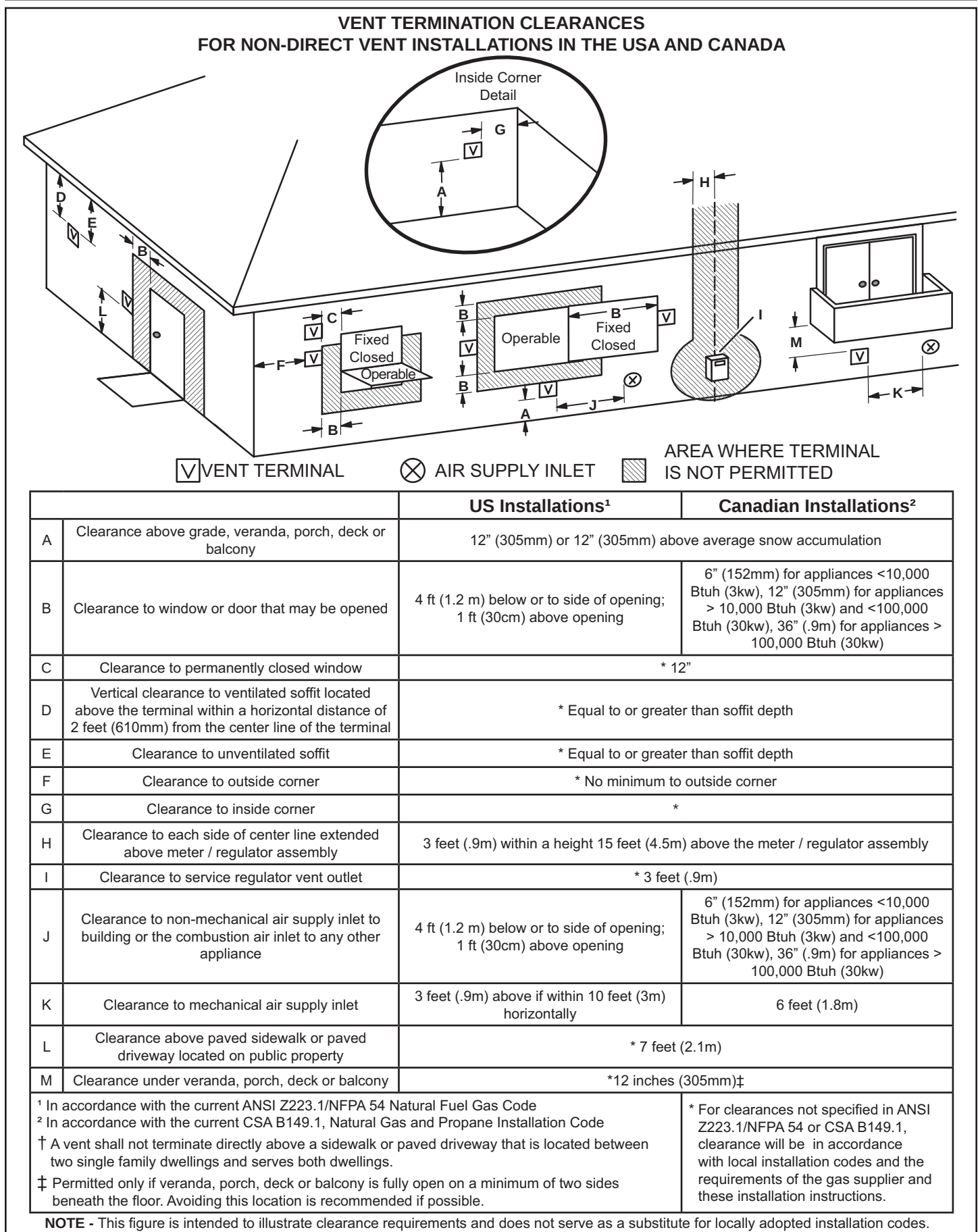


Figure 37. Vent Termination Clearances for Non-Direct Installations

Service Information

VENT PIPING GUIDELINES (Cont.)

Details of Exhaust Piping Terminations for Non- Direct Vent Applications

Exhaust pipes may be routed either horizontally through an outside wall or vertically through the roof. In attic or closet installations, vertical termination through the roof is preferred. **Figure 38** through **Figure 39** show typical terminations.

7. Exhaust piping must terminate straight out or up as shown. The termination pipe must be sized as listed in **Table 15**. 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 in. (305mm) for 2 in. PVC and 20 in. (508mm) for 3 in. (76mm) PVC beyond the outside wall.

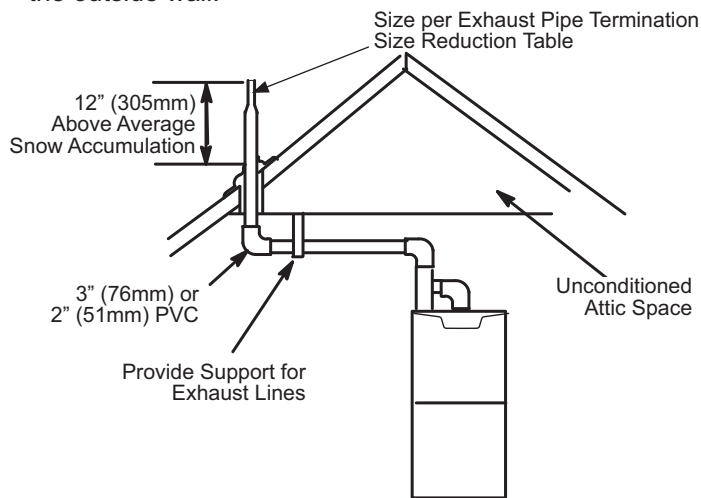


Figure 38. Non-Direct Vent Roof Termination Kit

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 in. (610mm). When exhaust piping must be run up an outside wall, any reduction in exhaust pipe size must be done after the final elbow.
4. Distance between exhaust pipe terminations on multiple furnaces must meet local codes.

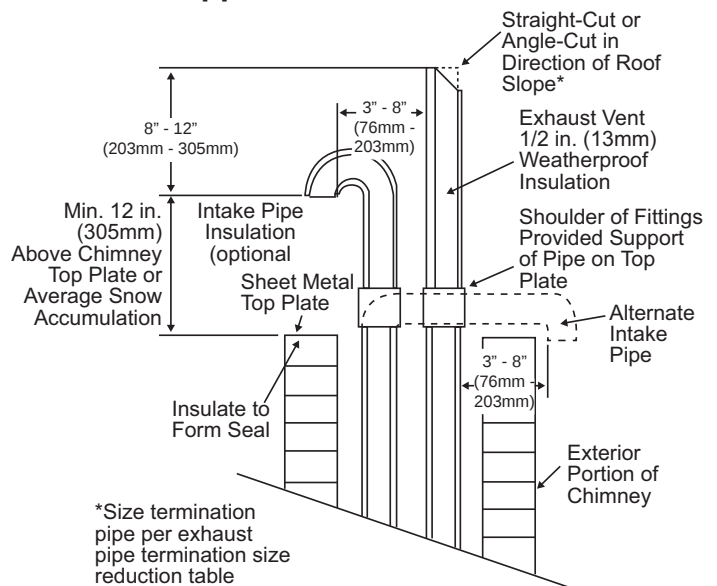


Figure 39. Non-Direct Vent Application Using Existing Chimney

Service Information

Details of Intake and Exhaust Piping Terminations for Direct Vent Installations (Cont.)

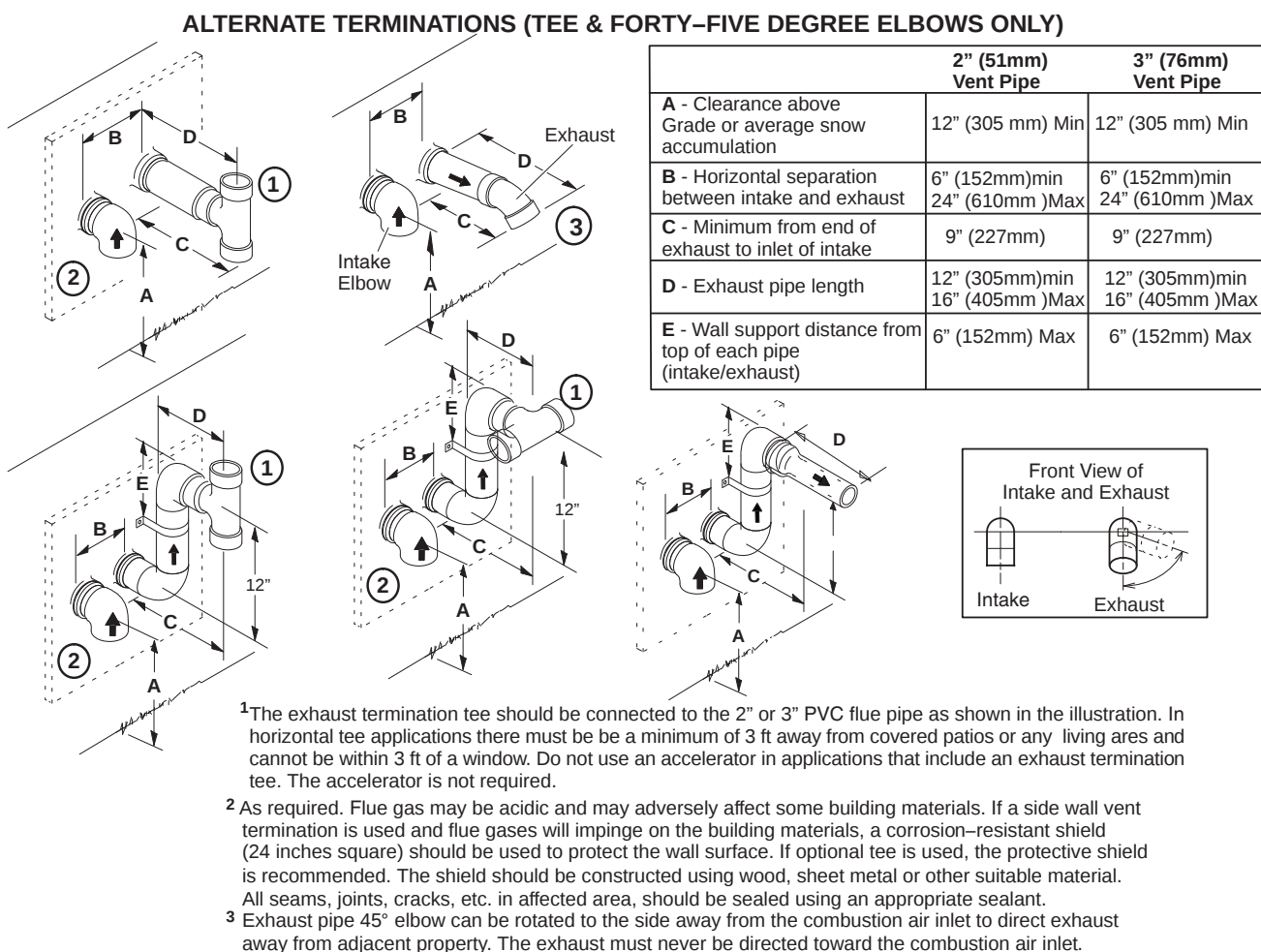
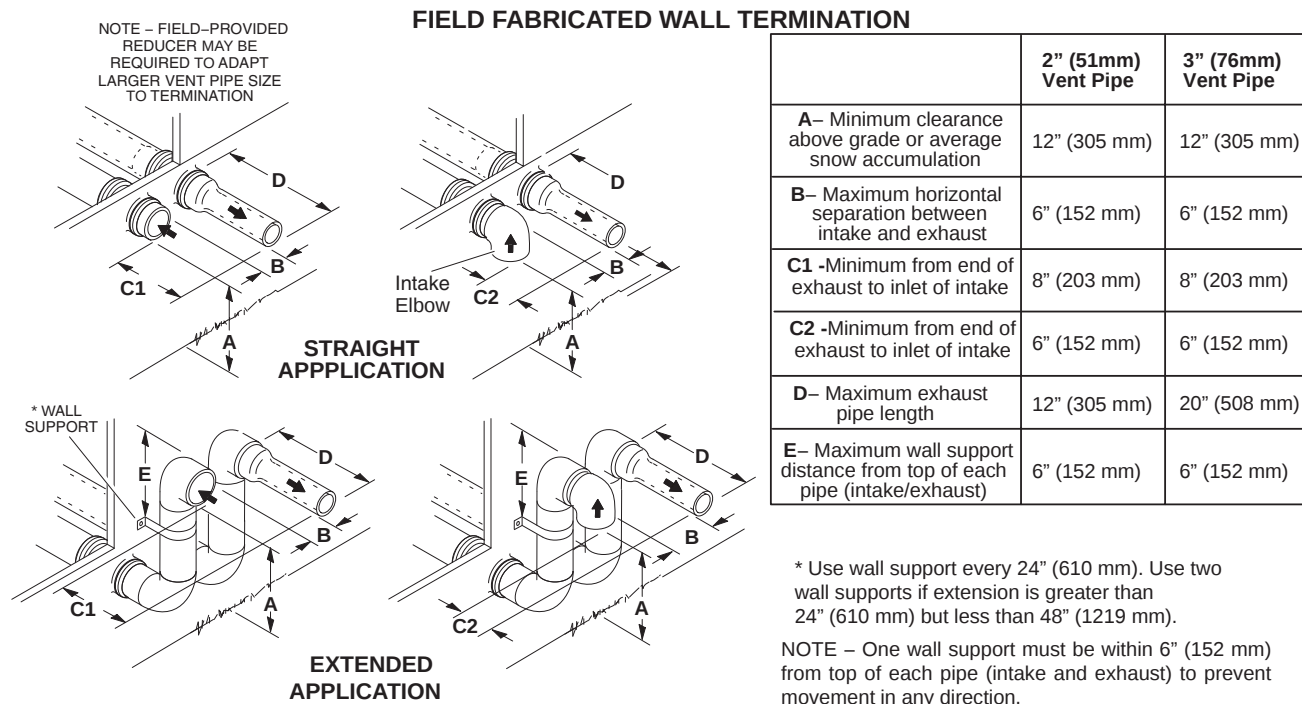


Figure 40.

