



**GE APPLIANCES**

# **Service Manual**

**NF97D\*\*\*M\*\*R**

97% Downflow Modulating  
Variable Speed Gas Furnace



**READ CAREFULLY.  
KEEP THESE INSTRUCTIONS.**

# SERVICE MANUAL

## NF97D\*\*\*M\*\*R Gas Furnace



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

NF97D\*\*\*M\*\*R series units are high-efficiency upflow, horizontal right and left) gas furnaces equipped with variable capacity gas valve, variable speed combustion air inducer and variable speed indoor blower motor. All models are designed only for direct vent (dual pipe) venting system. NF97D\*\*\*M\*\*R units are available in heating inputs from 66,000 to 110,000 Btuh (19.3 to 38.6 kW) and cooling applications from 2 to 5 tons (7.0 kW to 17.5 kW). Refer to Technical Specifications for proper sizing.

Units are factory-equipped for use with natural gas. Kits are available for conversion to LPG operation. All models include a variable capacity integrated control.

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

### **WARNING**

This furnace is equipped with a ignition control factory enabled for use with GE Appliances A2L refrigerant systems. Disabling the refrigerant detection functionality on A2L system is prohibited by safety codes. Refer to furnace installation instructions for non-A2L and non-GE Appliances refrigerant system setup.

### **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.

### **WARNING**



Electric shock hazard.

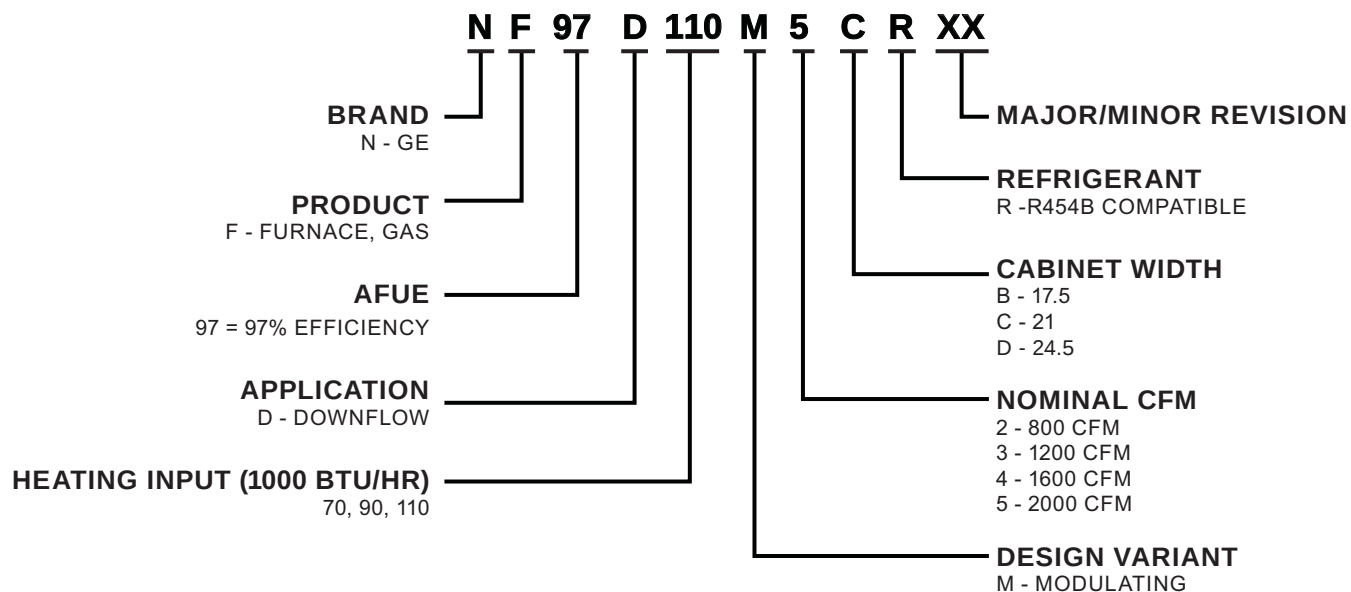
Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch(es). Unit may have multiple power supplies.

### **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 - NF97D\*\*\*M\*\*R

### MODEL NUMBER GUIDE



### PHYSICAL AND ELECTRICAL DATA

| Model        | Input (Btuh) | Output * (Btuh) | AFUE (ICS) | Nominal* Cooling Capacity | Gas Inlet (in.) | Volts-Hertz-Phase | Max. Time Delay Breaker or Fuse | Nominal F.L.A. | Trans. (V.A.) | Approx. Shipping Weight (lbs.) |
|--------------|--------------|-----------------|------------|---------------------------|-----------------|-------------------|---------------------------------|----------------|---------------|--------------------------------|
| NF97D070M3BR | 66,000       | 64,000          | 97.0%      | 3 Tons                    | 1/2             | 120-60-1          | 15                              | 7.7            | 40            | 140                            |
| NF97D090M4CR | 88,000       | 85,000          | 97.0%      | 4 Tons                    | 1/2             | 120-60-1          | 15                              | 10.1           | 40            | 165                            |
| NF97D110M5CR | 110,000      | 107,000         | 97.0%      | 5 Tons                    | 1/2             | 120-60-1          | 20                              | 12.8           | 40            | 174                            |

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

\* At full capacity

## BLOWER PERFORMANCE: RETURN INLET

| Model        | Motor Size (hp) | Blower Size | Temp Rise F°       | Heating<br>CFM @ 0" - 0.8" w.c. |           |           |            | Cooling Stages | Speed Adjustment | Cooling<br>CFM @ 0" - 0.8" w.c. |            |             |              |
|--------------|-----------------|-------------|--------------------|---------------------------------|-----------|-----------|------------|----------------|------------------|---------------------------------|------------|-------------|--------------|
|              |                 |             |                    | **                              | 40% Input | 70% Input | 100% Input |                |                  | Low                             | Medium Low | Medium High | High Default |
| NF97D070M3BR | 1/2 HP          | 10 x 9      | 50 - 80 Max. Input | +15%                            | 543       | 830       | 1118       | 2nd Stage      | +10%             | 910                             | 1075       | 1232        | 1366         |
|              |                 |             |                    | +7.5%                           | 516       | 778       | 1041       |                | Default          | 846                             | 963        | 1126        | 1267         |
|              |                 |             |                    | Default                         | 489       | 726       | 963        |                | -10%             | 759                             | 889        | 986         | 1154         |
|              |                 |             | 35 - 65 Min. Input | +10%                            |           |           |            | 1st Stage      | +10%             | 625                             | 788        | 890         | 998          |
|              |                 |             |                    | -7.5%                           | 467       | 687       | 908        |                | Default          | 573                             | 711        | 830         | 894          |
|              |                 |             |                    | -15%                            | 444       | 649       | 853        |                | -10%             | 520                             | 619        | 714         | 822          |
| NF97D090M4CR | 1/2 HP          | 10 x 9      | 60 - 90 Max. Input | +15%                            | 756       | 1033      | 1309       | 2nd Stage      | +10%             | 924                             | 1083       | 1218        | 1386         |
|              |                 |             |                    | +7.5%                           | 713       | 971       | 1230       |                | Default          | 835                             | 1000       | 1136        | 1259         |
|              |                 |             |                    | Default                         | 669       | 910       | 1150       |                | -10%             | 751                             | 890        | 1028        | 1145         |
|              |                 |             | 35 - 65 Min. Input | +10%                            |           |           |            | 1st Stage      | +10%             | 610                             | 771        | 902         | 1035         |
|              |                 |             |                    | -7.5%                           | 599       | 845       | 1091       |                | Default          | 549                             | 690        | 808         | 923          |
|              |                 |             |                    | -15%                            | 530       | 781       | 1032       |                | -10%             | 466                             | 623        | 721         | 812          |
| NF97D110M5CR | 1 HP            | 11 x 11     | 50 - 80 Max. Input | +15%                            | 906       | 1475      | 2045       | 2nd Stage      | +10%             | 1337                            | 1583       | 1792        | 2011         |
|              |                 |             |                    | +7.5%                           | 835       | 1380      | 1926       |                | Default          | 1222                            | 1440       | 1629        | 1867         |
|              |                 |             |                    | Default                         | 764       | 1285      | 1807       |                | -10%             | 1098                            | 1273       | 1473        | 1678         |
|              |                 |             | 35 - 65 Min. Input | +10%                            |           |           |            | 1st Stage      | +10%             | 922                             | 1093       | 1264        | 1442         |
|              |                 |             |                    | -7.5%                           | 707       | 1193      | 1679       |                | Default          | 830                             | 965        | 1129        | 1289         |
|              |                 |             |                    | -15%                            | 650       | 1101      | 1551       |                | -10%             | 738                             | 860        | 1034        | 1156         |

\*\* See installation instructions for proper blower setup

## ACCESSORY LIST

| Catalog Number                                                                                                                | Description                             |
|-------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| <b>Natural to LP Kits</b>                                                                                                     |                                         |
| 68W77                                                                                                                         | Modulating 97/98% (including gas valve) |
| 68W77                                                                                                                         | High Altitude > 7500 ft.                |
| <b>Downflow Combustible Flooring Base</b>                                                                                     |                                         |
| 11M60                                                                                                                         | 17.5" B Width                           |
| 11M61                                                                                                                         | 21.0" C Width                           |
| <b>Flush Mount Termination (90% Furnaces only) US Only</b>                                                                    |                                         |
| 51W11                                                                                                                         | 2" & 3.0" Vent                          |
| <b>Concentric Vent Kit (90% Furnaces only) US Only</b>                                                                        |                                         |
| 71M80                                                                                                                         | 1-1/2" Vent Version (United States)     |
| 69M29                                                                                                                         | 2" Vent Version (United States)         |
| 60L46                                                                                                                         | 3" Vent Version (United States)         |
| <b>Refrigerant Detection Sensor</b>                                                                                           |                                         |
| Refrigerant Detection System (RDS) Coil Sensor Kit<br>(for indoor coil)                                                       | 27V53                                   |
| <b>Transformer (75VA)</b>                                                                                                     |                                         |
| Recommended when furnace is used with zoning or defrost<br>thermostats and other 24V accessories requiring a higher VA rating | 27J32                                   |
| Circuit breaker (furnished) is wired in series                                                                                |                                         |
| Replaces the standard 40VA transformer                                                                                        |                                         |

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

## Parts Arrangement

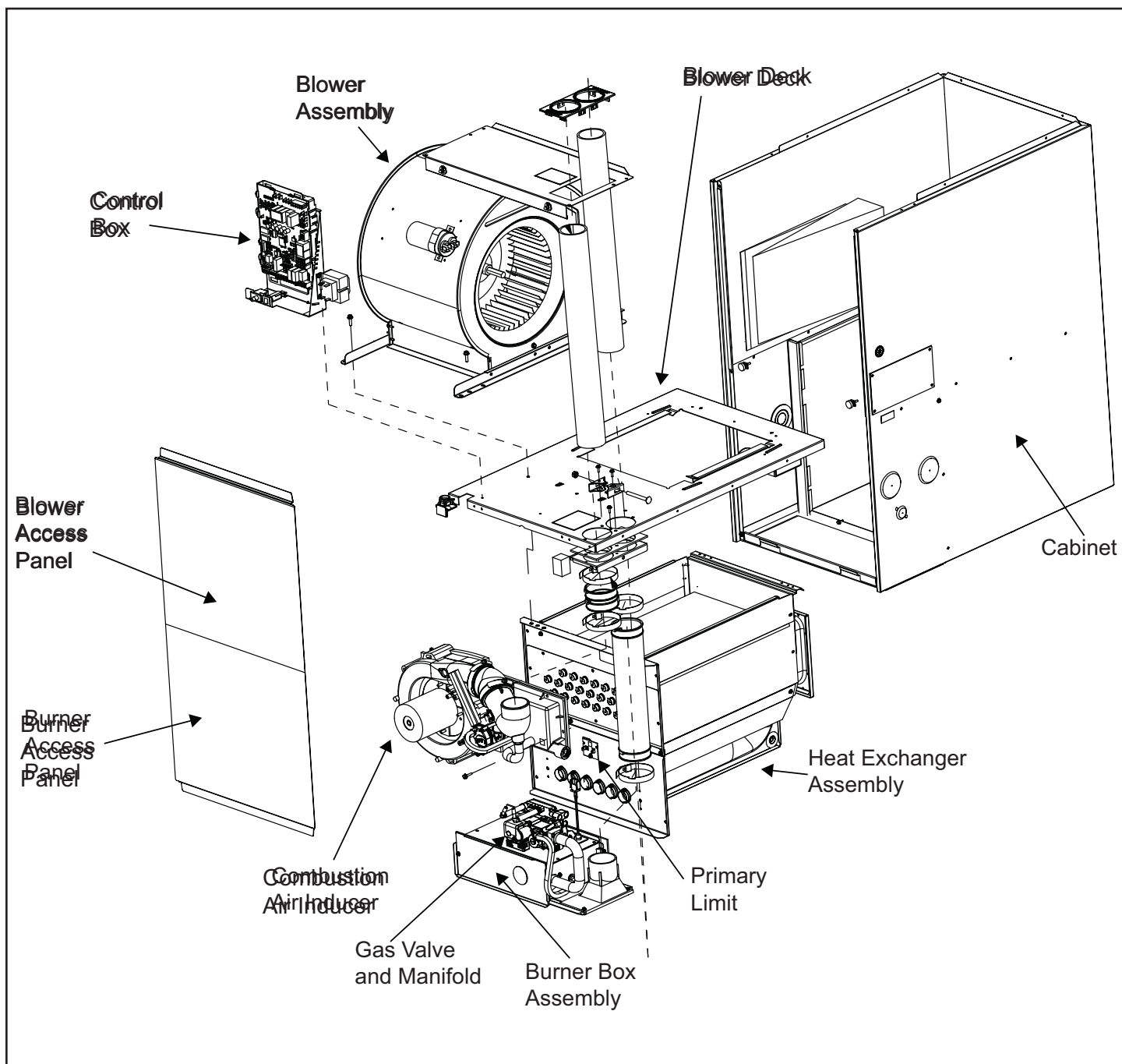
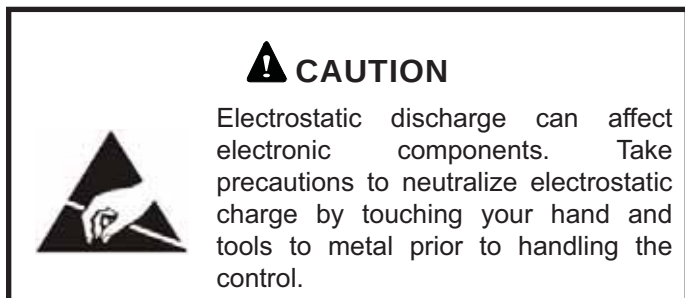


Figure 1.

## Unit Components

NF97D\*\*\*M\*\*R unit components are shown in Figure 1. The gas valve, combustion air inducer and burners can be accessed by removing the access panel. Electrical components are in the control box (Figure 2) found in the blower compartment..



### Control Box

#### Control Transformer (T1)

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

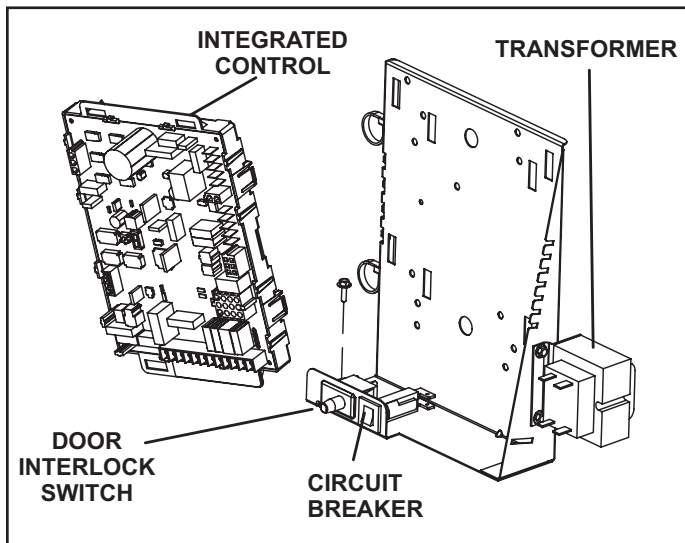


Figure 3. Control Box

#### Door Interlock Switch (S51)

A door interlock switch rated 14A at 125VAC 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 3A at 32V. If the current exceeds this limit the breaker will trip and all unit operation will shutdown. The breaker can be manually reset by pressing the button on the face. See Figure 3.

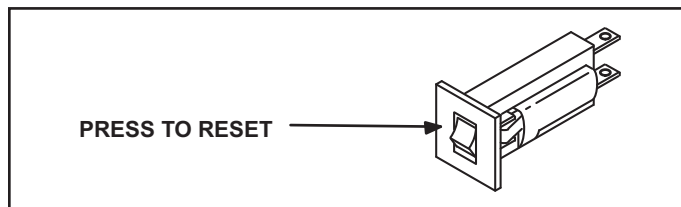


Figure 2. Circuit Breaker CB8

### WARNING

Shock hazard.

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

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

### Integrated Control (A92)

Units are equipped with a variable capacity integrated control. The control can operate with a non-communicating conventional single or two-stage thermostat. The system consists of an ignition / blower control (Figure 4 and Figure 5) with control pin designations (Table 1 through Table 4) and an ignitor. 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 (including indoor blower) and error codes. The LED flashes in single digits. For example, using Table 13 under CODE, an "E" followed by "2" followed by "5" followed by "0", the limit switch circuit is open. The control also has two unpowered (dry) 1/4" contacts for a humidifier and a 120 volt accessory terminal. Both rated at (1) one amp each.

