GE APPLIANCES

Service Manual

NF97D***T**R

97% Downflow 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.

31-5001163 Rev. 0 10-25

General Information

⚠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.
- **Electric Shock Hazard.** Can cause injury or death. Unit must be properly grounded in accordance with national and local codes.

⚠WARNING

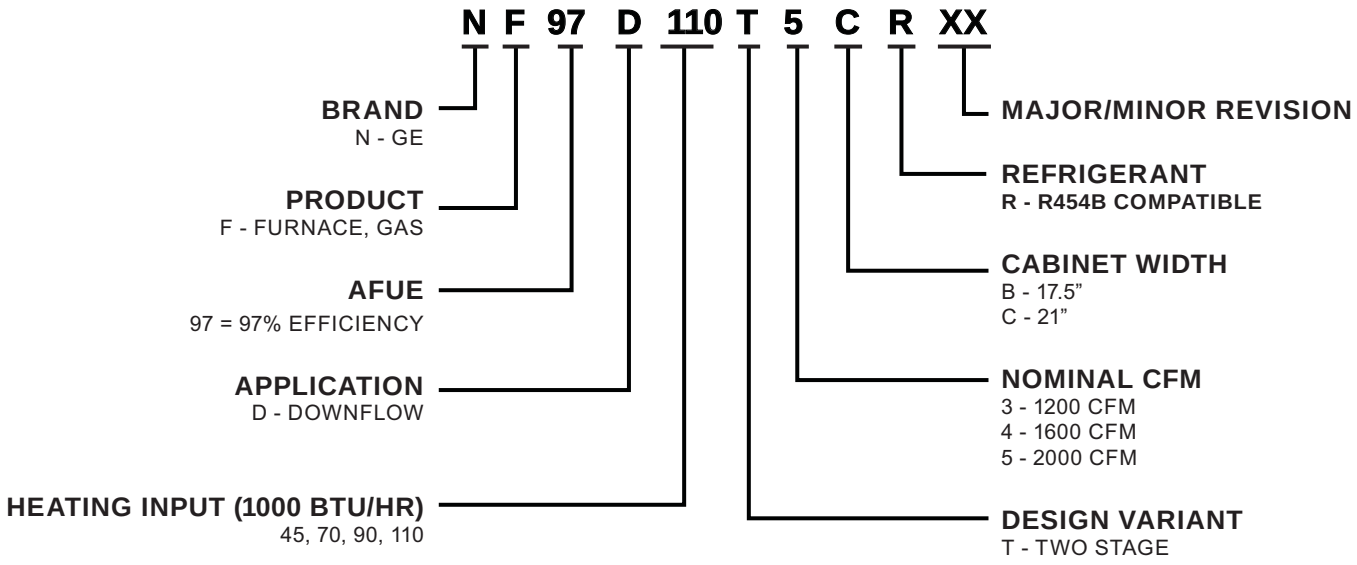
Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a licensed professional HVAC installer (or equivalent), service agency or the gas supplier.

⚠CAUTION

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

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	NF97D045T3BR	29,000	28,000	44,000	43,000	97.0	3	1/2	120-60-1	15	6.4	40	124
	NF97D070T4BR	43,000	42,000	66,000	65,000	97.0	4	1/2	120-60-1	15	9.3	40	138
	NF97D090T4CR	57,000	56,000	88,000	86,000	97.0	5	1/2	120-60-1	15	9.3	40	153
	NF97D110T5CR	72,000	70,000	110,000	108,000	97.0	5	1/2	120-60-1	20	12.3	40	164

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.)
3	576	288
4	768	384
5	960	480

1. 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 nominal tons of airflow.
2. Areas shown for permanent filters are based on filters rated at 600 feet per minute face velocity.

Blower Data: Downflow

NF97D045T3BR BBLOWER PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds									
	High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	1466	371	1313	266	1198	207	963	119	902	97
0.10	1434	383	1275	277	1169	217	921	126	860	106
0.20	1401	395	1237	288	1140	227	879	134	817	115
0.30	1363	398	1211	297	1101	238	833	140	773	122
0.40	1300	383	1179	308	1070	243	798	151	733	131
0.50	1228	367	1151	316	1036	256	755	156	692	136
0.60	1146	343	1105	319	1005	263	710	163	645	144
0.70	1058	318	1038	309	971	272	672	170	598	154
0.80	930	286	942	284	909	272	614	179	557	158
0.90	807	251	811	251	799	251	569	184	518	163
1.00	645	222	669	224	630	216	532	189	473	169

NF97D070T4BR BLOWER PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds									
	High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	1743	468	1546	327	1377	231	1271	187	1055	105
0.10	1709	485	1510	339	1336	240	1226	196	991	114
0.20	1675	501	1474	350	1294	249	1180	204	927	122
0.30	1638	513	1437	362	1244	261	1127	215	863	130
0.40	1601	529	1386	376	1187	270	1082	226	797	139
0.50	1563	541	1353	388	1139	282	1033	232	727	147
0.60	1511	539	1310	401	1100	293	979	245	661	155
0.70	1445	525	1272	410	1048	304	940	255	604	159
0.80	1339	499	1234	421	1013	313	862	264	531	174
0.90	1243	470	1161	424	952	326	811	272	481	182
1.00	1119	439	1092	414	907	330	763	281	435	192

Blower Data: Downflow

NF97D090T4CR BLOWER PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds									
	High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	1792	429	1553	294	1420	225	1348	194	1228	146
0.10	1750	446	1520	308	1389	240	1306	206	1179	158
0.20	1708	463	1487	323	1359	254	1265	217	1130	171
0.30	1685	477	1456	339	1326	264	1228	230	1090	182
0.40	1630	478	1421	350	1274	281	1192	239	1046	192
0.50	1558	462	1394	363	1246	291	1157	251	989	202
0.60	1458	432	1354	373	1209	300	1114	264	952	210
0.70	1371	408	1312	381	1177	314	1079	271	913	220
0.80	1231	368	1234	366	1138	324	1038	282	861	230
0.90	1118	343	1093	336	1093	327	997	291	843	237
1.00	1008	315	976	309	987	306	952	292	794	242

NF97D110T5CR BLOWER PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds									
	High (Black)		Medium-High (Brown)		Medium (Blue)		Medium-Low (Yellow)		Low (Red)	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	2211	681	1962	459	1799	351	1679	302	1494	214
0.10	2174	694	1920	474	1754	365	1631	312	1441	225
0.20	2136	706	1877	488	1709	379	1583	322	1387	237
0.30	2095	718	1832	500	1658	391	1530	332	1323	247
0.40	2058	734	1792	512	1617	403	1487	345	1276	256
0.50	2006	742	1745	525	1570	413	1433	354	1223	265
0.60	1940	727	1704	538	1523	426	1379	368	1168	276
0.70	1863	702	1665	550	1479	436	1340	377	1110	290
0.80	1765	669	1622	563	1439	445	1288	388	1061	293
0.90	1673	642	1582	572	1398	454	1254	397	1013	304
1.00	1559	599	1522	568	1354	466	1214	407	949	311

Accessory List

Description	Catalog Number
Downflow Combustible Flooring Base	
17.5” B Width	11M60
21.0” C Width	11M61
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	
RDS Sensor Kit, Downflow	29Z35
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	

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)
045	11K48	*51W01	11K47	14A51	14A53
070				14A48	14A54
090				14A54	14A53
110				25B93	14A45

*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

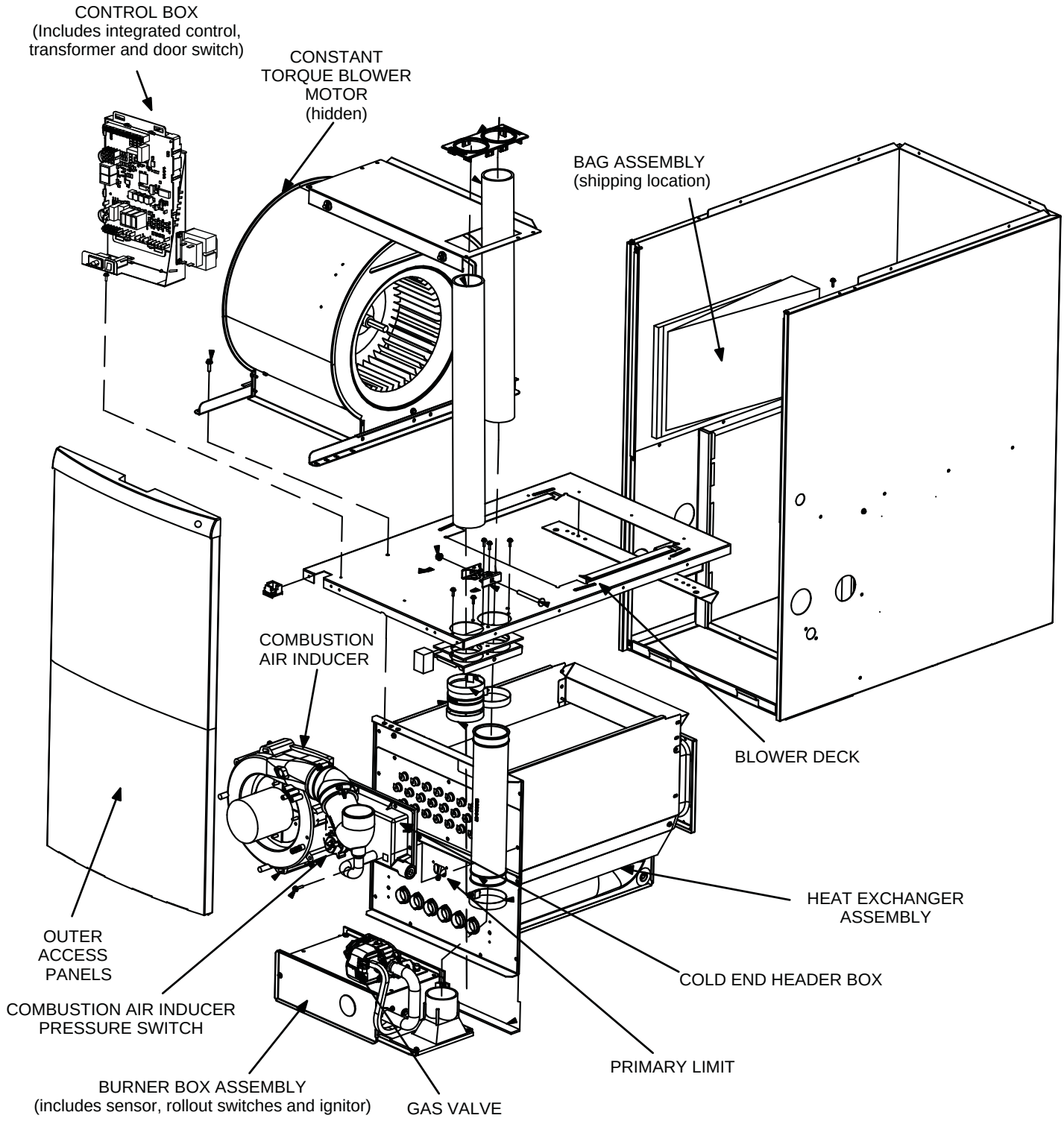


Figure 1.

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.

NF97D***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.

Control Box Components

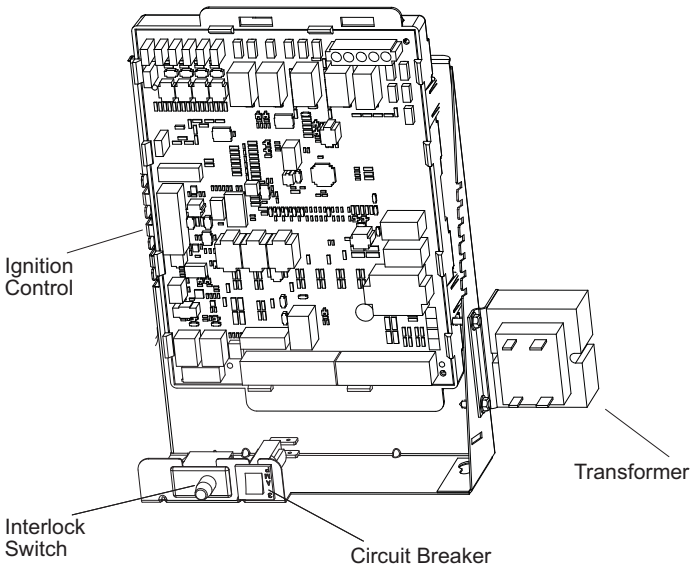


Figure 2. Control Box

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**.

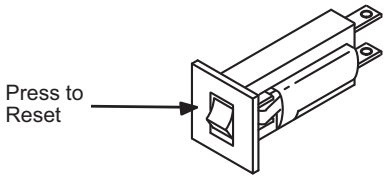


Figure 3. Circuit Breaker (CB8)

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 a two-stage, integrated control. The system consists of an 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.

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.

ELECTRICAL (Cont.)

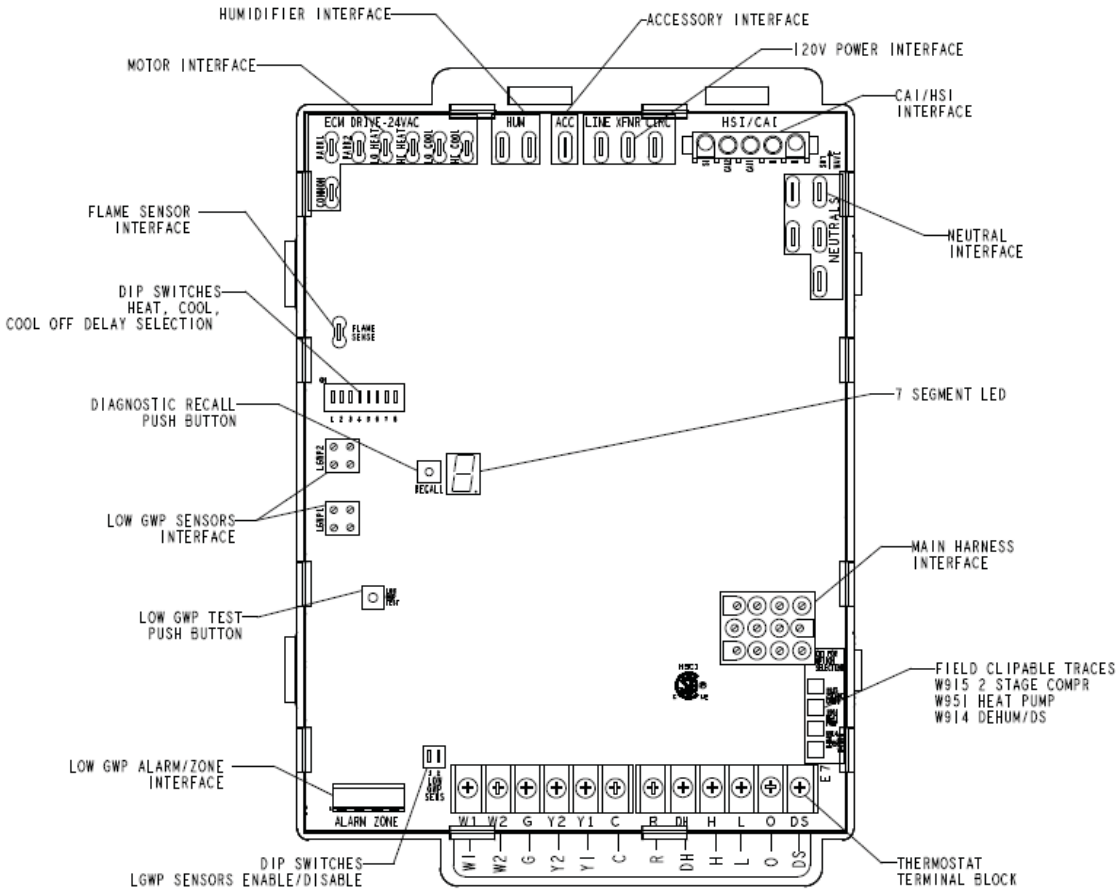


Figure 4. Integrated Control

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 (Unused0
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.

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

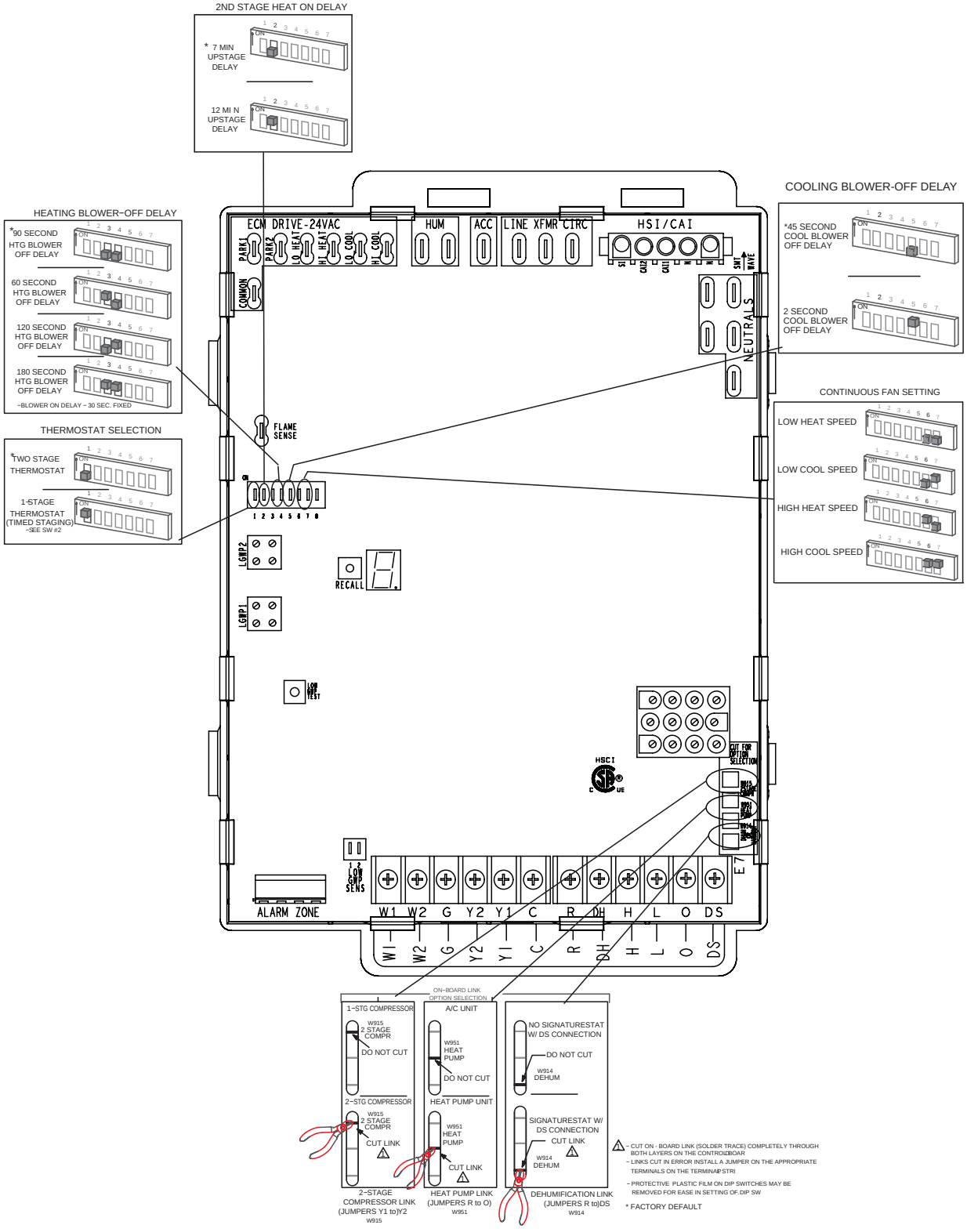


Figure 5. Integrated Control Configuration Guide

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

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.)

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 Allied 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 Allied 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.)

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 horizonta lines “≡” are displayed
- 10 minutes after entering the flame sense mode.