Service Information

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 41** and **Figure 43** for condensate trap locations. **Figure 49** (3/4" drain connection) and **Figure 41** (1/2" drain connection) show trap assembly using 1/2" PVC or 3/4" PVC.

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

1. Determine which side condensate piping will exit the unit, location of trap, field-provided fittings and length of PVC pipe required to reach available drain.
2. For furnaces with a 1/2" drain connection use a 3/8 allen wrench and remove plug (**Figure 41**) 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. For furnaces with a 3/4" drain connection use a large flat head screw driver or a 1/2" drive socket extension and remove plug. Install provided 3/4 NPT street elbow fitting into cold end header box. Use Teflon tape or appropriate pipe dope.

NOTE: Cold end header box drain plugs are factory installed. Check the unused plug for tightness to prevent leakage.

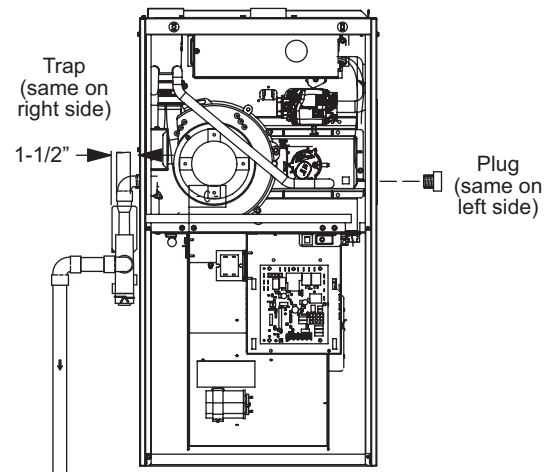
3. Install the cap over the clean out opening at the base of the trap. Secure with clamp. See **Figure 49**.
4. Install drain trap using appropriate PVC fittings, glue all joints. Glue the provided drain trap as shown in **Figure 49**. Route the condensate line to an open drain. Condensate line must maintain a 1/4" downward slope from the furnace to the drain.
5. **Figure 44** and **Figure 45** show the furnace and evaporator coil using a separate drain. If necessary the condensate line from the furnace and evaporator coil can drain together. See **Figure 47** and **Figure 48**.

Upflow furnace (**Figure 44** and **Figure 47**) - In upflow furnace applications the field provided vent must be a minimum 1" to a maximum 2" length above the condensate drain outlet connection. Any length above 2" may result in a flooded heat exchanger if the combined primary drain line were to become restricted.

Horizontal furnace (**Figure 45** and **Figure 48**) - In horizontal furnace applications the field provided vent must be a minimum 4" to a maximum 5" length above the condensate drain outlet connection. Any length above 5" may result in a flooded heat exchanger if the combined primary drain line were to become restricted.

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

NOTE: Appropriately sized tubing and barbed fitting may be used for condensate drain. Attach to the drain on the trap using a hose clamp. See **Figure 42**.



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 41. Condensate Trap and Plug Locations (Unit shown in upflow position)

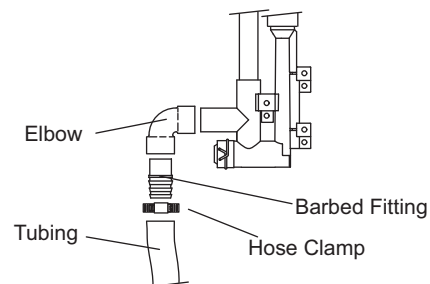


Figure 42. Field Provided Drain Components

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

Service Information

CONDENSATE PIPING (Cont.)

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

Condensate line must slope downward away from the trap to drain. If drain level is above condensate trap, condensate pump must be used. Condensate drain line should be routed within the conditioned space to avoid freezing of condensate and blockage of drain line. If this is not possible, a heat cable kit may be used on the condensate trap and line.

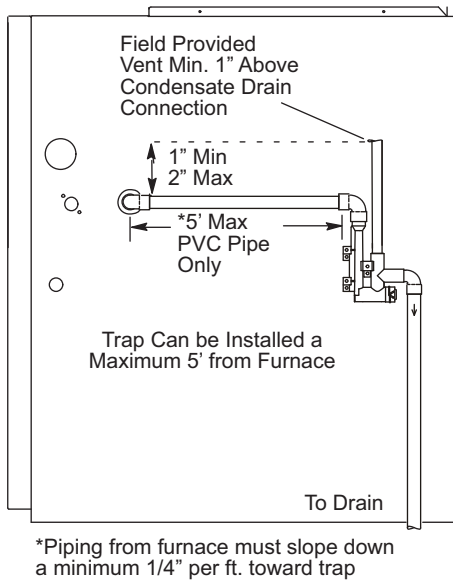


Figure 43. Condensate Trap Locations
(Unit shown in upflow position with remote trap)

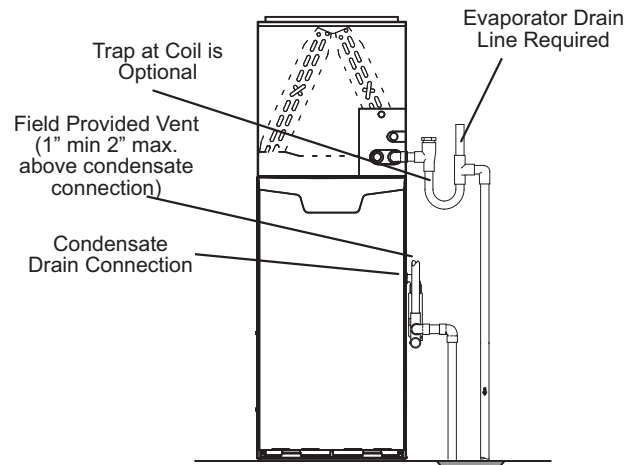


Figure 44. Unit with Cooling Coil Using Separate Drain

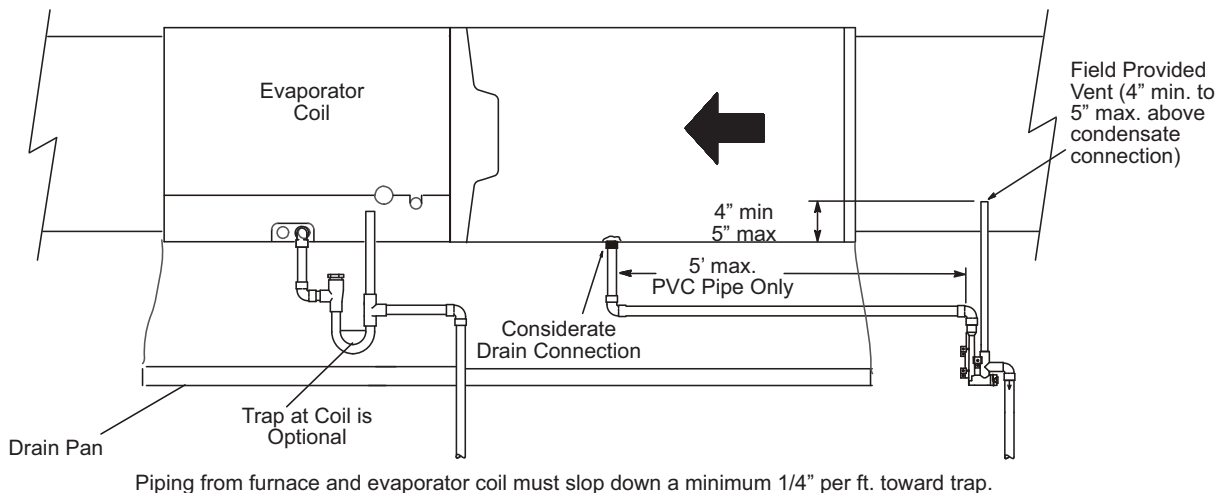


Figure 45. Evaporator Coil Using a Separate Drain

Service Information

CONDENSATE PIPING (Cont.)

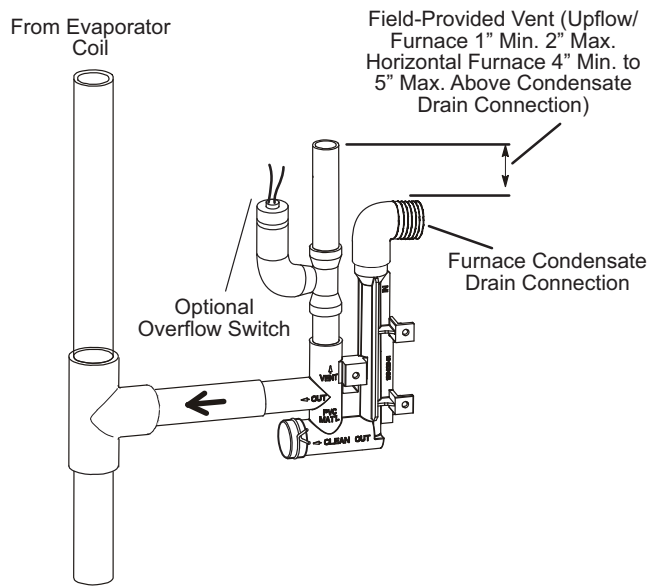


Figure 46. Condensate Trap with Optional Overflow Switch

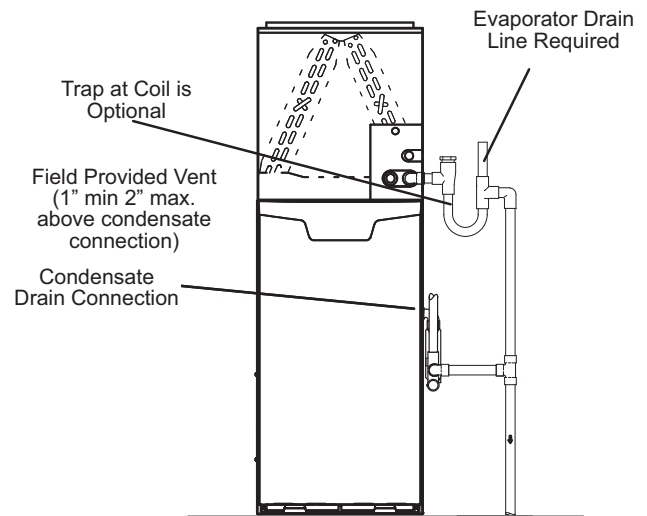


Figure 47. Furnace with Evaporator Coil Using a Common Drain

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

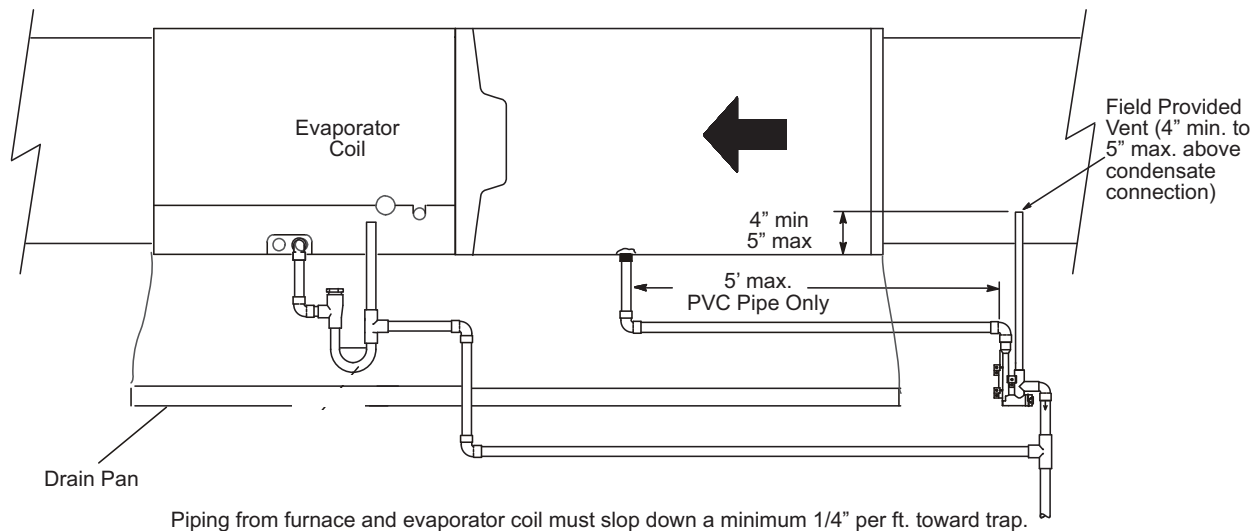


Figure 48. Evaporator Coil Using a Common Drain

Service Information

CONDENSATE PIPING (Cont.)