## Electronic Ignition

At the beginning of the heat cycle the integrated control monitors the low fire combustion air inducer pressure switch. The control will not begin the heating cycle if the low fire pressure switch is closed (by-passed). Likewise the control will not begin the high fire heating cycle if the high fire pressure switch is closed, and will remain in low fire heat. However, if the high fire pressure switch closes during the low fire heat pre-purge, the control will allow high fire heat. Once the low fire pressure switch is determined to be open, the combustion air inducer is energized on ignition speed. When the differential in the pressure switch is great enough, the pressure switch closes and a 15-second pre-purge begins. If the switch is not proven within 2-1/2 minutes, the inducer is de-energized and the control will initiate vent calibration. If the vent calibration is unsuccessful the control goes into a 5 minute delay. The control will attempt vent calibration 3 more times before going into a 1 hour soft lockout. After the 15 second pre-purge period the ignitor warms up for 20 seconds. The gas valve then opens for a 4-second trial for ignition. The ignitor stays energized during this trial until flame is sensed. If ignition is not proven during the 4-second trial for ignition, 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 Soft Lockout mode. After a 60-minute reset period, the control will begin the ignition sequence again.

## Thermostat Selection Modes

See **Table 6** for DIP switch settings

The control can be made to operate in three modes: variable capacity, three-stage timed or two-stage. The variable capacity and two-stage modes are only operational with a two-stage thermostat. The thermostat selection is made using dip switches one and / or two (**Figure 5**) and must be positioned for the particular application.

### Variable Capacity

Using a two-stage thermostat the system will operate in a variable capacity sequence mode. In this mode, the control will vary the firing rate anywhere between 35% and 100% of full capacity. The indoor blower will be automatically adjusted accordingly to provide the appropriate airflow at any rate. On the initial call for low fire, the furnace will operate at 35% and will remain there until the heat call is satisfied or a call for high fire is initiated. If there is a call for high fire the rate will increase by 10% if the current rate is above 60%. However, if the current rate is below 60% the rate will increase to 70%. After this initial rate increase to 70% capacity, the furnace will increase rate by 10% every 5 minutes while a high fire heat call is present. If the high fire heat call is satisfied but the low fire heat call is still present, the furnace will remain at the current firing rate until the demand is satisfied or another call for high fire is initiated.

## Three-Stage Timed Operation

Using a single-stage thermostat the system will operate in a three stage timed mode. Upon a call for heat and a successful ignition, the combustion air inducer will operate at 35% and the indoor blower will adjust to the appropriate cfm. After a field selectable 7 or 12 minute delay period, the inducer RPM will increase and the unit will operate at 70%. The indoor blower will adjust to the appropriate cfm. After a factory set non-adjustable 10 minute delay expires the furnace will increase rate to 100%. The indoor blower will adjust to the appropriate cfm.

## Two-Stage Operation

The system will also operate in conventional two-stage mode. While in two-stage mode, the furnace will fire on low fire (70% rate). The combustion air inducer will operate at 70% and the indoor blower will adjust to the appropriate cfm. The unit will switch to high fire on a W2 call from the thermostat. After a 30 second recognition period (during which the integrated control will receive a continuous W2 call) expires the furnace will increase to 100% rate. The inducer will increase to 100% speed and the indoor blower will adjust to appropriate cfm. 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.

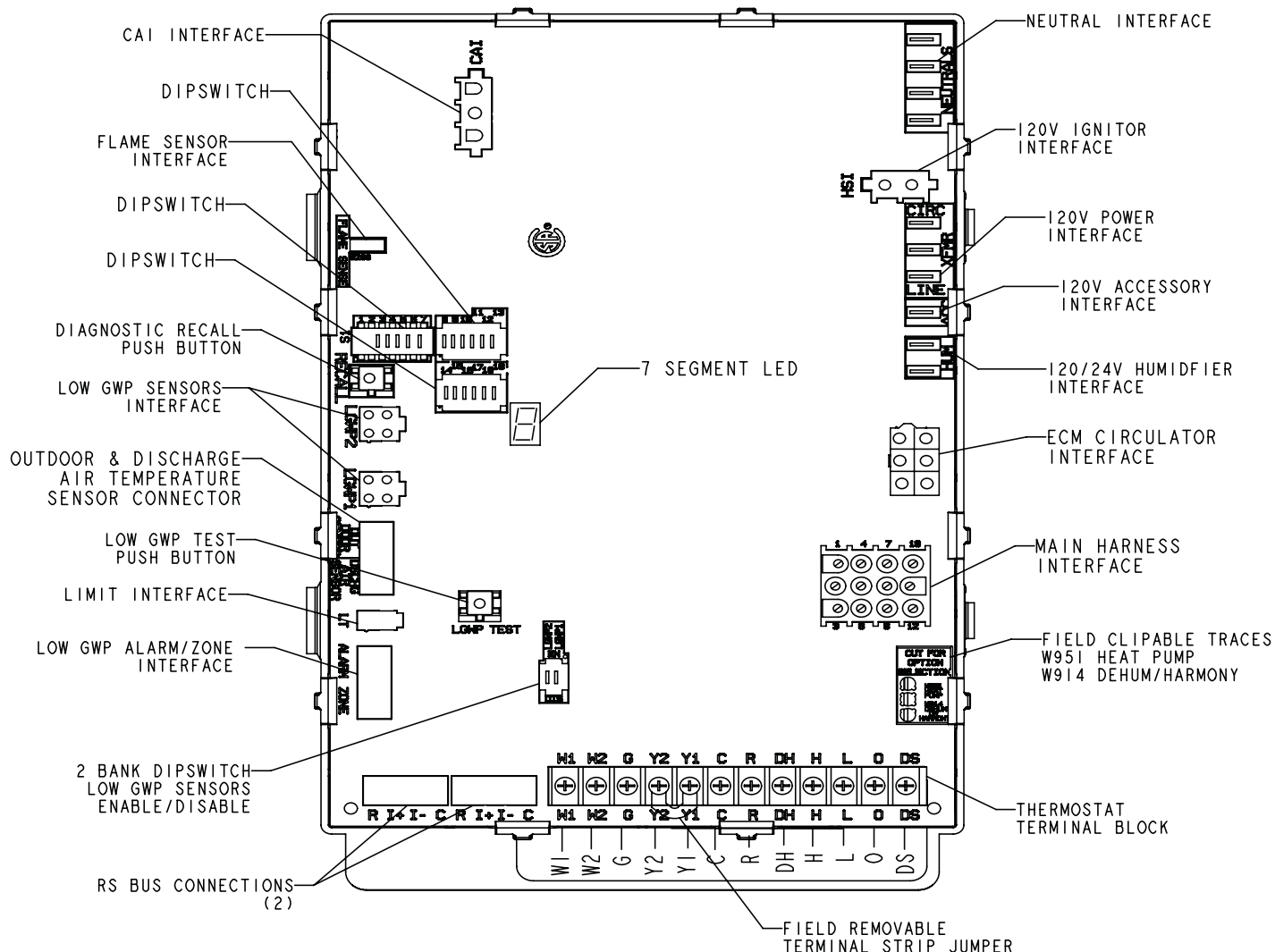


Figure 4. Integrated Control

Table 1.

| THERMOSTAT INPUT TERMINALS |                                  |
|----------------------------|----------------------------------|
| W1                         | LOW STAGE HEAT                   |
| W2                         | HIGH STAGE HEAT                  |
| G                          | FAN                              |
| Y1                         | LOW STAGE COOL                   |
| Y2                         | HIGH STAGE COOL                  |
| C                          | THERMOSTAT COMMON / GROUND       |
| R                          | 24VAC POWER TO THE THERMOSTAT    |
| DH                         | DEHUMIDIFICATION (COMM ONLY)     |
| H                          | 24V HUMIDIFIER OUTPUT            |
| L                          | LSOM (COMM ONLY)                 |
| O                          | HEAT PUMP REVERSING VALVE        |
| DS                         | DEHUMIDIFICATION (NON-COMM ONLY) |

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.

| 1/4"QUICK CONNECT TERMINALS |                                      |
|-----------------------------|--------------------------------------|
| HUM                         | 120 VAC OUTPUT TO HUMIDIFIER         |
| XMFR                        | 120 VAC OUTPUT TO TRANSFORMER        |
| L1                          | 120 VAC INPUT TO CONTROL             |
| CIRC                        | 120 VAC OUTPUT TO CIRCULATING BLOWER |
| ACC                         | 120 VAC TO ELECTRICAL AIR CLEANER    |
| NEUTRALS (5)                | 120 VAC NEUTRAL                      |

Table 4.

| RS - BUS OUTDOOR |                      |
|------------------|----------------------|
| R                | 24VAC                |
| i+               | DATA HIGH CONNECTION |
| i-               | DATA LOW CONNECTION  |
| C                | 24VAXC COMMON        |
| RS - BUS INDOOR  |                      |
| R                | 24VAC                |
| i+               | DATA HIGH CONNECTION |
| i-               | DATA LOW CONNECTION  |
| C                | 24VAXC COMMON        |

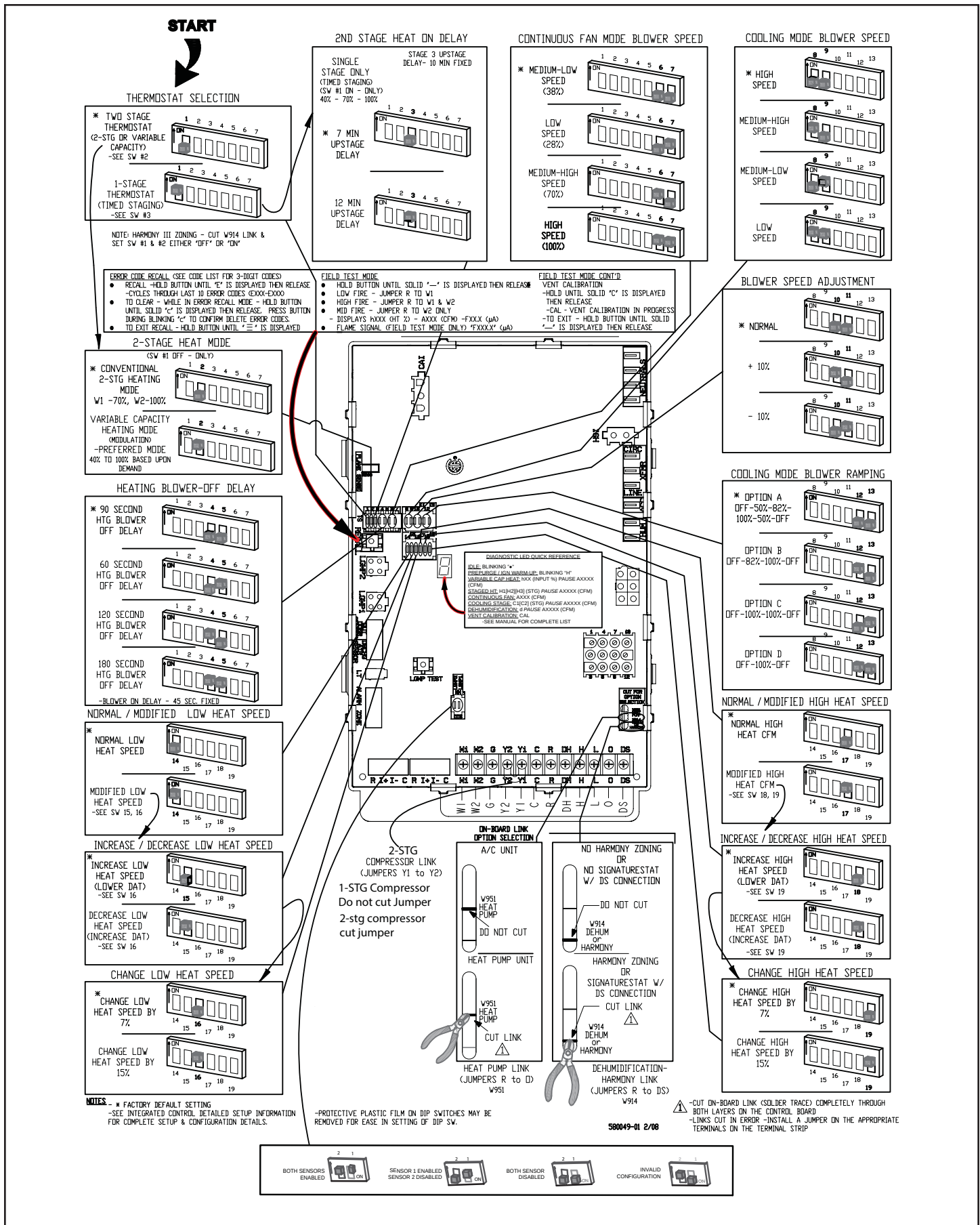


Figure 5. Integrated Control Configuration Guide

**Table 5. Diagnostic Code/Status of Furnace**

|       |                                                                                                                                                                                                                    |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| .     | Idle mode (Decimal blinks at 1 Hertz -- 0.5 second ON 0.5 second OFF).                                                                                                                                             |
| A     | Cubic feet per minute(cfm) setting for indoor blower (1 second ON 0.5 second OFF) / cfm setting for current mode displayed.                                                                                        |
| C     | Coolin11 sta11e (1 sec. ON 0.5 sec. OFF) 1 or 2 displayed/ Pause/ cfm settin11 displayed/ Pause/ Repeat codes.                                                                                                     |
| d     | Dehumidification mode l 1 second ON 1 second OFF CFM settina disolaved / Pause/ Reoeat Gades.                                                                                                                      |
| h     | Variable Capacitv Heat ( 1 second ON, 0.5 second OFF) % of input rate l Pause / CFM / Pause / Repeat codes.                                                                                                        |
| H     | Heat Stage ( 1 second ON 0.5 second OFF) 1 or 2 displayed / Pause/ cfm setting displayed / Pause / Repeat codes.                                                                                                   |
| dF    | Defrost mode.                                                                                                                                                                                                      |
| E 105 | Device communication problem - No other devices on BUS (Communication system).                                                                                                                                     |
| E 110 | Low line volta11e.                                                                                                                                                                                                 |
| E 111 | Line Voltage Polarity Reversed.                                                                                                                                                                                    |
| E 112 | Earth Ground Not Detected.                                                                                                                                                                                         |
| E 113 | High line voltage.                                                                                                                                                                                                 |
| E 114 | Line voltage frequency out-of-range.                                                                                                                                                                               |
| E 115 | Low 24V - Control will restart if the error recovers.                                                                                                                                                              |
| E 117 | Poor Ground Detected.                                                                                                                                                                                              |
| E 118 | Reset Limit Exceeded.                                                                                                                                                                                              |
| E 120 | Unresponsive Device.                                                                                                                                                                                               |
| E 124 | Active communicating thermostat signal missing for more than 3 minutes.                                                                                                                                            |
| E 125 | Control failed self-check, internal error, failed hardware. Will restart if error recovers. Integrated Furnace Control nat communicating. Covers hardware errors like flame sense circuit faults, pin shorts, etc. |
| E 126 | Failed internal control communication between microcontrollers.                                                                                                                                                    |
| E 131 | Corrupted control parameters (Verify configuration of system).                                                                                                                                                     |
| E 150 | Refrigerant leak detected                                                                                                                                                                                          |
| E 151 | Refrigerant Leak Detector Sensor #1 Fault                                                                                                                                                                          |
| E 152 | Refrigerant Leak Detector Sensor #2 Fault                                                                                                                                                                          |
| E 154 | Refrigerant Leak Detector Sensor #1 Comm. Lost or invalid sensor dip switch configuration (ON/OFF)                                                                                                                 |
| E 155 | Refrigerant Leak Detector Sensor #2 Comm. Lost                                                                                                                                                                     |
| E 160 | Refrigerant Leak Detector Sensor #1 Type Incorrect                                                                                                                                                                 |
| E 161 | Refri11erant Leak Detector Sensor #2 Type Incorrect                                                                                                                                                                |
| E 163 | Refrigerant Leak Detector Control Failure                                                                                                                                                                          |
| E 164 | LowGWPTest                                                                                                                                                                                                         |
| E 180 | Outdoor air sensor failure - NO error if disconnected. Only shown if shorted or out-of-range.                                                                                                                      |
| E200  | Hard lockout - Rollout circuit open or previously open.                                                                                                                                                            |
| E 201 | Indoor blower communication failure - Unable to communicate with blower motor.                                                                                                                                     |
| E202  | Indoor blower motor mis-match - Indoor motor horsepower does not match unit capacity.                                                                                                                              |
| E203  | APPiiance capacitv / size is NOT proaramed. Invalid unit codes Refer to configuration flow chart installation instructions.                                                                                        |
| E204  | Gas valve mis-wired.                                                                                                                                                                                               |
| E205  | Control gas valve relay contact shorted.                                                                                                                                                                           |
| E207  | Hot surface ignitor sensed open - Refer to troubleshooting in installation instruction.                                                                                                                            |
| E223  | Low pressure switch failed open - Refer to troubleshooting in installation instruction.                                                                                                                            |
| E224  | Low pressure switch failed closed - Refer to troubleshooting in installation instruction.                                                                                                                          |
| E225  | High pressure switch failed open - Refer to troubleshooting in installation instruction.                                                                                                                           |
| E226  | High pressure switch failed closed - Refer to troubleshooting in installation instruction.                                                                                                                         |
| E227  | Low pressure switch opened during trial for initiation or run mode - Refer to troubleshooting in installation instruction.                                                                                         |
| E228  | Unable to perform successful pressure switch calibration.                                                                                                                                                          |
| E240  | Low flame current - Run mode - Refer to troubleshooting in installation instruction.                                                                                                                               |
| E 241 | Flame sensed out of sequence - Flame still present.                                                                                                                                                                |
| E250  | Limit switch circuit open - Refer to troubleshooting in installation instruction.                                                                                                                                  |
| E252  | Discharge air temperature too high (gas heat only).                                                                                                                                                                |
| E270  | Soft lockout - Exceeded maximum number of retries. No flame current sensed.                                                                                                                                        |
| E 271 | Soft lockout - Exceeded maximum number of retries. Last retry failed due to pressure switch opening.                                                                                                               |
| E272  | Soft lockout - Exceeded maximum number of recycles. Last recycle failed due to pressure switch opening.                                                                                                            |
| E273  | Soft lockout - Exceeded maximum number of recycles. Last recycle failed due to a flame failure.                                                                                                                    |
| E274  | Soft lockout - Exceeded maximum number of recycles. Last recycle failed due to the limit circuit opening or the limit remained open longer than 3 minutes.                                                         |
| E275  | Soft lockout - Flame sensed out of sequence from code 241 fault. Flame sianal is aone.                                                                                                                             |
| E276  | Soft lockout - Exceeded maximum number of calibration retries.                                                                                                                                                     |
| E290  | Ignitor circuit fault - Failed ignitor or triggering circuitry.                                                                                                                                                    |
| E 291 | Restricted air flow - Cubic feet per minute is lower than what is needed for minimum firing rate.                                                                                                                  |
| E292  | Indoor blower motor unable to start - Seized bearings, stuck wheel, etc.                                                                                                                                           |
| E294  | Combustion air inducer motor amp draw too high.                                                                                                                                                                    |
| E295  | Indoor blower motor temperature is too high.                                                                                                                                                                       |
| E 310 | Discharge error sensor failure - No error if disconnected. Only shown if shorted or out of range.                                                                                                                  |
| E 311 | Heat rate reduced to match indoor blower air flow. Replace filter or repair duct restriction.                                                                                                                      |
| E 312 | Restricted air flow in cooling or continuous fan mode is lower than air flow settings.                                                                                                                             |
| E 313 | Indoor or outdoor unit capacity mis-match.                                                                                                                                                                         |
| E 331 | Global network connection - Communication link problem.                                                                                                                                                            |
| E345  | 0 Relay Failure.                                                                                                                                                                                                   |
| E347  | No 24 Volt output on Y1 to C with non-communicating outdoor unit.                                                                                                                                                  |
| E348  | No 24 Volt output on Y2 to C with non-communicating outdoor unit.                                                                                                                                                  |
| E370  | Interlock Switch Sensed Open                                                                                                                                                                                       |
| E390  | Low GWP Relay Stuck                                                                                                                                                                                                |