Integrated Control DIP Switches
NF97D***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, this feature will break and remake thermostat demand to the furnace and automatically reset the control to relight the furnace.

Heating Operation DIP Switch Settings
NOTE: Switch 8 is not powered and not used. Switching from on/off will not change any output.

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 second-stage heat is initiated.

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

Indoor Blower Operation DIP Switch Settings
Switches 3 and 4 -- Heating Mode Blower-Off Delay -- The blower-on delay of 30 seconds is not adjustable. The blower-off delay (time that the blower operates after the heating demand has been satisfied) can be adjusted by moving switches 3 and 4 on the integrated control. The unit is shipped from the factory with a blower-off delay of 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	Off	On
120 (Factory)	Off	Off
180	On	Off
210	On	On

Table 6. Blower Off Heating Mode Delay Switch Settings

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

ELECTRICAL (Cont.)

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.

NF97D***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**.

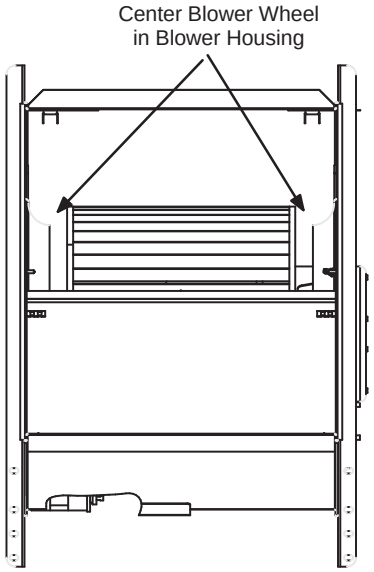


Figure 6. Blower Wheel Replacement

ELECTRICAL (Cont.)

BLOWER COMPARTMENT(Cont.)

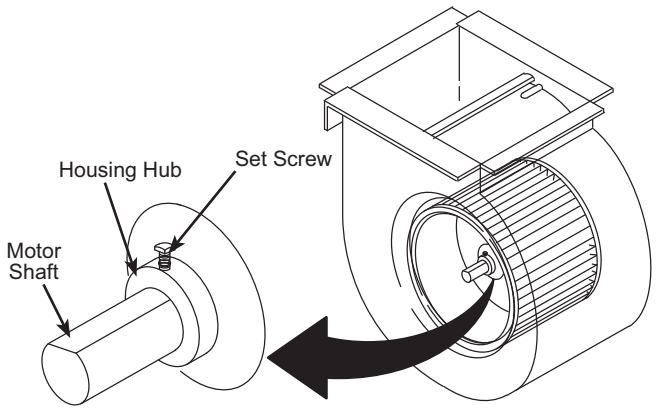


Figure 7.

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.

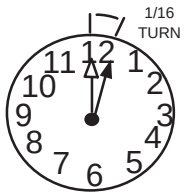
1. Using an ohmmeter check the resistance from any one of the motor connector pins to the aluminum end plate of the motor. This resistance should be greater than 100k ohms.
2. Check the resistances between each of the three motor connector pins. These should all read approximately the same resistance 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 exampled 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 directs moisture away from the motor and its electric connections on the motor.

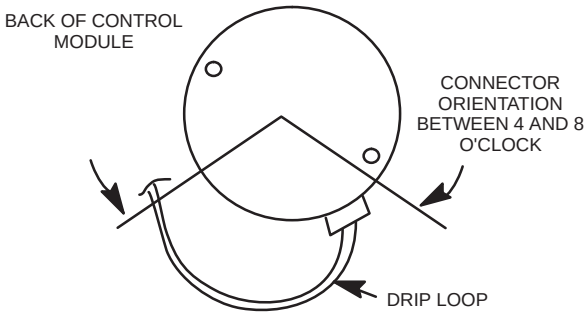
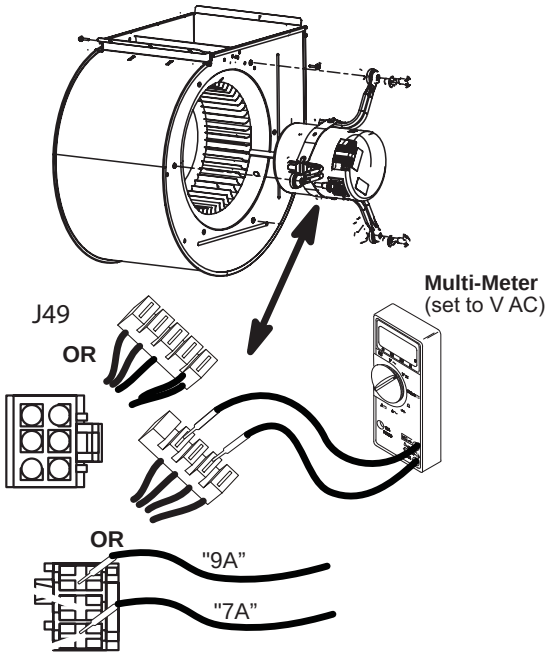


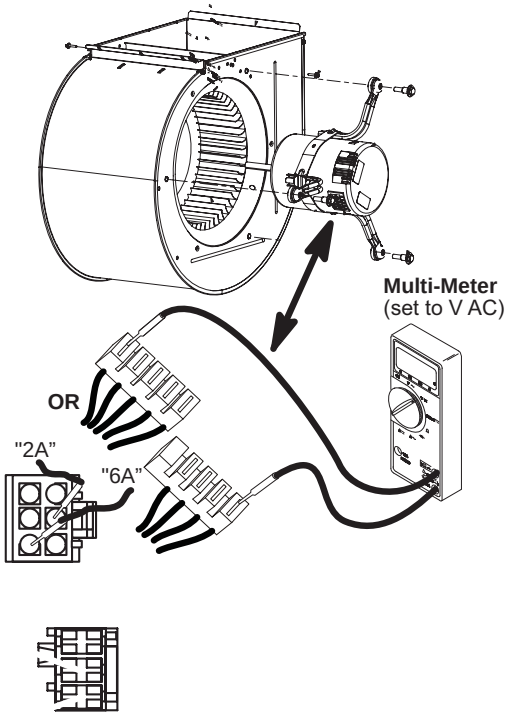
Figure 9. Drip Loop

Service Information

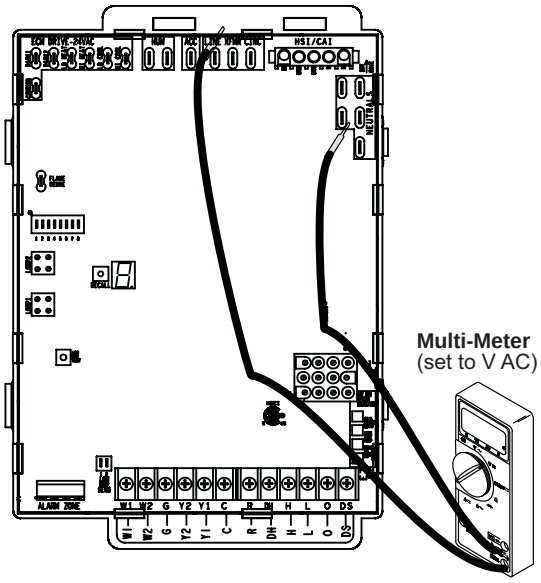


Test 1 - Turn power on to unit. Check for 120 volts across terminals “L” and “N” or terminals “7A” and “9A” of connector J48. If voltage is present continue to test 2. If voltage is not present, problem may be upstream of J48. Proceed to **Test 3**.

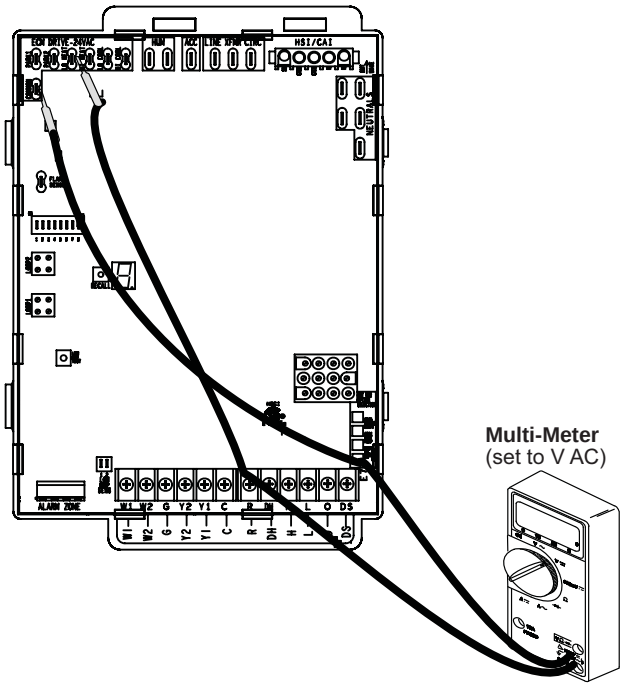
OR



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.

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 NF97D***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 Allied. 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.

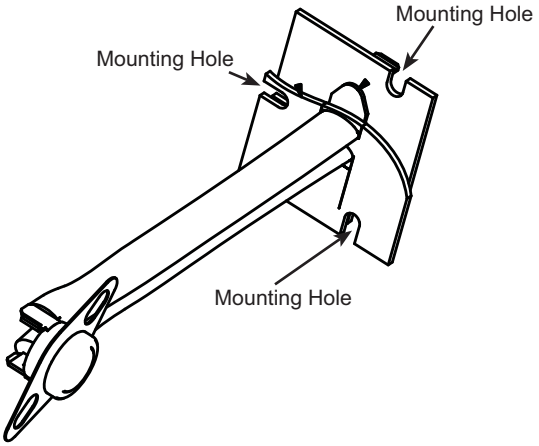


Figure 11. Primary Limit Control (S10)

ELECTRICAL (Cont.)

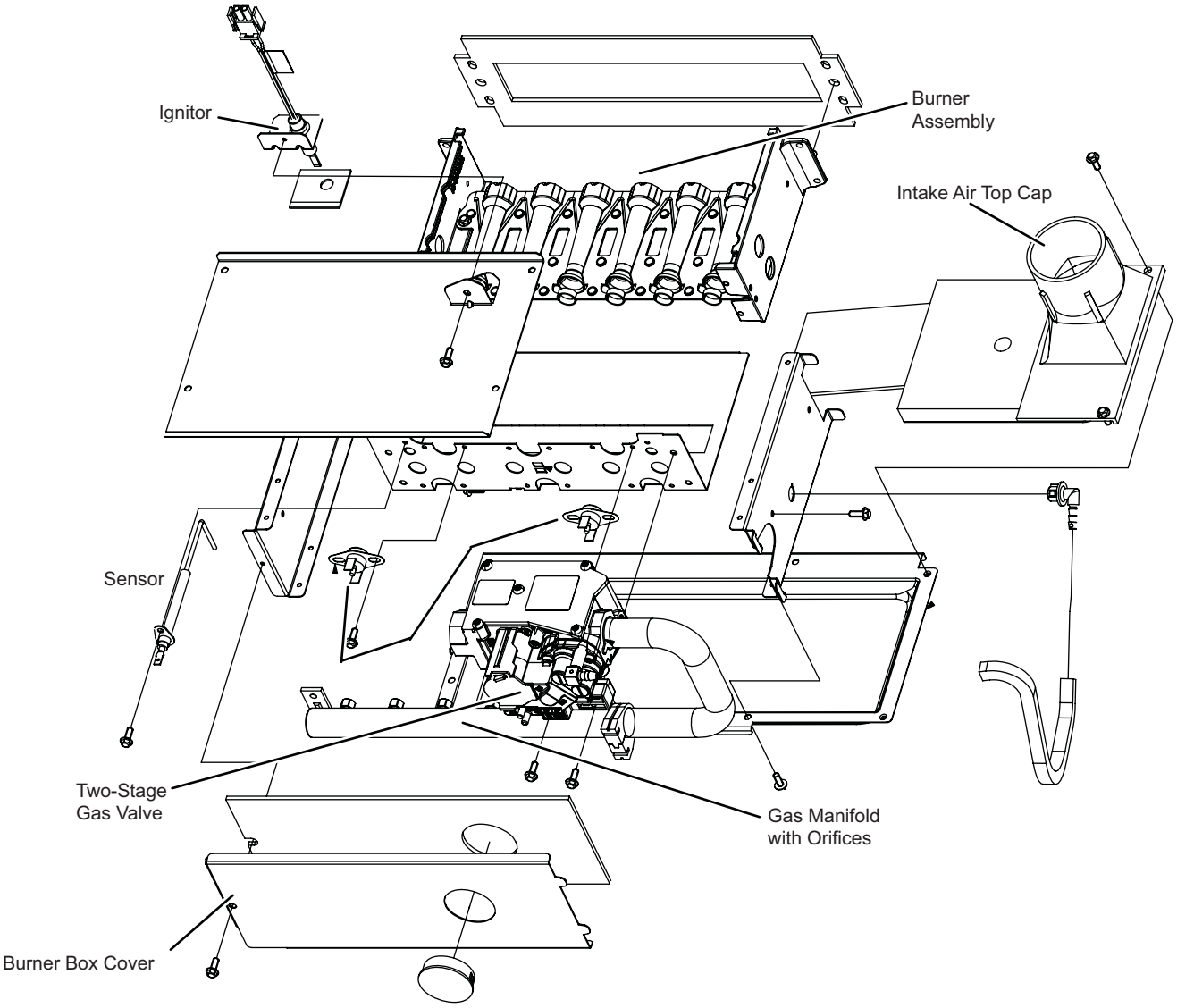


Figure 12. Heating Components

Service Information

Test 1 - Check ignitor circuit for correct resistance.

Remove HSI /CAI 5-pin plug from control. Check ohms reading across terminals 1 and 5. 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.

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.

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 ± 10%. If voltage reads below these values, check for correct supply voltage to furnace.

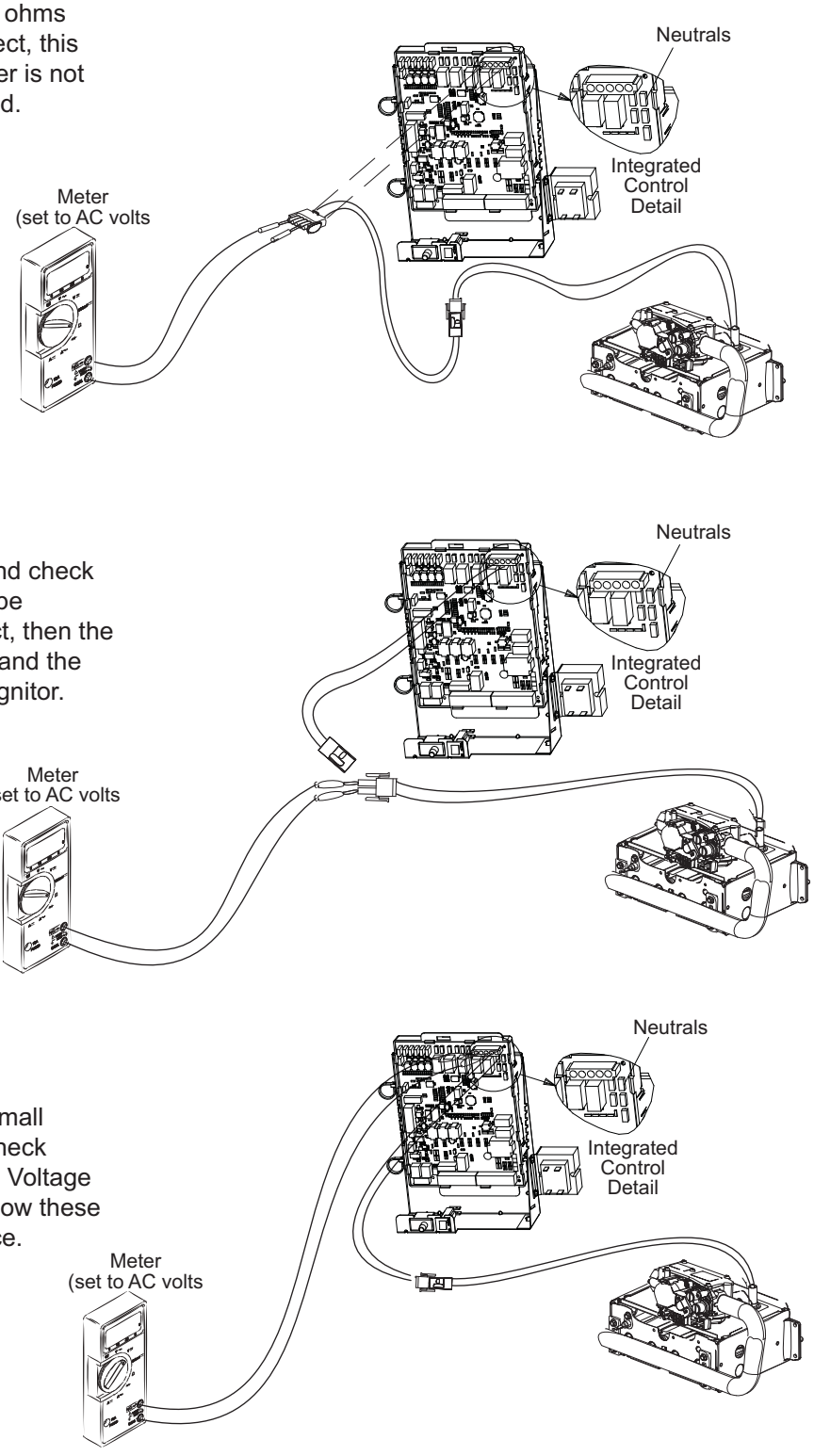


Figure 13. IGNITOR CHECKS

ELECTRICAL (Cont.)

Heating Components (Cont.)

Combustion Air Inducer (B6) and Cold End Header Box
All NF97D***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)
NF97D***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 then 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.

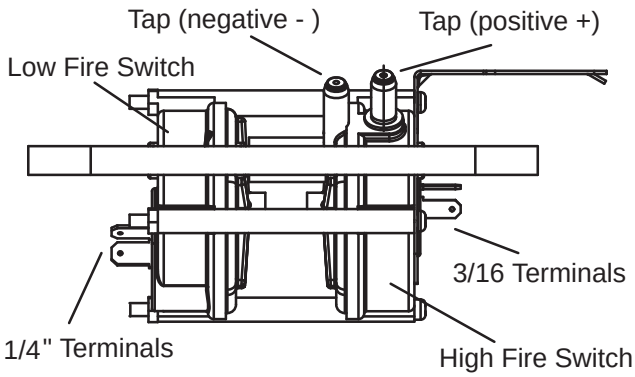


Figure 14. Combustion Air Inducer Pressure Switch

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	0.74	0.41
-070	0.90	0.50
-090	0.90	0.45
-110	1.00	0.55

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

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

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	
ECCO Polypropylene VentTM	

Table 11.

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
045	[1] 1-1/2			YES	YES		
	2	YES		YES	YES		
	2-1/2"	YES		YES	YES		
	3	YES		YES	YES		
070	[1] 1-1/2			YES	YES		
	2	YES		YES	YES		
	2-1/2	YES		YES	YES		
	3	YES		YES	YES		
090	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

[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 e 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.

NOTE: A sheet metal screw may be used to secure the intake pipe to the connector, if desired. Use a drill or self tapping screw to make a pilot hole.

⚠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 or cellular core pipe.

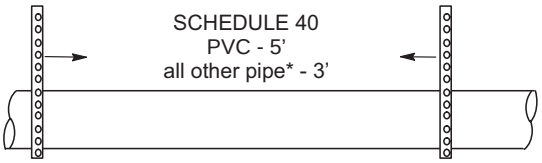
   NOTE: Assembly should be completed within 20 seconds after last application of cement. Hammer blows should not be used when inserting pipe.

JOINT CEMENTING PROCEDURE (Cont.)

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

9. Handle joints carefully until completely set.

VENTING PRACTICES



* 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.