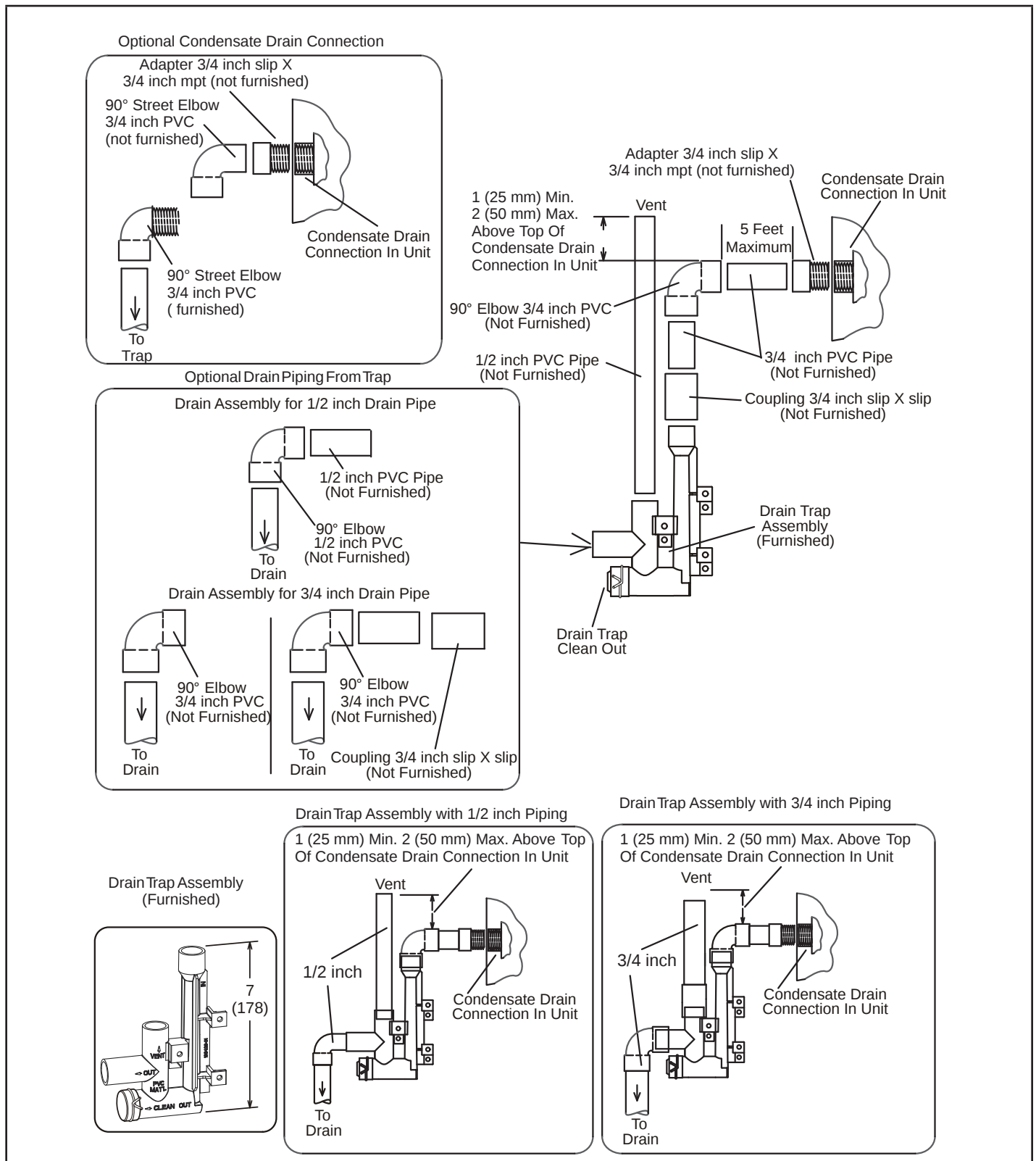


Figure 49. Trap/Drain Assembly Using 1/2" PVC or 3/4" PVC

Service Information

START-UP

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.

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 NF97U***T**R is equipped with a gas control switch. Use only your hand to move the switch. Never use tools. If 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:

NF97U***T**R units are equipped with a 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 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 outer 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**.

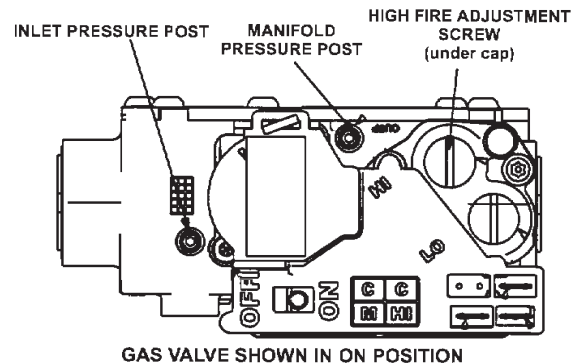


Figure 50. Gas Valve Shown in ON Position

9. Replace the upper outer access panel.
 10. Turn on all electrical power to the unit.
 11. Set the thermostat to desired setting.
- NOTE:** When unit is initially started, steps 1 through 11 may need to be repeated to purge air from gas line.
12. If the appliance will not operate, follow the instructions "Turning Off Gas to Unit" and call your service technician or gas supplier.

Turning Off Gas to Unit

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

Service Information

START-UP

Heating Start-Up (Cont.)

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.

HEATING SYSTEM SERVICE CHECKS

C.S.A. Certification

All units are C.S.A. design certified without modifications. Refer to the NF97U***T**R Operation and Installation Instruction.

GAS PIPING

⚠ CAUTION

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

⚠ WARNING

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

Gas supply piping should not allow more than 0.5" W.C. drop in pressure between gas meter and unit. Supply gas pipe must not be smaller than unit gas connection.

Compounds used on gas piping threaded joints should be resistant to action of liquefied petroleum gases.

Testing Gas Piping

⚠ IMPORTANT

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

When pressure testing gas lines, the gas valve must be disconnected and isolated. Gas valves can be damaged if subjected to more than 0.5 psig (14" W.C.). See **Figure 51**. If the pressure is greater than 0.5 psig (14" W.C.), use the manual shut-off valve before pressure testing to isolate furnace from gas supply.

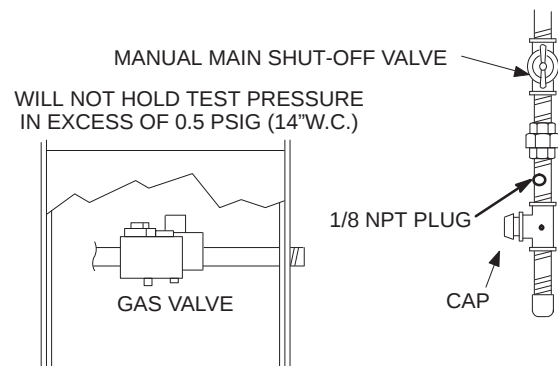


Figure 51.

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.

⚠ WARNING

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

Testing Gas Supply Pressure

An inlet post located on the gas valve provides access to the supply pressure. See **Figure 50**. Back out the 3/32 hex screw one turn, connect a piece of 5/16 tubing and connect to a manometer to measure supply pressure. See **Table 19** for supply line pressure.

Service Information

GAS PIPING (Cont.)

Testing Gas Piping (Cont.)

Manifold Pressure Measurement

A manifold pressure post located on the gas valve provides access to the manifold pressure. See **Figure 50**. Back out the 3/32 hex screw one turn. Follow the steps below and use **Figure 52** as a reference. Gas manifold Kit 10L34 provides additional components if needed.

1. Connect the 5/16" round tubing to the manifold post. Secure with the clamp.
2. Connect the reducer fitting to the 5/16" round tubing followed by a piece of 10" length square tubing.
3. Connect the other end of the square tubing to the "+" positive side of the measuring device.
4. Take the 2" length square tubing, tee, 10" length of square tubing and tee into the gas valve regulator vent hose. Connect to the measuring device negative "-" side.
5. Ignite unit on low fire and let run for 5 minutes to allow for steady state conditions.
6. After allowing unit to stabilize for 5 minutes, record manifold pressure and compare to value given in **Table 19**.
7. If necessary, make adjustments. **Figure 50** shows location of high fire and low fire adjustment screws.
8. Repeat steps 5, 6 and 7 on high fire. See values in **Table 19**.
9. Shut unit off and remove manometer as soon as an accurate reading has been obtained.
10. Start unit and perform leak check. Seal leaks if found.

▲IMPORTANT

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

Gas Flow (Approximate)

Furnace should operate at least 5 minutes before checking gas flow. Determine time in seconds for two revolutions of gas through the meter. (Two revolutions assures a more accurate time.) Divide by two and compare to time in **Table 17**. If manifold pressure matches **Table 19** 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.

Unit	Seconds for One Revolution			
	Natural		LP/Propane	
	1 cu ft Dial	2 cu ft Dial	1 cu ft Dial	2 cu ft Dial
-030	120	240	300	600
-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				

Table 17. Gas Meter Clocking Chart

▲IMPORTANT

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

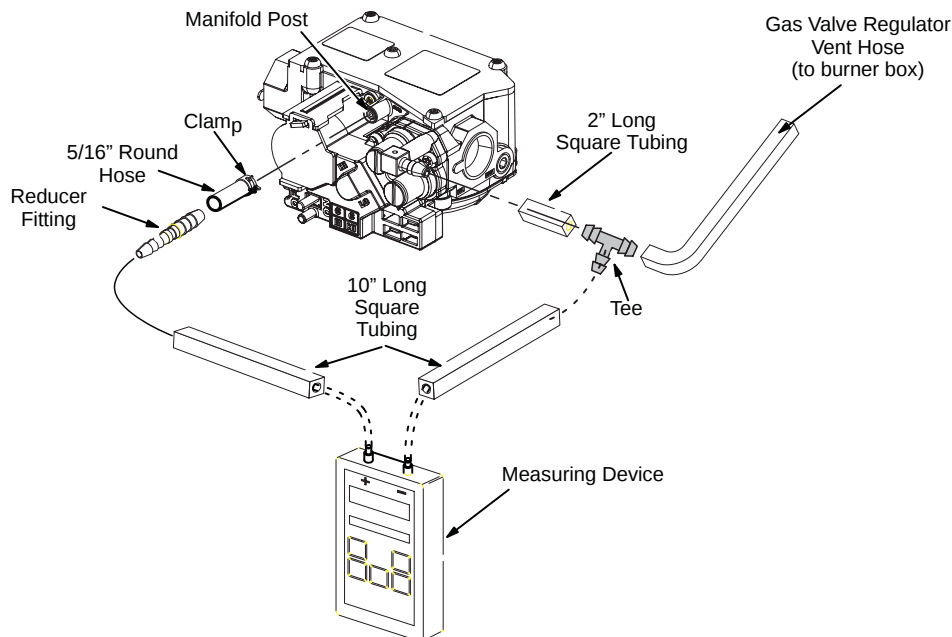


Figure 52. Manifold Pressure Check Setup

Service Information

GAS PIPING (Cont.)

Proper Combustion

Furnace should operate at least 15 minutes with correct manifold pressure and gas flow rate before checking combustions. See sections E- and F-. Take combustion sample beyond the flue outlet. **Table 18** shows acceptable combustions. The maximum carbon monoxide reading should not exceed 100 ppm.

Capacity	CO2% for Nat		CO2% for L.P.	
	Low Fire	High Fire	Low Fire	High Fire
030	5.4 - 6.4	7.5 - 8.5	6.4 - 7.4	8.8 - 9.8
045	5.4 - 6.4	7.5 - 8.5	6.4 - 7.4	8.8 - 9.8
070	5.3 - 6.3	7.4 - 8.4	6.3 - 7.3	8.7 - 9.7
090	6.1 - 7.1	8.0 - 9.0	7.1 - 8.1	9.3 - 10.3
110 & 135	6.1 - 7.1	7.8 - 8.8	7.1 - 8.2	9.1 - 10.1
The maximum carbon monoxide reading should not exceed 100 ppm.				

Table 18.

High Altitude

The manifold pressure, gas orifice and pressure switch may require adjustment or replacement to ensure proper operation at higher altitudes. See **Table 19** for manifold pressures and **Table 20** for gas conversion and pressure switch kits.

Unit	Gas	Manifold Pressure in. w.g.										Supply Line Pressure in w.g. 0 - 10000 ft.	
		0 - 4500 ft.		4501 - 5500 ft.		5501 - 6500 ft.		6501 - 7500 ft.		7501 - 10000 ft.		Min	Max
		Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire		
All Sizes	Natural	1.7	3.5	1.6	3.3	1.5	3.2	1.5	3.1	1.7	3.5	4.5	13.0
	LP/Propane	4.5	10.0	4.2	9.4	4.0	9.1	3.9	8.9	4.5	10.0	11.0	13.0

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

Table 19. Manifold and Supply Line Pressure 0 - 10,000 ft.

Model	Natural to LP/Propane	High Altitude Natural Burner Orifice Kit	High Altitude LP/Propane Burner Orifice Kit	High Altitude Pressure Switch	
	0 - 7500 ft (0 - 2286m)	7501 - 10000 ft (2286 - 3048m)	7501 - 10000 ft (2286 - 3048m)	4501 - 7500 ft (1371 - 2286m)	7501 - 10000 ft (2286 - 3048m)
030	17H64	14C92	17H65	14A47	14A50
045	11K48	*51W01	11K47	14A51	14A53
070				14A48	14A54
090				14A54	14A53
110				25B93	14A45
135	11K51	73W37	11K36	25B94	25B95

*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).

Table 20. Conversion Kit Fan Pressure Switch Requirements at Varying Altitudes

Service Information

GAS PIPING (Cont.)

Proper Ground and Voltage

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.