**Table 6. Thermostat Selection Switch Settings**

| Operation                            | Thermostat   | Switch 1 | Switch 2 | Switch 3                                                                               |
|--------------------------------------|--------------|----------|----------|----------------------------------------------------------------------------------------|
| Variable Capacity Heat (35% to 100%) | Two Stage    | Off      | On       | Off                                                                                    |
| Three Stage Heat (35%, 70%, 100%)    | Single Stage | On       | Off      | 2nd stage delay OFF = 7 minutes ON = 12 minutes<br>3rd stage delay<br>10 minutes fixed |
| Two Stage Heat (W1 70%, W2 100%)     | Single Stage | Off      | Off      | Off                                                                                    |

**Heating Operation DIP Switch Settings -- Figure 4**

**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. See **Table 6**.

**NOTE:** All DIP switches are factory shipped in the "OFF" position.

**Switch 2 -- Operating Mode with Two-Stage Thermostat** -- If a two-stage thermostat is used, the furnace can operate in either variable-capacity or conventional two-stage mode. When variable-capacity mode is selected, the firing rate of the unit is varied to maximize comfort. Conventional twostage mode is the factory default setting. See **Table 3**.

**Switch 3 -- Second-Stage Heat On Delay** -- If a singlestage thermostat is used, the integrated control can be used to energize second-stage heat after either 7 minutes or 12 minutes of first-stage heat operation. See **Table 3**.

**Switches 4 and 5 -- Blower-Off Delay** -- The blower-on delay of 45 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 4 and 5 on the integrated control. The unit is shipped from the factory with a blower-off delay of 90 seconds. The blower off delay affects comfort and is adjustable to satisfy individual applications. Adjust the blower off delay to achieve a supply air temperature between 90° and 110°F at the exact moment that the blower is de-energized. Longer off delay settings provide lower supply air temperatures; shorter settings provide higher supply air temperatures. **Table 7** provides the blower off timings that will result from different switch settings.

**Table 7. Blower Off Delay Switch Settings**

| Blower Off Delay (Seconds) | Switch 4 | Switch 5 |
|----------------------------|----------|----------|
| 90                         | Off      | On       |
| 120 (Factory)              | Off      | Off      |
| 180                        | On       | Off      |
| 210                        | On       | On       |

**Switches 6 and 7 - Continuous Indoor Fan Operation - Blower Speed** - The unit is shipped from the factory with the DIP switches positioned for medium low (38%) speed during continuous indoor blower operation. Continuous fan setting is 38% of cool setting and is not adjustable.

**Switches 8 and 9 -- Cooling Mode Blower Speed** -- Switches 8 and 9 are used to select cooling blower motor speed. The unit is shipped from the factory with the DIP switches positioned for high speed (4) indoor blower motor operation during the cooling mode. **Table 8** provides the cooling mode blower speeds that will result from different switch settings. Refer to blower tables at the front of this manual for corresponding cfm values.

**Table 8. Cooling Mode Blower Speeds**

| Speed              | Switch 8 | Switch 9 |
|--------------------|----------|----------|
| 1 - Low            | On       | On       |
| 2 - Medium Low     | Off      | On       |
| 3 - Medium High    | On       | Off      |
| 4 - High (Factory) | Off      | Off      |

**Switches 10 and 11 -- Cooling Mode Blower Speed Adjustment** -- Switches 10 and 11 are used to select blower speed adjustment settings. The unit is shipped from the factory with the DIP switches positioned for NORMAL (no) adjustment. The DIP switches may be positioned to adjust the blower speed by +10% or -10% to better suit the application. **Table 6** provides blower speed adjustments that will result from different switch settings. Refer to blower tables at the front of this manual for corresponding cfm values. With switches 10 and 11 set to ON, motor will bypass ramping profiles and all delays and immediately upon a call for cool, run at COOLING speed selected. LED will continue to operate as normal. This mode is used to check motor operation.

**Table 9. Blower Speed Adjustment**

| Adjustment       | Switch 10 | Switch 11 |
|------------------|-----------|-----------|
| +10% (approx.)   | On        | Off       |
| NORMAL (Factory) | Off       | Off       |
| -10% (approx.)   | Off       | On        |
| MOTOR TEST       | On        | On        |

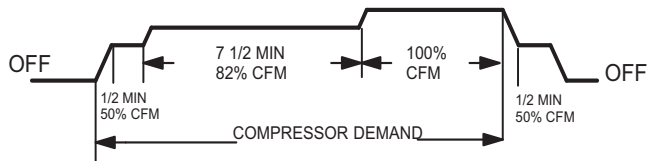
**Switches 12 and 13 -- Cooling Mode Blower Speed Ramping** -- Switches 12 and 13 are used to select cooling mode blower speed ramping options. Blower speed ramping may be used to enhance dehumidification performance. The switches are factory set at option A which has the greatest effect on blower motor performance. **Table 10** provides the cooling mode blower speed ramping options that will result from different switch settings. The cooling mode blower speed ramping options are detailed below.

**Table 10. Cooling Mode Blower Speed Ramping**

| Ramping Option | Switch 12 | Switch 13 |
|----------------|-----------|-----------|
| A (Factory)    | Off       | Off       |
| B              | On        | Off       |
| C              | Off       | On        |
| D              | On        | On        |

#### Ramping Option A (Factory Selection)

- Motor runs at 50% for 30 seconds.
- Motor then runs at 82% for approximately 7-1/2 minutes.
- If demand has not been satisfied after 7-1/2 minutes, motor runs at 100% until demand is satisfied.
- Once demand is met, motor runs at 50% for 30 seconds then ramps down to stop.



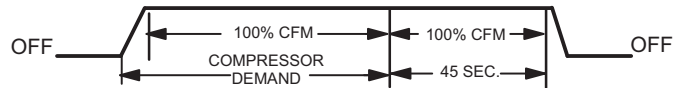
#### Ramping Option B

- Motor runs at 82% for approximately 7-1/2 minutes. If demand has not been satisfied after 7-1/2 minutes, motor runs at 100% until demand is satisfied.
- Once demand is met, motor ramps down to stop.



#### Ramping Option C

- Motor runs at 100% until demand is satisfied.
- Once demand is met, motor runs at 100% for 45 seconds then ramps down to stop.



#### Ramping Option D

- Motor runs at 100% until demand is satisfied.
- Once demand is met, motor ramps down to stop.



#### Switches 14 through 19 -- Heating Mode Blower Speed

-- Switches 14 through 19 are used to select heating mode blower motor speeds. These switches are factory set at the OFF position which provides 100 % of normal speed during **HIGH HEAT** demand, 70% of normal speed during **MIDRANGE HEAT** demand and 40% of normal speed during **LOW HEAT** demand. Switches 14, 15 and 16 are used to adjust the **LOW FIRE** blower motor speed. Switches 17, 18 and 19 are used to adjust the **HIGH FIRE** blower motor speed. **Figure 6** and **Table 11** and **Table 12** provides the heating mode blower speeds that will result from different switch settings. **Figure 6** indicates the effect the DIP switch settings have upon the heating airflow at various furnace firing rates.

Refer to blower tables at the front of this manual for corresponding cfm values.

**Table 11. Low Heat Blower Speeds**

| Thermostat Demand  | Blower Speed Adjustments | DIP Switch Settings |     |     |
|--------------------|--------------------------|---------------------|-----|-----|
|                    |                          | 14                  | 15  | 16  |
| Low Heat (R to W1) | +15%                     | On                  | Off | On  |
|                    | +7.5%                    | On                  | Off | Off |
|                    | Normal                   | Off                 | Off | Off |
|                    | -7.5%                    | On                  | On  | Off |
|                    | -15%                     | On                  | On  | On  |

**Table 12. High Heat Blower Speeds**

| Thermostat Demand        | Blower Speed Adjustments | DIP Switch Settings |     |     |
|--------------------------|--------------------------|---------------------|-----|-----|
|                          |                          | 17                  | 18  | 19  |
| High Heat (R to W1 & W2) | +15%                     | On                  | Off | On  |
|                          | +7.5%                    | On                  | Off | Off |
|                          | Normal                   | Off                 | Off | Off |
|                          | -7.5%                    | On                  | On  | Off |
|                          | -15%                     | On                  | On  | On  |

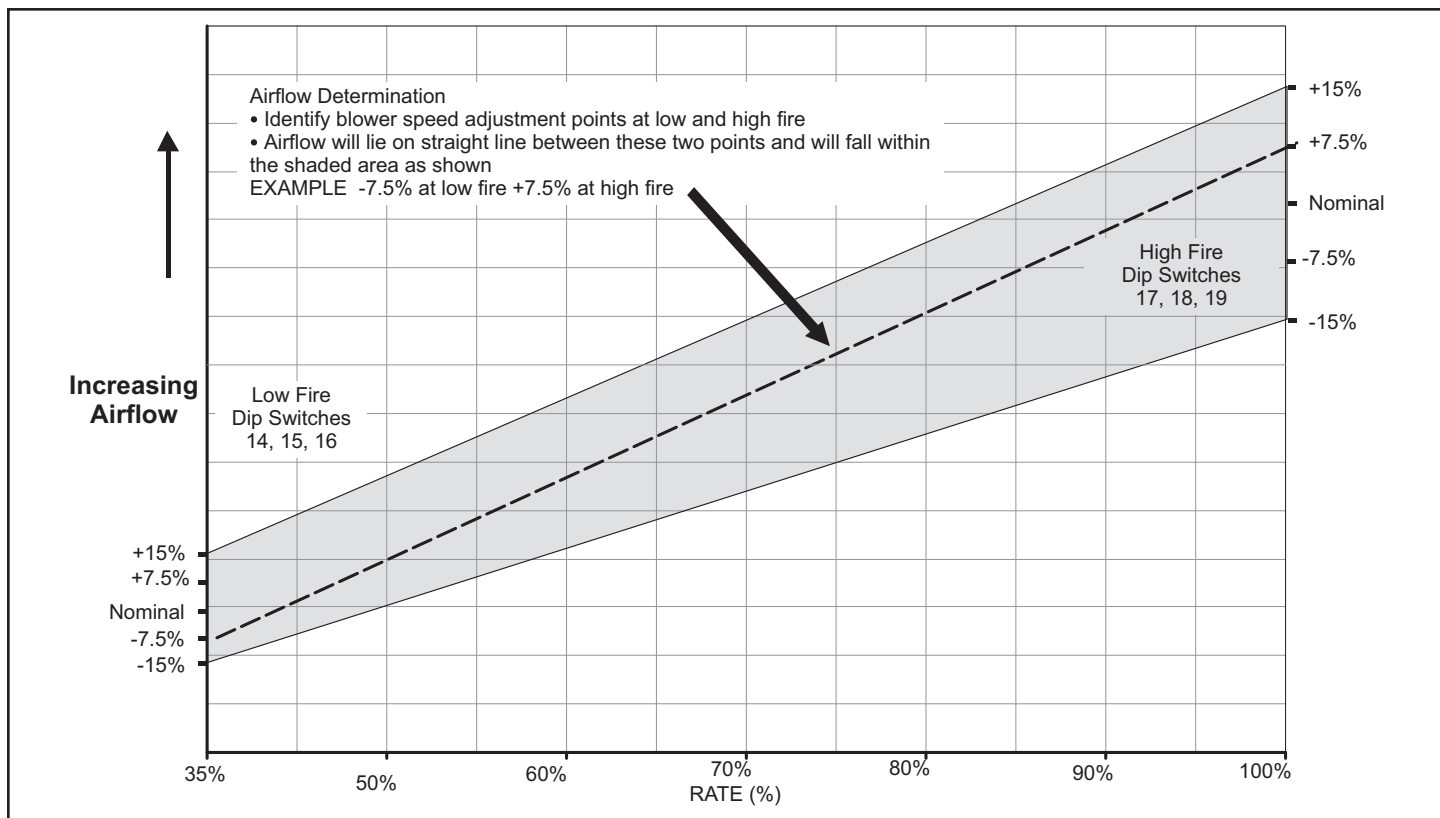


Figure 6.

#### On-Board Link W914 DS to R (Figure 4)

On-board link W914, is a clippable connection between terminals DS and R on the integrated control. W914 must be cut when the furnace is installed with either the zone control or a thermostat which features humidity control. If the link is left intact the PWM signal from the control will be blocked and also lead to control damage. Refer to **Table 17** for operation sequence in applications including NF97D\*\*\*M\*\*R, a thermostat which features humidity control and a single-speed outdoor unit. **Table 18** gives the operation sequence in applications with a two-speed outdoor unit.

#### On-Board Link W951 R to O (Figure 4)

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

#### On-Board Link W915 Y1 to Y2 (Figure 4)

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

#### Diagnostic LED (Figure 4)

The seven-segment diagnostic LED displays operating status, target airflow, error codes and other information. **Table 16** 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 mode and the Field Test 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.

#### Field Test Mode

Use the diagnostic push button to scroll through the menu as described above. Release the button when the LED flashes "-" to select the Field Test mode.

While in the Field Test mode the technician can:

- Initiate furnace ignition and move to and hold low-fire rate by applying a R to W1 jumper.
- Initiate furnace ignition sequence and move to and hold high-fire rate by applying a jumper from R to W1 and W2.

- Initiate furnace ignition sequence and move to and hold mid-fire rate by applying a jumper to R and W2.
- Apply then remove the jumper from R to W1 and W2 to change the firing rate from low fire to mid fire and high fire.
- A vent calibration sequence can be initiated even if a thermostat signal is not present. Press and hold the push button until a solid "C" is displayed. Release the button and calibration will begin. The furnace will perform the high-fire and low-fire pressure switch calibrations and display "CAL". After calibration, the LED will return to the flashing "-" display.

During Field Test mode operation, all safety switches are still in the circuit (they are not by-passed) and indoor blower performance and timings will match DIP switch selections. Current furnace firing rate, indoor blower CFM and flame signal will be displayed. To exit the Field Test mode, press and hold the button. The menu will resume from the beginning. Also, cycle the main power to exit the Field Test mode. The integrated control will automatically exit the Field Test mode after 45 minutes of operation.

**Table 13. Idle Menu Options**

These options are displayed on the menu when the button is pressed during normal operation

| Display                                                                                                               | Action (when button is released) |
|-----------------------------------------------------------------------------------------------------------------------|----------------------------------|
| No change (idle)                                                                                                      | Remain in idle mode              |
| Solid "E"                                                                                                             | Enter diagnostic mode            |
| Solid "-"                                                                                                             | Enter field test mode            |
| NOTE - No change implies the display will continue to show whatever is currently being displayed for normal operation |                                  |

These options are displayed when the button is used in Field Test Mode.

**Table 14. Field Test Menu Options**

| Display                  | Action (when button is released)  |
|--------------------------|-----------------------------------|
| No change (blinking "-") | Remain in field test mode         |
| Solid "-"                | Exit field test mode              |
| Solid "c"                | Start pressure switch calibration |

These options are displayed when the button is used in diagnostic recall mode

**Table 15. Diagnostic Recall Menu Options**

| Display                                                                                                                                                                                                                                                                                                                 | Action (when button is released) |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| No change (displaying error history)                                                                                                                                                                                                                                                                                    | Remain in diagnostic recall mode |
| Solid (3 horizontal bars)                                                                                                                                                                                                                                                                                               | Exit diagnostic recall mode      |
| Solid "c"                                                                                                                                                                                                                                                                                                               | Clear error history              |
| Once the button is released to clear the error history a blinking "c" will be shown on the display for up to 10 seconds. During this time the user must press and release the button one additional time to confirm the action of deleting the error history. Once the error history is deleted it cannot be recovered. |                                  |

## Configuring Unit Size Codes

Power-Up - Number displayed by integrated control represents unit size code (furnace model and capacity). If three horizontal bars are displayed followed by continuous E203, furnace control does not recognize unit size code. Configure per the following:



Turn room thermostat to OFF.

Furnace control  
in IDLE mode (No  
heating, cooling, or  
indoor fan operation)

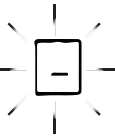
Yes

No

To enter **Field Test** mode: Push and hold button next to 7-segment LED display until **solid dash** symbol appears. Release button.