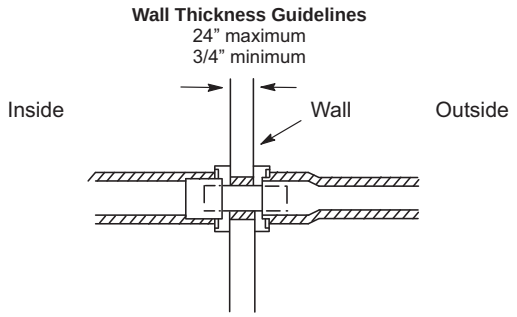


Figure 15. Piping Suspension Guidelines

- 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.

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

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

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

2. Inspect the venting system for proper size and horizontal pitch. Determine that there is no blockage, restriction, leakage, corrosion, or other deficiencies which could cause an unsafe condition.

3. Close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliances not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.

4. Follow the lighting instructions. Turn on the appliance that is being inspected. Adjust the thermostat so that the appliance operates continuously.

5. After the main burner has operated for 5 minutes, test for leaks of flue gases at the draft hood relief opening. Use the flame of a match or candle.

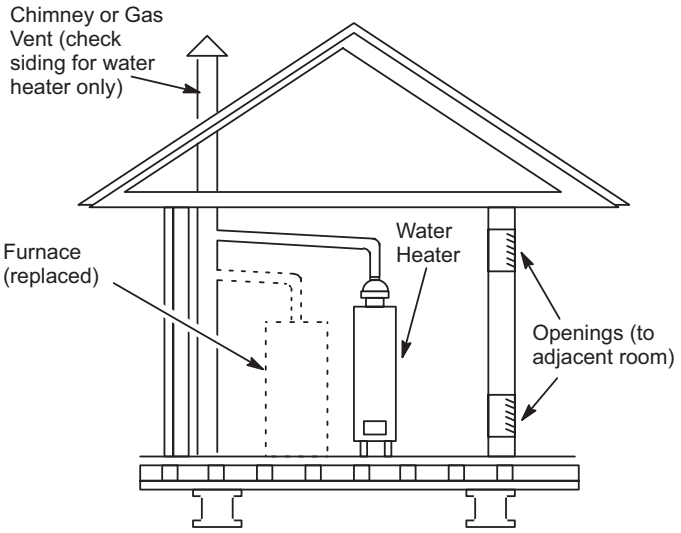
6. After determining that each appliance connected to the common venting system is venting properly, (step 3) return all doors, widows, exhaust fans, fireplace dampers, and any other gas-burning appliances to their previous mode of operation.

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).

VENTING PRACTICES (Cont.)

Removal of the Furnace from Common Vent (Cont.)



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.

Exhaust Piping (Figure 18)

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 PoyPro 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 NF97D*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 13** lists the minimum vent pipe lengths permitted. **Table 14A** through **Table 14C** 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 Allied Technical Services Department for assistance in sizing vent pipe in these applications.

NOTE: It is acceptable to use any pipe size which fits within the guidelines allowed in **Table 13A** through **Table 13C.**

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

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

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

NOTE: If right side venting option is used, you must include the elbow at the furnace in the elbow count. If transitioning to 3” dia pipe, this elbow equates to 20’ of equivalent vent length for all models.

Model	Min. Vent Length*
045, 070, 090, 110	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.	

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.

VENT PIPING GUIDELINES (Cont.)

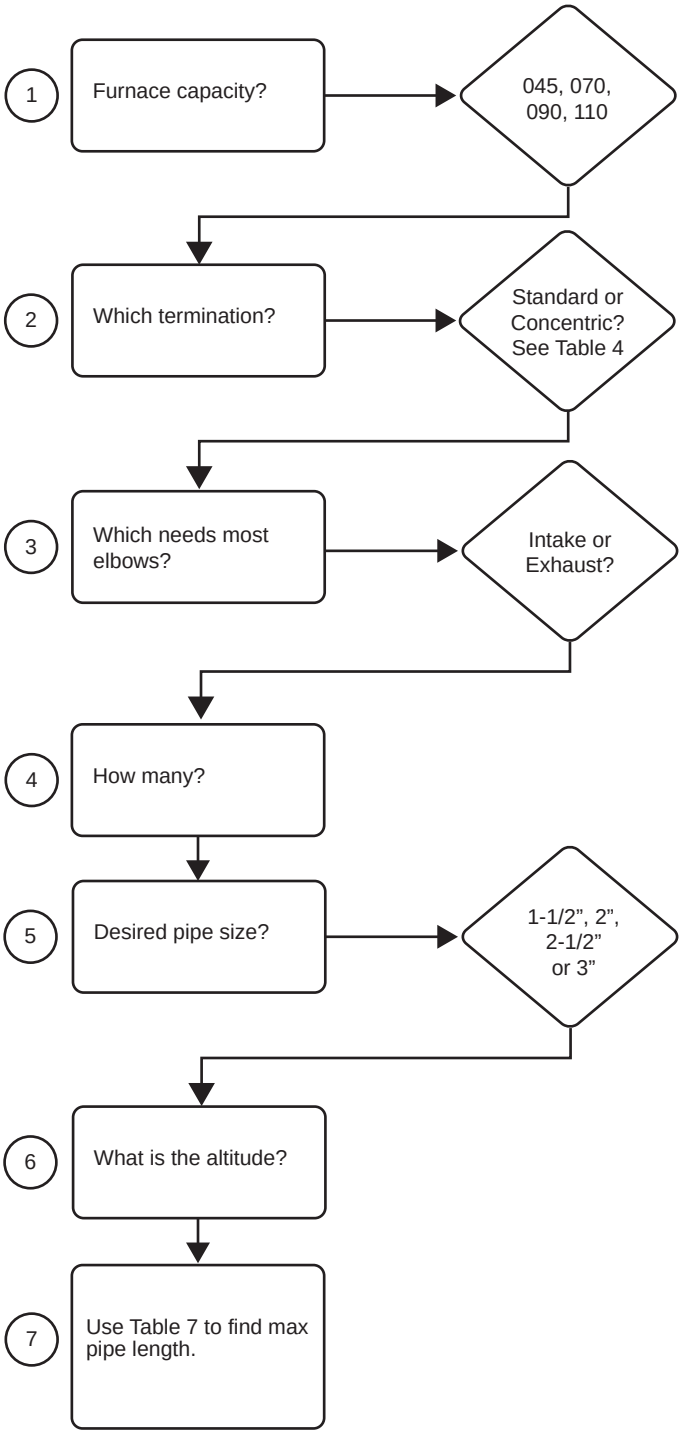


Figure 17. Vent Pipe Diameter Sizing

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			
	045	070	090	110	045	070	090	110	045	070	090	110	045	070	090	110
1	20	15	n/a	n/a	66	51	29	9	100	100	78	43	123	122	103	103
2	15	10			61	46	24	n/a	95	95	73	38	118	117	98	98
3	10	n/a			56	41	19		90	90	68	33	113	112	93	93
4	n/a				51	36	14		85	85	63	28	108	107	88	88
5					46	31	9		80	80	58	23	103	102	83	83
6					41	26	n/a		75	75	53	18	98	97	78	78
7					36	21			70	70	48	13	93	92	73	73
8					31	16			65	65	43	8	89	87	68	68
9					26	11			60	60	38	n/a	83	82	63	63
10					21	6			55	55	33		78	77	58	58

Standard Termination at Elevation 4,501 - 10,000 ft																
No. Of 90° Elbows Used	1-1/2" Pipe				2" Pipe				2-1/2" Pipe				3" Pipe			
	Model				Model				Model				Model			
	045	070	090	110	045	070	090	110	045	070	090	110	045	070	090	110
1	20	15	n/a	n/a	66	51	29	n/a	100	100	78	43	123	122	103	103
2	15	10			61	46	24		95	95	73	38	118	117	98	98
3	10	n/a			56	41	19		90	90	68	33	113	112	93	93
4	n/a				51	36	14		85	85	63	28	108	107	88	88
5					46	31	9		80	80	58	23	103	102	83	83
6					41	26	n/a		75	75	53	18	98	97	78	78
7					36	21			70	70	48	13	93	92	73	73
8					31	16			65	65	43	8	89	87	68	68
9					26	11			60	60	38	n/a	83	82	63	63
10					21	6			55	55	33		78	77	58	58

*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 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			
	045	070	090	110	045	070	090	110	045	070	090	110	045	070	090	110
1	15	10	n/a	n/a	58	43	27	7	90	90	74	39	106	106	99	99
2	10	10 n/a			53	38	22	n/a	85	85	69	34	101	101	94	94
3	n/a				48	33	17		80	80	64	29	96	96	89	89
4					43	28	12		75	75	59	24	91	91	84	84
5					38	23	7		70	70	54	19	86	86	79	79
6					33	18	n/a		65	65	49	14	81	81	74	74
7					28	13			60	60	44	9	76	76	69	69
8					23	n/a			55	55	39	n/a	71	71	64	64
9					18				50	50	34		66	66	59	59
10					13				45	45	29		61	61	54	54

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			
	045	070	090	110	045	070	090	110	045	070	090	110	045	070	090	110
1	15	10	n/a	n/a	58	43	27	n/a	90	90	74	39	106	106	99	99
2	10	n/a			53	38	22		85	85	69	34	101	101	94	94
3	n/a				48	33	17		80	80	64	29	96	96	89	89
4					43	28	12		75	75	59	24	91	91	84	84
5					38	23	7		70	70	54	19	86	86	79	79
6					33	18	n/a		65	65	49	14	81	81	74	74
7					28	13			60	60	44	9	76	76	69	69
8					23	8	n/a		55	55	39	n/a	71	71	64	64
9					18	n/a			50	50	34		66	66	59	59
10					13				45	45	29		61	61	54	54

*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

VENT PIPING GUIDELINES (Cont.)

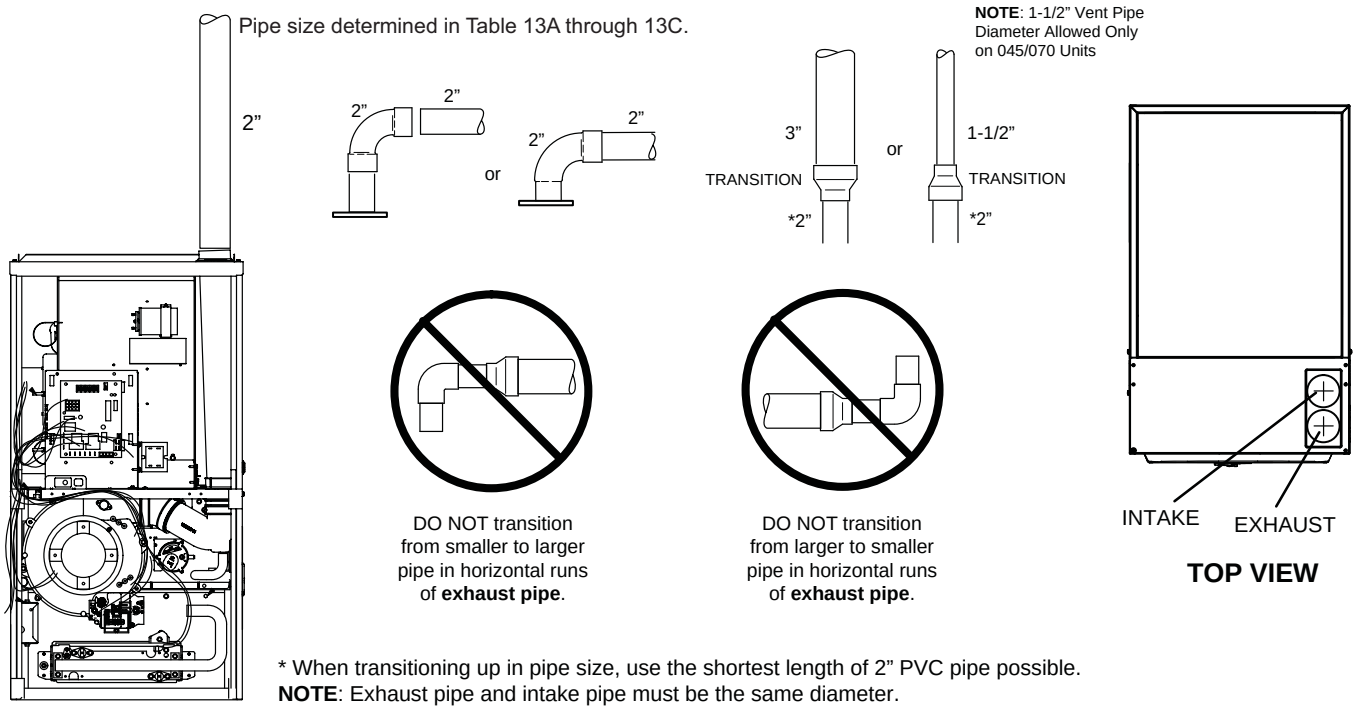
Standard Termination at Elevation 0 - 10,000 ft																
No. Of 90° Elbows	1-1/2" Pipe				2" Pipe				2-1/2" Pipe				3" Pipe			
	Model				Model				Model				Model			
	045	070	090	110	045	070	090	110	045	070	090	110	045	070	090	110
1	15	10	n/a	n/a	56	41	24	n/a	85	85	63	28	103	102	83	83
2	10	n/a			51	36	19		80	80	58	23	98	97	78	78
3	n/a				46	31	14		75	75	53	18	93	92	73	73
4					41	26	9		70	70	48	13	88	87	68	68
5					36	21	4		65	65	43	8	83	82	63	63
6					31	16	n/a		60	60	38	3	78	77	58	58
7					26	11			55	55	33	n/a	73	72	53	53
8					21	6			50	50	28		68	67	48	48
9					16	1			45	45	23		63	62	43	43
10					11	n/a			40	40	18		58	57	38	38

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 Using Ventilated Attic or Crawl Space for Intake Air in Feet

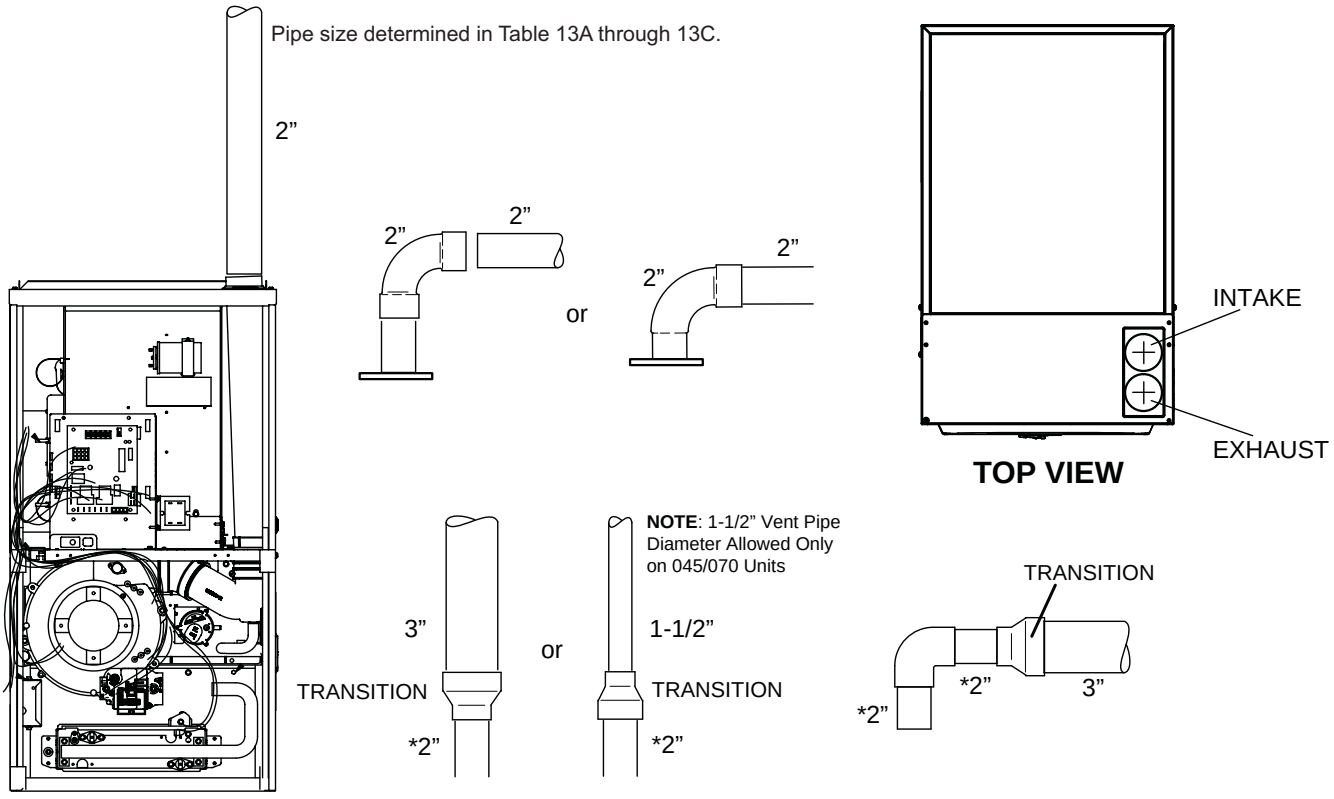
Service Information

VENT PIPING GUIDELINES (Cont.)



* When transitioning up in pipe size, use the shortest length of 2” PVC pipe possible.
NOTE: Exhaust pipe and intake pipe must be the same diameter.

Figure 18. Typical Exhaust Pipe Connections



* When transitioning up in pipe size, use the shortest length of 2” PVC pipe possible.
NOTE: Exhaust pipe and intake pipe must be the same diameter.

Figure 19. Typical Intake Pipe Connections (Direct Vent Applications)

VENT PIPING GUIDELINES (Cont.)

Intake Piping

The NF97D***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 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. If intake air is drawn from a ventilated attic (**Figure 21**) or ventilated crawlspace (**Figure 22**) the exhaust vent length must not exceed those listed in **Table 14C**. If 3" diameter pipe is used, reduce to 2" diameter pipe at the termination point to accommodate the debris screen.
3. 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 14A** through **Table 14C** for pipe sizes.

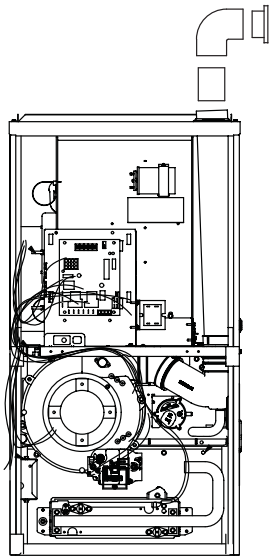
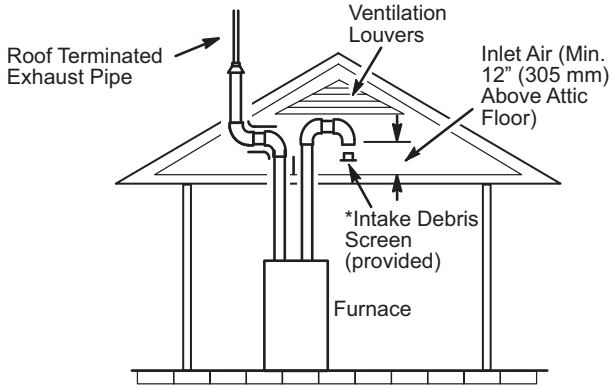


Figure 20. Typical Air Intake Pipe Connections Upflow Non−Direct Vent Applications

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 22**. 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 sideways.
2. Use cement to secure the intake pipe to the connector, if desired.

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

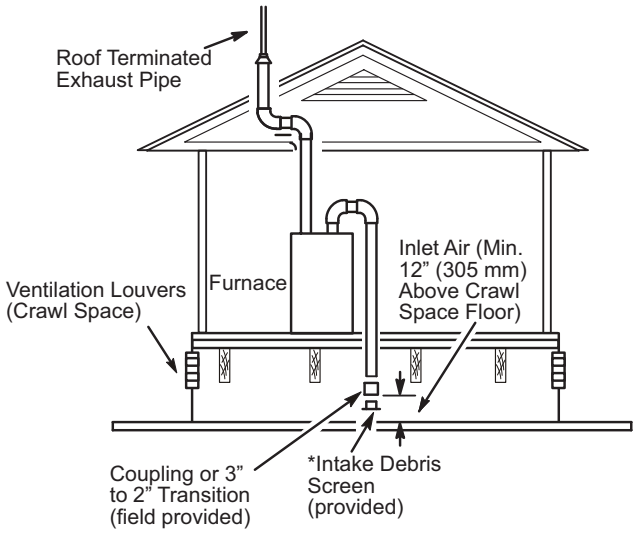


NOTE: The inlet and outlet air openings shall each have a free area of at least one square inch per 4,000 Btu (645mm² per 1.17kW) per hour of the total input rating of all equipment in the enclosure.