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

1. Measure the AC voltage between Line Neutral (spade terminals) and "C" terminal (low voltage terminal block) on the integrated control. See **Figure 53**. A wide variation in the voltage between Line Neutral and "C" as a function of load indicates a poor or partial ground. Compare the readings to **Table 21**. If the readings

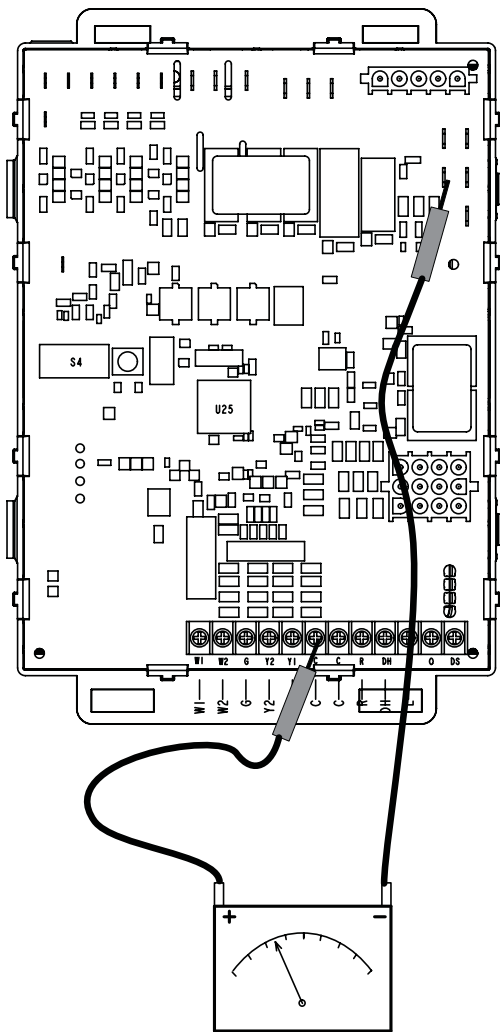
exceed the maximum shown in **Table 21**, make repairs before operating the furnace.

2. In addition, measure the AC voltage from Line Hot to Line Neutral (spade terminals) on the integrated control. See **Figure 59**. This voltage should be in the range of 97 to 132 Vac.

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

Table 21.

CHECK VOLTAGE BETWEEN LINE NEUTRAL AND LOW VOLTAGE "C" TERMINAL



CHECK VOLTAGE BETWEEN LINE HOT AND LINE NEUTRAL

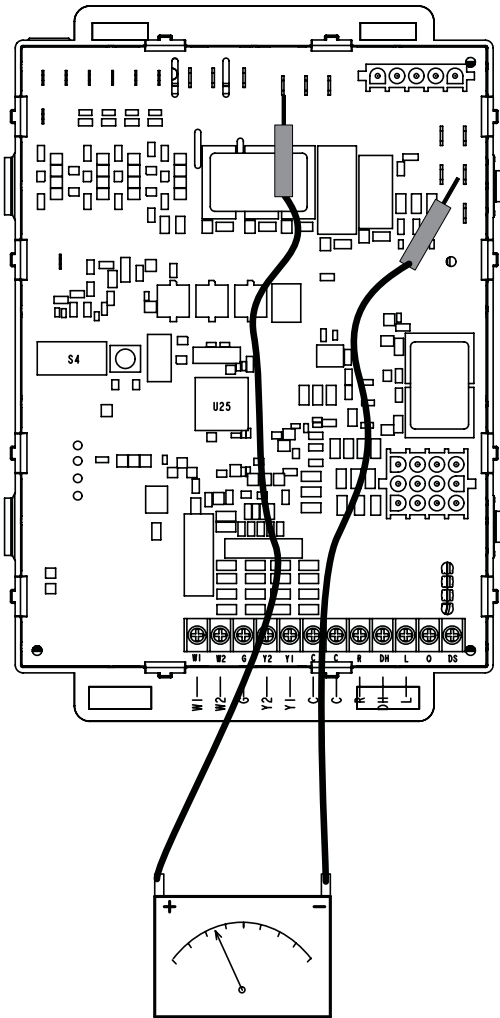


Figure 53.

Service Information

TYPICAL OPERATING CHARACTERISTICS

Blower Operation and Adjustment

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

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

Temperature Rise (Figure 54)

Temperature rise for NF97U***T**R units depends on unit input, blower speed, blower horsepower and static pressure as marked on the unit rating plate. The blower speed must be set for unit operation within the range of "TEMP. RISE °F" listed on the unit rating plate.

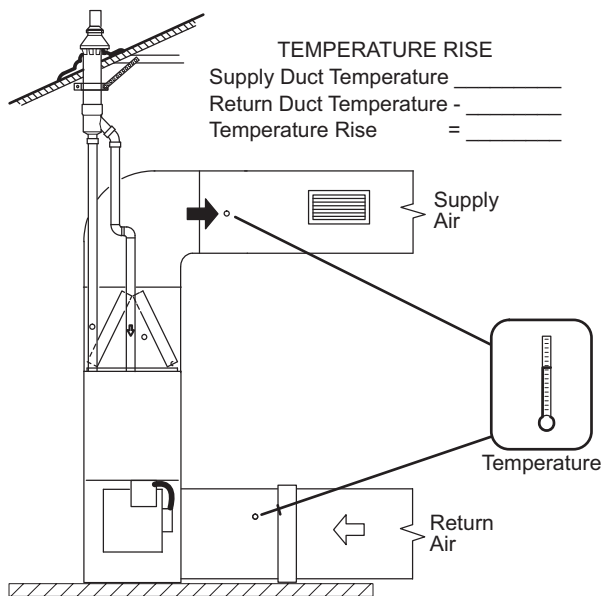


Figure 54.

External Static Pressure

1. Tap locations shown in **Figure 55**.
2. Punch a 1/4" diameter hole in supply and return air plenums. Insert manometer hose flush with inside edge of hole or insulation. Seal around the hose with permagum. Connect the zero end of the manometer to the discharge (supply) side of the system. On ducted systems, connect the other end of manometer to the return duct as above.
3. With only the blower motor running and the evaporator coil dry, observe the manometer reading. Adjust blower motor speed to deliver the air desired according to the job requirements. For heating speed (second stage heat speed) external static pressure drop must not be more than 0.5" W.C. For cooling speed (second stage cool speed) external static pressure drop must not be more than 0.5" W.C.
4. Seal the hole when the check is complete.

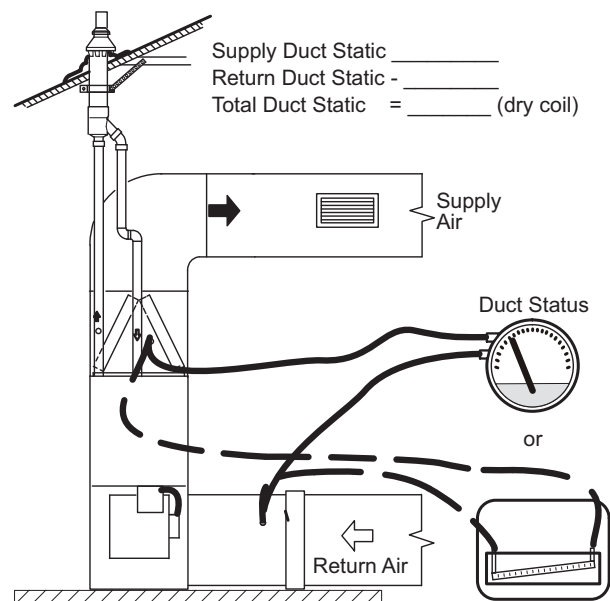


Figure 55. Static Pressure Test

Service Information

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 22** lists recommended filter

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

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

Table 22.

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

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

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

1. Check all wiring for loose connections.
2. Check for the correct voltage at the furnace (furnace operating). Correct voltage is 120VAC + 10%
3. Check amp-draw using a true RMS meter on the blower motor with blower access panel in place. See **Figure 56**.

Furnace Nameplate _____ Actual _____

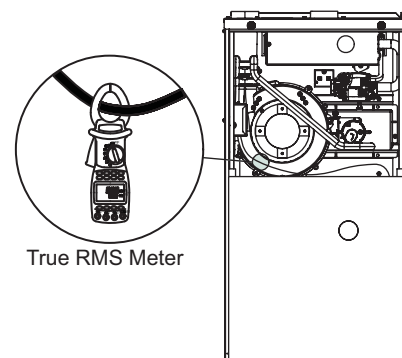


Figure 56. Check Motor AMP Draw

Service Information

MAINTENANCE (Cont.)

Winterizing and Condensate Trap Care

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

Condensate Hose Screens (Figure 57)

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

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

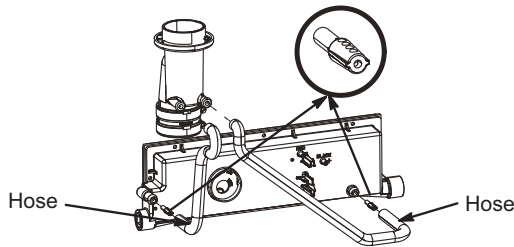


Figure 57. Condensate Hose Screens

Cleaning Heat Exchanger

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

1. Turn off electrical and gas supplies to the furnace.
 2. Remove the furnace access panels.
 3. Disconnect the 2 wires from the gas valve.
 4. Remove gas supply line connected to gas valve. Remove the burner box cover (if equipped) and remove gas valve/manifold assembly.
 5. Remove sensor wire from sensor. Disconnect 2-pin plug from the ignitor.
 6. Disconnect wires from flame roll-out switches.
 7. Disconnect combustion air intake pipe. It may be necessary to cut the existing pipe to remove burner box assembly.
 8. Remove four burner box screws at the vestibule panel and remove burner box. Set burner box assembly aside.
- NOTE:** If necessary, clean burners at this time. Follow procedures outlined in Burner Cleaning section.
9. Loosen the clamps to the flexible exhaust coupling.
 10. Disconnect condensate drain line from the cold end header box.

11. Disconnect condensate drain tubing from flue collar. Remove screws that secures the flue collar into place. Remove flue collar. It may be necessary to cut the exiting exhaust pipe for removal of the fitting.
12. Mark and disconnect all combustion air pressure tubing from cold end header collector box.
13. Mark and remove wires from pressure switch assembly. Remove the assembly. Keep tubing attached to pressure switches.
14. Disconnect the plug from the combustion air inducer. Remove two screws which secure combustion air inducer to collector box. Remove combustion air inducer assembly. Remove ground wire from vest panel.
15. Disconnect the condensate drain line.
16. Remove cold end header box.
17. Remove electrical junction box from the side of the furnace.
18. Mark and disconnect any remaining wiring to heating compartment components. Disengage strain relief bushing and pull wiring and bushing through the hole in the blower deck.
19. Remove the primary limit from the vestibule panel.
20. Remove two screws from the front cabinet flange at the blower deck. Spread cabinet sides slightly to allow clearance for removal of heat exchanger.
21. Remove screws along vestibule sides and bottom which secure vestibule panel and heat exchanger assembly to cabinet. Remove two screws from blower rail which secure bottom heat exchanger flange. Remove heat exchanger from furnace cabinet.
22. Back wash heat exchanger with soapy water solution or steam. If steam is used it must be below 275°F (135°C).
23. Thoroughly rinse and drain the heat exchanger. Soap solutions can be corrosive. Take care to rinse entire assembly.
24. Reinstall heat exchanger into cabinet making sure that the clamshells of the heat exchanger assembly is engaged properly into the support bracket on the blower deck. Remove the indoor blower to view this area through the blower opening.
25. Re-secure the supporting screws along the vestibule sides and bottom to the cabinet.
26. Reinstall cabinet screws on front flange at blower deck.
27. Reinstall the primary limit on the vestibule panel.
28. Route heating component wiring through hole in blower deck and reinsert strain relief bushing.
29. Reinstall electrical junction box.

Service Information

MAINTENANCE(cont.)

Cleaning Heat Exchanger (Cont.)

30. Reinstall the cold end header box.
31. Reinstall the combustion air inducer. Reconnect the plug to the wire harness.
32. Reinstall pressure switches and reconnect pressure switch wiring.
33. Carefully connect combustion air pressure switch tubing from pressure switches to proper ports on cold end header collector box.
34. Reconnect condensate drain line to the cold end header box.
35. Use securing screws to reinstall flue collar to the top cap on the furnace. Reconnect exhaust piping and exhaust drain tubing.
36. Replace flexible exhaust adapter on combustion air inducer and flue collar. Secure using two existing hose clamps.
37. Reinstall burner box assembly in vestibule area. Secure burner box assembly to vestibule panel using four existing screws. Make sure burners line up in center of burner ports.
38. Reconnect flame roll-out switch wires.
39. Reconnect sensor wire and reconnect 2-pin plug from ignitor.
40. Reinstall gas valve manifold assembly. Reconnect gas supply line to gas valve.
41. Reconnect the combustion air intake pipe.
42. Reinstall burner box cover.
43. Reconnect wires to gas valve.
44. Replace the blower compartment access panel.
45. Reconnect gas supply piping. Turn on power and gas supply to unit.
46. Follow lighting instructions on unit nameplate to light and operate furnace for 5 minutes to ensure the furnace is operating properly.
47. Check all piping connections, factory and field, for gas leaks. Use a leak detecting solution or other preferred means.
48. Replace heating compartment access panel.