If alarm is present, furnace control will display error code. If alarm is not present, solid dash starts blinking on 7-segment LED display.

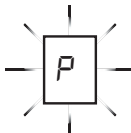


To enter **Program Unit Capacity/Size** mode: Push and hold button next to 7-segment LED display until solid "P" symbol appears. Release button.



**IMPORTANT:** Field replacement controls may need to be manually configured to validate furnace unit size code.

Solid P starts blinking on 7-segment LED.



Push and hold button. Integrated control will display unit size code number for each furnace model for three seconds.

| UNIT SIZE CODE | FURNACE MODEL |
|----------------|---------------|
| 7              | NF97D070M3BR  |
| 9              | NF97D090M4CR  |
| 11             | NF97D110M5CR  |

When the correct unit size code is displayed, release button. Selected code will flash for 10-second period. During that period, press and hold button for 5 seconds. Integrated control will store code in memory and will automatically exit **Field Test** mode and reset. (If second period expires or button is held less than 5 seconds, control will automatically exit **Field Test** mode and go into **Idle** mode without storing unit size code. If this happens, programming function must be repeated.)

Verify that the selected unit size code is correct and stored in non-volatile memory by cycling the 24 volt power to the furnace control. (At 24 volt power-up of the furnace control, the 7-segment LED will display a unit size code. If three horizontal bars display, the board does not recognize the unit size code. The programming function must be repeated.)

FINISHED

**Table 16. Integrated Diagnostic Codes/Status of Equipment**

| Code | Diagnostic Codes / Status of Equipment                                                                                                             | Action Required to Clear and Recover                                                                                                                                                                                                                                                                                                                                                          |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | Idle mode (Decimal blinks at 1 Hertz - 0.5 seconds ON, 0.5 seconds OFF).                                                                           |                                                                                                                                                                                                                                                                                                                                                                                               |
| A    | Cubic feet per minute (cfm) setting for indoor blower (1 second ON, 0.5 seconds OFF) / cfm setting for current mode displayed.                     |                                                                                                                                                                                                                                                                                                                                                                                               |
| C    | Cooling stage (1 second ON, 0.5 seconds OFF) / 1 or 2 displayed / Pause / cfm setting displayed / Pause / Repeat codes.                            |                                                                                                                                                                                                                                                                                                                                                                                               |
| d    | Dehumidification mode (1 second ON, 1 second OFF) / cfm setting displayed / Pause / Repeat codes.                                                  |                                                                                                                                                                                                                                                                                                                                                                                               |
| h    | Heat pump stage (1 second ON, 0.5 seconds OFF) / % of input rate displayed / Pause / cfm setting / Pause / Repeat codes.                           |                                                                                                                                                                                                                                                                                                                                                                                               |
| H    | Gas Heat stage (1 second ON, 0.5 seconds OFF) / 1 or 2 displayed / Pause / cfm setting displayed / Pause / Repeat codes. Blinking during ignition. |                                                                                                                                                                                                                                                                                                                                                                                               |
| dF   | Defrost mode.                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                               |
| U    | Discharge Air Temperature                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                               |
| E105 | Device communication problem - No other devices on RS BUS (Communication system)                                                                   | Equipment is unable to communicate. Indicates numerous message errors. In most cases, errors are related to electrical noise. Make sure high voltage power is separated from RSBus. Check for mis-wired and/or loose connections between the stat, indoor unit, and outdoor unit. Check for a high voltage source of noise close to the system. Fault clears after communication is restored. |
| 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 | Earth 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 high (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.                                                                                                                                                                                                                                                     |
| E118 | Reset limit exceeded (Hard-Lockout).                                                                                                               | The unit entered and manually exited a soft lockout state six times within a 15-minute interval. Perform a power cycle to clear the fault condition and restore normal operation.                                                                                                                                                                                                             |
| E120 | Unresponsive device (Communicating systems only).                                                                                                  | Usually caused by delay in outdoor unit responding to indoor unit polling. Recycle power. Check all wiring connections. Cleared after unresponsive device responds to any inquiry.                                                                                                                                                                                                            |

| Code | Diagnostic Codes / Status of Equipment                                                                                                                                                                 | Action Required to Clear and Recover                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E124 | Active communicating thermostat signal missing for more than 3 minutes (Communicating systems only).                                                                                                   | Equipment lost communication with the thermostat. Check four wiring connections, ohm wires, and cycle power at the thermostat. Alert stops all services and waits for heartbeat message from thermostat (subnet controller). Cleared after valid thermostat (subnet) message is received.                                                                                                                                                                                                                                                                                                                                                     |
| 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. Cleared 300 seconds after fault recovered.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| E126 | Control internal communication problem.                                                                                                                                                                | Hardware problem on the control. Cycle power on control. Replace if problem prevents service and is persistent. Cleared 300 seconds after fault recovered.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| E131 | Corrupted control parameters (Verify configuration of system) (Communicating systems only).                                                                                                            | Reconfigure the system. Replace control if heating or cooling is not available. Only applicable in the communicating mode not in startup. Exit from Commissioning and Execute Se+ factory Default mode. Control will still operate on default parameter settings.                                                                                                                                                                                                                                                                                                                                                                             |
| 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 operation. Additionally, it may indicate that proper refrigerant charge will need to be verified. The 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 #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 #1 Communication lost or invalid sensor dip switch configuration ((Disable/ Enable)                                                                                          | "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 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 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. See installation instructions." |
| E155 | Refrigerant Leak Detector #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 connector for damage or improper connectivity. Check the sensor for damage or obstruction on the harness plug. This fault clears when communications with the sensor has been reestablished, but blower latches for a minimum of 5 minutes. Retest of the presence of fault can be effected by pressing the LOW GWP test button on the furnace unit control board.                                                                                             |
| E160 | Refrigerant Leak Detector Sensor #1 type incorrect                                                                                                                                                     | The sensor #1 is of a type not suitable for use in the application. Replace the sensor with a GE Appliances approved replacement part. This fault clears when a sensor suitable for the application is detected by the furnace control board, but blower will latch for a minimum of 5 minutes. Retest of the presence of the fault can be effected by pressing the LOW GWP test button on the furnace unit control board.                                                                                                                                                                                                                    |

| Code | Diagnostic Codes / Status of Equipment                                                                     | Action Required to Clear and Recover                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E161 | Refrigerant Leak Detector Sensor #2 type incor-rect                                                        | The sensor #2 is of a type not suitable for use in the application. Replace the sensor with a GE Appliances approved replacement part. This fault clears when a sensor suitable for the application is detected by the furnace control board, but blower will latch for a minimum of 5 minutes. Retest of the pres-ence 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 but-ton. Normal operations resumes and codes clear automatically after 1-min-ute.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| E180 | Outdoor air temperature sensor failure. Only shown if shorted or out of range (Communicating systems only) | "Compare outdoor sensor resistance to temperature resistance charts in unit installation instructions. Replace sensor pack if necessary. At beginning of (any) configuration, furnace or air handler control will sense outdoor air and discharge air temperature sensor(s) If detected (reading in range), appropriate feature will be set as installed and that could be seen in 'About ' screen. In normal operation after control recognizes sensors, alarm will be sent if valid temperature reading is lost. To get rid of setting and alarm, redo configuration and make sure that temperature sensor is marked as not installed in indoor Unit 'About' screen. When indoor unit control is replaced thermostat will 'tell' new control if temperature sensor is in system or not. Clears 30 seconds after fault recovered." |
| E200 | Hard Lock out - Rollout circuit open or previously open                                                    | Correct cause of rollout trip or replace flame rollout switch. Test furnace operation. Cleared after fault recovered.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| E201 | Indoor blower/communication failure - Unable to communicate with blower motor                              | Indoor blower communication failure including power outage. Lost communication with indoor blower motor. Possible causes: motor not powered, loose wiring. Problem may be on control or motor side. Cleared after fault recovered.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| E202 | Indoor blower motor mismatch - indoor motor horsepower does not match unit capacity                        | Incorrect appliance capacity code selected. Check for proper configuring under Unit Size Code for Furnace/Air Handler on configuration guide or in installation instructions. Cleared after the correct match is detected following a reset. (Remove thermostat from system while applying power and reprogramming)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| E203 | Appliance capacity size is NOT programmed. Invalid unit codes. Refer to configuration flow chart.          | No appliance capacity code selected. Check for proper configuring under Unit Size Codes for Furnace on configuration guide or in installation instruction. Critical Alert Cleared after valid unit code is read following a reset (remove thermostat from system while applying power and reprogramming)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| E207 | Hot surface igniter sensed open - Refer to troubleshooting                                                 | Measure resistance of hot surface igniter. Replace if open or not within specified range found in installation/operation manual. Resumes normal operation after fault is cleared.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| E223 | Low pressure switch failed open                                                                            | Check pressure(inches W.C) of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

| Code | Diagnostic Codes / Status of Equipment                                                                                                                 | Action Required to Clear and Recover                                                                                                                                                                                                                                                                          |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E224 | Low pressure switch failed closed -Refer to troubleshooting                                                                                            | Check pressure(inches W.C) of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.                                                             |
| E225 | High pressure switch failed open -Refer to troubleshooting                                                                                             | 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 -Refer to troubleshooting                                                                                           | Check operation of high pressure 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. Refer to troubleshooting                                                               | Check operation 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.                                                                        |
| E228 | Combustion air inducer calibration failure                                                                                                             | Unable to perform pressure switch calibration. Check vent system and pressure switch wiring connections. Resumes normal operation after fault is cleared                                                                                                                                                      |
| E240 | Low flame current - Run mode- Refer to troubleshooting                                                                                                 | 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 all 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 - Refer to troubleshooting.                                                                                                  | 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.                                                                       |
| E252 | Discharge air temperature too high (gas heat only).                                                                                                    | Check temperature rise airflow and input rate. Clear when heat call is finished.                                                                                                                                                                                                                              |
| E270 | Soft lockout - Exceeded maximum number of retries. No flame current sensed.                                                                            | Check for proper gas flow. Ensure that igniter is lighting burners. 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 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. 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. Alert clears after current heat call has been completed.                                                                     |
| 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.                                                                                                                                                                                                        |
| E276 | Soft lockout calibration failure.                                                                                                                      | Unable to perform pressure switch calibration. Check vent system and pressure switch wiring connections. 1-hour soft lockout. Clears when calibration has finished successfully.                                                                                                                              |
| E290 | Ignitor circuit fault - Failed ignitor or triggering circuitry.                                                                                        | Measure resistance of hot surface igniter. Replace if open or not within specifications. 1-hour soft lockout. Clears when flame has been proven stable.                                                                                                                                                       |

| Code | Diagnostic Codes / Status of Equipment                                             | Action Required to Clear and Recover                                                                                                                                                                                                                                                                                                                                                                                                       |
|------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E291 | Heat airflow restricted below the minimum.                                         | Check for dirty filter and airflow restriction. Check blower performance. 1-hour soft lockout. Cleared when heat call finishes successfully.                                                                                                                                                                                                                                                                                               |
| E292 | Indoor blower motor unable to start due to obstructed wheel seized bearings.       | Indoor blower motor unable to start (seized bearing, stuck wheel, etc.) Replace motor or wheel if assembly does not operate or meet performance standards. 1-hour soft lockout. Clears after circulator successfully starts.                                                                                                                                                                                                               |
| E294 | Combustion air inducer over current.                                               | Check combustion blower bearings wiring and amps. Replace if does not operate or does not meet performance standards. Clears after inducer current is sensed to be in-range after the ignition following the soft lockout or reset.                                                                                                                                                                                                        |
| E295 | Indoor blower motor temperature is too high.                                       | Indoor blower motor over temperature (motor tripped on internal protector). Check motor bearings and amps. Replace if necessary. Cleared after blower demand is satisfied.                                                                                                                                                                                                                                                                 |
| E310 | Discharge error temperature sensor failure. Only shown if shorted or out of range. | Compare discharge sensor resistance to temperature resistance charts in installation instructions. Replace sensor if necessary. Cleared after the current heat call is completed.                                                                                                                                                                                                                                                          |
| E311 | Heat rate reduced to match indoor blower airflow.                                  | Warning Only. Furnace blower in cutback mode due to restricted airflow. Reduce firing rate every 60 seconds to match available CFM. Check filter and duct system. To clear replace filter if needed or repair/add duct. 2-stage controls will reduce firing rate to 1-stage. Clears when heat call finished successfully.                                                                                                                  |
| E312 | Restricted airflow in cooling or continuous fan mode is lower than CFM setting.    | Warning Only. Restricted airflow - Indoor blower is running at a reduced CFM (Cutback Mode - The variable speed motor has pre-set speed and torque limiters to protect the motor from damage caused by operating outside of design parameters (0 to 0.8" W.C. total external static pressure). Check filter and duct system. To clear, replace filter if needed or repair/add duct. Cleared after the current service demand is satisfied. |
| E313 | Indoor or outdoor unit capacity mismatch. Communication only.                      | "Incorrect indoor/outdoor capacity code selected. Check for proper configuring in installation instructions. Alarm is just a warning. The system will operate, but might not meet efficiency and capacity parameters. Alarm will clear when commissioning is complete."                                                                                                                                                                    |
| E331 | Global network connection - Communications link problem.                           | For Future Use.                                                                                                                                                                                                                                                                                                                                                                                                                            |
| E345 | O Relay failure                                                                    | Replace integrated control.                                                                                                                                                                                                                                                                                                                                                                                                                |
| E347 | No 24 Volt output on Y1 of "integrated control" with outdoor unit.                 | Operation stopped. Y1 relay/Stage 1 failed. (Pilot relay contacts did not close or the relay coil did not energize; no input back to IFC chip.) Critical Alert. Cleared after reset and Y1 input sensed.                                                                                                                                                                                                                                   |
| E348 | No 24 Volt output on Y2 of "integrated control" with outdoor unit.                 | Y2 relay/Stage 2 failed. (Pilot relay contacts did not close or the relay coil did not energize; no input back to IFC chip.) Critical Alert. Cleared after reset and Y1 input sensed.                                                                                                                                                                                                                                                      |
| E370 | Interlock switch sensed open for 2 minutes.                                        | Control sees the loss of 24VAC for 2 minutes. Terminate all services and wait for interlock switch to close. The alarm will clear when 24VAC is continuously sensed on DS terminal for a minimum of 10 seconds or on a power reset.                                                                                                                                                                                                        |
| 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 control board. This fault clears when the relay operates normally.                                                                                                                                                                                                                                                   |

**Table 17. Cooling Operating Sequence  
NF97D\*\*\*M\*\*R and Single Stage Outdoor Unit**

| Operating Sequence                                              |                                                                                                                                                                                                                                                                            | System Demand     |    |    |                   |        | System Response |                   |                                                                                                                                                                                             |
|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----|----|-------------------|--------|-----------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| System Condition                                                | Step                                                                                                                                                                                                                                                                       | Thermostat Demand |    |    | Relative Humidity |        | Compressor      | Blower CFM (COOL) | Comments                                                                                                                                                                                    |
|                                                                 |                                                                                                                                                                                                                                                                            | 1st Stage         | O  | G  | Status            | D      |                 |                   |                                                                                                                                                                                             |
| NO CALL FOR DEHUMIDIFICATION                                    |                                                                                                                                                                                                                                                                            |                   |    |    |                   |        |                 |                   |                                                                                                                                                                                             |
| Normal Operation                                                | 1                                                                                                                                                                                                                                                                          | On                | On | On | Acceptable        | 24 VAC | High            | 100%              | Compressor and indoor blower follow thermostat demand                                                                                                                                       |
| BASIC MODE (only active on a Y1 thermostat demand)              |                                                                                                                                                                                                                                                                            |                   |    |    |                   |        |                 |                   |                                                                                                                                                                                             |
| Normal Operation                                                | 1                                                                                                                                                                                                                                                                          | On                | On | On | Acceptable        | 24 VAC | High            | 100%              | Thermostat energizes Y1 and de-energizes D on a call for de-humidification                                                                                                                  |
| Dehumidification Call                                           | 2                                                                                                                                                                                                                                                                          | On                | On | On | Demand            | 0 VAC  | High            | 70%               |                                                                                                                                                                                             |
| PRECISION MODE (operates independent of a Y1 thermostat demand) |                                                                                                                                                                                                                                                                            |                   |    |    |                   |        |                 |                   |                                                                                                                                                                                             |
| Normal Operation                                                | 1                                                                                                                                                                                                                                                                          | On                | On | On | Acceptable        | 24 VAC | High            | 100%              | Dehumidification mode begins when humidity is greater than set point. Maximum overcool from cooling setpoint is 2°F.                                                                        |
| Dehumidification Call                                           | 2                                                                                                                                                                                                                                                                          | On                | On | On | Demand            | 0 VAC  | High            | 70%               |                                                                                                                                                                                             |
| Dehumidification Call ONLY                                      | 1                                                                                                                                                                                                                                                                          | On                | On | On | Demand            | 0 VAC  | High            | 70%               | Thermostat will keep outdoor unit energized after cooling temperature setpoint has been reached in order to maintain room humidity setpoint. Maximum overcool from cooling setpoint is 2°F. |
|                                                                 | <ul style="list-style-type: none"><li>On-board links at indoor unit with a single stage outdoor unit</li><li>With Condensing unit - Cut W914 (R to OS) on integrated control</li><li>With Heat Pump - Cut W914 (R to DS) and W951 (R to O) on integrated control</li></ul> |                   |    |    |                   |        |                 |                   |                                                                                                                                                                                             |