Figure 21. Equipment in Confined Space (Inlet Air from Ventilated Attic and Outlet Air to Outside)

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 22. 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 **NF97D***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 **NF97D***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 24 or Figure 33. 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 15** 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).

VENT PIPING GUIDELINES (Cont.)

General Guidelines for Vent Terminations (Cont.)

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

[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: 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 14A** through **Table 14C**.
NOTE: If insulation is required in an unconditioned space, it must be located on the pipe closest to the furnace. See **Figure 23**.
NOTE: Concentric terminations are the equivalent of 5ft. and should be considered when measuring pipe length.

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

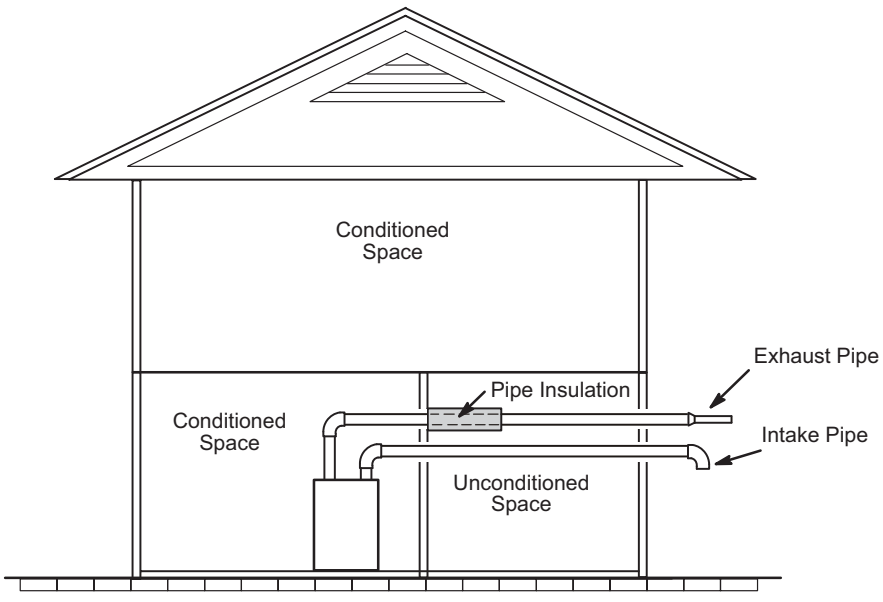
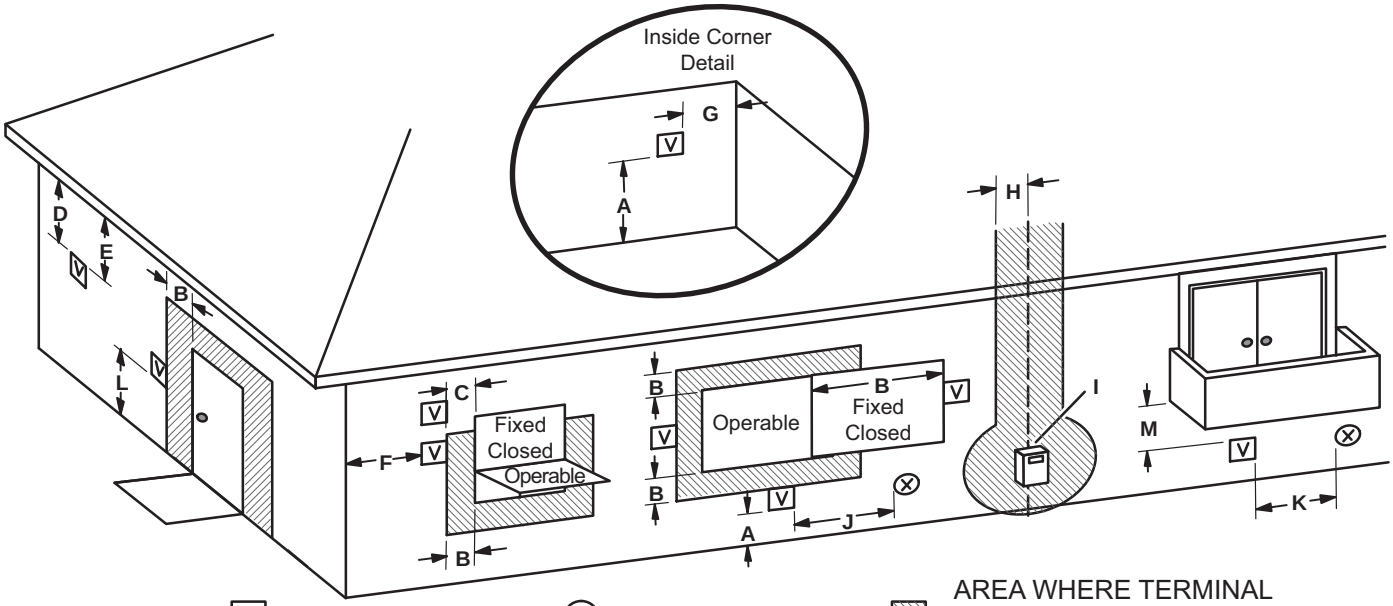


Figure 23. Insulating Exhaust Pipe in an Unconditioned Space

Service Information

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



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

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

[1] In accordance with the current ANSI Z223.1/NFPA 54 Natural Fuel Gas Code
[2] In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

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

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

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

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

Figure 24. Vent Termination Clearances for Direct Installations

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 36**.

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 25** through **Figure 29** 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 26**). You may exit the exhaust out the roof and the intake out the side of the structure (**Figure 27**).
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 25**).
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	Exhaust Pipe Size	Termination Pipe Size
*045 & *070	2” (51mm), 2-1/2” (64mm), 3” (76mm)	1-1/2” (38mm)
*090		2” (51mm)
110	3” (76mm)	
*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 36.**

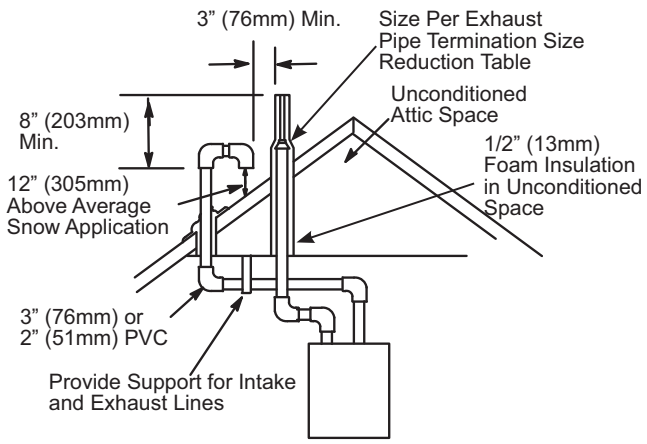


Figure 25. Direct Vent Roof Termination Kit

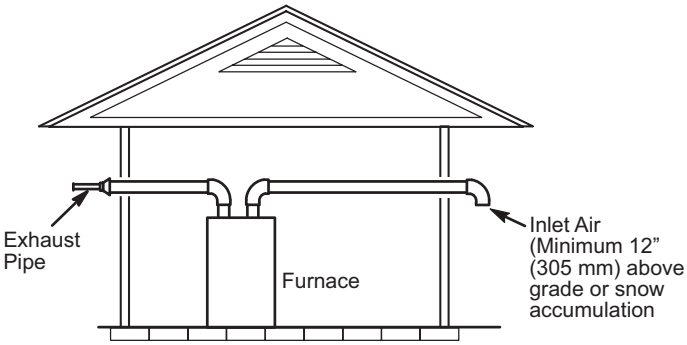


Figure 26. Exiting Exhaust and Intake Vent (No Common Pressure Zone)

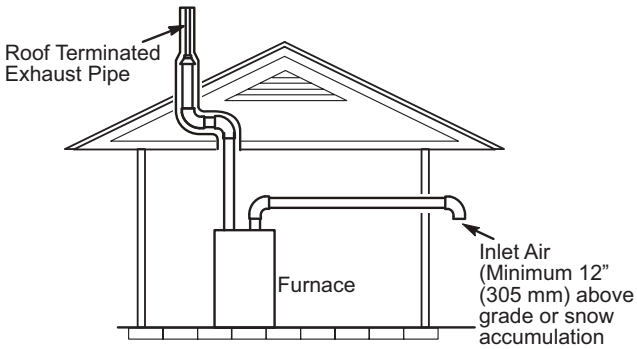


Figure 27. Existing Exhaust and Intake Vent (No Common Pressure Zone)

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 36**.

VENT PIPING GUIDELINES (Cont.)

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

7. If intake and exhaust piping must be run up a side wall to position above snow accumulation or other obstructions, piping must be supported. At least one bracket must be used within 6” from the top of the elbow and then every 24 in. (610mm) as shown in **Figure 36**, 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.
8. A multiple furnace installation may use a group of up to four terminations assembled together horizontally, as shown in **Figure 32**.

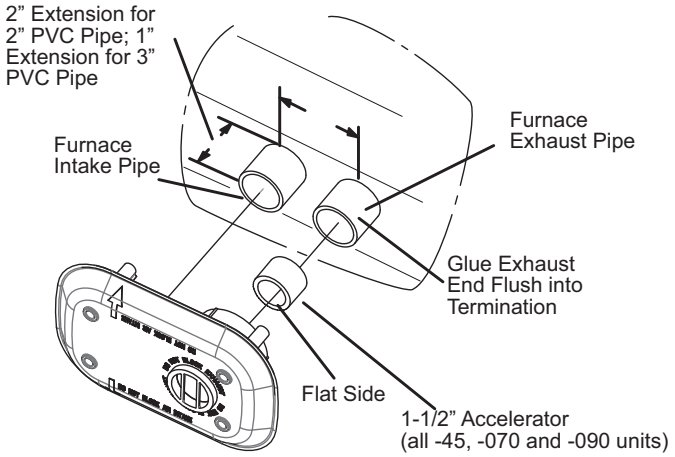


Figure 28. Flush-Mount Side Wall Termination

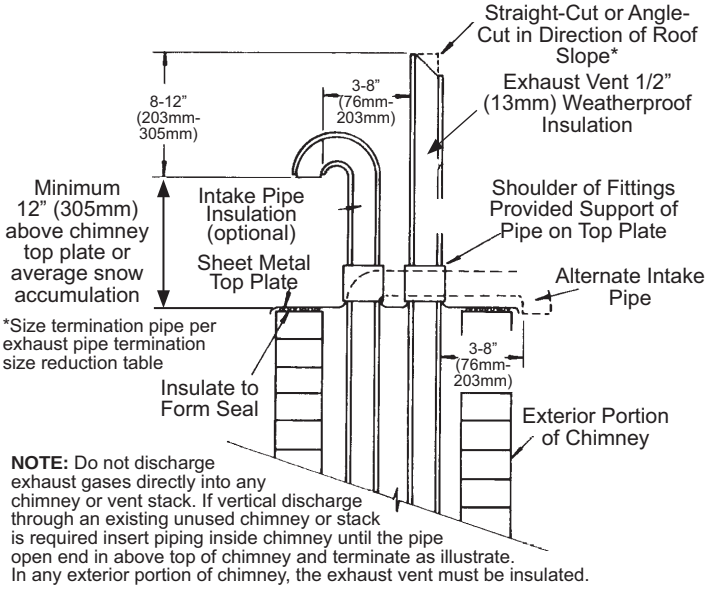


Figure 29. Direct Vent Application Using Existing Chimney

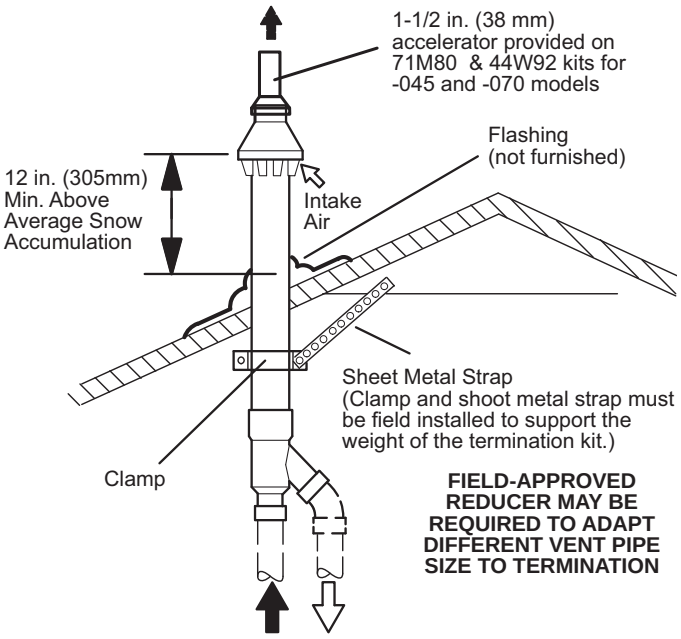


Figure 30. Direct Vent Concentric Wall Termination

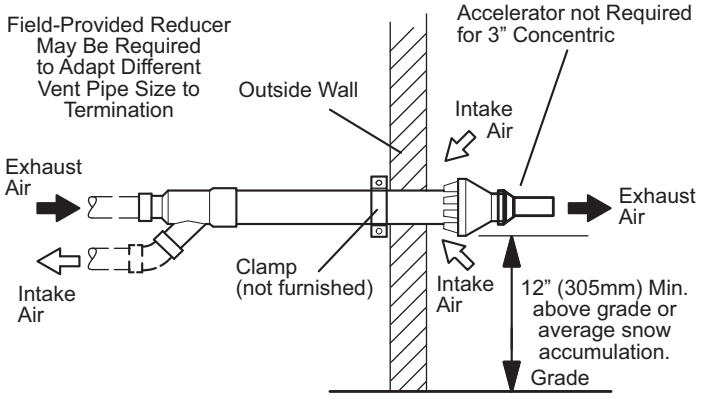


Figure 31. Direct Vent Concentric Wall Termination

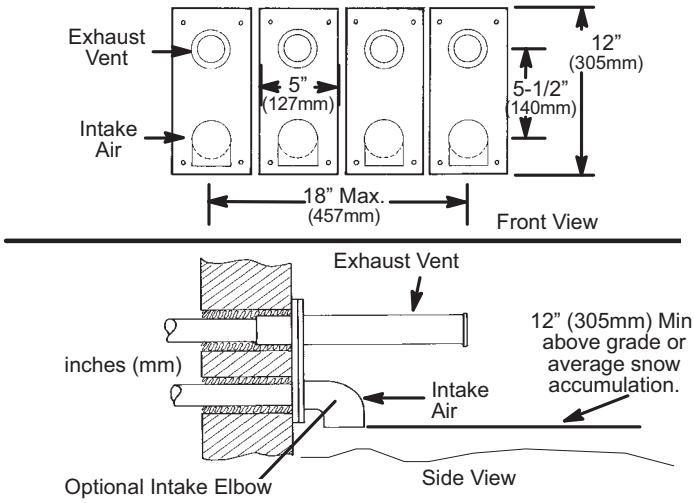
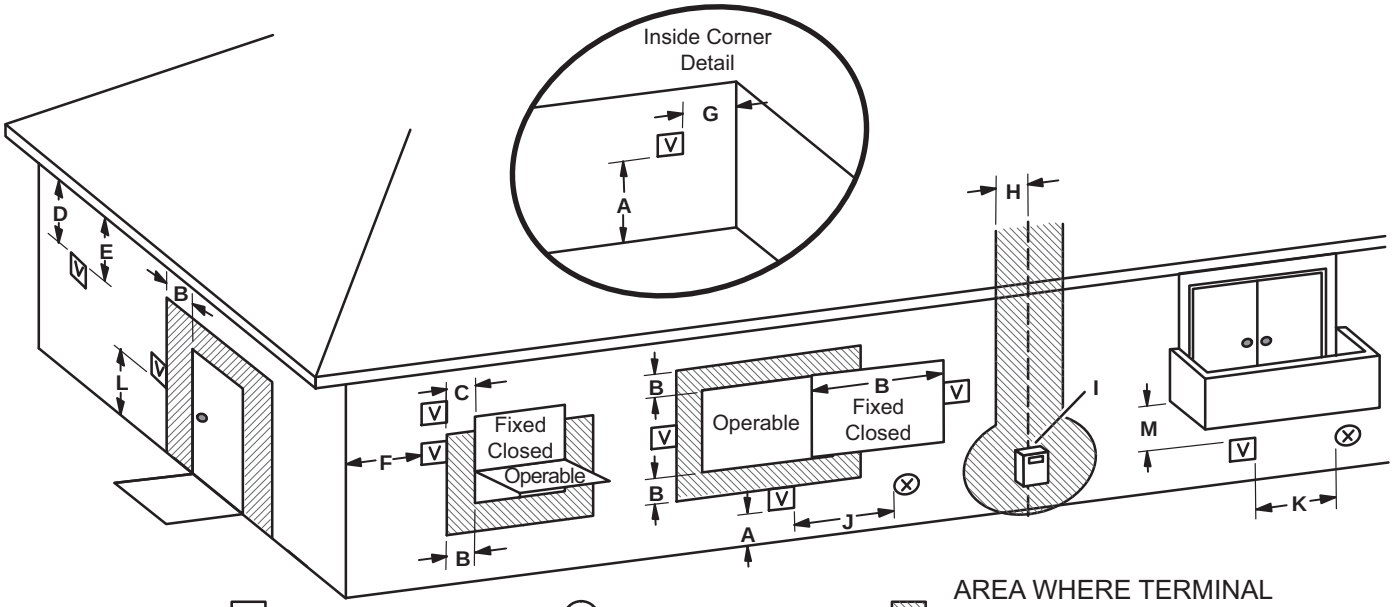


Figure 32. Optional Vent Termination for Multiple Unit Installation of Direct Vent Wall Termination Kit

Service Information

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



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

		US Installations[1]	Canadian Installations[2]
A	Clearance above grade, veranda, porch, deck or balcony	12” (305mm) or 12” (305mm) above average snow accumulation	
B	Clearance to window or door that may be opened	4 ft (1.2 m) below or to side of opening; 1 ft (30cm) above opening	6” (152mm) for appliances <10,000 Btuh (3kw), 12” (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36” (.9m) for appliances > 100,000 Btuh (30kw)
C	Clearance to permanently closed window	* 12”	
D	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (610mm) from the center line of the terminal	* Equal to or greater than soffit depth	
E	Clearance to unventilated soffit	* Equal to or greater than soffit depth	
F	Clearance to outside corner	* No minimum to outside corner	
G	Clearance to inside corner	*	
H	Clearance to each side of center line extended above meter / regulator assembly	3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly	
I	Clearance to service regulator vent outlet	* 3 feet (.9m)	
J	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	4 ft (1.2 m) below or to side of opening; 1 ft (30cm) above opening	6” (152mm) for appliances <10,000 Btuh (3kw), 12” (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36” (.9m) for appliances > 100,000 Btuh (30kw)
K	Clearance to mechanical air supply inlet	3 feet (.9m) above if within 10 feet (3m) horizontally	6 feet (1.8m)
L	Clearance above paved sidewalk or paved driveway located on public property	* 7 feet (2.1m)	
M	Clearance under veranda, porch, deck or balcony	*12 inches (305mm)‡	

[1] In accordance with the current ANSI Z223.1/NFPA 54 Natural Fuel Gas Code
[2] In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

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

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

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

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

Figure 33. Vent Termination Clearances for Non-Direct Installations

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 34** through **Figure 35** 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.