⚠ CAUTION

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

Cleaning the Burner Assembly (if needed)

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

Service Information

WIRING DIAGRAM

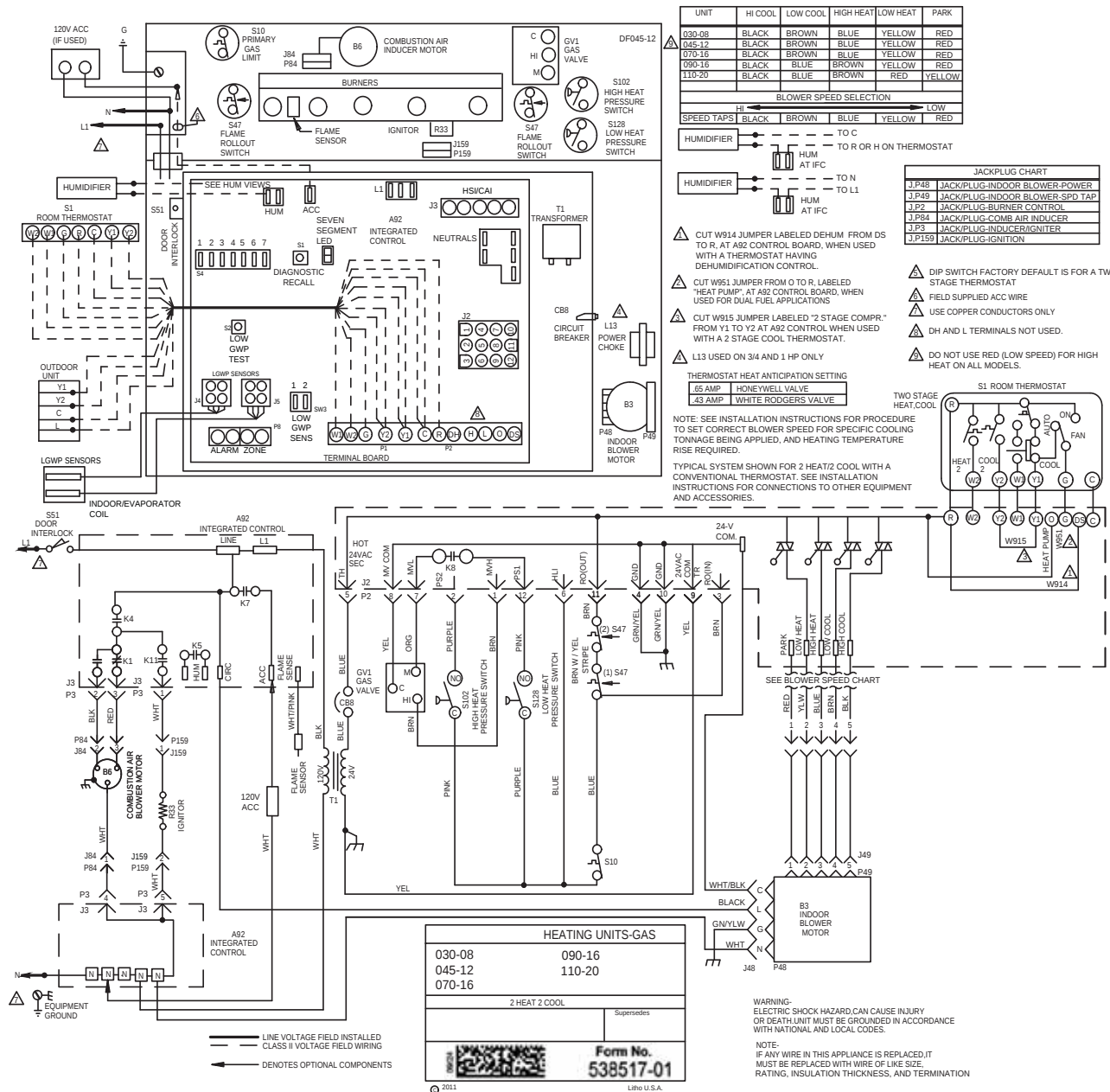


Figure 58A. Wiring Diagram for 30, 45, 70, 90 and 110 Units.

Service Information

WIRING DIAGRAM

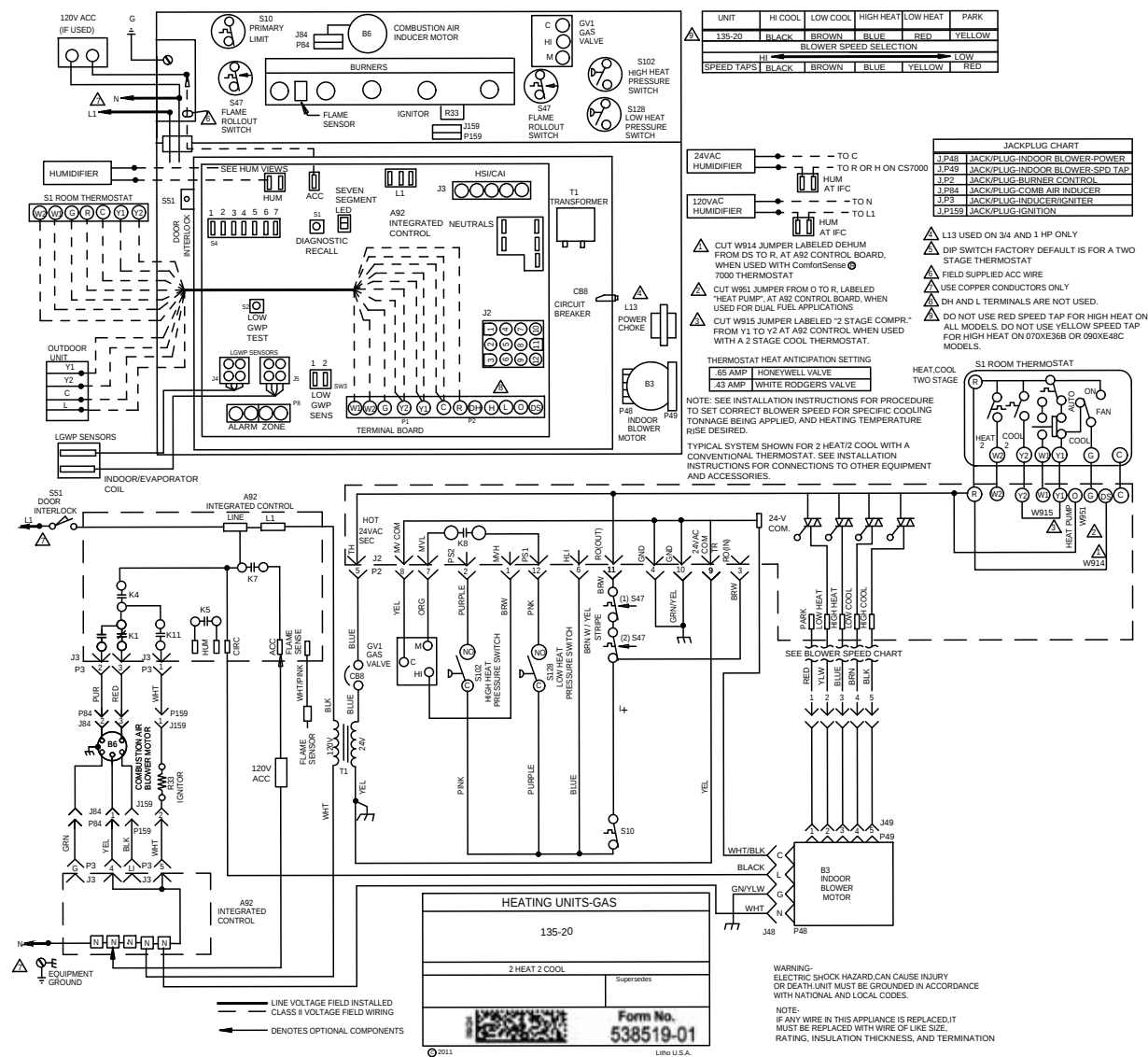


Figure 58B. Wiring Diagram for 135 Units.

Service Information

ELECTRONIC IGNITION

The two-stage, variable speed integrated control used in NF97U***T**R units has an added feature of an internal control. The feature serves as an automatic reset device for ignition control lockout caused by ignition failure. After one hour of continuous thermostat demand for heat, the feature will break and remake thermostat demand to the furnace and automatically reset the control to begin the ignition sequence.

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

Applications Using a Two-Stage Thermostat

See **Figure 59** for ignition control sequence

Heating Sequence -- Integrated Control Thermostat Selection DIP Switch 1 OFF in "Two-Stage" Position (Factory Setting)

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

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

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

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

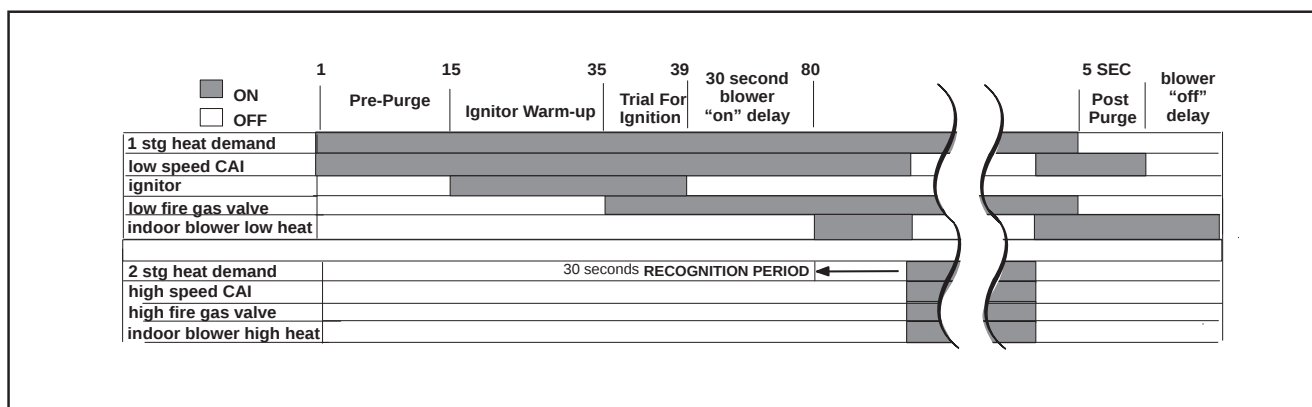


Figure 59. Heating Operation with Two-Stage Thermostat

Service Information

ELECTRONIC IGNITION (Cont.)

Applications Using A Single-Stage Thermostat

See **Figure 60** for ignition control sequence

Heating Sequence -- Integrated Control Thermostat Selection DIP Switch 1 OFF in "Single-Stage" Position

NOTE: In these applications, two-stage heat will be initiated by the integrated control if heating demand has not been satisfied after the field adjustable period (7 or 2 minutes).

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

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

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

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

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

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

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

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

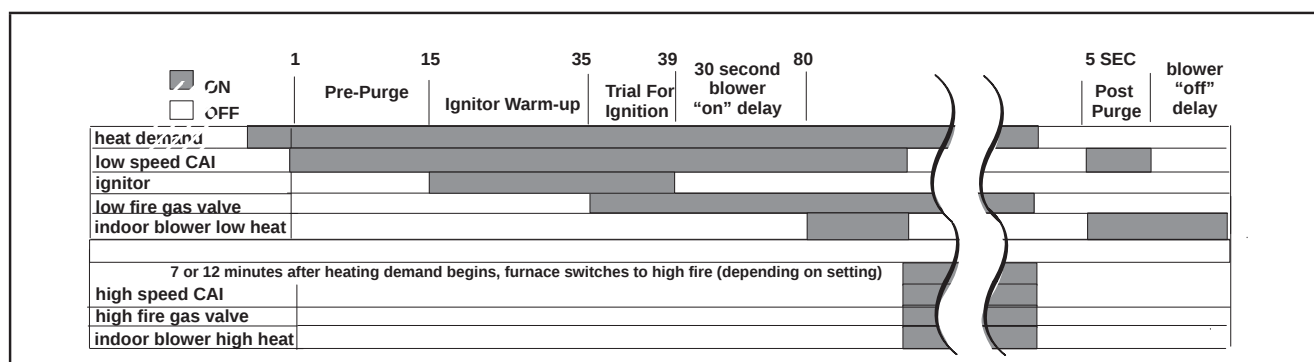
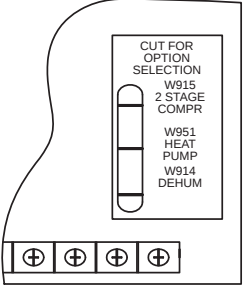
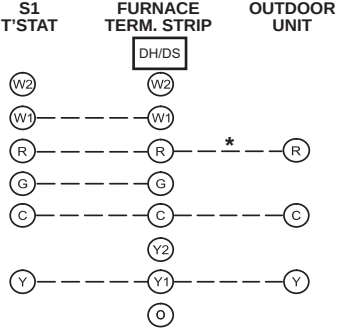
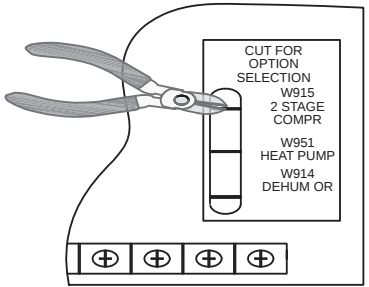
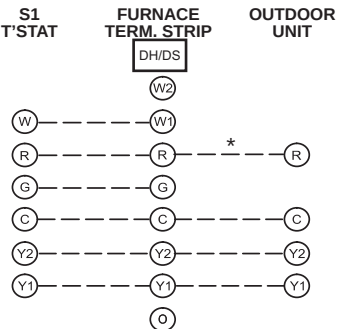
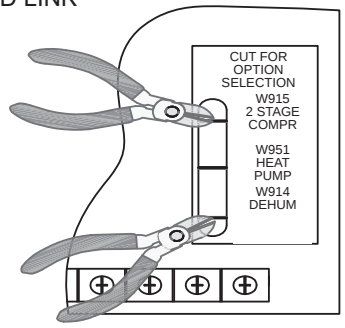
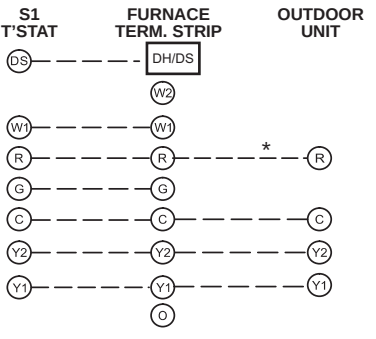


Figure 60. Heating Operation with Single-Stage Thermostat

Service Information

ELECTRONIC IGNITION (Cont.)