**Table 18. Cooling Operating Sequence  
NF97D\*\*\*M\*\*R and Two Stage Outdoor Unit**

| Operating Sequence                                              |                                                                                                                                                                                                                                                                                                                                                             | System Demand     |           |    |    |                   |        | System Response |                   |                                                                                                                                                                                             |
|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------|----|----|-------------------|--------|-----------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| System Condition                                                | Step                                                                                                                                                                                                                                                                                                                                                        | Thermostat Demand |           |    |    | Relative Humidity |        | Compressor      | Blower CFM (COOL) | Comments                                                                                                                                                                                    |
|                                                                 |                                                                                                                                                                                                                                                                                                                                                             | 1st Stage         | 2nd Stage | O  | G  | Status            | D      |                 |                   |                                                                                                                                                                                             |
| NO CALL FOR DEHUMIDIFICATION                                    |                                                                                                                                                                                                                                                                                                                                                             |                   |           |    |    |                   |        |                 |                   |                                                                                                                                                                                             |
| Normal Operation - Y1                                           | 1                                                                                                                                                                                                                                                                                                                                                           | On                |           | On | On | Acceptable        | 24 VAC | Low             | 70%               | Compressor and indoor blower follow thermostat demand                                                                                                                                       |
| Normal Operation - Y2                                           | 2                                                                                                                                                                                                                                                                                                                                                           | On                | On        | On | On | Acceptable        | 24 VAC | High            | 100%              |                                                                                                                                                                                             |
| ROOM THERMOSTAT CALLS FOR FIRST STAGE COOLING                   |                                                                                                                                                                                                                                                                                                                                                             |                   |           |    |    |                   |        |                 |                   |                                                                                                                                                                                             |
| BASIC MODE (only active on a Y1 thermostat demand)              |                                                                                                                                                                                                                                                                                                                                                             |                   |           |    |    |                   |        |                 |                   |                                                                                                                                                                                             |
| Normal Operation                                                | 1                                                                                                                                                                                                                                                                                                                                                           | On                |           | On | On | Acceptable        | 24 VAC | Low             | 70%               | Thermostat energizes 2nd Stage and de-energizes D on a call for de-humidification                                                                                                           |
| Dehumidification Call                                           | 2                                                                                                                                                                                                                                                                                                                                                           | On                | On        | On | On | Demand            | 0 VAC  | High            | 70%               |                                                                                                                                                                                             |
| PRECISION MODE (operates independent of a Y1 thermostat demand) |                                                                                                                                                                                                                                                                                                                                                             |                   |           |    |    |                   |        |                 |                   |                                                                                                                                                                                             |
| Normal Operation                                                | 1                                                                                                                                                                                                                                                                                                                                                           | On                |           | On | On | Acceptable        | 24 VAC | Low             | 70%               | Dehumidification mode begins when humidity is greater than set point. Maximum overcool from cooling setpoint is 2°F.                                                                        |
| Dehumidification Call                                           | 2                                                                                                                                                                                                                                                                                                                                                           | On                | On        | On | On | Demand            | 0 VAC  | High            | 70%               |                                                                                                                                                                                             |
| Dehumidification Call ONLY                                      | 1                                                                                                                                                                                                                                                                                                                                                           | On                | On        | On | On | Demand            | 0 VAC  | High            | 70%               | Thermostat will keep outdoor unit energized after cooling temperature setpoint has been reached in order to maintain room humidity setpoint. Maximum overcool from cooling setpoint is 2°F. |
| ROOM THERMOSTAT CALLS FOR FIRST AND SECOND STAGE COOLING        |                                                                                                                                                                                                                                                                                                                                                             |                   |           |    |    |                   |        |                 |                   |                                                                                                                                                                                             |
| BASIC MODE (only active on a Y1 thermostat demand)              |                                                                                                                                                                                                                                                                                                                                                             |                   |           |    |    |                   |        |                 |                   |                                                                                                                                                                                             |
| Normal Operation                                                | 1                                                                                                                                                                                                                                                                                                                                                           | On                | On        | On | On | Acceptable        | 24 VAC | High            | 100%              | Thermostat energizes 2nd Stage and de-energizes D on a call for de-humidification                                                                                                           |
| Dehumidification Call                                           | 2                                                                                                                                                                                                                                                                                                                                                           | On                | On        | On | On | Demand            | 0 VAC  | High            | 70%               |                                                                                                                                                                                             |
| PRECISION MODE (operates independent of a Y1 thermostat demand) |                                                                                                                                                                                                                                                                                                                                                             |                   |           |    |    |                   |        |                 |                   |                                                                                                                                                                                             |
| Normal Operation                                                | 1                                                                                                                                                                                                                                                                                                                                                           | On                |           | On | On | Acceptable        | 24 VAC | Low             | 70%*\             | Dehumidification mode begins when humidity is greater than set point. Maximum overcool from cooling setpoint is 2°F.                                                                        |
| Dehumidification Call                                           | 2                                                                                                                                                                                                                                                                                                                                                           | On                | On        | On | On | Demand            | 0 VAC  | High            | 70%               |                                                                                                                                                                                             |
| Dehumidification Call ONLY                                      | 1                                                                                                                                                                                                                                                                                                                                                           | On                | On        | On | On | Demand            | 0 VAC  | High            | 70%               | Thermostat will keep outdoor unit energized after cooling temperature setpoint has been reached in order to maintain room humidity setpoint. Maximum overcool from cooling setpoint is 2°F. |
|                                                                 | <ul style="list-style-type: none"><li>On-board links at indoor unit with a two stage outdoor unit</li><li>Cut factory link from Y1 to Y2 or cut W915 (Y1 to Y2) on integrated control</li><li>With Condensing unit - Cut W914 (R to OS) on integrated control</li><li>With Heat Pump - Cut W914 (R to DS) and W951 (R to O) on integrated control</li></ul> |                   |           |    |    |                   |        |                 |                   |                                                                                                                                                                                             |

## Indoor Blower Motor

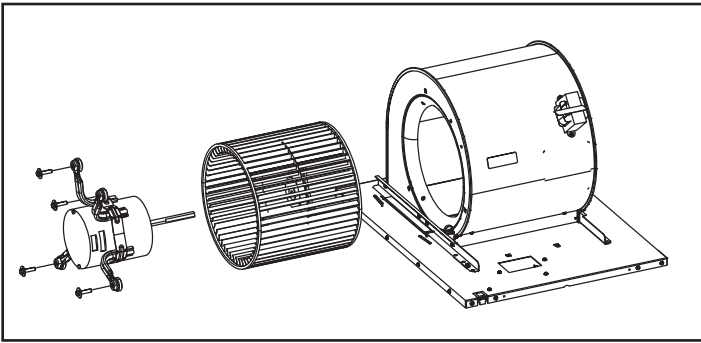


Figure 7.

### WARNING

During blower operation, the ECM motor emits energy that may interfere with pacemaker operation. Interference is reduced by both the sheet metal cabinet and distance.

The NF97D\*\*\*M\*\*R line uses three different motor sizes; 1/2 hp, 3/4 hp and 1hp. The motor communicates with the integrated control via a 2-way serial connection. The motor receives all necessary functional parameters from the integrated control and does not rely on a factory program like traditional variable speed motors. NF97D\*\*\*M\*\*R units use a three-phase, electronically controlled D.C. brushless motor (controller converts single phase a.c. to three phase D.C.), with a permanent magnet-type rotor (Figure 8). Because this motor has a permanent magnet rotor it does not need brushes like conventional D.C. motors.

Internal components are shown in **Figure 8**. The stator windings are split into three poles which are electrically connected to the controller. This arrangement allows motor windings to turn on and off in sequence by the controller.

### IMPORTANT

Earlier ECM motors used on other GE Appliances furnace models are not interchangeable with motors used on the NF97D\*\*\*M\*\*R furnace line.

A solid-state controller is permanently attached to the motor. The controller is primarily an A.C. to D.C. converter. Converted D.C. power is used to drive the motor. The controller contains a microprocessor which monitors varying conditions inside the motor (such as motor workload).

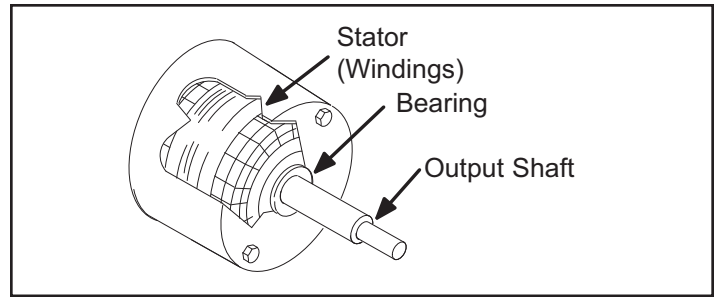


Figure 8. Blower Motor Components

The controller uses sensing devices to sense what position the rotor is in at any given time. By sensing the position of the rotor and then switching the motor windings on and off in sequence, the rotor shaft turns the blower.

All NF97D\*\*\*M\*\*R blower motors use single phase power. An external run capacitor is not used. The motor uses permanently lubricated ball-type bearings.

### Internal Operation

The motor is controlled via serial communication between the integrated control on the furnace and the controller attached to the motor shell. The messages sent back and forth between the two controls serve to communicate rotational direction, demand, motor size, current draw, torque, and rpm, among other variables.

Motor rpm is continually adjusted internally to maintain constant static pressure against the blower wheel. The controller monitors the static work load on the motor and motor amp-draw to determine the amount of rpm adjustment. Blower rpm may be adjusted any amount in order to maintain a constant cfm as shown in Blower Ratings Tables. The cfm remains relatively stable over a broad range of static pressure. Since the blower constantly adjusts rpm to maintain a specified cfm, motor rpm is not rated. Hence, the terms “cool speed”, “heat speed” or “speed tap” in this manual, on the unit wiring diagram and on blower B3, refer to blower cfm regardless of motor rpm.

### Initial Power Up

When line voltage is applied to B3, there will be a large inrush of power lasting less than 1/4 second. This inrush charges a bank of DC filter capacitors inside the controller. If the disconnect switch is bounced when the disconnect is closed, the disconnect contacts may become welded. Try not to bounce the disconnect switch when applying power to the unit.

### Motor Start-Up

When B3 begins start-up, the motor gently vibrates back and forth for a moment. This is normal. During this time the electronic controller is determining the exact position of the rotor. Once the motor begins turning, the controller slowly eases the motor up to speed (this is called “soft-start”). The motor may take as long as 10-15 seconds to reach full speed. If the motor does not reach 200 rpm within 13 seconds, the motor shuts down. Then the motor will immediately attempt

a restart. The shutdown feature provides protection in case of a frozen bearing or blocked blower wheel. The motor may attempt to start eight times. If the motor does not start after the eighth try, the controller locks out. Reset controller by momentarily turning off power to unit.

The DC filter capacitors inside the controller are connected electrically to the motor supply wires. The capacitors take approximately 5 minutes to discharge when the disconnect is opened. For this reason it is necessary to wait at least 5 minutes after turning off power to the unit before attempting to service motor.



**⚠ DANGER**

Disconnect power from unit and wait at least five minutes to allow capacitors to discharge before attempting to service motor. Failure to wait may cause personal injury or death.

Power Choke (L13)

A choke coil is used on 4 and 5 ton units equipped with 1 hp motors. The choke is located on the blower housing and is used to suppress transient current spikes.

Remove Blower from Unit

1. Remove unit access panels, control box, bolts and wiring jackplugs.
2. Slide blower out front of unit.

Troubleshooting Motor Operation

To verify motor operation see steps below and Figure 9 and Figure 10.

1. Remove J48 (5 pin power plug) from P48 on the motor.
2. With the power on at the furnace and door switch depressed, use a test meter to verify 120V between pins 4 and 5 on J48.
3. Reconnect J48 to P48 on the motor.
4. Remove J49 (4 pin low voltage connector) from P49 on the motor.
5. Using test jumpers, apply 24V to pins 3 and 4 on P49 on the motor.  
**NOTE:** Do not apply 24V to pins 2 and 4 on P49. Doing so will cause permanent damage to the motor.
6. Motor should run at 75%.
7. Test is complete. Remove jumpers and reconnect plugs.

Another option is to use the TECMate PRO motor tester with the 16 to 4 pin adaptor. The use of the TECMate PRO isolates the motor from the integrated control. Follow the instructions provided with the kit. If the motor runs, do not replace.

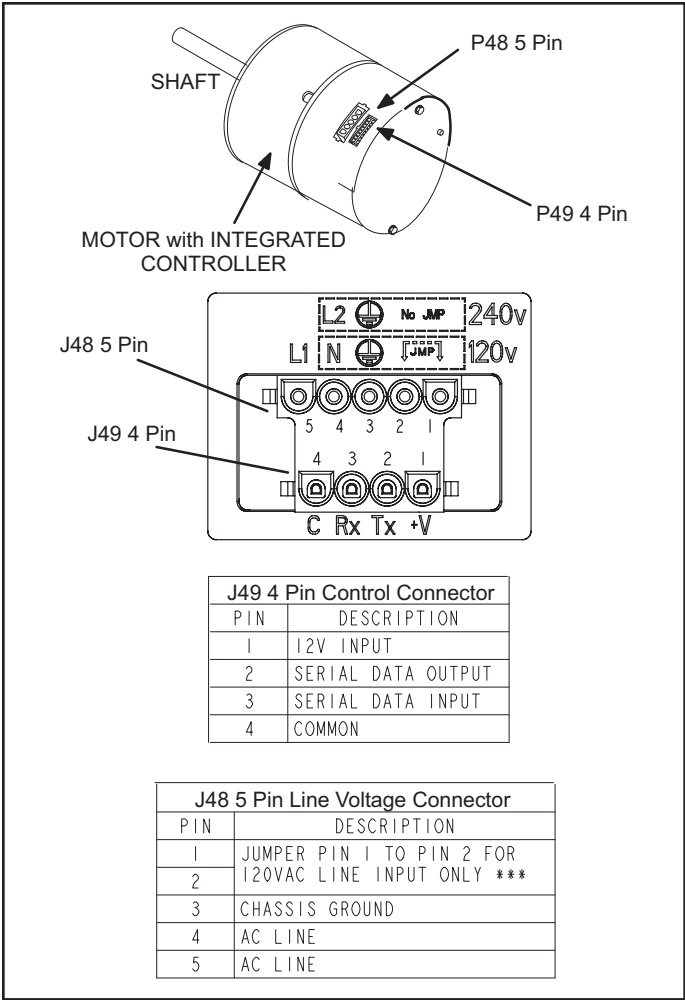


Figure 9. Blower B3 Harness Connectors

**Troubleshooting Motor Windings**  
Ensure that motor windings are not damaged by performing the following tests:

**NOTE:** If your ohm meter is not an auto-ranging type, set it to the highest ohm scale (100k ohms or greater) before performing tests.

Table 19. Ohm Meter Range

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

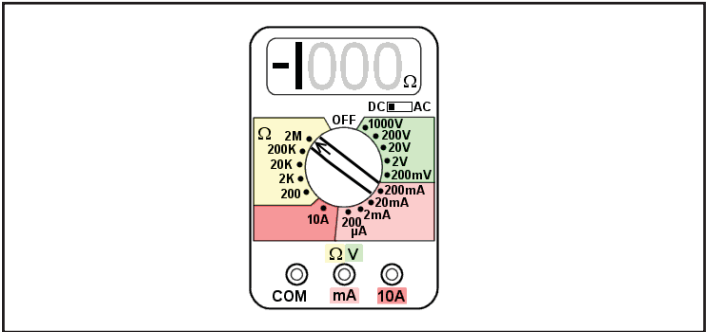


Figure 11.

**TEST A**

Measure the resistance between each of the three motor leads (3-pin plug) and the unpainted part of the end shield.

If the winding resistance to ground is <100k ohms, replace the motor and control module. If the resistance to ground is >100k, the motor windings are fine. Proceed to Test B.



Figure 12. Test A

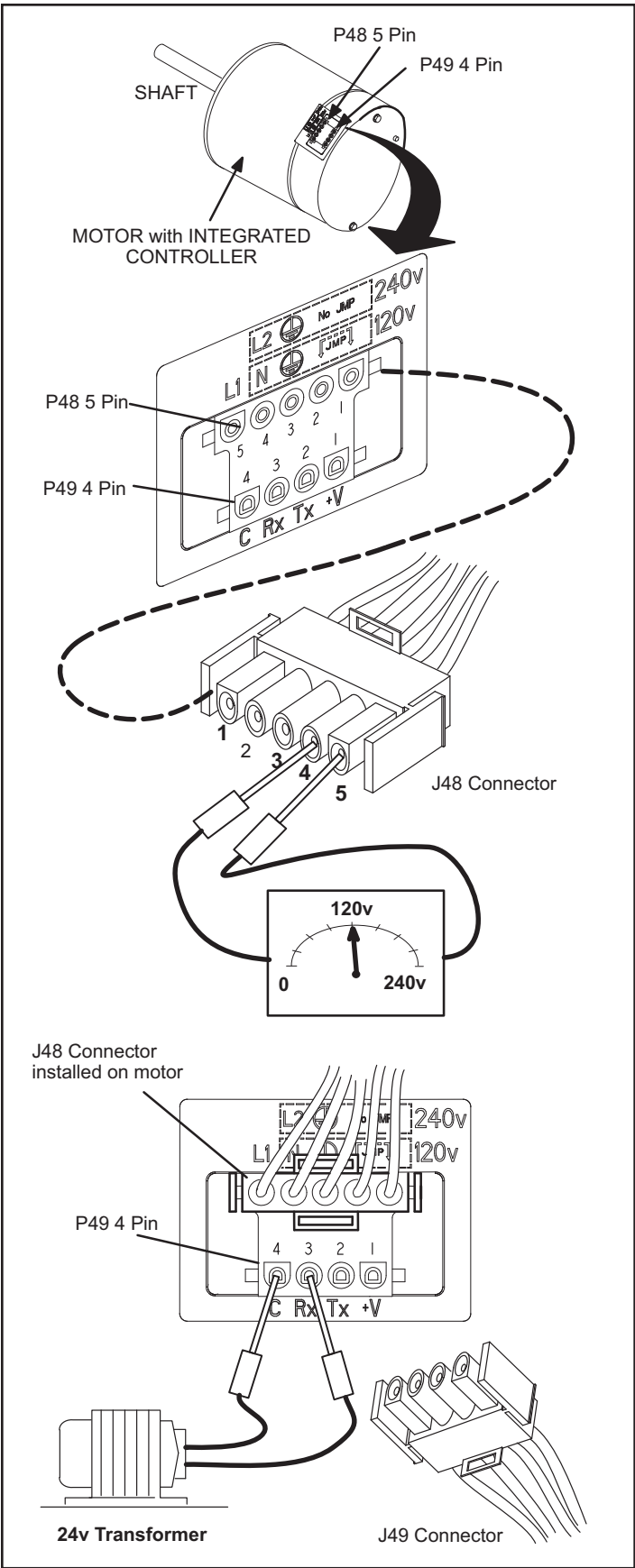


Figure 10. Blower B3 Harness Connectors

## TEST B

Use an ohmmeter to measure the motor phase-to-phase resistance by checking these combinations of the the 3-pin motor plug. For the purpose of this test, start at either end of the connector as lead 1.