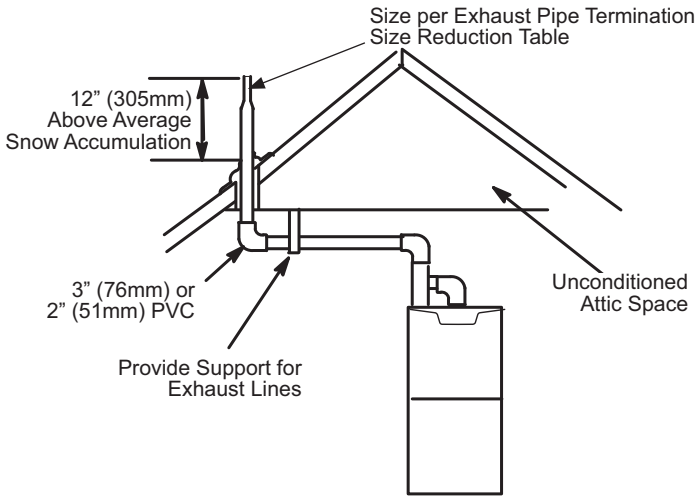


Figure 34. Non-Direct Vent Roof Termination Kit

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.

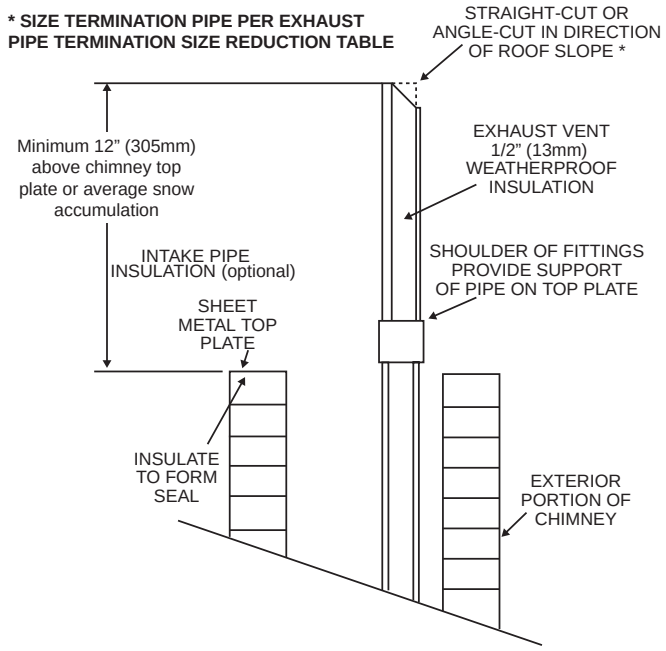
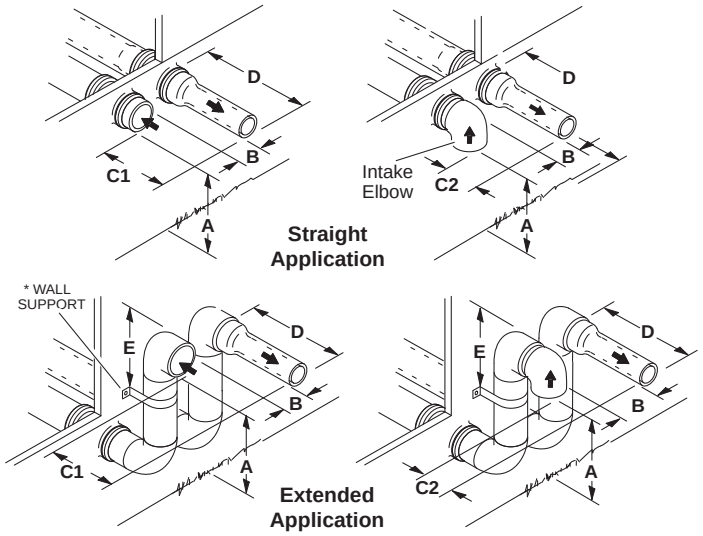


Figure 35. Non-Direct Vent Application Using Existing Chimney

Service Information

NOTE - Field-Provided reducer may be required to adapt larger vent pipe size to termination.

Field Fabricated Wall Termination

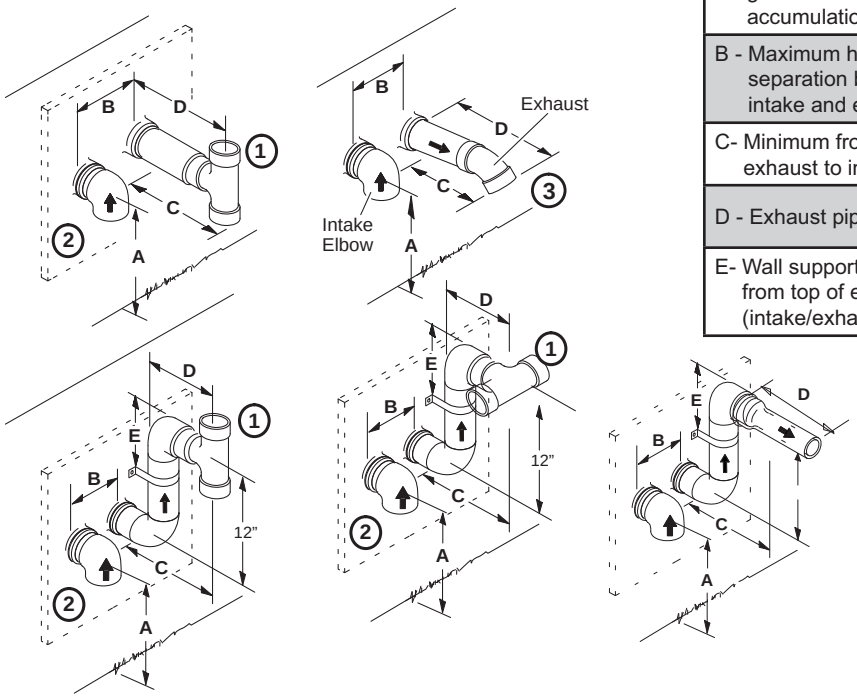


	2” (51mm) Vent Pipe	3” (76mm) Vent Pipe
A - Minimum clearance above grade or average snow accumulation	12” (305mm)	12” (305mm)
B - Maximum horizontal seperation between intake and exhaust	6” (152 mm)	6” (152 mm)
C1- Minimum from end of exhaust to inlet of intake	8” (203 mm)	8” (203 mm)
C2- Minimum from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

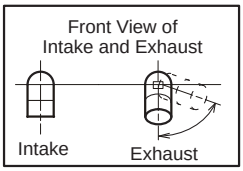
* Use wall support every 24” (610 mm). Use two wall supports if extension is greater than 24” (610 mm) but less than 48” (1219 mm).

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

Alternate Terminations (Tee & Forty-Five Degree Elbows Only)



	2” (51mm) Vent Pipe	3” (76mm) Vent Pipe
A - Clearance above grade or average snow accumulation	12” (305mm)	12” (305mm)
B - Maximum horizontal separation between intake and exhaust	6” (152mm) 24” (610mm) Max	6” (152mm) 24” (610mm) Max
C- Minimum from end of exhaust to inlet of intake	9” (227mm)	9” (227mm)
D - Exhaust pipe length	12” (305mm) Min 16” (405mm) Max	20” (508mm) Min 16” (405mm) Max
E- Wall support distance from top of each pipe (intake/exhaust)	6” (152mm)	6” (152mm)



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

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

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

Figure 36.

Condensate Piping

This unit is designed for either right- or left-side exit of condensate piping. Refer to **Figure 37** and **Figure 39** for condensate trap locations.

NOTE - If necessary the condensate trap may be installed up to 5' away form 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 37) 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 43** (3/4" drain connection) or **Figure 44** (1/2" drain connection).
4. Install drain trap using appropriate PVC fittings, glue all joints. Glue the provided drain trap as shown in **Figure 43 or Figure 44**. 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 41** shows 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 42**. The field provided vent must be a minimum 1" to a maximum 2" length above the condensate drain outlet connection.

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

   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 38**.

⚠CAUTION

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

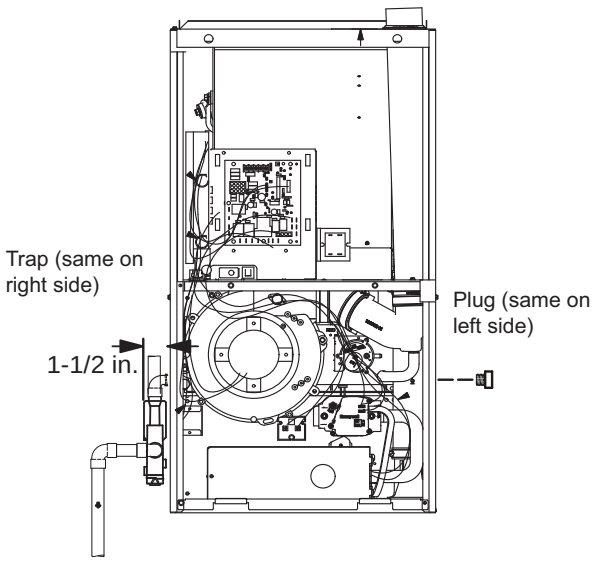


Figure 37. Condensate Trap and Plug Locations

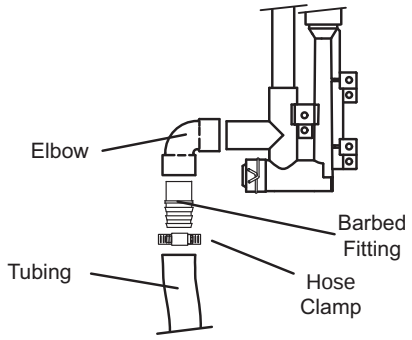
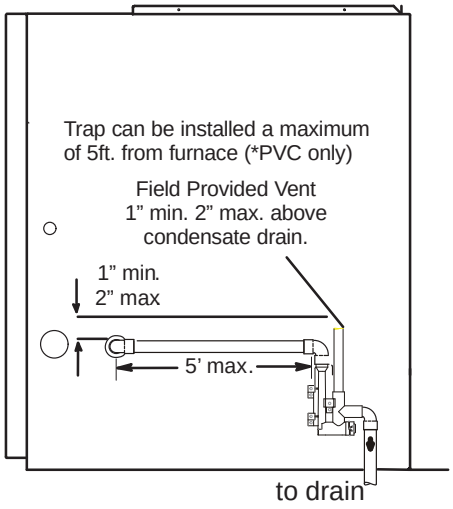


Figure 38. Field Provided Drain Components

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. Heat cable kit is available in various lengths; 6 ft. (1.8m) - kit no. 26K68 and 24 ft. (7.3m) - kit no. 26K69.

Service Information



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

Figure 39. Condensate Trap Locations (Unit shown in upflow position with remote trap)

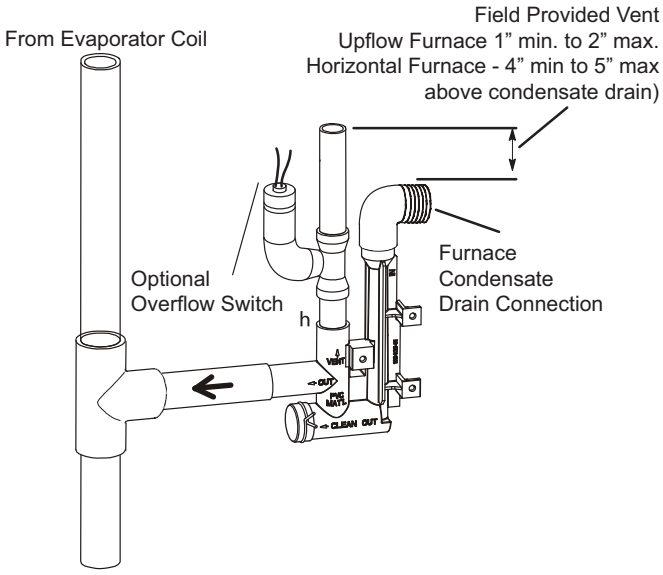


Figure 40. Condensate Trap with Optional Overflow Switch

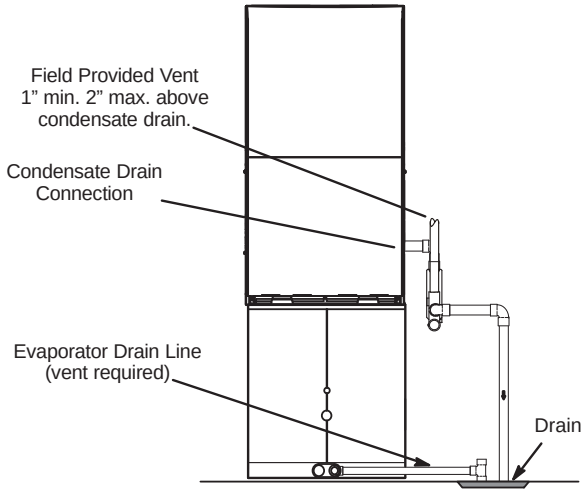


Figure 41. Unit with Cooling Coil Using Separate Drain

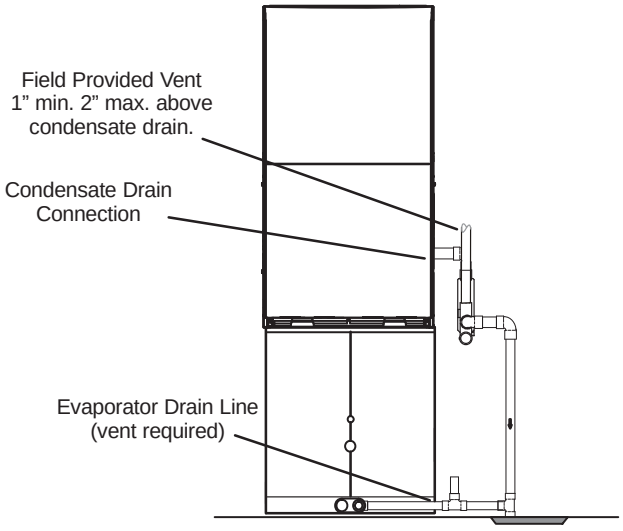


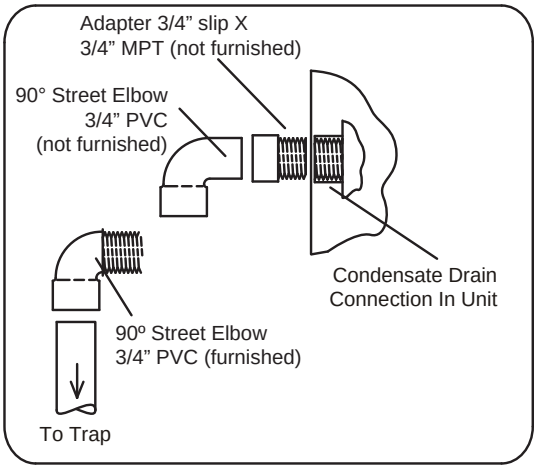
Figure 42. Evaporator Coil Using a Common Drain

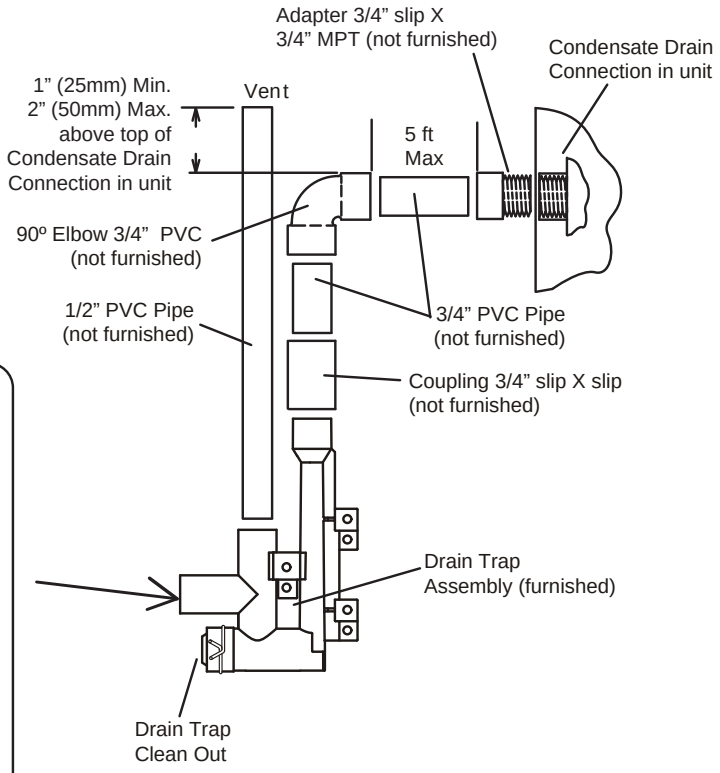
⚠IMPORTANT

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.

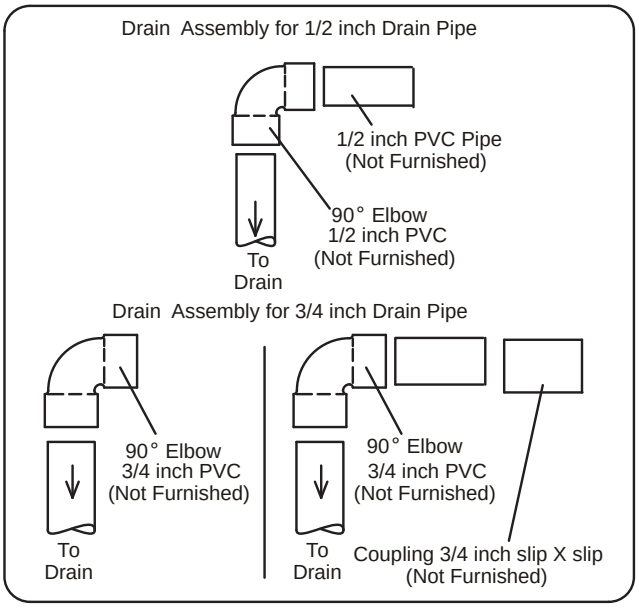
Service Information

Optional Condensate Drain Connection

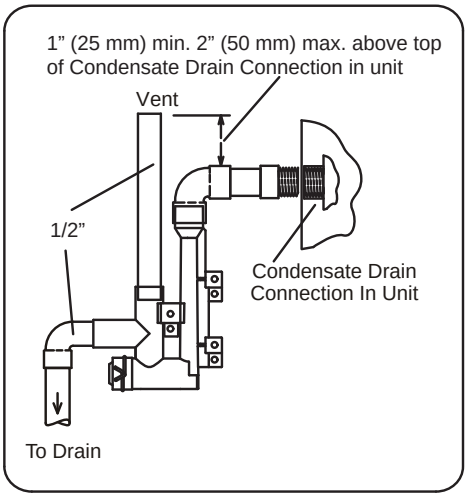




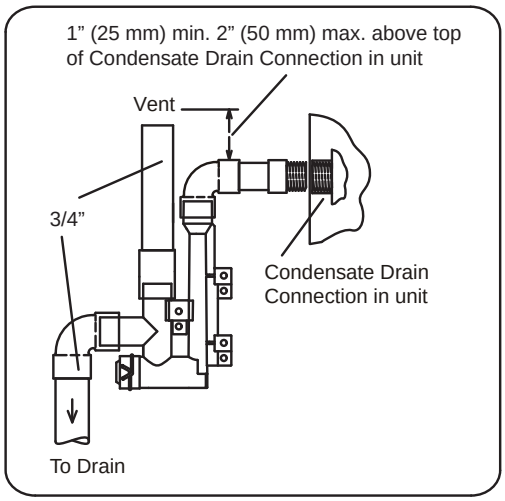
Optional Drain Piping from Trap



Drain Trap Assembly with 1/2" Piping



Drain Trap Assembly with 3/4" Piping



Drain Trap Assembly (furnished)