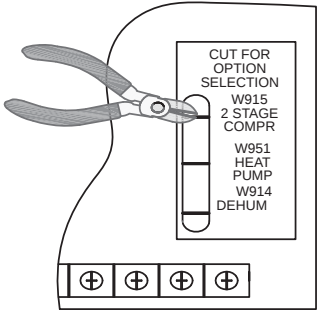
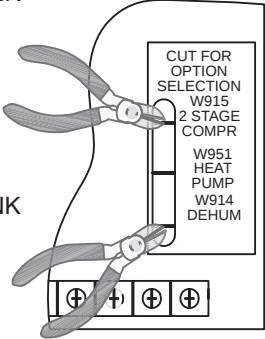
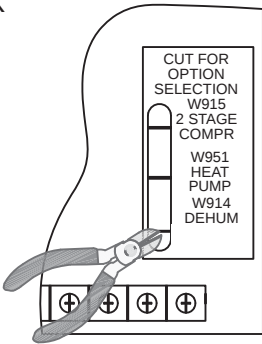
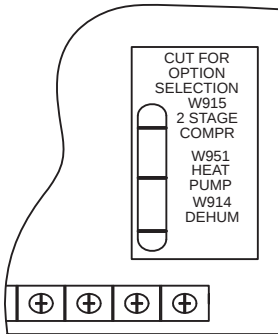
Thermostat	DIP Switch Settings and On-Board Links		Wiring Connections
	DIP Switch 1 Thermostat Heating Stages	On Board Links Must Be Cut To Select System Options	
1 Heat / 1 Cool NOTE - Use DIP switch 2 to set second-stage heat ON delay. OFF-7 minutes. ON-12 minutes.	ON	DO NOT CUT ANY ON-BOARD LINKS 	
1 Heat / 2 Cool NOTE - Use DIP switch 2 to set second-stage heat ON delay. OFF-7 minutes. ON-12 minutes.	ON	CUT ON-BOARD LINK W915 2 STAGE COMPR 	
1 Heat / 2 Cool with t'stat with humidity control. NOTE - Use DIP switch 2 to set second-stage heat ON delay. OFF-7 minutes. ON-12 minutes.	ON	CUT ON-BOARD LINK W914 DEHUM CUT ON-BOARD LINK W914 DEHUM 	

* Not required on all units.

Table 23A.

Service Information

ELECTRONIC IGNITION (Cont.)

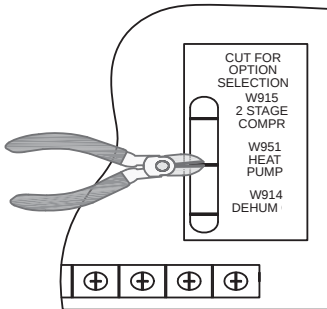
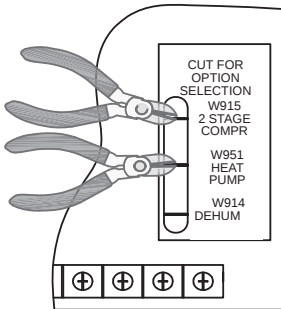
Thermostat	DIP Switch Settings and On-Board Links		Wiring Connections
	DIP Switch 1 Thermostat Heating Stages	On Board Links Must Be Cut To Select System Options	
2 Heat / 2 Cool	OFF	CUT ON-BOARD LINK W915 2 STAGE COMPR 	S1 T'STAT FURNACE TERM. STRIP OUTDOOR UNIT DH/DS W2-----W2 W1-----W1 R-----R-----*-----R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

* Not required on all units.

Table 23B.

Service Information

ELECTRONIC IGNITION (Cont.)

Thermostat	DIP Switch Settings and On-Board Links		Wiring Connections
	DIP Switch 1 Thermostat Heating Stages	On Board Links Must Be Cut To Select System Options	
Dual Fuel Single Stage Heat Pump Thermostat w/ dual fuel capabilities Capable of 2 stage gas heat control	OFF	CUT ON-BOARD LINK W951 HEAT PUMP 	S1 T'STAT (R) (H) (W2) (W1) (O) FURNACE TERM. STRIP (R) (W2) (W1) (O) OUTDOOR UNIT (R) (W) (Y) (Y2) (G) (D) (B) (C) 67M41* connects W1 to W1
Dual Fuel Two Stage Heat Pump Thermostat w/ dual fuel capabilities Capable of 2 stage gas heat control	OFF	CUT ON-BOARD LINK W915 2 STAGE COMPR CUT ON-BOARD LINK W951 HEAT PUMP 	S1 T'STAT (R) (H) (W2) (W1) (O) (L) (Y1) (Y2) (G) (D) (B) (C) FURNACE TERM. STRIP (R) (W2) (W1) (O) (Y1) (Y2) (G) (D) (Y2) (C) OUTDOOR UNIT (R) (W) (L) (Y1) (Y2) (Y2 out blue) (C) 67M41* connects W1 to W1

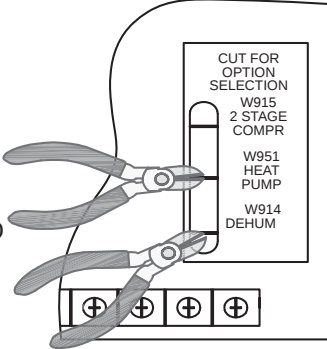
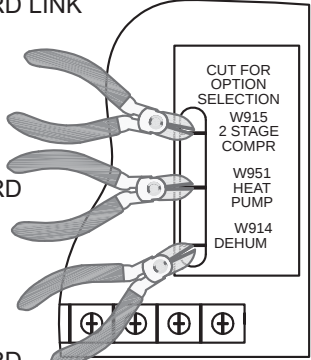
* Connect W1 to W1 ONLY if using defrost tempering kit 67M41

NOTE: DO NOT make a wire connection between the room thermostat L terminal and the L terminal of the furnace integrated control.

Table 23C.

Service Information

ELECTRONIC IGNITION (Cont.)

Thermostat	DIP Switch Settings and On-Board Links		Wiring Connections																																							
	DIP Switch 1 Thermostat Heating Stages	On Board Links Must Be Cut To Select System Options																																								
Dual Fuel Single Stage Heat Pump Thermostat w/ dual fuel capabilities Capable of 2 stage gas heat control w/ dehumidification control	OFF	CUT ON-BOARD LINK W951 HEAT PUMP  CUT ON-BOARD LINK W914 DEHUM	<table><thead><tr><th>S1 STAT</th><th>FURNACE TERM. STRIP</th><th>OUTDOOR UNIT</th></tr></thead><tbody><tr><td>(R) ———</td><td>(R) ———</td><td>(R)</td></tr><tr><td>(H) ———</td><td></td><td></td></tr><tr><td>(W2) ———</td><td>(W2) ———</td><td></td></tr><tr><td>(W1) ———</td><td>(W1) ———</td><td>(W) ← 67M41* →</td></tr><tr><td>(O) ———</td><td>(O) ———</td><td>(O)</td></tr><tr><td>(L) ———</td><td></td><td>(L)</td></tr><tr><td>(Y1) ———</td><td>(Y1) ———</td><td>(Y)</td></tr><tr><td>(Y2) ———</td><td></td><td></td></tr><tr><td>(G) ———</td><td>(G) ———</td><td></td></tr><tr><td>(D) ———</td><td>(DS) ———</td><td></td></tr><tr><td>(B) ———</td><td>(Y2) ———</td><td></td></tr><tr><td>(C) ———</td><td>(C) ———</td><td>(C)</td></tr></tbody></table>	S1 STAT	FURNACE TERM. STRIP	OUTDOOR UNIT	(R) ———	(R) ———	(R)	(H) ———			(W2) ———	(W2) ———		(W1) ———	(W1) ———	(W) ← 67M41* →	(O) ———	(O) ———	(O)	(L) ———		(L)	(Y1) ———	(Y1) ———	(Y)	(Y2) ———			(G) ———	(G) ———		(D) ———	(DS) ———		(B) ———	(Y2) ———		(C) ———	(C) ———	(C)
S1 STAT	FURNACE TERM. STRIP	OUTDOOR UNIT																																								
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(C) ———	(C) ———	(C)																																								
Dual Fuel Two Stage Heat Pump Thermostat w/ dual fuel capabilities Capable of 2 stage gas heat control w/ dehumidification control	OFF	CUT ON-BOARD LINK W915 2 STAGE COMPR  CUT ON-BOARD LINK W951 HEAT PUMP CUT ON-BOARD LINK W914 DEHUM	<table><thead><tr><th>S1 STAT</th><th>FURNACE TERM. STRIP</th><th>OUTDOOR UNIT</th></tr></thead><tbody><tr><td>(R) ———</td><td>(R) ———</td><td>(R)</td></tr><tr><td>(H) ———</td><td></td><td></td></tr><tr><td>(W2) ———</td><td>(W2) ———</td><td></td></tr><tr><td>(W1) ———</td><td>(W1) ———</td><td>(W) ← 67M41* →</td></tr><tr><td>(O) ———</td><td>(O) ———</td><td>(O)</td></tr><tr><td>(L) ———</td><td></td><td>(L)</td></tr><tr><td>(Y1) ———</td><td>(Y1) ———</td><td>(Y1)</td></tr><tr><td>(Y2) ———</td><td></td><td>(Y2)</td></tr><tr><td>(G) ———</td><td>(G) ———</td><td></td></tr><tr><td>(D) ———</td><td>(DS) ———</td><td></td></tr><tr><td>(B) ———</td><td>(Y2) ———</td><td>Y2 out blue</td></tr><tr><td>(C) ———</td><td>(C) ———</td><td>(C)</td></tr></tbody></table>	S1 STAT	FURNACE TERM. STRIP	OUTDOOR UNIT	(R) ———	(R) ———	(R)	(H) ———			(W2) ———	(W2) ———		(W1) ———	(W1) ———	(W) ← 67M41* →	(O) ———	(O) ———	(O)	(L) ———		(L)	(Y1) ———	(Y1) ———	(Y1)	(Y2) ———		(Y2)	(G) ———	(G) ———		(D) ———	(DS) ———		(B) ———	(Y2) ———	Y2 out blue	(C) ———	(C) ———	(C)
S1 STAT	FURNACE TERM. STRIP	OUTDOOR UNIT																																								
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(W2) ———	(W2) ———																																									
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(D) ———	(DS) ———																																									
(B) ———	(Y2) ———	Y2 out blue																																								
(C) ———	(C) ———	(C)																																								

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

NOTE: DO NOT make a wire connection between the room thermostat L terminal and the L terminal of the furnace integrated control.

Table 23D.

Service Information

LOW GWP APPLICATION

⚠ WARNING For use with GE Appliances approved evaporator coil and LGWP sensors only. Use original manufacturer recommended LGWP sensors if using non GE Appliances approved evaporator coil.

Connecting the Furnace Control Board Sensor.

See Figure 63 and follow steps below:

1. Route sensor wire #1 through provided grommet. Form a drip loop below the control board on upflow installations to prevent condensate dripping on the control board.
2. Avoid sharp edges when routing sensor wire during installation.
3. Sensor wire must not block view of 7 segment LED .

Ensure the cable is properly seated into the SENSOR 1 plug (LGWP1). The Molex plug clip should lock into the Molex connection point for a secured connection, as shown below in **Figure 61**. Verify the connection is free of dust, debris, and moisture.

NOTE: In confined space applications, connect the second sensor to the SENSOR 2 plug (LGWP2). Refer to evaporator coil installation instructions for more detail.



Figure 61. Two Stage Constant Torque Control

Low GWP Dip Switch Settings

Adjust the DIP switch settings to the sensor configuration. Failure to do so will cause faults on power-up. See **Figure 62** and **Table 24**



Figure 62

Configuration	Switch 1	Switch 2
One (1) sensor, connected to SENSOR 1 plug	OFF (enable)	ON (disable)
Two (2) sensors, connected to SENSOR 1 plug and SENSOR 2 plug	OFF (enable)	OFF (enable)
No sensor (R410A or heat only applications)	ON (disable)	ON (disable)

Table 24. DIP Switch Settings

In single sensor configurations, the sensor must be connected to the SENSOR 1 plug (LGWP1). Configurations other than the ones shown in **Table 24** will cause a servicing fault.

Each DIP switch corresponds to a sensor position (i.e., DIP switch 1 to sensor 1; DIP switch 2 to sensor 2). The default factory switch positions are set to OFF (ENABLED)

The furnace control board software reads the OFF position as an active sensor. A sensor should be present for the corresponding sensor connector. Setting the DIP switch to ON disables the sensor position.

Secondary Sensor Requirements

Additional Line Sets

If additional refrigerant line joints are present outside of the line set sleeve and a secondary refrigerant detection sensor is required, its installation must comply with the requirements listed in Refrigerant Detection Sensor Kit (27V53). See **Figure 63** for routing the secondary sensor cable through the furnace cabinet.

Service Information

NON-LOW GWP APPLICATION

⚠ WARNING

For Furnace only applications or Furnace replacement in a Non-Low GWP applications, the LOW GWP sensors should be disabled, otherwise the blower will operate continuously. To do this, the Low GWP Dip switches setting for both – Sensor 1 and the Sensor 2 must be moved to the ON position.

Furnace Control Board Low GWP Modes of Operation

The modes of operation for the furnace control board are Initializing, Normal, Leak Detected, and Fault.

Initializing

The furnace control board is establishing connection with the refrigerant detection sensor and is completing an initial five-minute purge sequence.

Normal

The HVAC system is functioning normally. The furnace control board has not detected a refrigerant leak.