1. The lead-to-lead resistance across any two leads should be less than 20 ohms.
2. Each lead-to-lead resistance should be the same.

If the measured resistance is greater than 20 ohms, replace the motor and control module.



Figure 13. Test B

## Heating Components

### Ignitor

The ignitor is made of durable silicon nitride. Ignitor longevity is enhanced by controlling voltage to the ignitor. The integrated control provides 120 volts to the ignitor for a consistent ignition. Due to this feature of the control, voltage measured with a digital meter will be slightly lower. To measure correct voltage use a true RMS meter or ignitor can be ohmed. Ohm value should be 39 to 70.

### Flame Sensor

A flame sensor (Figure 14) is located on the left side of the burner support. The sensor is mounted on the flame rollout plate and the tip protrudes into the flame envelope of the left-most burner. The sensor can be removed for service 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 16 for flame signal.

**NOTE:** A much higher than normal micro amp reading (15 for example) may appear when checking flame signal.

Table 20. Flame Signal in Microamps

| Normal         | Low         | Drop Out |
|----------------|-------------|----------|
| 2.6 or greater | 2.5 or less | 1.1      |

## Flame Rollout Switches

Flame rollout switch S47 is a high temperature limit located inside the burner box. Each furnace is equipped with two identical switches. The limit is a N.C. SPST manual-reset limit connected in series with the primary limit S10. When S47 senses rollout, the circuit breaks and the integrated control immediately stops ignition and closes the gas valve. If unit is running and flame rollout is detected, the gas valve will close and integrated control will be disabled. Rollout can be caused by a blocked heat exchanger, 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 center of the switch.

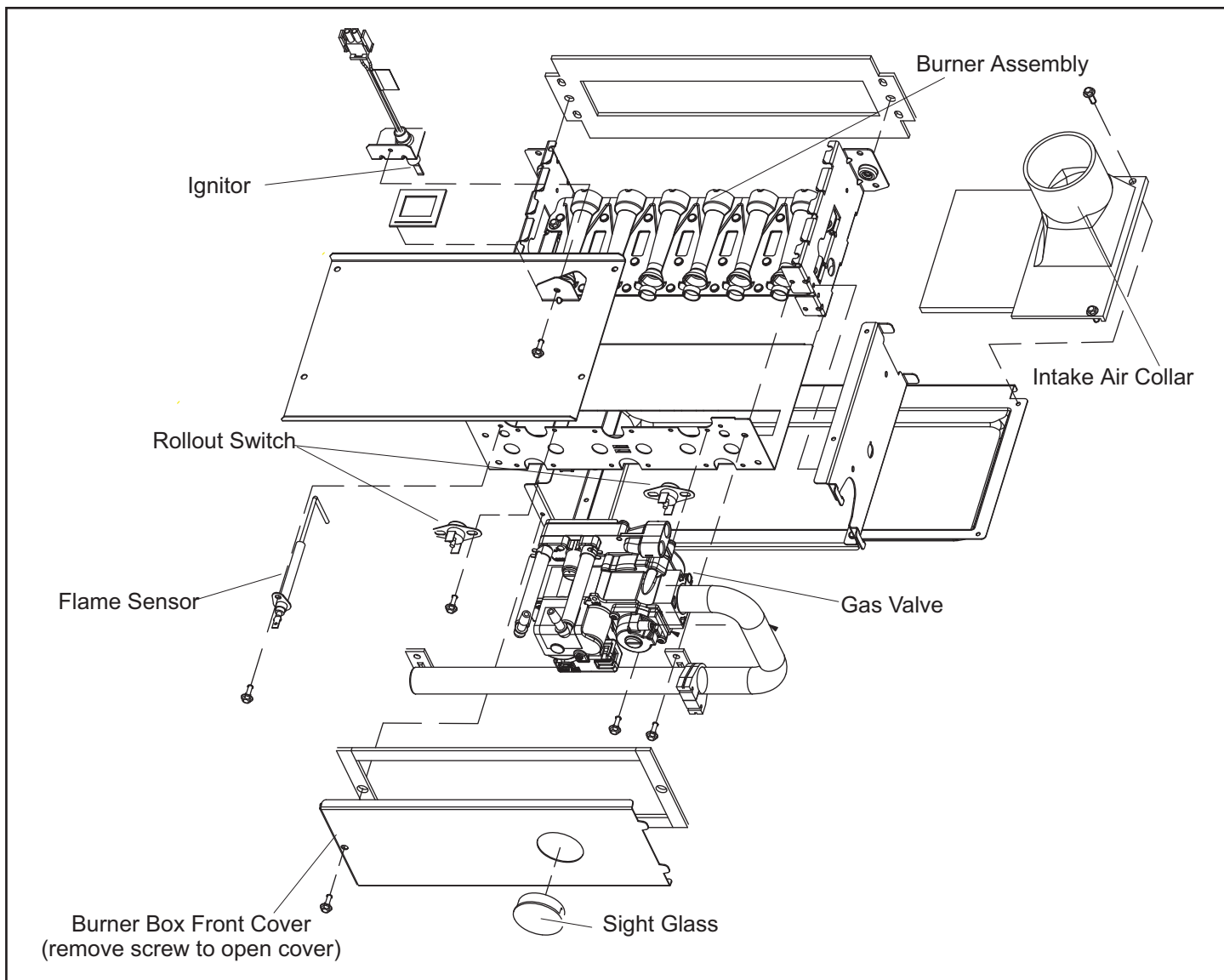
## Burners

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

## Heat Exchanger (Figure 15)

NF97D\*\*\*M\*\*R units use an aluminized steel primary and stainless steel secondary heat exchanger assembly. Heat is transferred to the air stream from all surfaces of the heat exchanger. The shape of the heat exchanger ensures maximum efficiency.

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



**Figure 14. Burner Box Assembly**

## Primary Limit Control (S10)

Figure 15 shows the primary limit (S10) used on NF97D\*\*\*M\*\*R units located in the heating vestibule panel. When excess heat is sensed in the heat exchanger, the limit will open. Once the limit opens, the furnace control energizes the supply air blower and de-energizes the gas valve. The limit automatically resets when unit temperature returns to normal. The switch is factory set and cannot be adjusted. In the event of restricted air flow, the integrated control will reduce firing rate and indoor blower airflow in 10% increments until a sustainable air flow is reached. If the furnace reaches 35% firing rate, and adequate air flow is not available, the furnace will shutdown and enter one hour Soft Lockout. For limit replacement remove wires from limit terminals and rotate limit switch 90 degrees. Slowly remove from the vestibule panel.

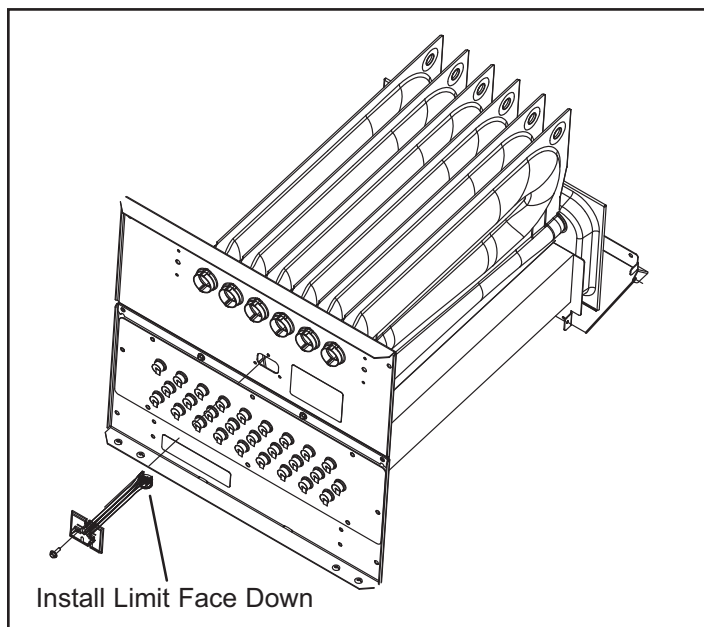


Figure 15.

## Gas Valve (GV1)

The NF97D\*\*\*M\*\*R uses a variable capacity gas valve (Figure 16) and is applicable for two-stage or variable capacity settings. See "Thermostat selection modes" in the integrated control section for more details. The valve is internally redundant to assure safety shut-off. If the gas valve must be replaced, the same type valve must be used.

A 24VAC 2-pin plug and gas control switch are located on the valve. 24V applied to the pins enables valve operation. Inlet and outlet pressure taps are located on the valve.

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



**⚠ DANGER**

**Danger of explosion.**

There are circumstances in which odorant used with LP/propane gas can lose its scent. In case of a leak, LP/propane gas will settle close to the floor and may be difficult to smell. An LP/propane leak detector should be installed in all LP applications.

The burner box is sealed and operates under a negative pressure. A pressure hose is connected from the burner box to the gas valve. The gas valve senses the pressure in the burner box and uses that to set the maximum manifold pressure while the pressure switch with pressure conditioning device adjusts the gas flow. This will compensate for different vent configurations which can greatly affect the rate of the unit.

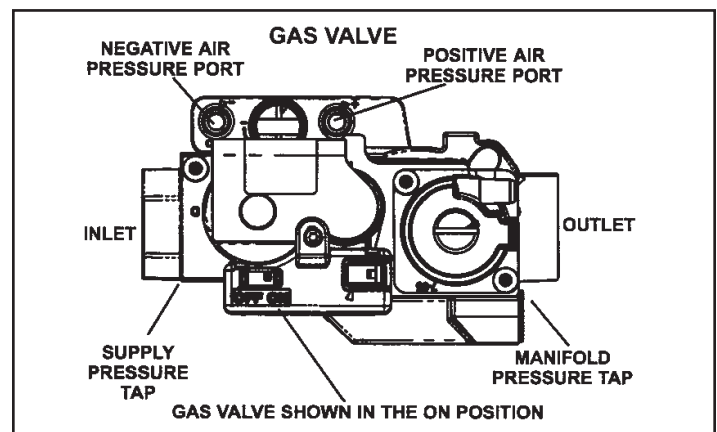


Figure 16.

## Combustion Air Inducer (B6) & Pressure Switch (S18)

All NF97D\*\*\*M\*\*R units are equipped with a combustion air inducer (B6) and dual pressure switch assembly (high fire and low fire). The pressure switch (Figure 17) serves four functions. First it establishes calibration points for the vent calibration routine. The combustion air inducer's speed at a given firing rate is a function of the vent system resistance. The calibration routine establishes the inducer speed required to make low and high fire switches for a given vent pipe installation and interpolates the speeds required to achieve all intermediate rates between these two points. The setting for lowfire switch on the assembly is such that it does not normally enter into the vent calibration routine.

Second, the switch proves combustion air inducer operation by sensing a vacuum energizing the control circuit and allowing ignition. The low fire pressure switch provides this function.

Third, the switch interrupts the combustion process in the event vent outlet or combustion air intake blockage.

Finally, the switch interrupts the combustion process if the condensate drainage system becomes blocked to the point the condensate level builds up in the cold end header box/ secondary coil or vent system.

If the switch assembly is to be replaced, replace the entire assembly. Individual switch components cannot be replaced.

## ⚠ WARNING

The pressure switch is a safety shut-down control in the furnace and must not be jumpered for any reason other than troubleshooting.

To troubleshoot the pressure switch, add a temporary jumper. The unit will not fire with the switch jumpered. Therefore, the pressure switch must be bypassed after the combustion air inducer is activated. This will determine if the pressure switch and furnace are operating properly. However, this may not indicate if the sealed combustion system is operating properly.

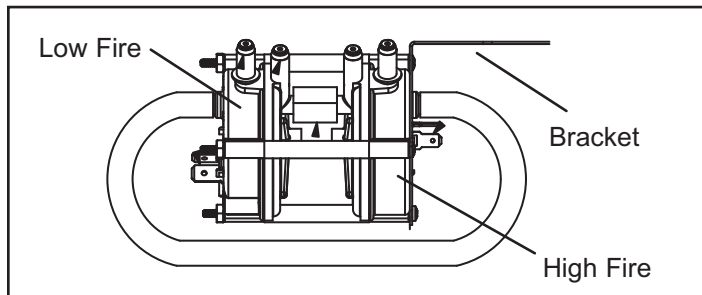


Figure 17.

## Vent Calibration

The vent calibration sequence establishes furnace operating parameters in a specific installation. The integrated control runs the calibration and may be repeated as necessary to maintain proper furnace operation. Prior to calibration, all duct work (and returns) vent pipe and condensate trap (primed) must be connected.

If calibration is successful the data is stored in memory and will be used to determine furnace operation and maintain parameters during heat call. If calibration is not successful, the integrated control will proceed to a 5 minute delay and signal the appropriate code. After the 5 minute delay the calibration will be repeated 4 more times with a 5 minute delay in between. If still unsuccessful after the 4 trials (total 5) the integrated control will go into a 1 hour soft lockout.

Calibration may be initiated by:

- Initial call for heat
- Cycling main power off / on and then call for heat
- Venting conditions change (affecting high and low pressure switch operation)
- Ramp down low fire switch check failed (calibration will follow next call for heat)

- The service technician (by pressing the push button found on the integrated control until the control cycles through to "Field Test Mode")

The integrated control will do the following during calibration:

1. Verify both low pressure switch and high pressure switch are open. If either are closed log error and end calibration.
2. Start inducer at a predetermined low RPM (1600). Wait 7.5 seconds.
3. Check low pressure switch, if open, increase RPM by 250, wait 5 seconds. Repeat this step until low pressure switch is closed.
4. Decrease RPM by 50, wait 5 seconds and look for the low pressure switch to open. Repeat this step until it is open.
5. Keep this RPM as RPM1.
6. Increase RPM by 1250. Wait 5 seconds.
7. Check high pressure switch, if open, increase RPM by 250, wait 5 seconds. Repeat this step until high pressure switch is closed.
8. Decrease RPM by 50, check after 5 seconds. Repeat this step until switch is open.
9. Keep this RPM as RPM2.
10. Calibration complete.

**NOTE:** If after a successful calibration and a heat call is present the integrated control will by-pass the prepurge state and go straight into ignitor warm up.

After calibration, the integrated control stores the RPM1 and RPM2 values. The low fire (35%) and high fire (100%) RPM points are calculated by adding margin values to the RPM1 and RPM2 values.

The integrated control also initiates a low fire switch check at the end of a normal heating cycle described below. If this check fails the pressure switch calibration will follow on the next call for heat.

1. The inducer runs 15 seconds at the last firing rate before the heat call ended.
2. Inducer runs at 35% firing rate RPM ( $\text{RPM1} + \text{low pressure switch open RPM margin value}$ ).
3. If low pressure switch is open, set flag for calibration on next call for heat. Turn inducer off until next call for heat.
4. If low pressure switch is closed move inducer speed to RPM1. Allow 5 seconds for stabilization.
5. If low pressure switch opens turn off inducer. No further action.
6. If low pressure switch is still closed, decrease inducer speed 1/2 of the low pressure switch open RPM margin. Allow 5 seconds to stabilize.
7. If low pressure switch is open turn off inducer. No further action.
8. If low pressure switch is still closed, set flag for calibration on next call for heat and turn off inducer.

## Measuring Pressure Differential (Figure 18)

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

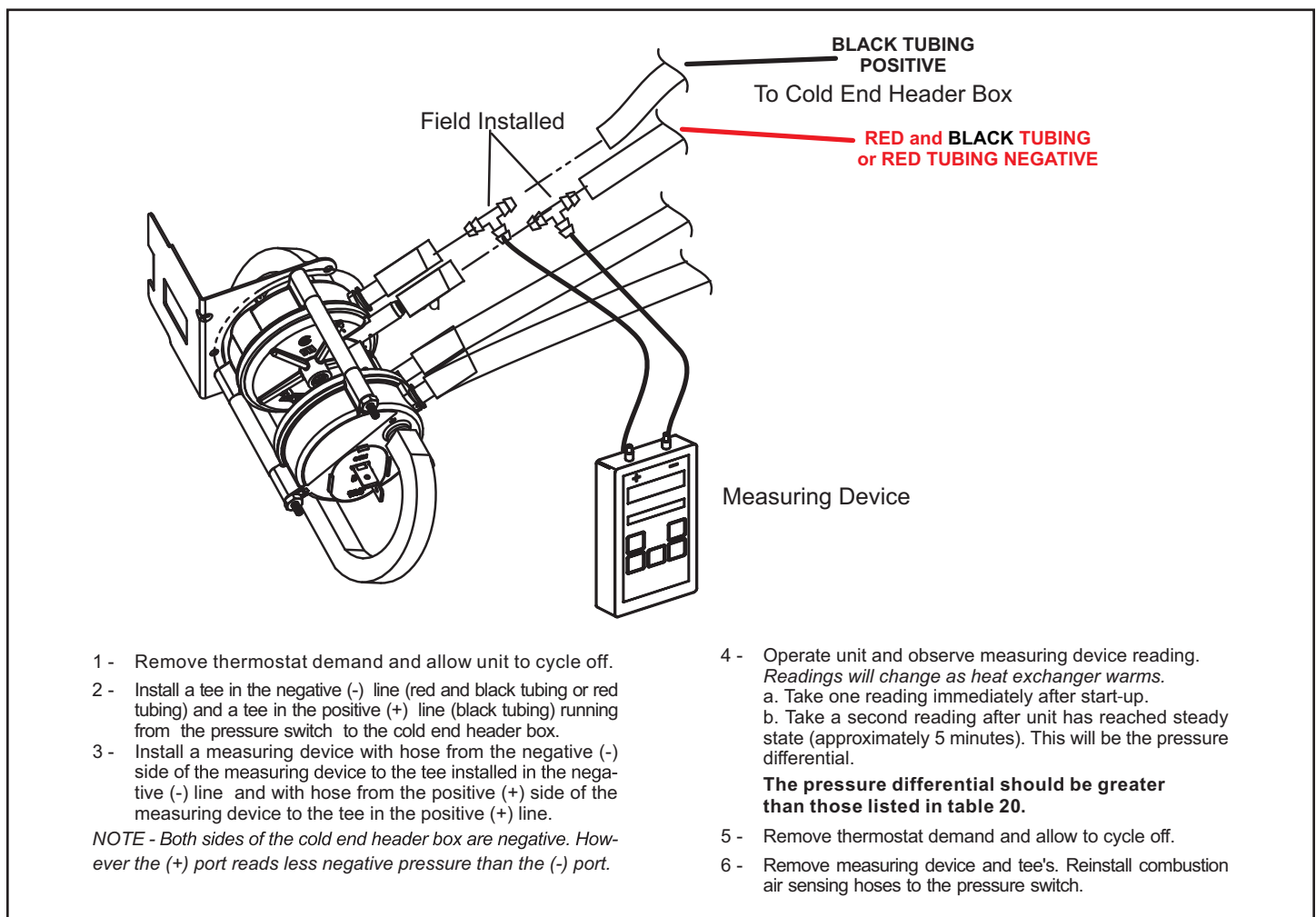
The differential pressure is the difference in pressure measured across the cold end header box orifice.