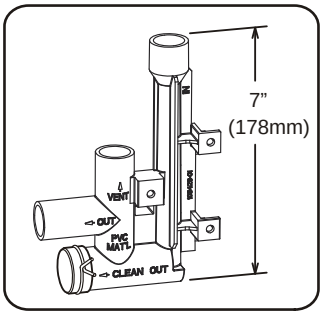


Figure 43. Trap / Drain Assembly using 1/2" PVC or 3/4" PVC, Cold End Header Box with 3/4" Drain Connection

Service Information

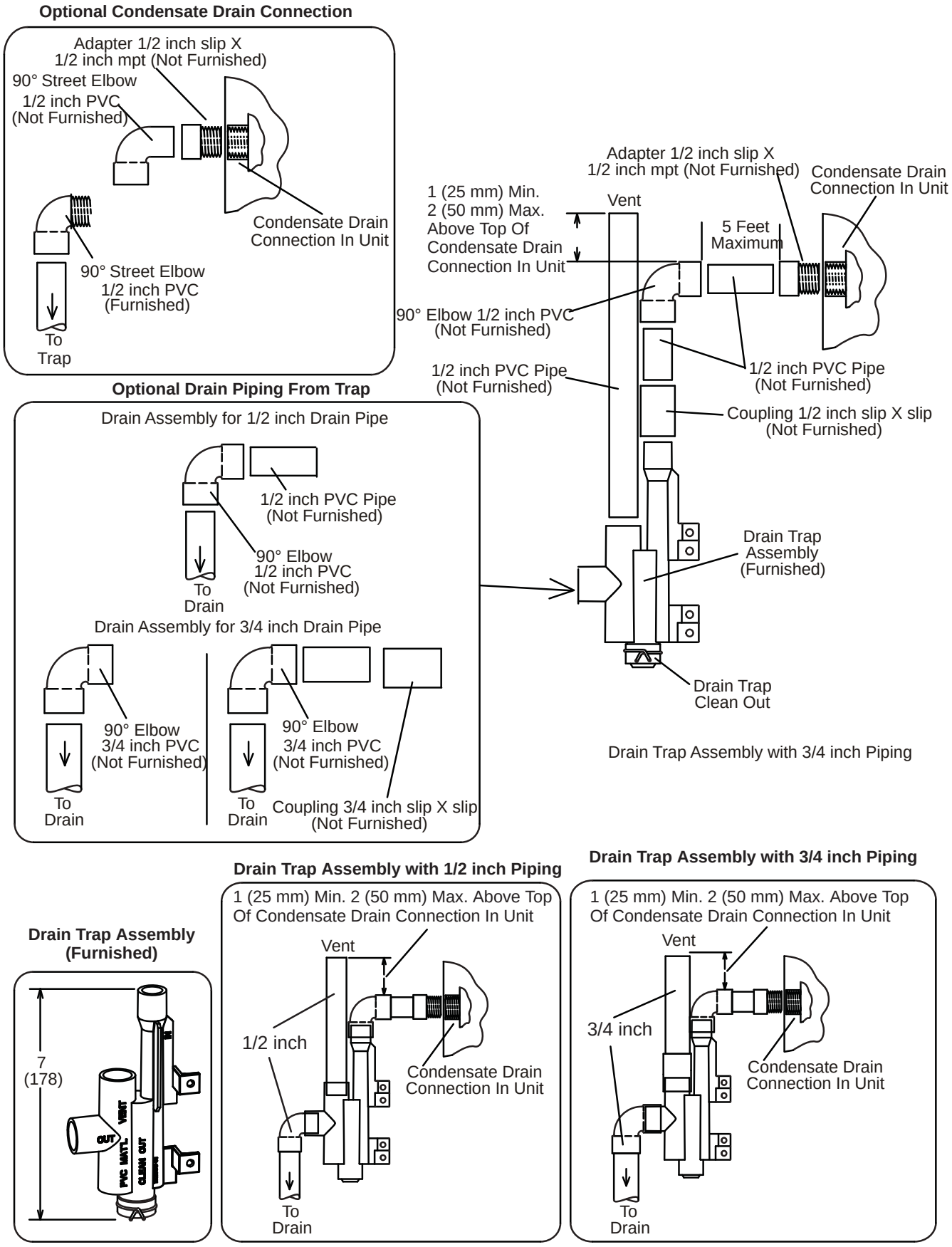


Figure 44. Trap / Drain Assembly using 1/2” PVC or 3/4” PVC, Cold End Header Box with 1/2” Drain Connection

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 **NF97D***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:

NF97D*T**R** units are equipped with an 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 an 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 sufficien 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 45)

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 access panel.
6. Move gas valve switch to OFF. See **Figure 45**.
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 45**.

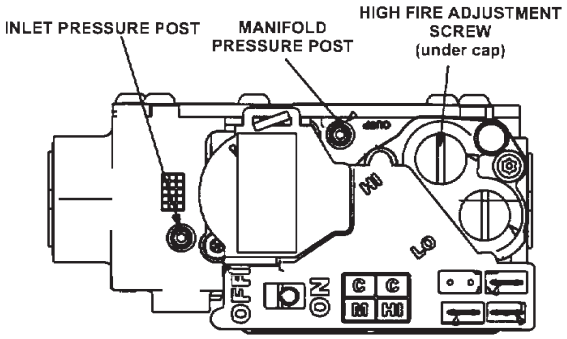


Figure 45. Gas Valve Shown in the ON Position

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

Turning Off Gas to Unit

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

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 **NF97D***T**R** Operation and Installation Instruction Manual Information.

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 46**. If the pressure is greater than 0.5psig (14”W.C.), use the manual shut-off valve before pressure testing to isolate furnace from gas supply.

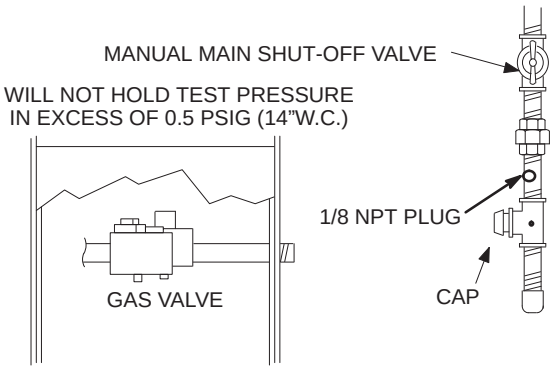


Figure 46.

When checking piping connections for gas leaks, use preferred means. Kitchen detergents can cause harmful corrosion 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 45**. 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.

Manifold Pressure Measurement

NOTE: Pressure test adapter kit (10L34) is available from Allied to facilitate manifold pressure measurement.

A manifold pressure post located on the gas valve provides access to the manifold pressure. See **Figure 45**. Back out the 3/32 hex screw one turn, connect a piece of 5/16 tubing and connect to a manometer to measure manifold pressure.

To correctly measure manifold pressure, the differential pressure between the positive gas manifold and the negative burner box must be considered.

⚠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.

HEATING SYSTEM SERVICE CHECKS (Cont.)

Manifold Pressure Measurement (Cont.)

1. Connect the test gauge positive side “+“ to manifold pressure tap on gas valve as noted above.
2. Tee into the gas valve regulator vent hose and connect to test gauge negative “-”.
3. Ignite unit on low fire and let run for 5 minutes to allow for steady state conditions.
4. After allowing unit to stabilize for 5 minutes, record low fire manifold pressure and compare to value given in Table 19. If necessary, make adjustment. Figure 45 shows location of low fire adjustment screw.
5. Repeat on high fire and compare to value given in Table 19. If necessary, make adjustment. Figure 45 shows location of high fire adjustment screw.
6. Shut unit off and remove manometer as soon as an accurate reading has been obtained. Take care to replace pressure tap plug.
7. Start unit and perform leak check. Seal leaks if found. The gas valve is factory set and should not require adjustment. All gas valves are factory regulated.

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.

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
-045	80	160	200	400
-070	55	110	136	272
-090	41	82	102	204
-110	33	66	82	164
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.

HEATING SYSTEM SERVICE CHECKS (Cont.)

Proper Combustion

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

Unit	CO2 % For Nat		CO2 % For LP	
	Low Fire	High Fire	Low Fire	High Fire
045	5.6 - 6.6	7.8 - 8.8	6.6 - 7.6	9.1 - 10.1
070	5.6 - 6.5	7.3 - 8.3	6.5 - 7.5	8.6 - 9.6
090	5.9 - 6.9	7.8 - 8.8	6.9 - 7.9	9.1 - 10.1
110	6.63 - 7.3	8.2 - 9.2	7.3 - 8.3	9.5 - 10.5
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.			
		Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire	Min	Max
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)
045	11K48	*51W01	11K47	14A51	14A53
070				14A48	14A54
090				14A54	14A53
110				25B93	14A45
*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

HEATING SYSTEM SERVICE CHECKS (Cont.)

Proper Ground and Voltage

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 47**. 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 47**. 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

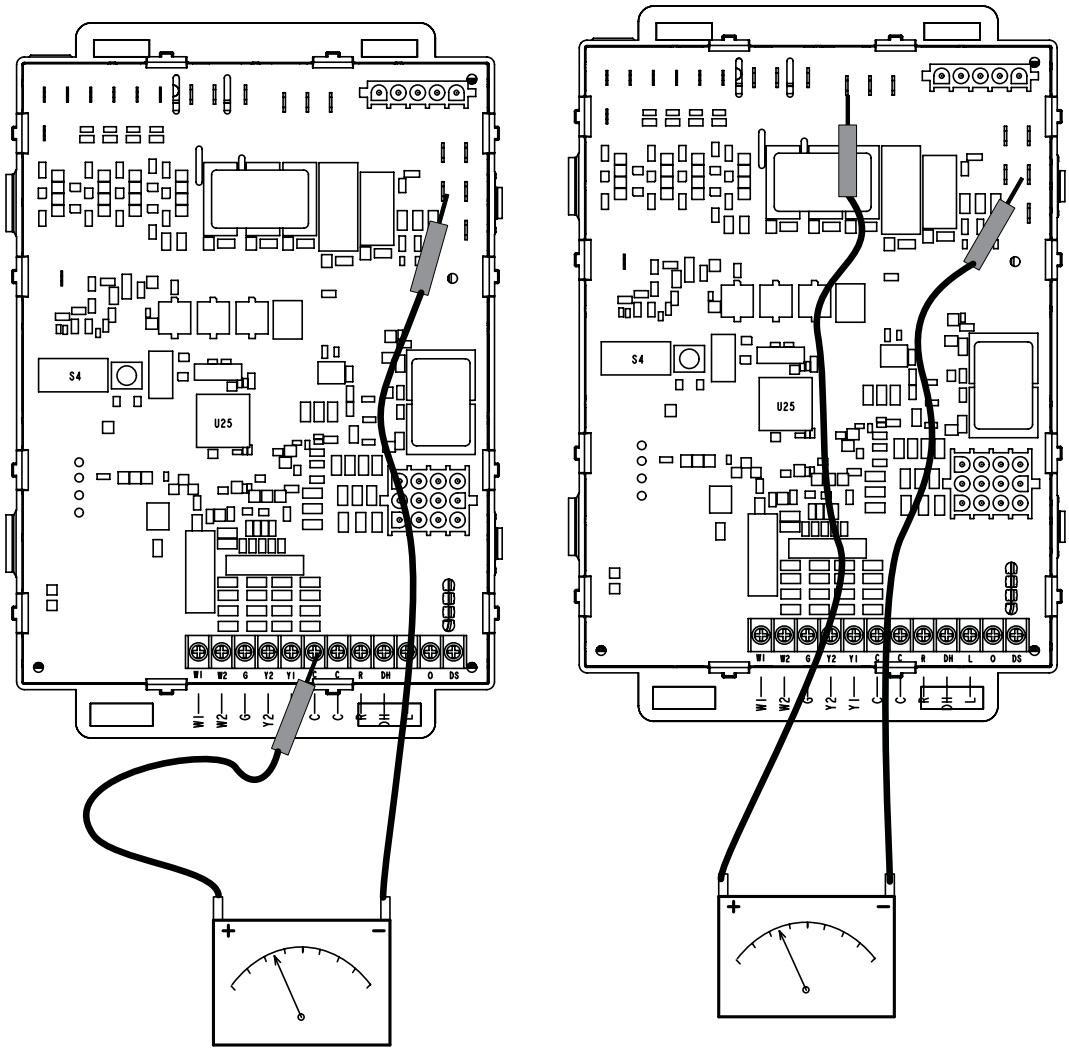


Figure 47.

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 48)

Temperature rise for **NF97D***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.

TEMPERATURE RISE
Supply Duct Temperature _____
Return Duct Temperature – _____
Temperature Rise = _____

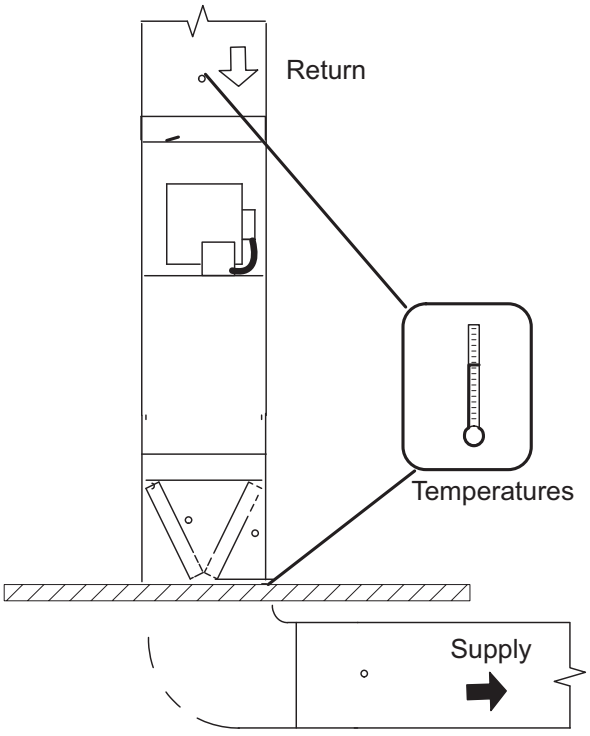


Figure 48.

External Static Pressure

1. Tap locations shown in **Figure 49**.
2. Punch a 1/4" diameter hole in supply and return air plenums. Insert manometer hose flush with inside edge of hole or insulation. Seal around the hose with permagum. Connect the zero end of the manometer to the discharge (supply) side of the system. On ducted systems, connect the other end of manometer to the return duct as above.
3. With only the blower motor running and the evaporator coil dry, observe the manometer reading. Adjust blower motor speed to deliver the air desired according to the job requirements. For heating speed external static pressure drop must not be more than 0.5" W.C. For cooling speed external static pressure drop must not be more than 0.8" W.C.
4. Seal the hole when the check is complete.

EXTERNAL STATIC PRESSURE
Supply Duct Static _____
Return Duct Static + _____
Total Duct Static = _____ (dry coil)

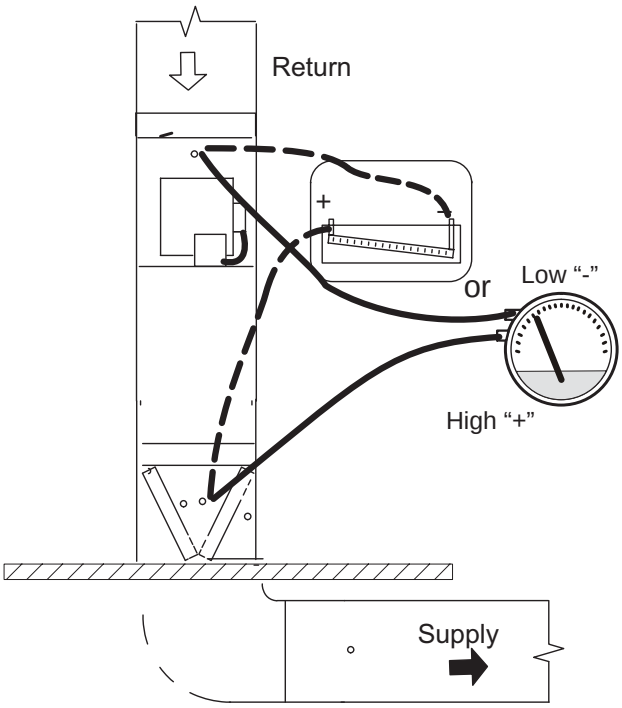


Figure 49.

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 the 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 sizes.

⚠IMPORTANT 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
17-1/2”	16 X 25 X 1 (1)
21”	

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 50.**
Furnace Nameplate _____ Actual _____

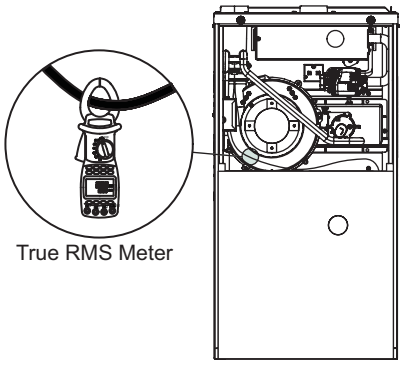


Figure 50. Check Motor AMP Draw

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 51)

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.

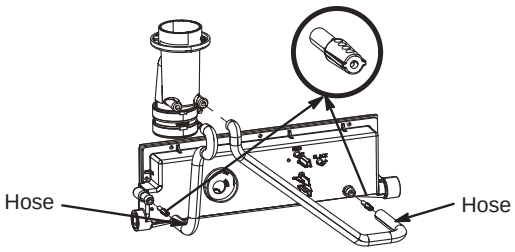


Figure 51. Condensate Hose Screens

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 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. Loosen clamps at vent elbow. Disconnect condensate drain tubing from flue collar. and remove the vent elbow.
8. Loosen clamps and remove combustion air intake flexible connector if equipped.
9. 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.
10. Mark and disconnect all combustion air pressure tubing from cold end header collector box.
11. Mark and remove wires from pressure switch assembly. Remove pressure switch assembly. Keep tubing attached to pressure switch assembly.
12. 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.
13. Remove electrical junction box from the side of the furnace.
14. Disconnect condensate line from cold end header box. Remove cold end header box.
15. Loosen clamps on exhaust and air intake pipe seal plate. Slide exhaust and intake pipes up and out to clear blower deck. Remove exhaust and air intake pipe seal plate.
16. 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.
17. Remove the primary limit from the vestibule panel.
18. Remove two screws from the front cabinet flange at the blower deck. Spread cabinet sides slightly to allow clearance for removal of heat exchanger.
19. Remove screws along vestibule sides which secure vestibule panel and heat exchanger assembly to cabinet. Remove two screws from blower rail which secure top heat exchanger flange. Remove heat exchanger from furnace cabinet.
20. Back wash heat exchanger with soapy water solution or steam. If steam is used it must be below 275°F (135°C).
21. Thoroughly rinse and drain the heat exchanger. Soap solutions can be corrosive. Take care to rinse entire assembly.
22. Reinstall heat exchanger into cabinet making sure that the clamshells of the heat exchanger assembly are engaged properly into the support bracket on the blower deck. Remove the indoor blower to view this area through the blower opening.
23. Re-secure the supporting screws along the vestibule sides and top to the cabinet.
24. Reinstall cabinet screws on front flange at blower deck.
25. Reinstall the primary limit on the vestibule panel.
26. Route heating component wiring through hole in blower deck and reinsert strain relief bushing.
27. Reinstall electrical junction box.

MAINTENANCE (Cont.)

Cleaning Heat Exchanger(Cont.)