Leak Detected

When the furnace control board detects a refrigerant leak:

1. The furnace control board shuts off the (R) input (24VAC power) to the thermostat, which de-energizes the outdoor unit compressor and heat sources, such as gas and/or electric strip heat. No heating or cooling demands will be met.

2. The furnace control board activates the blower (high speed). The blower purges refrigerant from the cabinet, plenum, and ductwork.
3. After the furnace control board determines the refrigerant levels are below the safety threshold, the blower will continue to operate for the remainder of the seven (7) -minute cycle.
4. After the blower sequence is complete, the HVAC system resumes normal operation.

NOTE: The HVAC system may not maintain a cooling or heating setpoint if a significant leak exists. Any refrigerant leaks that remain unaddressed for an extended time may cause the HVAC system to shut down on a low refrigerant pressure limit condition.

Fault

When a Low GWP fault is detected by the furnace control board, the indoor unit blower engages and remains engaged at a constant air flow output until the fault is cleared.

NOTE: See Table 4 “Ignition control diagnostic codes”.

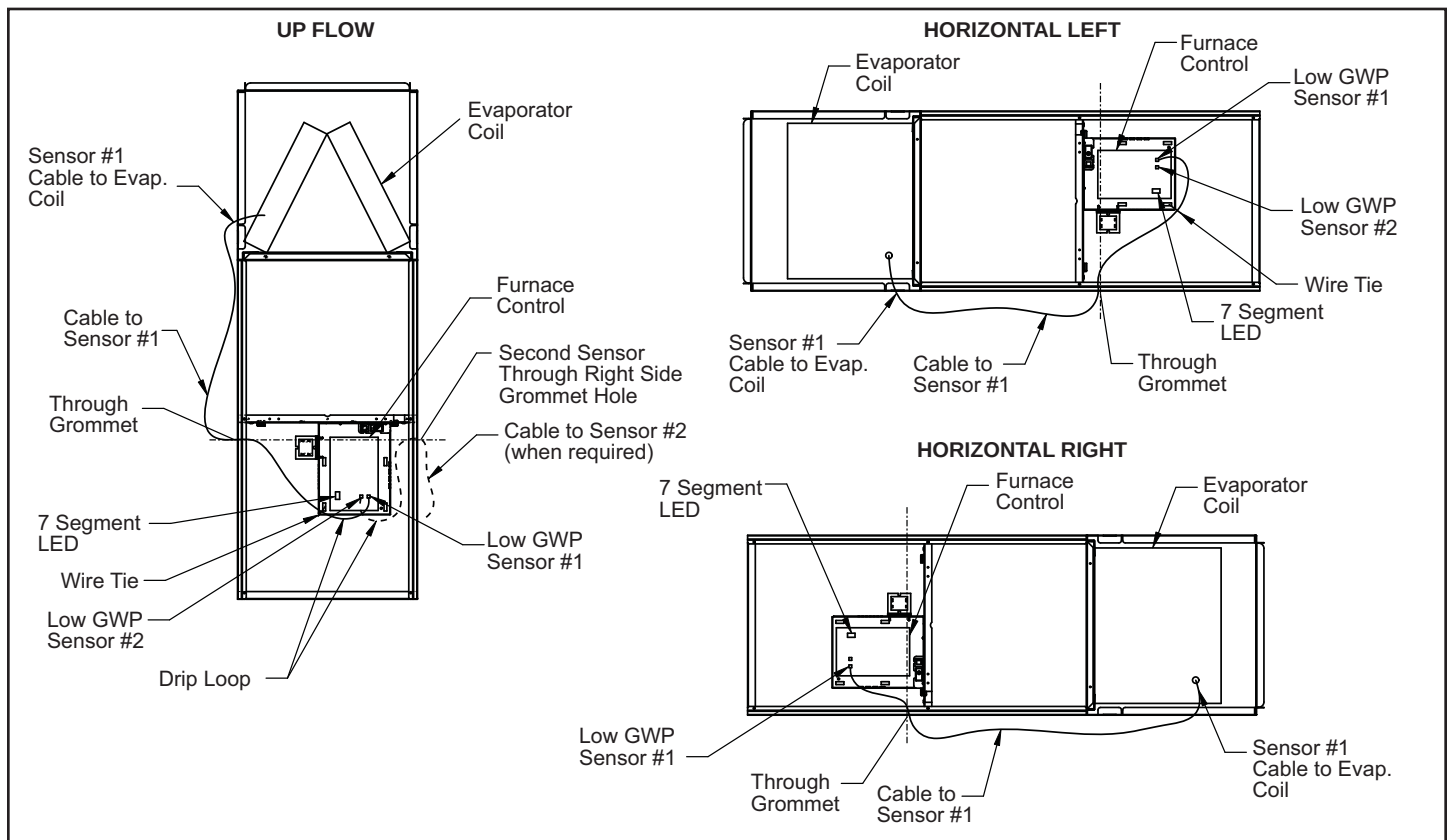


Figure 63

Service Information

LGWP Test Button Functionality

The furnace control board is equipped with a **Test/Reset** push button. The Test button can be used to perform several functions, depending on the mode of operation of the furnace control board.

Table 25 lists the functions of the Test button during each mode of operation.

Mode of Operation	Press the Test Button to:
Normal	Trigger a leak detection response. Verify all equipment is wired correctly into the furnace blower control board (after installation).
Leak Detected	Reset the furnace control board to a normal mode of operation after a previous leak has been detected and purged from the HVAC system.
Fault	Reset the furnace control board after troubleshooting and resolving a fault condition. If the fault is not resolved, the furnace control board will enter the Fault mode again.

Table 25. LGWP Test Button Function

LGWP Test Button - Additional Functions

Table 26 lists the additional functions of the Test Button while the furnace control board is functioning within the states of Initializing, Monitoring, Leak Detection, Servicing and Fault.

State	Press	Action
Initializing	Short	Skips remaining pre-purge after sensors are recognized by the furnace control board
Initializing	Long	Reset control
Monitoring	Short	Clear purge-counter if prior mitigation has occurred; Test mitigation
Monitoring	Long	Reset control
Mitigating	Short	If testing mitigation, end test
Servicing	Short	Reevaluate fault condition - if cleared return to monitoring, otherwise update indicator
Servicing	Long	Reset control
Fault	Short	Reevaluate fault condition - if cleared return to monitoring, otherwise update indicator
Fault	Long	Reset control

Table 26. Additional Button Functions

External Alarm

(For applications with external alarms wired directly to the furnace control board)

The furnace control board triggers the external alarm system when it enters Leak Detected mode. For alarm notifications, the furnace control board provides a dry relay contact that is rated 3A at 30 VAC/DC.

Thermostat Compatibility

Thermostats that preserve memory settings are compatible with the furnace control board. Examples include:

- Battery-powered thermostats
- Analog Thermostat
- Late-model programmable thermostats

NOTE: Early-generation digital and programmable thermostats may not retain the operation mode and temperature setpoints after a power outage.

The following scenarios are likely to occur when home occupants are not available to adjust the thermostat setpoints as the system is recovering from leak detection and resuming normal operation:

- Heating could be lost during a cold night
- Cooling could be lost during a hot day
- The thermostat could reset to an incorrect temperature setpoint

Start Up Procedure

The furnace control board is equipped with a **LGWP Test/Reset** button, see Test Button Functionality. After the furnace control board has been mounted and wired, restore power to the HVAC system. The system will then run through a purge sequence for five minutes. After the purge sequence is complete, proceed to testing cooling demand and heating demand.

Cooling Demand

1. Prompt a cooling demand at the thermostat.
2. Press the LGWP Test button on the furnace control board. The system then executes a leak detection response.
3. Observe the following sequence:
 - a. The LED indicator for leak detection. See **Table 4** "Ignition control diagnostic codes".
 - b. The blower powers up.
 - c. The outdoor compressor powers down.
4. Press the **LGWP Test** button to terminate the simulated Leak Detected mode upon test completion

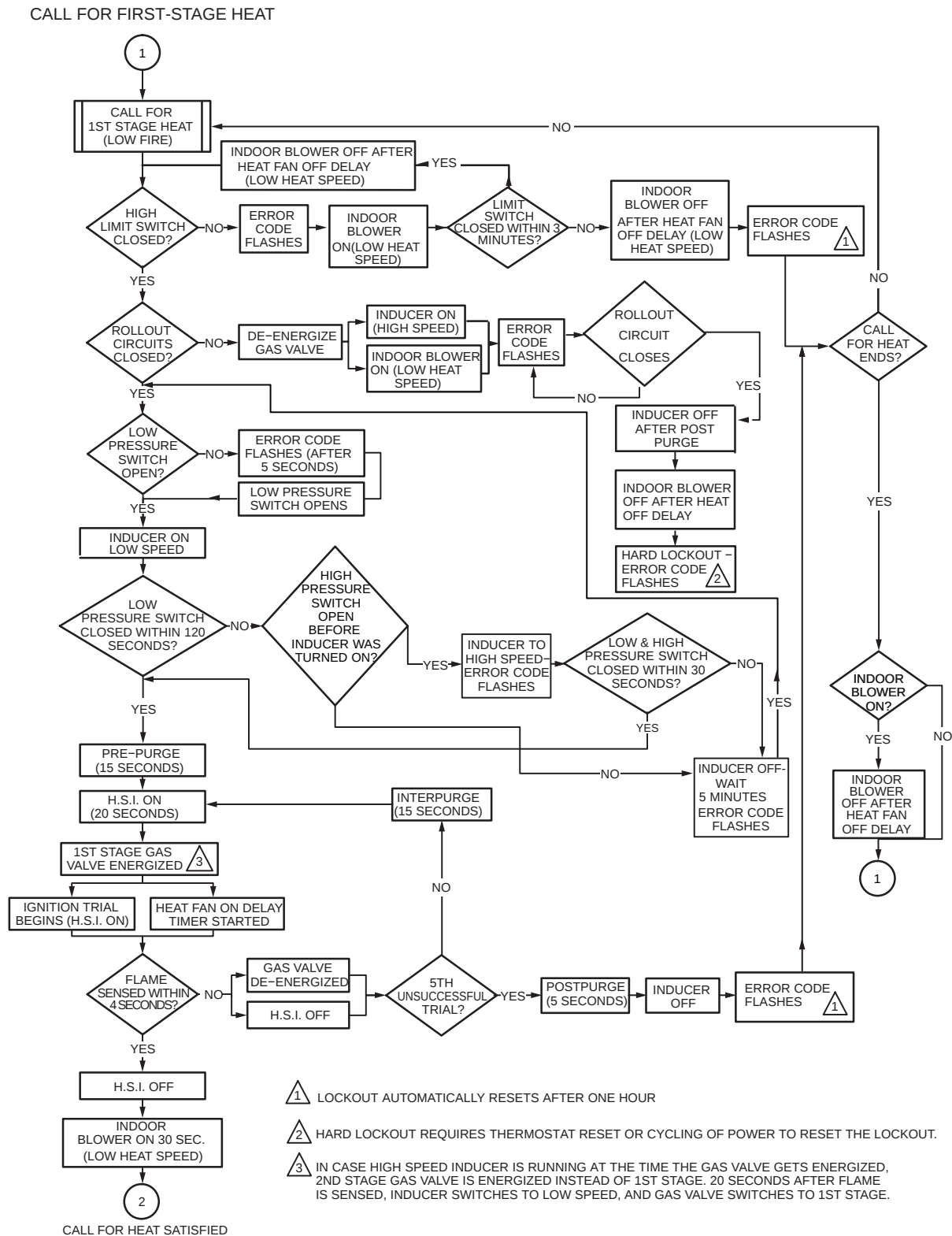
Heating Demand

1. Prompt a heating demand at the thermostat.
2. Press the LGWP Test button on the furnace control board. The system then executes a leak detection response.
3. Observe the following sequence:
 - a. The LED indicator for leak detection. See **Table 4** "Ignition control diagnostic codes".
 - b. The blower powers up.
 - c. The gas burners power down.
 - d. The outdoor compressor powers down.
4. Press the **LGWP Test** button to terminate the simulated Leak Detected mode upon test completion.

The installation of the furnace control board is complete after both sequences are successfully completed.