The CAI is installed on the cold end header box. The cold end header box is a single piece made of hard plastic. The box has an internal channel where the combustion air inducer creates negative pressure at unit start up. The channel contains an orifice used to regulate flow created by the CAI. The box has pressure taps for the CAI pressure switch hoses.

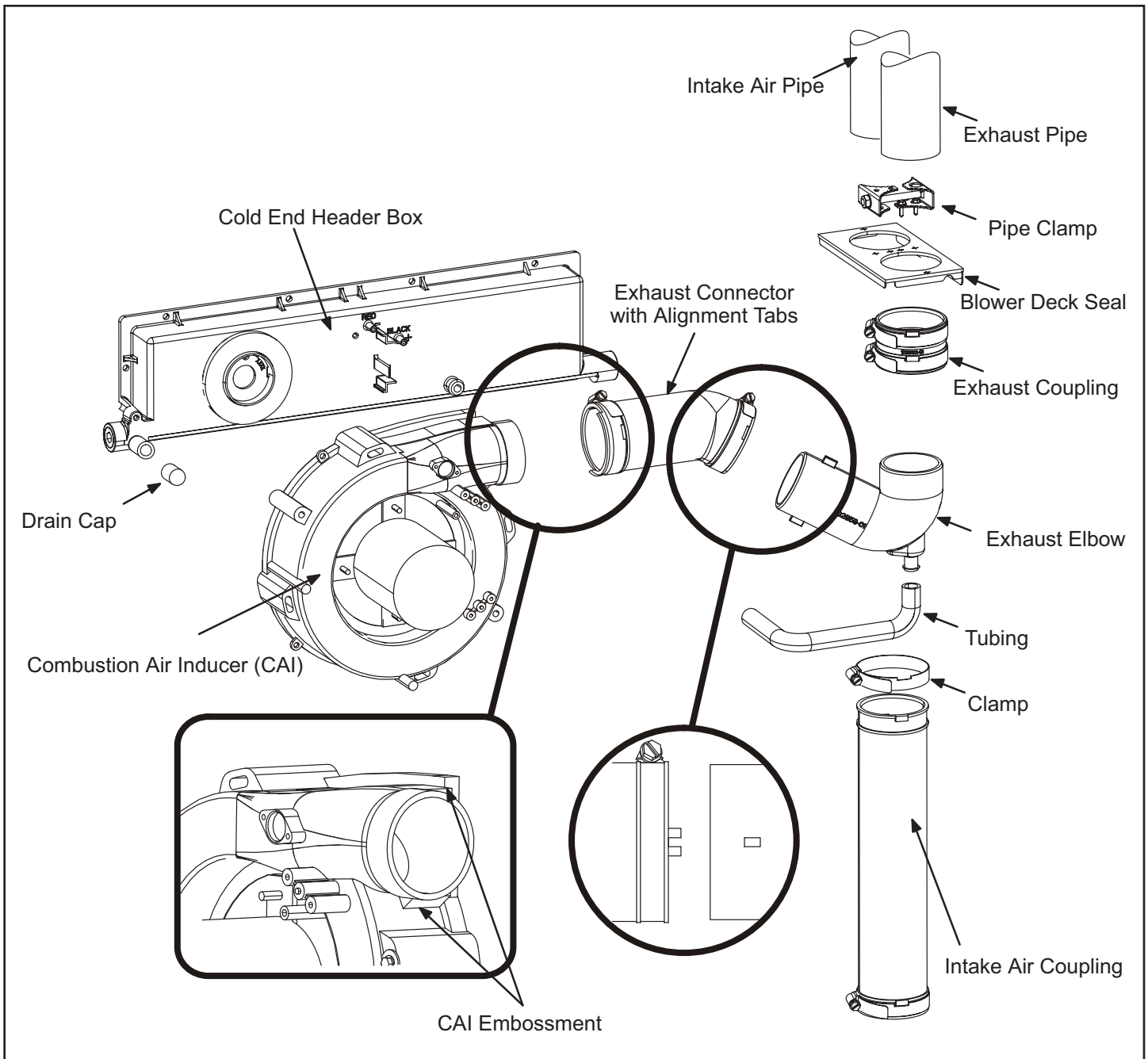
The pressure switch measures the pressure differential across the CAI orifice (difference in the channel and cold end header box). **If replacement is necessary, the gaskets used to seal the box to the vestibule panel and the CAI to the box must also be replaced.**

**Table 21. Pressure Switch 0' to 7500'**

| Unit                                                             | Set Point High Fire | Set Point Low Fire |
|------------------------------------------------------------------|---------------------|--------------------|
| All                                                              | 1.00 ± 0.05         | 0.25 ± 0.05        |
| *Units over 7500 ft will require a conversion kit. See Table 28. |                     |                    |



**Figure 18. Measuring Pressure Differential**



**Figure 19. Combustion Air Inducer / Cold End Header Box / Vent Pipe Assembly**

## Placement and Installation

All pipe, fittings, primer and solvent cement must conform with American National Standard Institute and the American Society for Testing and Materials (ANSI/ASTM) standards. The solvent shall be free flowing and contain no lumps, undissolved particles or any foreign matter that adversely affects the joint strength or chemical resistance of the cement. The cement shall show no gelation, stratification, or separation that cannot be removed by stirring. Refer to the Table 18 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

NF97D\*\*\*M\*\*R 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 18. As an alternate, use all purpose cement, to bond ABS, PVC, or CPVC pipe when using fittings and pipe made of the same materials. Use transition solvent cement when bonding ABS to either PVC or CPVC.

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

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

Table 19 lists the available exhaust termination kits.

**Table 22. 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)<br>(Pipe & Fittings)                           | D2661                         |
| PVC-DWV (Drain Waste & Vent)<br>Pipe & Fittings)                            | D2665                         |
| <b>PRIMER &amp; SOLVENT CEMENT</b>                                          | <b>ASTM<br/>SPECIFICATION</b> |
| PVC & CPVC Primer                                                           | F656                          |
| PVC Solvent Cement                                                          | D2564                         |
| CPVC Solvent Cement                                                         | F493                          |
| ABS Solvent Cement                                                          | D2235                         |
| PVC/CPVC/ABS All Purpose Cement For<br>Fittings & Pipe of the same material | D2564, D2235,<br>F493         |
| ABS to PVC or CPVC Transition Solvent<br>Cement                             | D3138                         |
| <b>CANADA PIPE &amp; FITTING &amp; SOLVENT<br/>CEMENT</b>                   | <b>MARKING</b>                |
| PVC & CPVC Pipe and Fittings                                                | ULCS636                       |
| PVC & CPVC Solvent Cement                                                   |                               |
| ABS to PVC or CPVC Transition Cement                                        |                               |
| <b>POLYPROPYLENE VENTING SYSTEM</b>                                         | ULC-S636                      |
| PolyPro® by Duravent                                                        |                               |
| InnoFlue® by Centrotherm                                                    |                               |
| ECCO Polypropylene Vent™                                                    | ULC-S636                      |

Table 23. Outdoor Termination Kits Usage

| Unit | VENT<br>PIPE DIA.<br>(in.) | STANDARD                                          |                                                      |                    | CONCENTRIC                 |                      |                         |
|------|----------------------------|---------------------------------------------------|------------------------------------------------------|--------------------|----------------------------|----------------------|-------------------------|
|      |                            | Outdoor Exhaust<br>Accelerator<br>(Dia. X Length) | Outdoor<br>Exhaust<br>Accelerator<br>(Dia. X Length) | Flush<br>Mount Kit | 1-1/2<br>Concentric<br>Kit | 2" Concentric<br>Kit | 3"<br>Concentric<br>Kit |
|      |                            | 1-1/2" X 12"                                      | 2" X 12"                                             | <sup>2</sup> 51W11 | <sup>4</sup> 71M80         | <sup>5</sup> 69M29   | <sup>5</sup> 60L46      |
| 070  | <sup>1</sup> 1-1/2         | NO                                                | NO                                                   | YES                | YES                        | NO                   | NO                      |
|      | 2                          | YES                                               | NO                                                   | YES                | YES                        | NO                   | NO                      |
|      | 2-1/2                      | YES                                               | NO                                                   | YES                | YES                        | NO                   | NO                      |
|      | 3                          | YES                                               | NO                                                   | YES                | YES                        | NO                   | NO                      |
| 090  | 2                          | NO                                                | YES                                                  | YES                | NO                         | YES                  | YES                     |
|      | 2-1/2                      | NO                                                | YES                                                  | YES                | NO                         | YES                  | YES                     |
|      | 3                          | NO                                                | YES                                                  | YES                | NO                         | YES                  | YES                     |
| 110  | 2                          | NO                                                | YES                                                  | YES                | NO                         | YES                  | YES                     |
|      | 2-1/2                      | NO                                                | YES                                                  | YES                | NO                         | YES                  | YES                     |
|      | 3                          | NO                                                | YES                                                  | YES                | NO                         | YES                  | YES                     |

1. 2" pipe to 1-1/2" reducer required to connect 1-1/2", vent pipe to furnace and must be field provided.

2. Flush mount kit 51W11 includes a 1-1/2" outdoor exhaust accelerator, which is required when used with 045, 070, and 090 input models. The flush mount kit may be installed with 2", 2-1/2" (with provided reducer) or 3" vent pipe. When using 1-1/2" pipe, transition to 2" pipe prior to the installation of the flush mount kit.

3. Field provided or filed fabricated termination require use of a field provided exhaust accelerator as defined in the table.

4. Concentric kit 71M80 includes a 1-1/2" outdoor accelerator which must be installed on the exhaust outlet when used with 045 and 070 input models.

5. No Accelerator is required for kits 69M29 or 60L46

6. When the vent/intake diameters are different from the concentric vent kit size, field provided transitions must be used..

## 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.

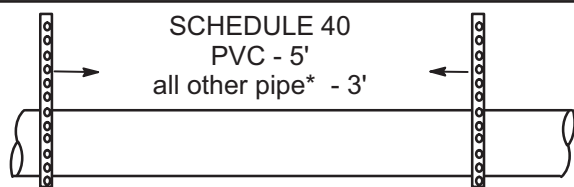
**NOTE:** Time is critical at this stage. Do not allow primer to dry before applying cement.

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 pipe.

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

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

## Venting Practices

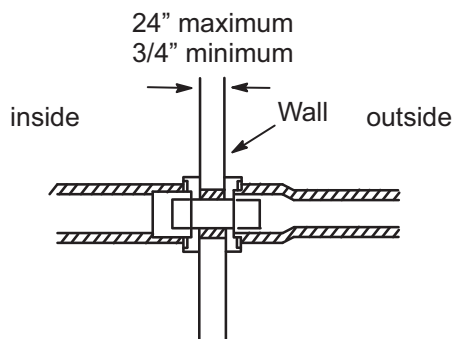


\* See table 2 for allowable pipe.

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

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

### Wall Thickness 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.

### Exhaust Piping (Figure 21 and Figure 22)

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

### CAUTION

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

### CAUTION

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

Figure 20. Piping Suspension Guidelines

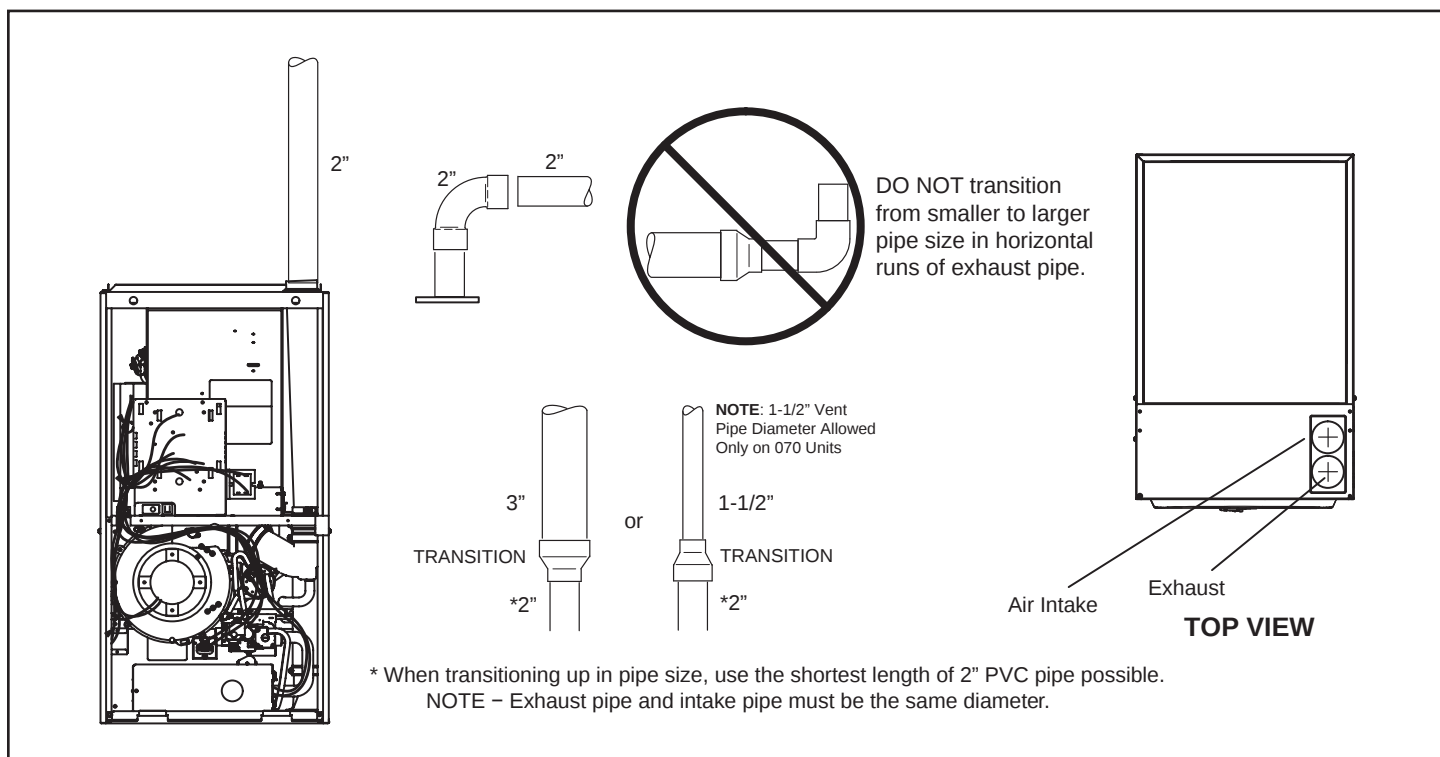
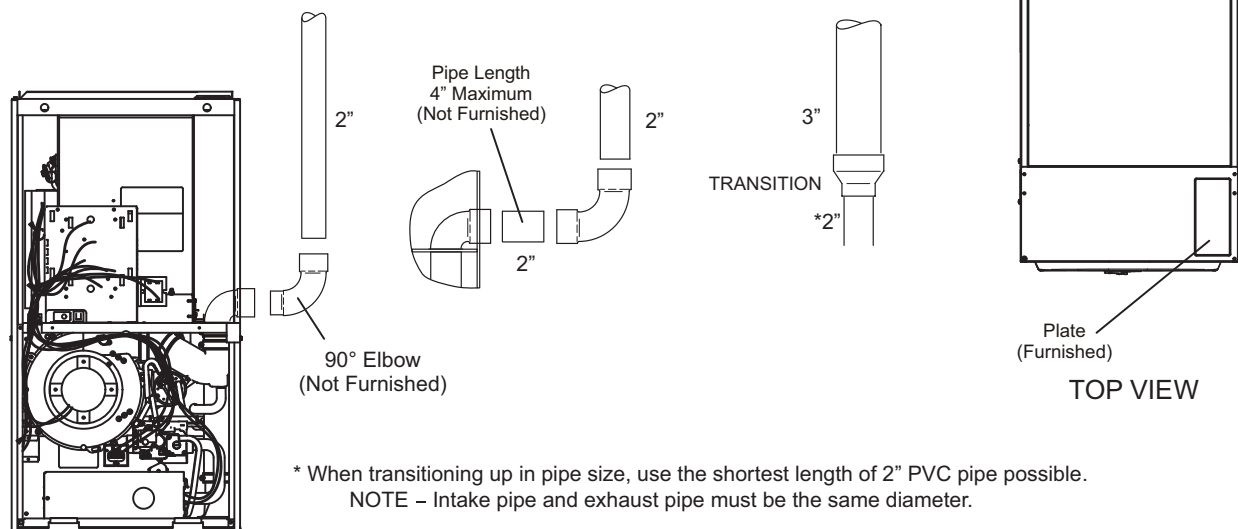
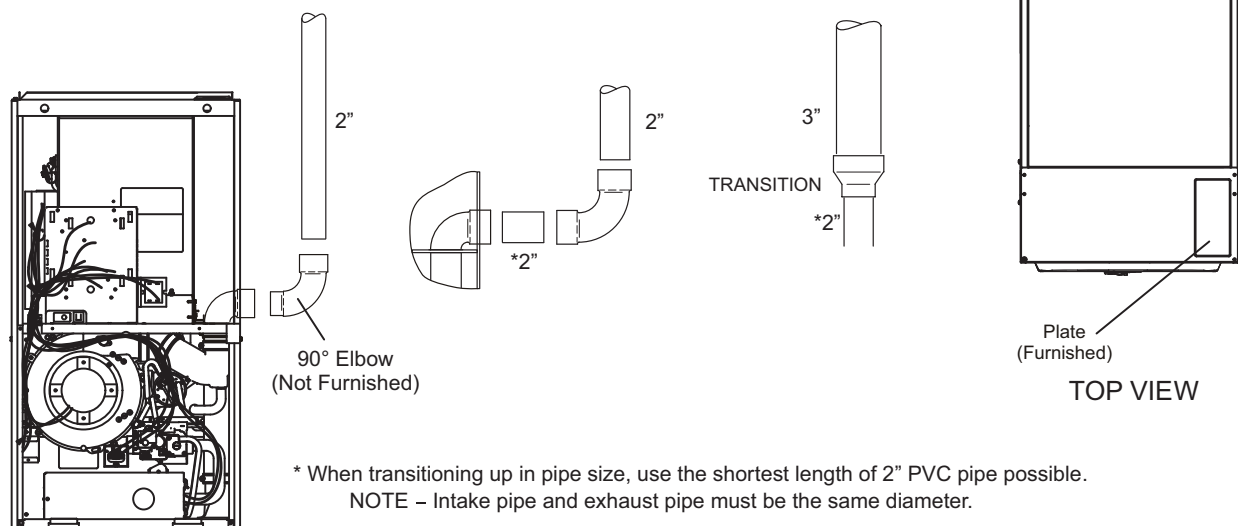