28. Reinstall exhaust and air intake pipe seal plate. Reinstall exhaust and air intake pipes and tighten clamps on pipe seal plate.
29. Reinstall the cold end header box.
30. Reinstall the combustion air inducer. Reconnect the combustion air inducer to the wire harness.
31. Reinstall pressure switch assembly and reconnect pressure switch wiring.
32. Carefully connect combustion air pressure switch tubing from pressure switches to proper ports on cold end header collector box.
33. Reinstall condensate trap.
34. Secure burner box assembly to vestibule panel using four existing screws. **Make sure burners line up in center of burner ports.**
35. Reconnect exhaust piping and exhaust drain tubing.
36. Reconnect flame roll-out switch wires.
37. Reconnect sensor wire and reconnect 2-pin plug from ignitor.
38. Reinstall gas valve manifold assembly. Reconnect gas supply line to gas valve.
39. Reinstall burner box cover if equipped.
40. Reconnect plug to gas valve.
41. Replace the blower compartment access panel.
42. Follow lighting instructions on unit nameplate to light and operate furnace for 5 minutes to ensure the furnace is operating properly.
43. Check all piping connections, factory and field, for gas leaks. Use a leak detecting solution or other preferred means.
44. Replace 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 2-pin plug 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. Loosen clamps and remove combustion air intake flexible connector (if equipped).
6. Mark and disconnect sensor wire from the sensor. Disconnect plug from the ignitor at the burner box.
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.
11. Reinstall combustion air intake flexible connector (if equipped), secure using existing clamps.
12. Reinstall the gas valve manifold assembly. Reconnect the gas supply line to the gas valve. Reinstall the burner box cover.
13. Reconnect plug to gas valve.
14. Replace the blower compartment access panel.
15. Refer to instruction on verifying gas and electrical connections when re-establishing supplies.
16. 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.
17. Replace access panel.

Service Information

WIRING DIAGRAM

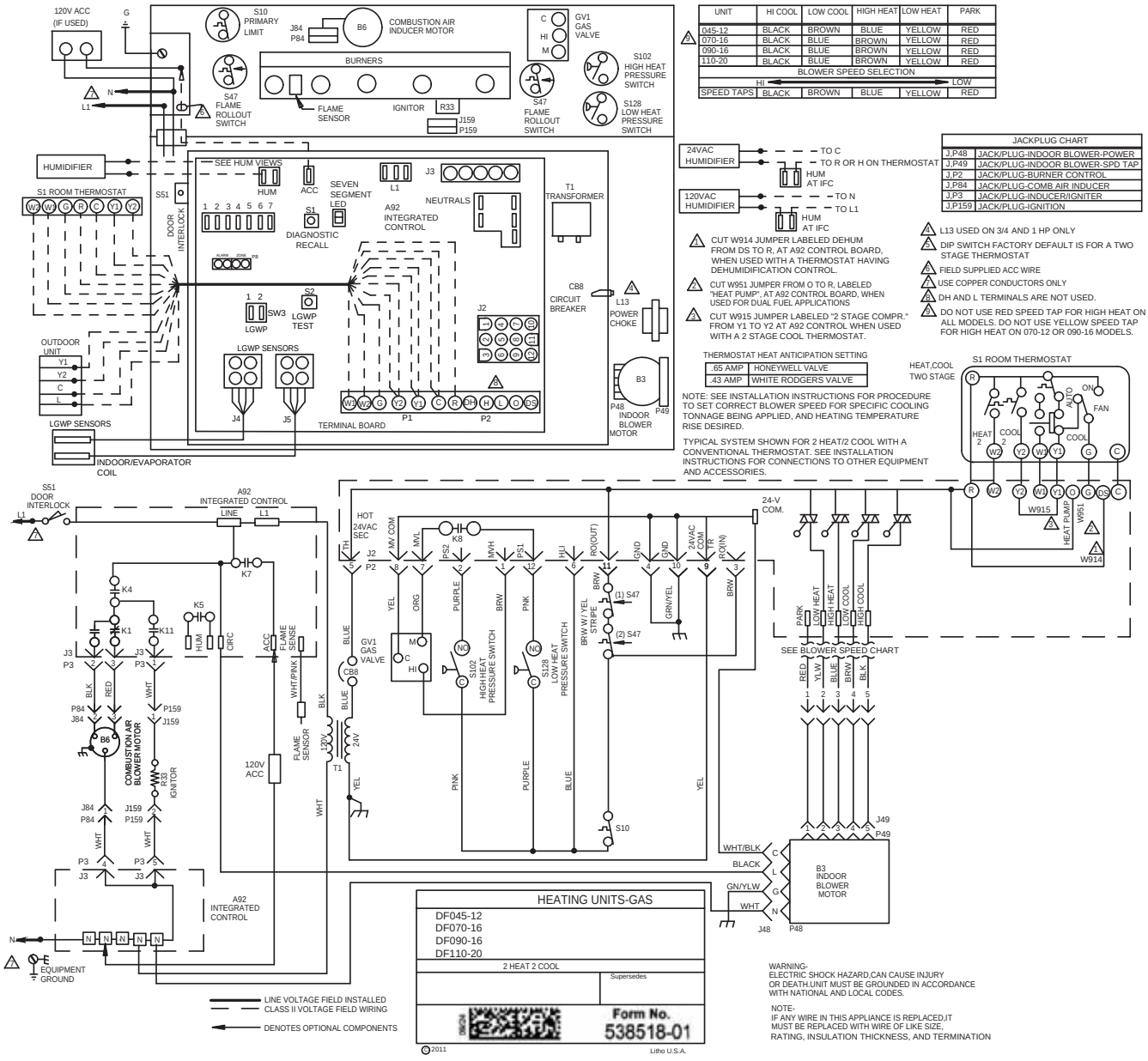


Figure 52.

ELECTRONIC IGNITION

The two-stage, variable speed integrated control used in NF97D***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 53** 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 a s the 120V ACC terminal.

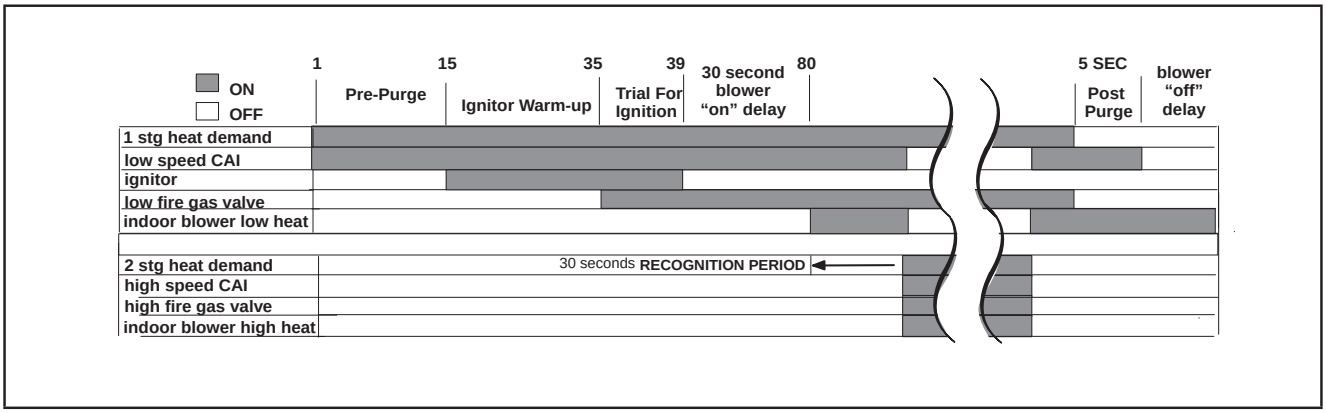


Figure 53. Heating Operation with Two-Stage Thermostat

ELECTRONIC IGNITION (Cont.)

Applications Using A Single-Stage Thermostat
See **Figure 54** 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.

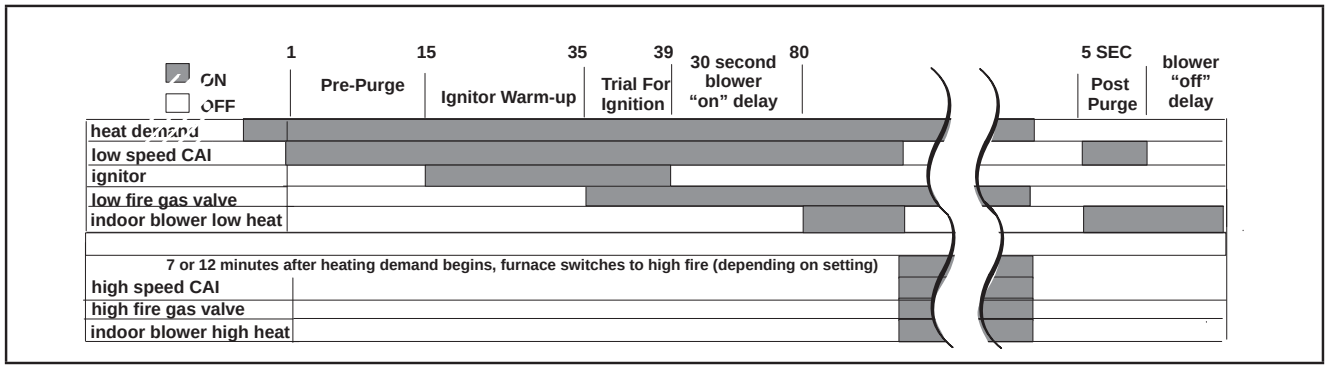
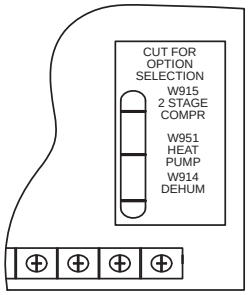
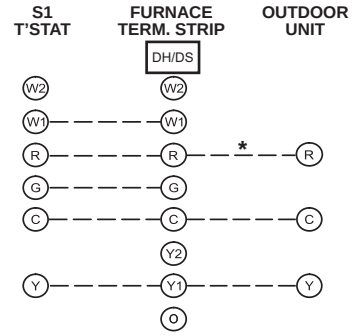
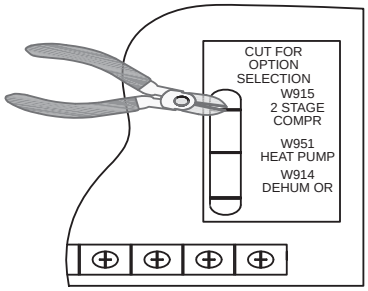
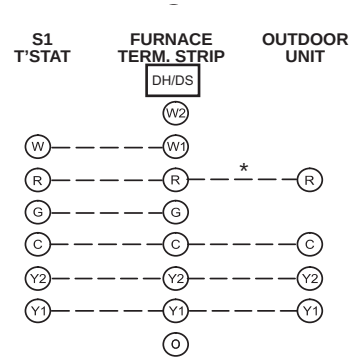
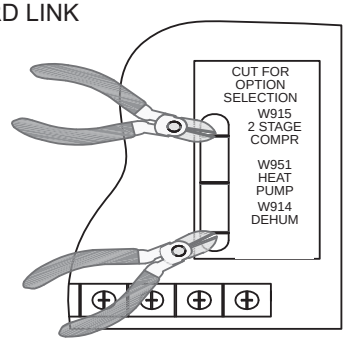
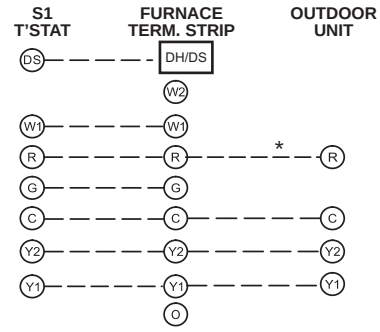


Figure 54. Heating Operation with Single-Stage Thermostat

Service Information

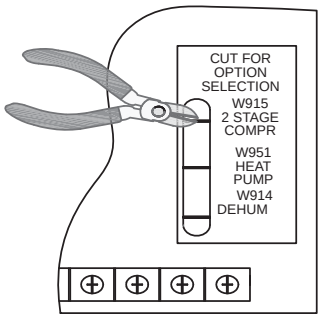
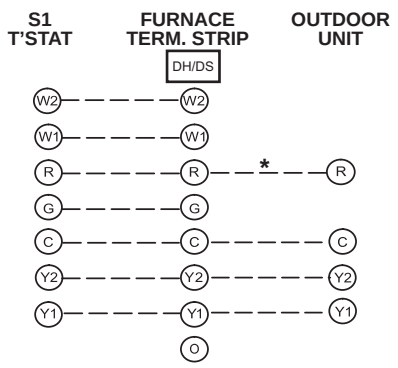
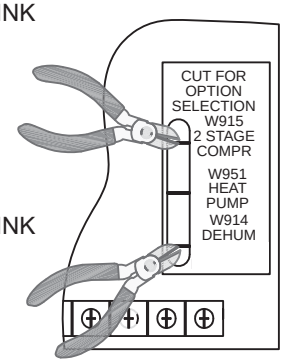
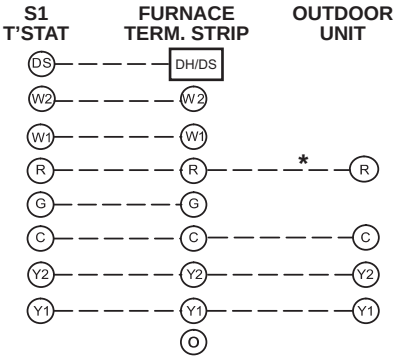
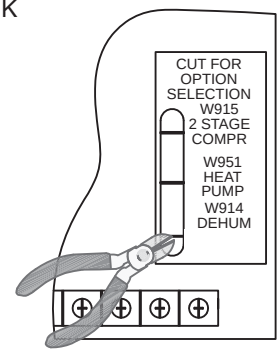
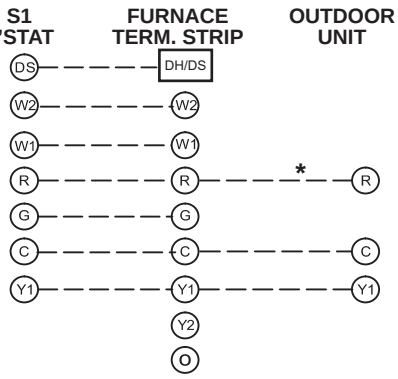
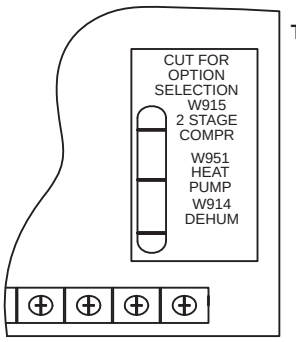
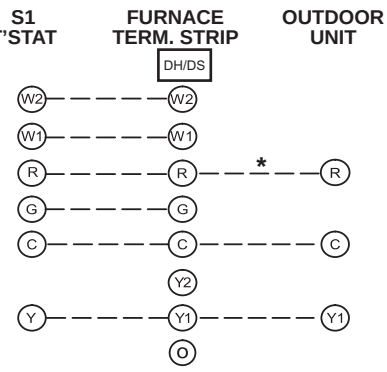
FIELD WIRING APPLICATIONS

Thermostat	DIP Switch Settings and On-Board Links		Wiring Connections
	DIP Switch 1 Thermostat Heating Stages	On Board Links Must Be Cut To Select System Options	
1 Heat / 1 Cool **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.

FIELD WIRING APPLICATIONS (Cont.)

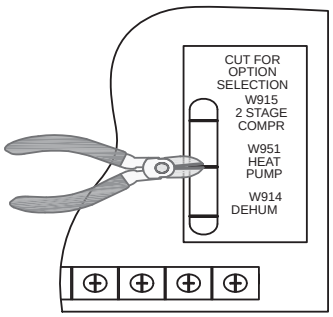
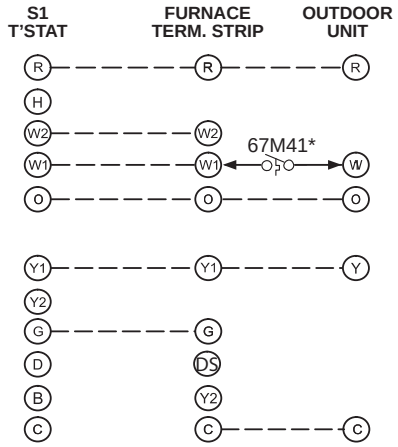
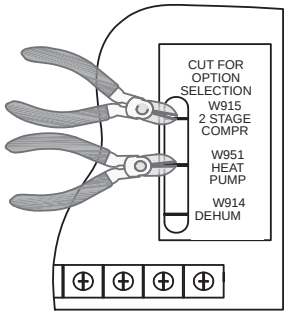
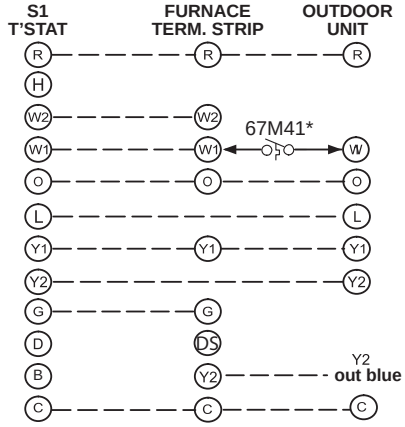
Thermostat	DIP Switch Settings and On-Board Links		Wiring Connections
	DIP Switch 1 Thermostat Heating Stages	On Board Links Must Be Cut To Select System Options	
2 Heat / 2 Cool	OFF	CUT ON-BOARD LINK W915 2 STAGE COMPR 	
2 Heat / 2 Cool with t'stat with humidity control.	OFF	CUT ON-BOARD LINK W915 2 STAGE COMPR  CUT ON-BOARD LINK W914 DEHUM	
2 Heat / 1 Cool with t'stat with humidity control.	OFF	CUT ON-BOARD LINK W914 DEHUM 	
2 Heat / 1 Cool.	OFF	DO NOT CUT ANY ON-BOARD LINKS 	

* Not required on all units.

Table 23B.

Service Information

FIELD WIRING APPLICATIONS (Cont.)

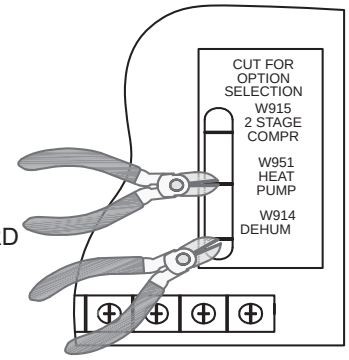
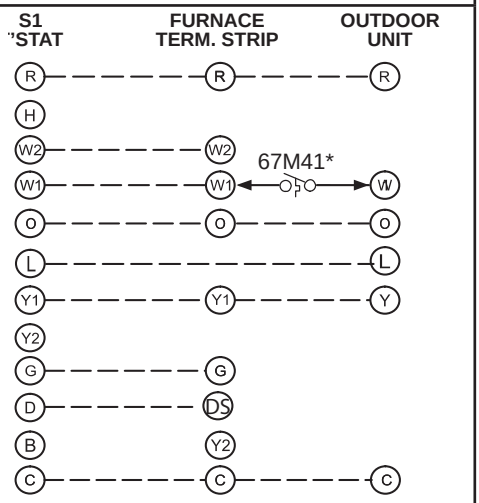
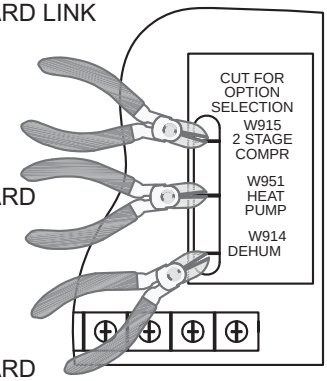
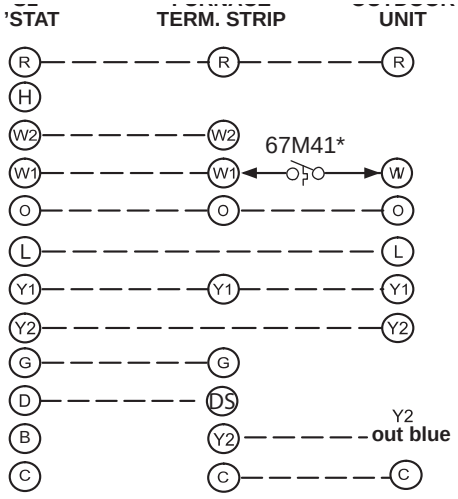
Thermostat	DIP Switch Settings and On-Board Links		Wiring Connections
	DIP Switch 1 Thermostat Heating Stages	On Board Links Must Be Cut To Select System Options	
Dual Fuel Single Stage Heat Pump Thermostat w/ dual fuel capabilities Capable of 2 stage gas heat control	OFF	CUT ON-BOARD LINK W951 HEAT PUMP 	
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 	

* 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.