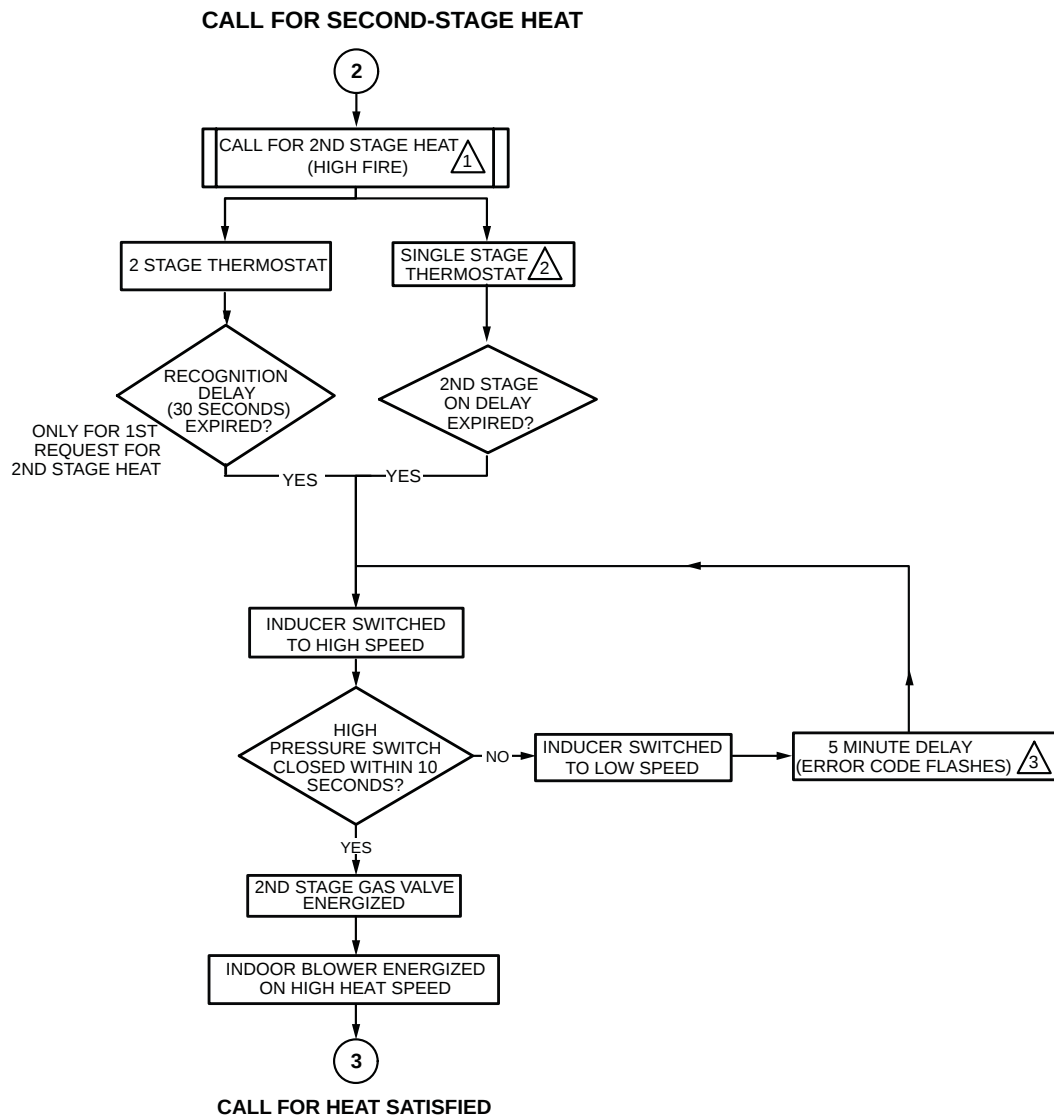
Service Information

TROUBLESHOOTING - Heating Sequence of Operation



Service Information

TROUBLESHOOTING - Heating Sequence of Operation (cont)



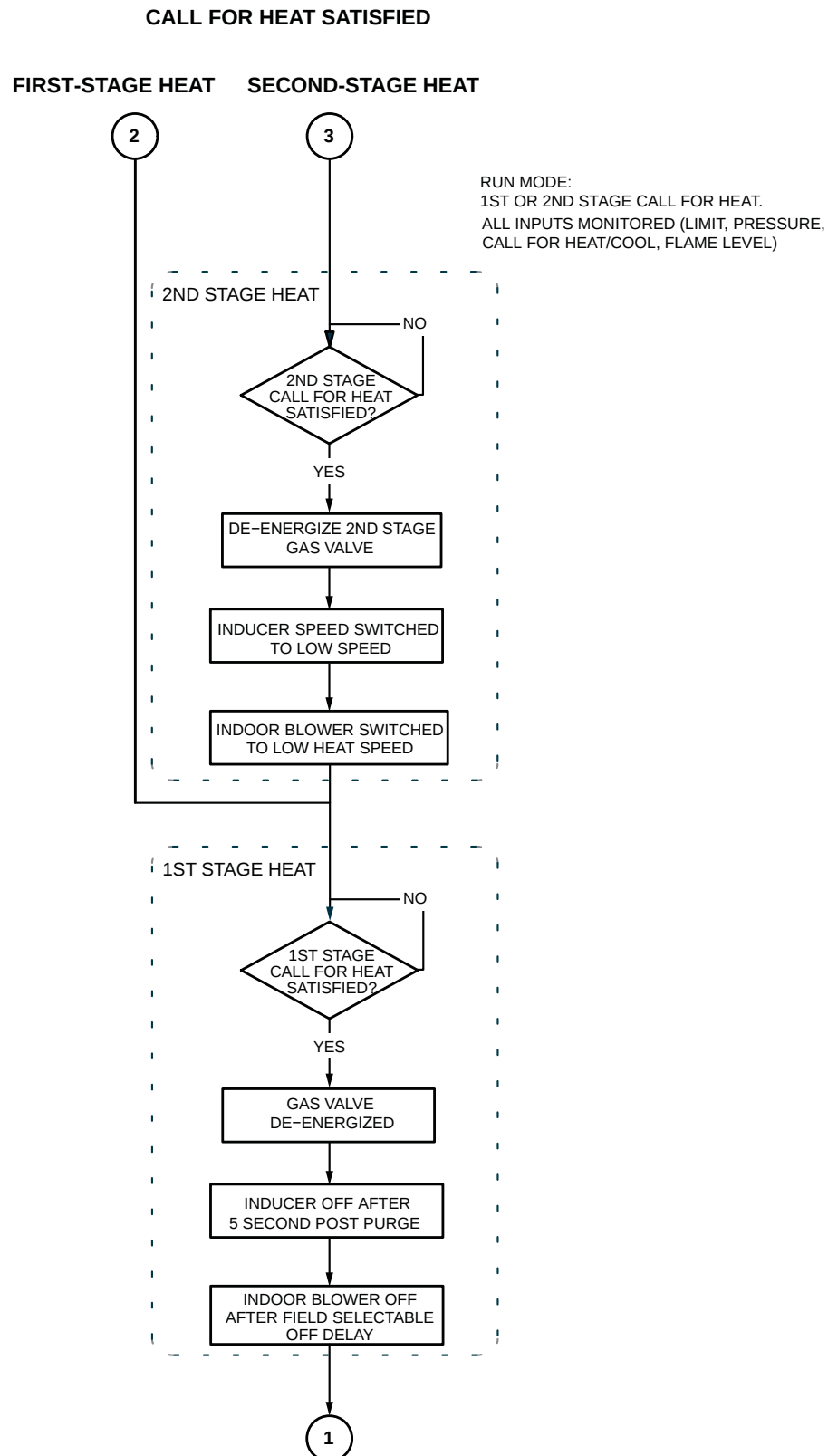
1 SYSTEM WILL ALWAYS LIGHT ON LOW FIRE, EVEN IF 2ND STAGE HEAT IS IN PLACE.

2 WHEN USED WITH A SINGLE STAGE THERMOSTAT, SET SW1 TO THE ON POSITION IN DIP SWITCH S4.

3 IF THE HIGH FIRE PRESSURE SWITCH DOES NOT CLOSE WITHIN 5 ATTEMPTS, THE SYSTEM WILL OPERATE AT LOW FIRE FOR THE REMAINDER OF THE CALL FOR HEAT REQUEST.

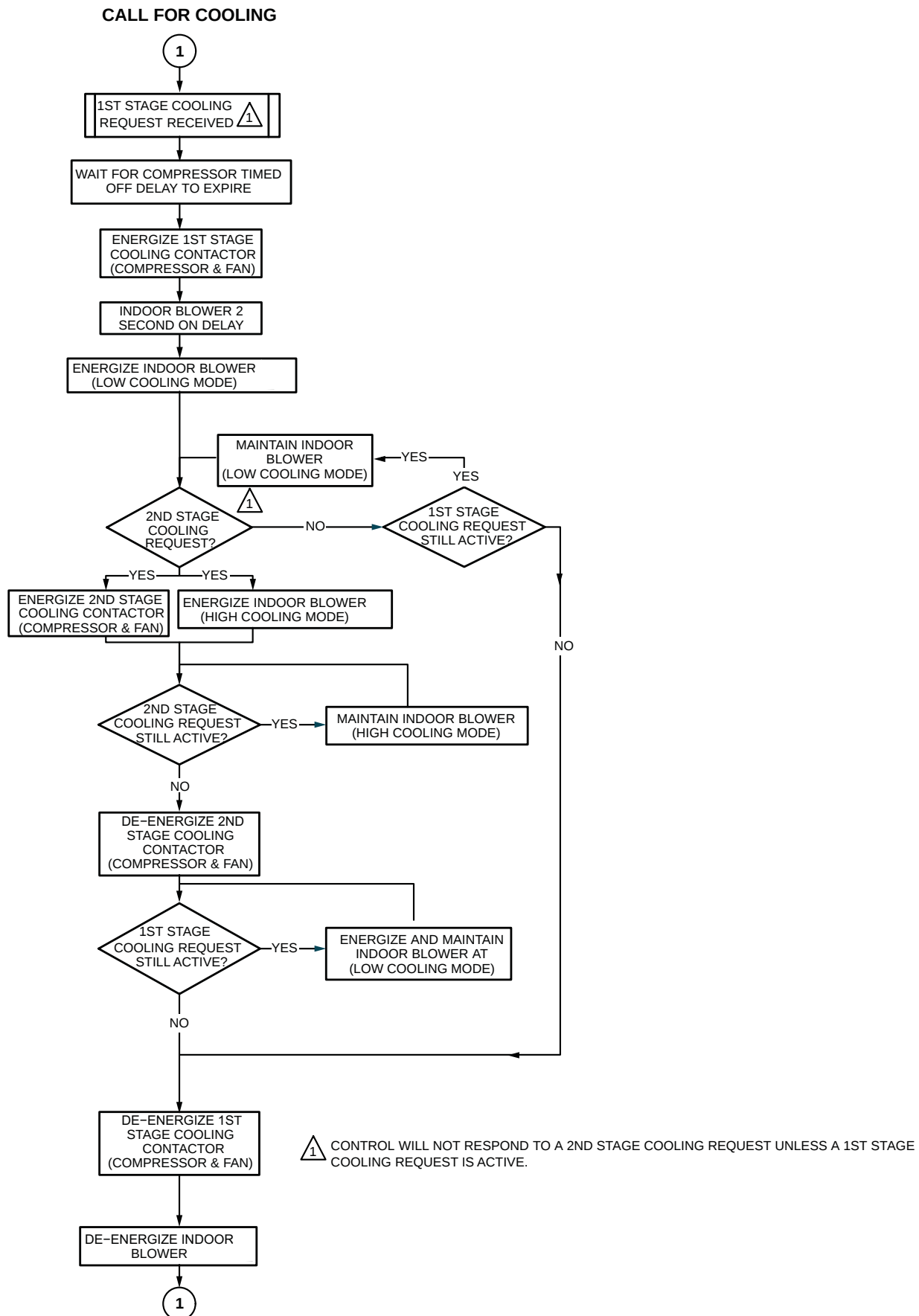
Service Information

TROUBLESHOOTING - Heating Sequence of Operation (cont)



Service Information

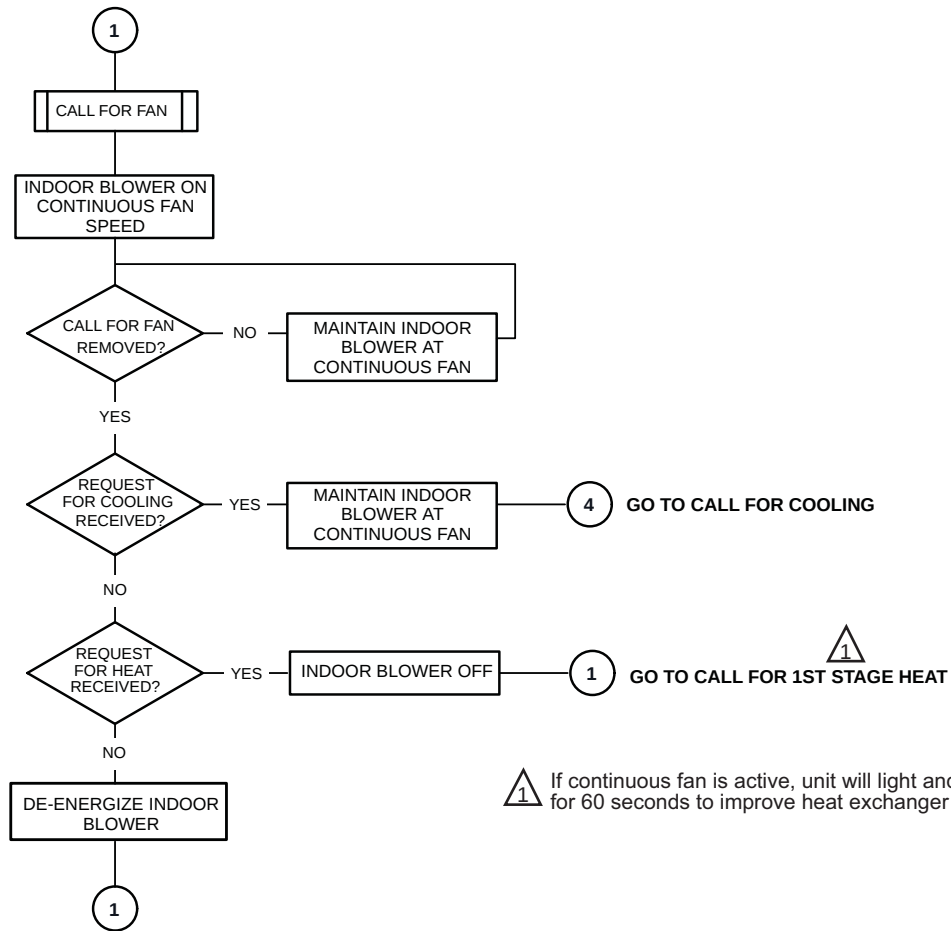
TROUBLESHOOTING - Cooling Sequence of Operation



Service Information

TROUBLESHOOTING - Continuous Fan / Accessories Sequence of Operation

CALL FOR FAN



GE APPLIANCES