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 	
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 	

* 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.

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 57 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 55**. 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.

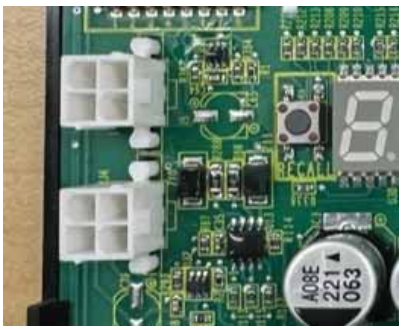


Figure 55. Two Stage Constant Torque Control

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 56** and **Table 24**

Figure 56.

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 57** for routing the secondary sensor cable through the furnace cabinet.

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”.

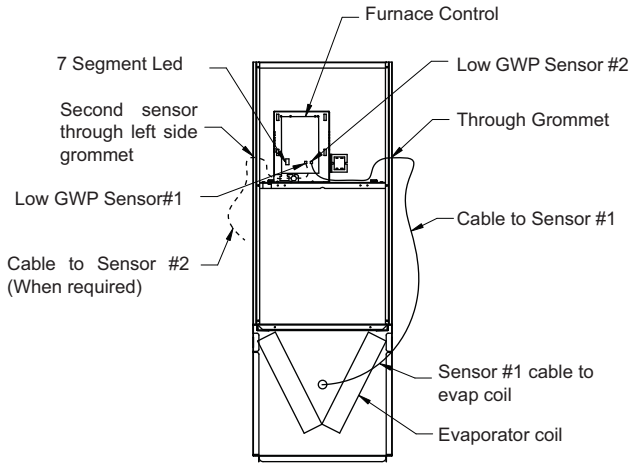


Figure 57.

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	Short	Reset control
Mitigating	Long	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 set-points after a power outage.

The following scenarios are likely to occur when home occupants are not available to adjust the thermostat set-points 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 set-point.

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

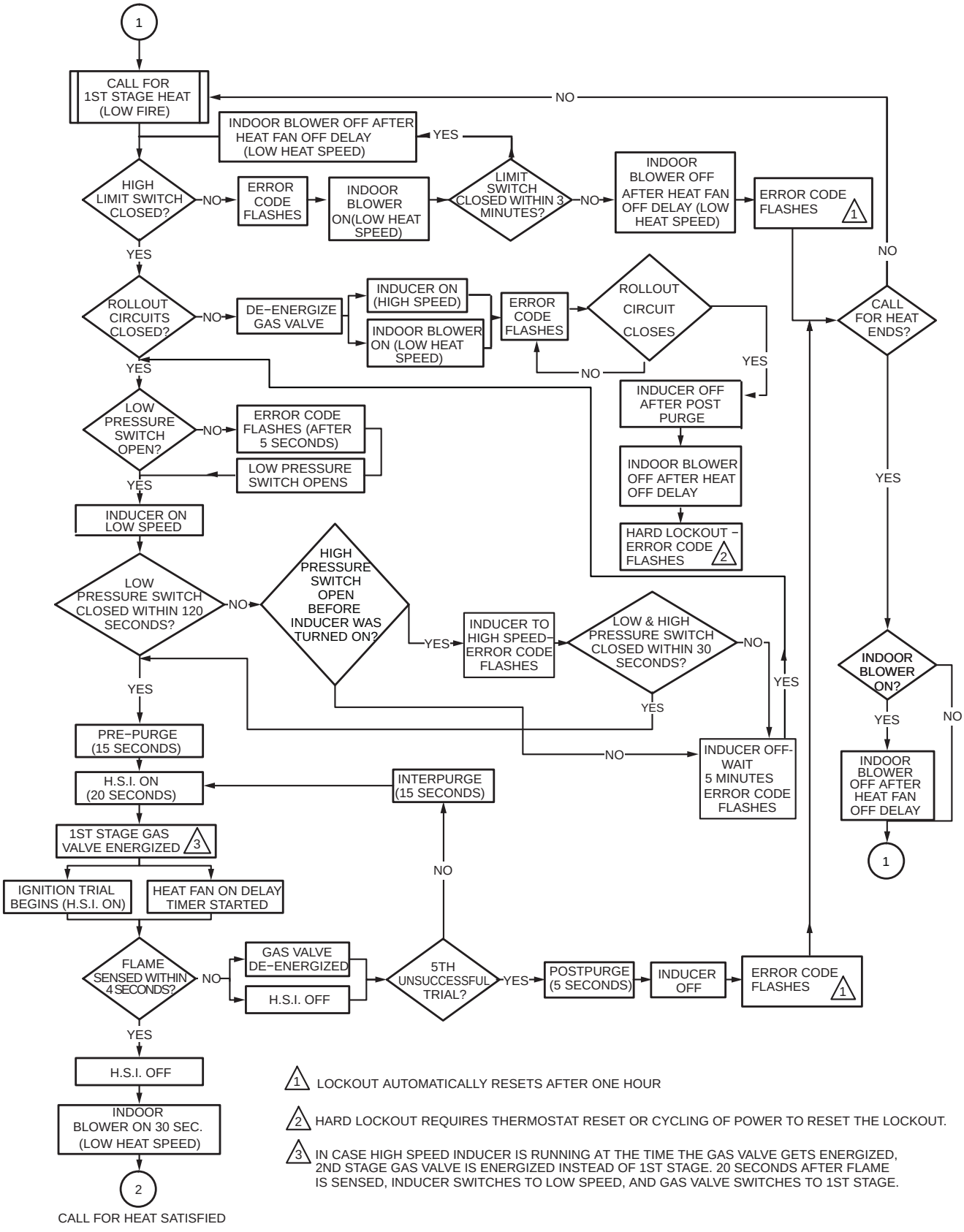
Heating Demand

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 powers 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 Refrigerant Detection System is complete after both sequences are successfully completed.

TROUBLESHOOTING - Heating Sequence of Operation

CALL FOR FIRST-STAGE HEAT

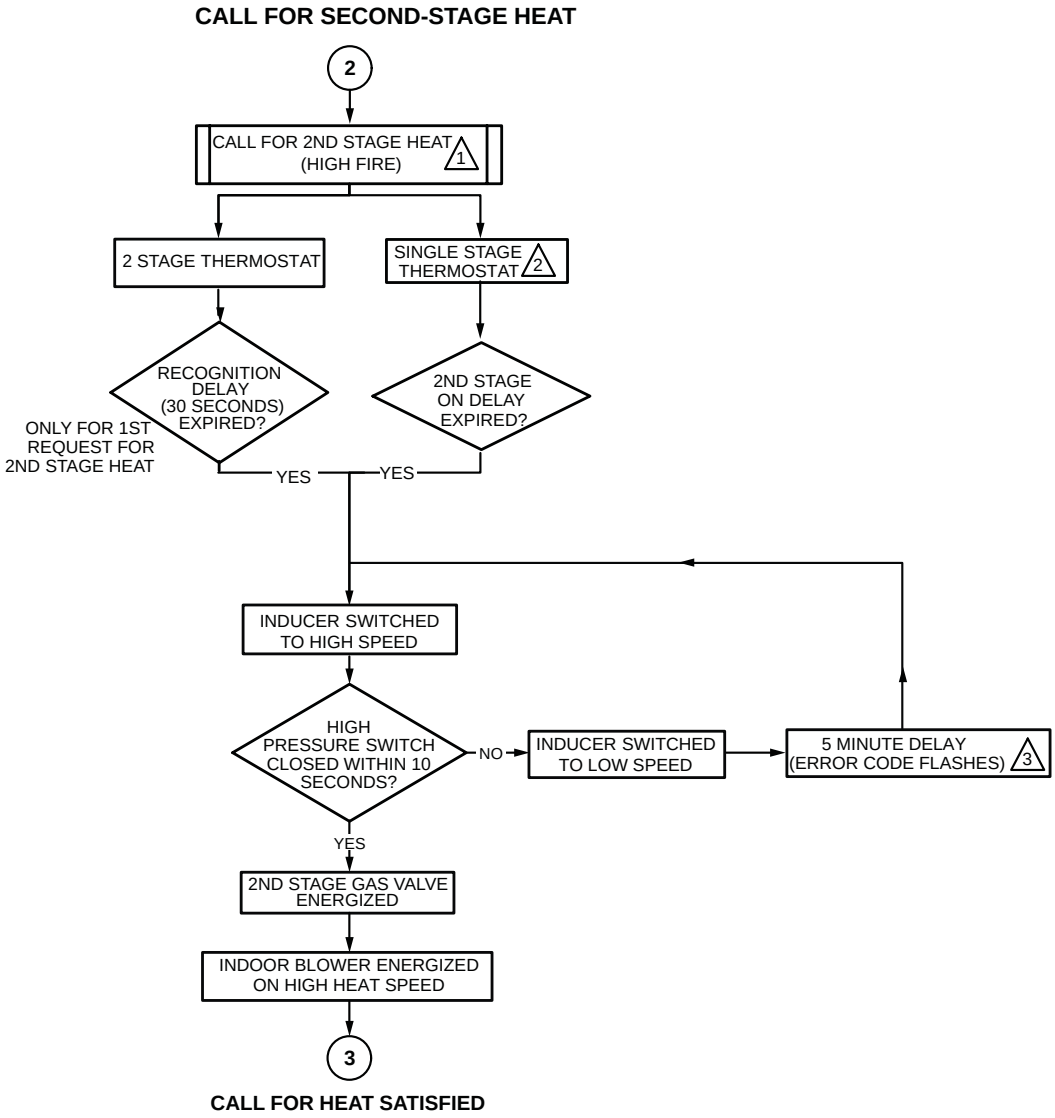


1 LOCKOUT AUTOMATICALLY RESETS AFTER ONE HOUR

2 HARD LOCKOUT REQUIRES THERMOSTAT RESET OR CYCLING OF POWER TO RESET THE LOCKOUT.

3 IN CASE HIGH SPEED INDUCER IS RUNNING AT THE TIME THE GAS VALVE GETS ENERGIZED, 2ND STAGE GAS VALVE IS ENERGIZED INSTEAD OF 1ST STAGE. 20 SECONDS AFTER FLAME IS SENSED, INDUCER SWITCHES TO LOW SPEED, AND GAS VALVE SWITCHES TO 1ST STAGE.

TROUBLESHOOTING - Heating Sequence of Operation (cont)

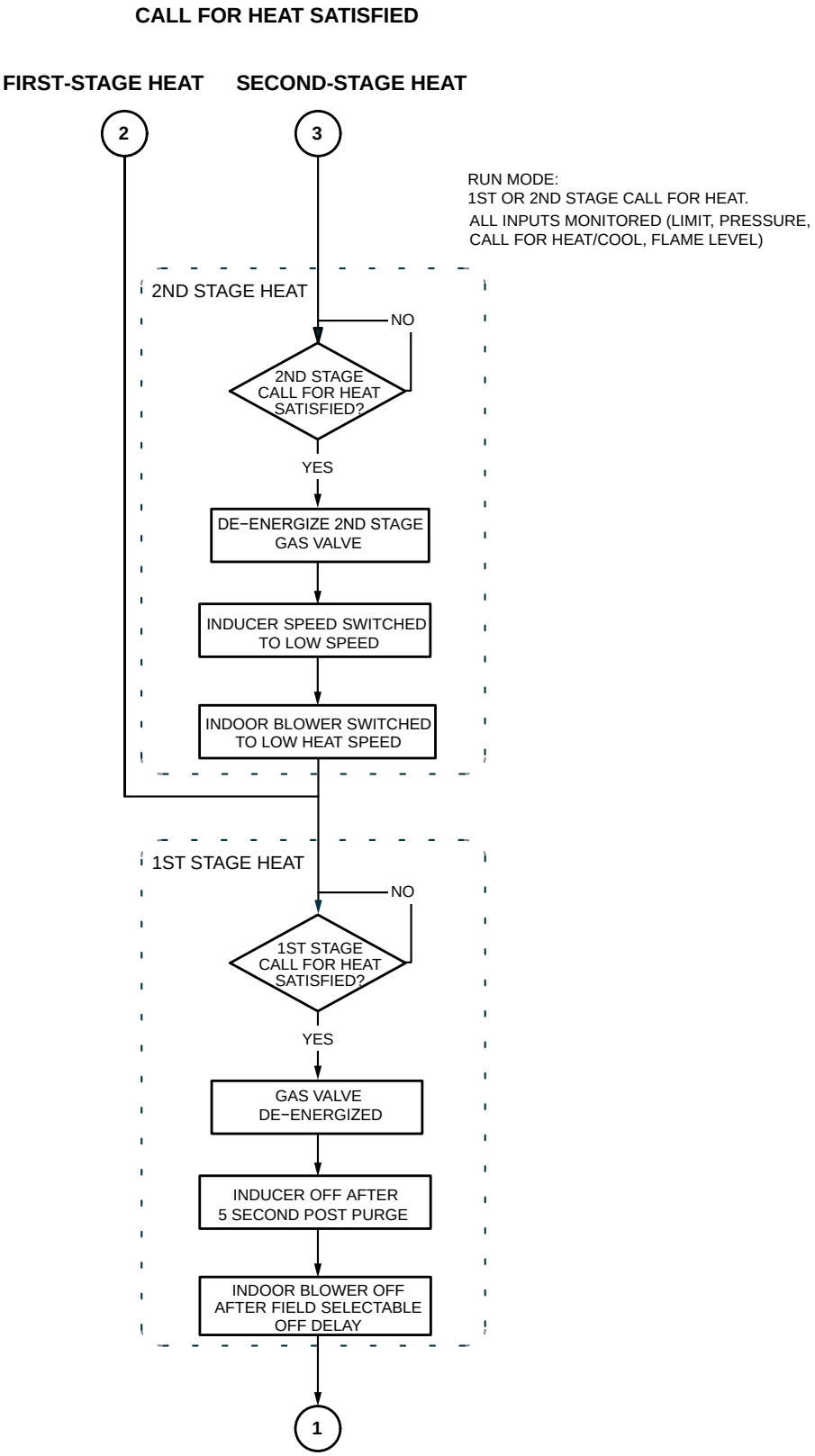


1 SYSTEM WILL ALWAYS LIGHT ON LOW FIIRE, EVEN IF 2ND STAGE HEAT IS IN PLACE.

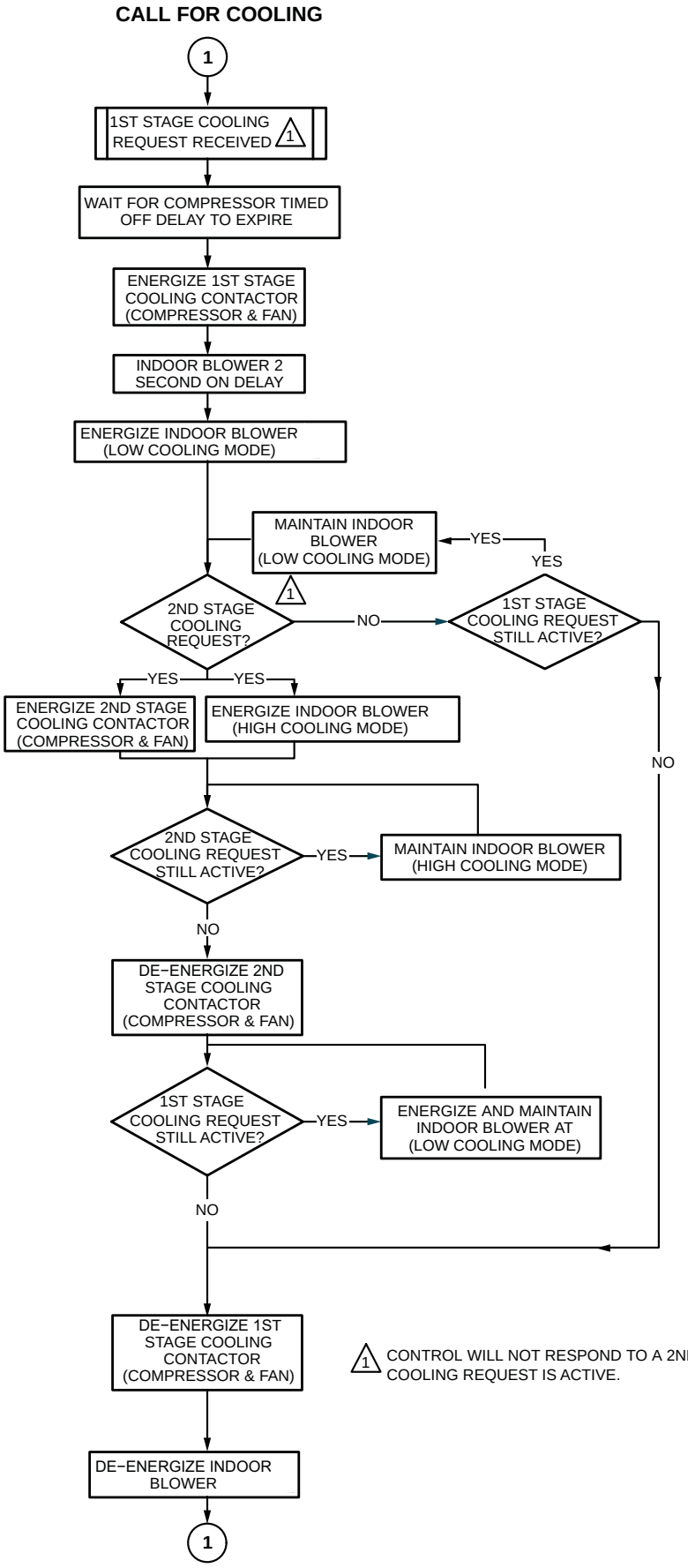
2 WHEN USED WITH A SINGLE STAGE THERMOSTAT, SET SW1 TO THE ON POSITION IN DIP SWITCH S4.

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.

TROUBLESHOOTING - Heating Sequence of Operation (cont)

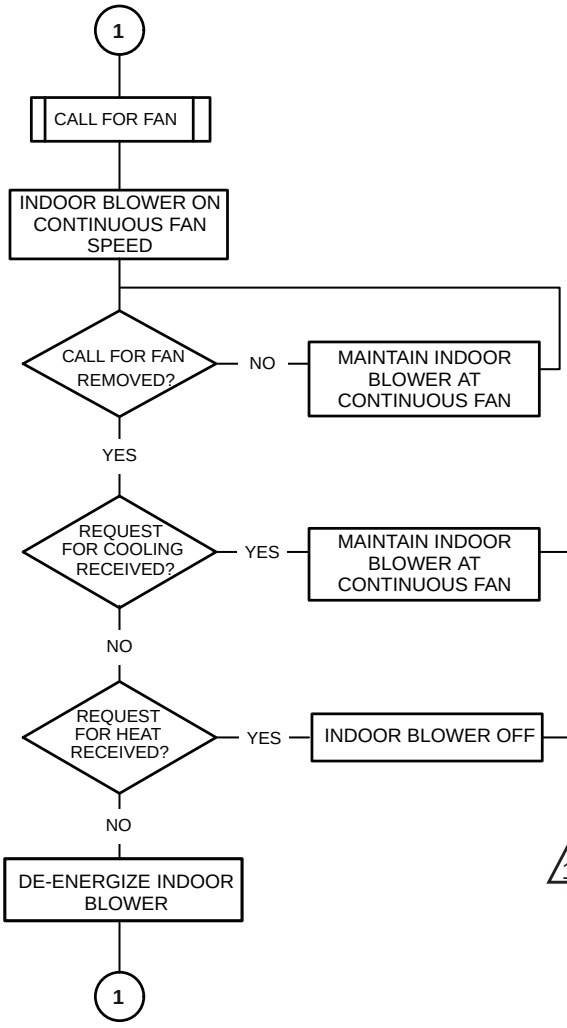


TROUBLESHOOTING - Cooling Sequence of Operation



TROUBLESHOOTING - Continuous Fan / Accessories Sequence of Operation

CALL FOR FAN



1 If continuous fan is active, unit will light and run at high fire for 60 seconds to improve heat exchanger warm up.

Notes

GE APPLIANCES

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