Figure 21. Typical Exhaust Pipe Connections



**Figure 22. Typical Exhaust Pipe Connections with Right Side Vent Option**



**Figure 23. Typical Air Intake Pipe Connections with Right Side Vent Option**

## Vent Piping Guidelines

**NOTE:** GE Appliances has approved the use of DuraVent® and Centrotherm manufactured vent pipe and terminations as an option to PVC. When using the PolyPro® by DuraVent or InnoFlue® by Centrotherm venting system the vent pipe requirements stated in the unit installation instruction – minimum & maximum vent lengths, termination clearances, etc. – apply and must be followed. Follow the instructions provided with PolyPro by DuraVent and InnoFlue by Centrotherm venting system for assembly or if requirements are more restrictive. The PolyPro by DuraVent and InnoFlue by Centrotherm venting system must also follow the uninsulated and unconditioned space criteria listed in **Table 24**.

**The NF97D\*\*\*M\*\*R is installed as a Direct Vent gas central furnace only.**

**NOTE:** 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 25A** through **Table 25B**. Count all elbows inside and outside the home. **Table 24** lists the minimum vent pipe lengths permitted. **Table 25A** through **Table 25B** list 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 26**.

In some applications which permit the use of several different sizes of vent pipe, a combination vent pipe may be used. Contact GE Appliances 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 24**.

**NOTE:** The exhaust collar on all models is sized to accommodate 2" Schedule 40 vent pipe. Contact the Application Department for more information concerning sizing of vent systems which include multiple pipe sizes.

**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.

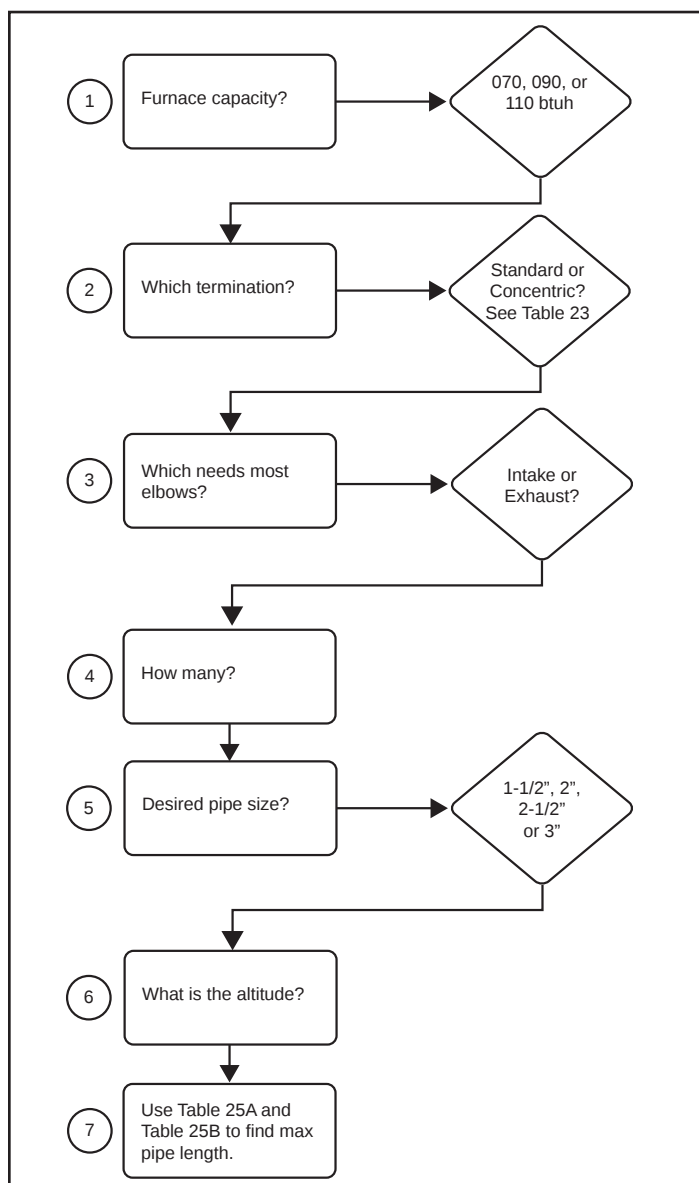
## ⚠ IMPORTANT

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

**Table 24. Minimum Vent Pipe Lengths**

| Model | Min. Equiv. Vent Length | Example                                                       |
|-------|-------------------------|---------------------------------------------------------------|
| 70    | 15 ft.*                 | 5 ft. plus 2 elbows of 1-1/2", 2", 2-1/2" or 3" diameter pipe |
| 90    |                         | 5 ft. plus 2 elbows of 2", 2-1/2" or 3" diameter pipe         |
| 110   |                         | 5 ft. plus 2 elbows of 2-1/2" or 3" diameter pipe             |

Use the following steps to correctly size vent pipe diameter.



**Figure 25.**

Table 25. A.

## Maximum Allowable Intake or Exhaust Vent Length (feet)

| Standard Termination at Elevation 0 - 4,500 ft                                                                                                                 |             |     |     |         |     |     |             |    |     |         |     |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----|-----|---------|-----|-----|-------------|----|-----|---------|-----|-----|
| Number of<br>90° Elbows<br>Used                                                                                                                                | 1-1/2" Pipe |     |     | 2" Pipe |     |     | 2-1/2" Pipe |    |     | 3" Pipe |     |     |
|                                                                                                                                                                | Model       |     |     | Model   |     |     | Model       |    |     | Model   |     |     |
|                                                                                                                                                                | 70          | 90  | 110 | 70      | 90  | 110 | 70          | 90 | 110 | 70      | 90  | 110 |
| 1                                                                                                                                                              | 15          | n/a | n/a | 86      | 64  | n/a | 135         | 88 | 38  | 157     | 138 | 113 |
| 2                                                                                                                                                              | 10          |     |     | 81      | 59  |     | 130         | 83 | 33  | 152     | 133 | 108 |
| 3                                                                                                                                                              | n/a         |     |     | 76      | 54  |     | 125         | 78 | 28  | 147     | 128 | 103 |
| 4                                                                                                                                                              |             |     |     | 71      | 49  |     | 120         | 73 | 23  | 142     | 123 | 98  |
| 5                                                                                                                                                              |             |     |     | 66      | 44  |     | 115         | 68 | 18  | 137     | 118 | 93  |
| 6                                                                                                                                                              |             |     |     | 61      | 39  |     | 110         | 63 | 13  | 132     | 113 | 88  |
| 7                                                                                                                                                              |             |     |     | 56      | 34  |     | 105         | 58 | 8   | 127     | 108 | 83  |
| 8                                                                                                                                                              |             |     |     | 51      | 29  |     | 100         | 53 | n/a | 122     | 103 | 78  |
| 9                                                                                                                                                              |             |     |     | 46      | 24  |     | 95          | 48 |     | 117     | 98  | 73  |
| 10                                                                                                                                                             |             |     |     | 41      | 19  |     | 90          | 43 |     | 112     | 93  | 68  |
| Standard Termination at Elevation 4,501 - 10,000 ft                                                                                                            |             |     |     |         |     |     |             |    |     |         |     |     |
| Number of<br>90° Elbows<br>Used                                                                                                                                | 1-1/2" Pipe |     |     | 2" Pipe |     |     | 2-1/2" Pipe |    |     | 3" Pipe |     |     |
|                                                                                                                                                                | Model       |     |     | Model   |     |     | Model       |    |     | Model   |     |     |
|                                                                                                                                                                | 70          | 90  | 110 | 70      | 90  | 110 | 70          | 90 | 110 | 70      | 90  | 110 |
| 1                                                                                                                                                              | n/a         | n/a | n/a | 61      | 39  | n/a | 110         | 63 | n/a | 132     | 113 | 88  |
| 2                                                                                                                                                              |             |     |     | 56      | 34  |     | 105         | 58 |     | 127     | 108 | 83  |
| 3                                                                                                                                                              |             |     |     | 51      | 29  |     | 100         | 53 |     | 122     | 103 | 78  |
| 4                                                                                                                                                              |             |     |     | 46      | 24  |     | 95          | 48 |     | 117     | 98  | 73  |
| 5                                                                                                                                                              |             |     |     | 41      | 19  |     | 90          | 43 |     | 112     | 93  | 68  |
| 6                                                                                                                                                              |             |     |     | 36      | 14  |     | 85          | 38 |     | 107     | 88  | 63  |
| 7                                                                                                                                                              |             |     |     | 31      | 9   |     | 80          | 33 |     | 102     | 83  | 58  |
| 8                                                                                                                                                              |             |     |     | 26      | n/a |     | 75          | 28 |     | 97      | 78  | 53  |
| 9                                                                                                                                                              |             |     |     | 21      |     |     | 70          | 23 |     | 92      | 73  | 48  |
| 10                                                                                                                                                             |             |     |     | 16      |     |     | 65          | 18 |     | 87      | 68  | 43  |
| *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 25. B.

## Maximum Allowable Intake or Exhaust Vent Length (feet)

| Concentric Termination at Elevation 0 - 4,500 ft                                                                                                               |             |     |     |         |     |     |             |    |     |         |     |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----|-----|---------|-----|-----|-------------|----|-----|---------|-----|-----|
| Number of<br>90° Elbows<br>Used                                                                                                                                | 1-1/2" Pipe |     |     | 2" Pipe |     |     | 2-1/2" Pipe |    |     | 3" Pipe |     |     |
|                                                                                                                                                                | Model       |     |     | Model   |     |     | Model       |    |     | Model   |     |     |
|                                                                                                                                                                | 70          | 90  | 110 | 70      | 90  | 110 | 70          | 90 | 110 | 70      | 90  | 110 |
| 1                                                                                                                                                              | 15          | n/a | n/a | 78      | 62  | n/a | 125         | 84 | 34  | 141     | 134 | 109 |
| 2                                                                                                                                                              | n/a         |     |     | 73      | 57  |     | 120         | 79 | 29  | 136     | 129 | 104 |
| 3                                                                                                                                                              |             |     |     | 68      | 52  |     | 115         | 74 | 24  | 131     | 124 | 99  |
| 4                                                                                                                                                              |             |     |     | 63      | 47  |     | 110         | 69 | 19  | 126     | 119 | 94  |
| 5                                                                                                                                                              |             |     |     | 58      | 42  |     | 105         | 64 | 14  | 131     | 114 | 89  |
| 6                                                                                                                                                              |             |     |     | 53      | 37  |     | 100         | 59 | 9   | 116     | 109 | 84  |
| 7                                                                                                                                                              |             |     |     | 48      | 32  |     | 95          | 54 | n/a | 111     | 104 | 79  |
| 8                                                                                                                                                              |             |     |     | 43      | 27  |     | 90          | 49 |     | 106     | 99  | 74  |
| 9                                                                                                                                                              |             |     |     | 38      | 22  |     | 85          | 44 |     | 101     | 94  | 69  |
| 10                                                                                                                                                             |             |     |     | 33      | 17  |     | 80          | 39 |     | 96      | 89  | 64  |
| Concentric Termination Elevation 4,501 - 10,000 ft                                                                                                             |             |     |     |         |     |     |             |    |     |         |     |     |
| Number of<br>90° Elbows<br>Used                                                                                                                                | 1-1/2" Pipe |     |     | 2" Pipe |     |     | 2-1/2" Pipe |    |     | 3" Pipe |     |     |
|                                                                                                                                                                | Model       |     |     | Model   |     |     | Model       |    |     | Model   |     |     |
|                                                                                                                                                                | 70          | 90  | 110 | 70      | 90  | 110 | 70          | 90 | 110 | 70      | 90  | 110 |
| 1                                                                                                                                                              | n/a         | n/a | n/a | 53      | 37  | n/a | 100         | 59 | n/a | 116     | 109 | 84  |
| 2                                                                                                                                                              |             |     |     | 48      | 32  |     | 95          | 54 |     | 111     | 104 | 79  |
| 3                                                                                                                                                              |             |     |     | 43      | 27  |     | 90          | 49 |     | 106     | 99  | 74  |
| 4                                                                                                                                                              |             |     |     | 38      | 22  |     | 85          | 44 |     | 101     | 94  | 69  |
| 5                                                                                                                                                              |             |     |     | 33      | 17  |     | 80          | 39 |     | 96      | 89  | 64  |
| 6                                                                                                                                                              |             |     |     | 28      | 12  |     | 75          | 34 |     | 91      | 84  | 59  |
| 7                                                                                                                                                              |             |     |     | 23      | 7   |     | 70          | 29 |     | 86      | 79  | 54  |
| 8                                                                                                                                                              |             |     |     | 18      | n/a |     | 65          | 24 |     | 81      | 74  | 49  |
| 9                                                                                                                                                              |             |     |     | 13      |     |     | 60          | 19 |     | 76      | 69  | 44  |
| 10                                                                                                                                                             |             |     |     | 8       |     |     | 55          | 14 |     | 71      | 64  | 39  |
| *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. |             |     |     |         |     |     |             |    |     |         |     |     |

## General Guidelines for Vent Terminations

In Direct Vent applications, combustion air is taken from outdoors and the flue gases are discharged to the outdoors. The NF97D\*\*\*M\*\*R is then classified as a direct vent, Category IV gas furnace.

In 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 36. 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 an outdoor AC unit because the condensate can damage the painted coating.

**NOTE:** See Table 21 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

For Canadian Installations Only:

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

## IMPORTANT

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

**Maximum Allowable Vent Pipe Length<sup>3</sup> without Insulation in Unconditioned Space for Winter Design Temperatures  
Modulating High Efficiency Furnace**

| Winter Design Temperatures <sup>1</sup> °F (°C) | Vent Pipe Diameter |     |                 |     |                 |     |                 |
|-------------------------------------------------|--------------------|-----|-----------------|-----|-----------------|-----|-----------------|
|                                                 |                    | 070 |                 | 090 |                 | 110 |                 |
|                                                 |                    | PVC | <sup>2</sup> PP | PVC | <sup>2</sup> PP | PVC | <sup>2</sup> PP |
| 32 to 21<br>(0 to -6)                           | 1-1/2 in.          | N/A | N/A             | N/A | N/A             | N/A | N/A             |
|                                                 | 2 in.              | 11  | 9               | 14  | 12              | 18  | 15              |
|                                                 | 2-1/2 in.          | 7   | N/A             | 10  | N/A             | 12  | N/A             |
|                                                 | 3 in.              | N/A | N/A             | 6   | 6               | 8   | 8               |
|                                                 |                    |     |                 |     |                 |     |                 |
| 20 to 1<br>(-7 to -17)                          | 1-1/2 in.          | N/A | N/A             | N/A | N/A             | N/A | N/A             |
|                                                 | 2 in.              | N/A | N/A             | 6   | 4               | 8   | 6               |
|                                                 | 2-1/2 in.          | N/A | N/A             | N/A | N/A             | N/A | N/A             |
|                                                 | 3 in.              | N/A | N/A             | N/A | N/A             | N/A | N/A             |
| 0 to -20<br>(-18 to -29)                        | 1-1/2 in.          | N/A | N/A             | N/A | N/A             | N/A | N/A             |
|                                                 | 2 in.              | N/A | N/A             | N/A | N/A             | N/A | N/A             |
|                                                 | 2-1/2 in.          | N/A | N/A             | N/A | N/A             | N/A | N/A             |
|                                                 | 3 in.              | N/A | N/A             | N/A | N/A             | N/A | N/A             |

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

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

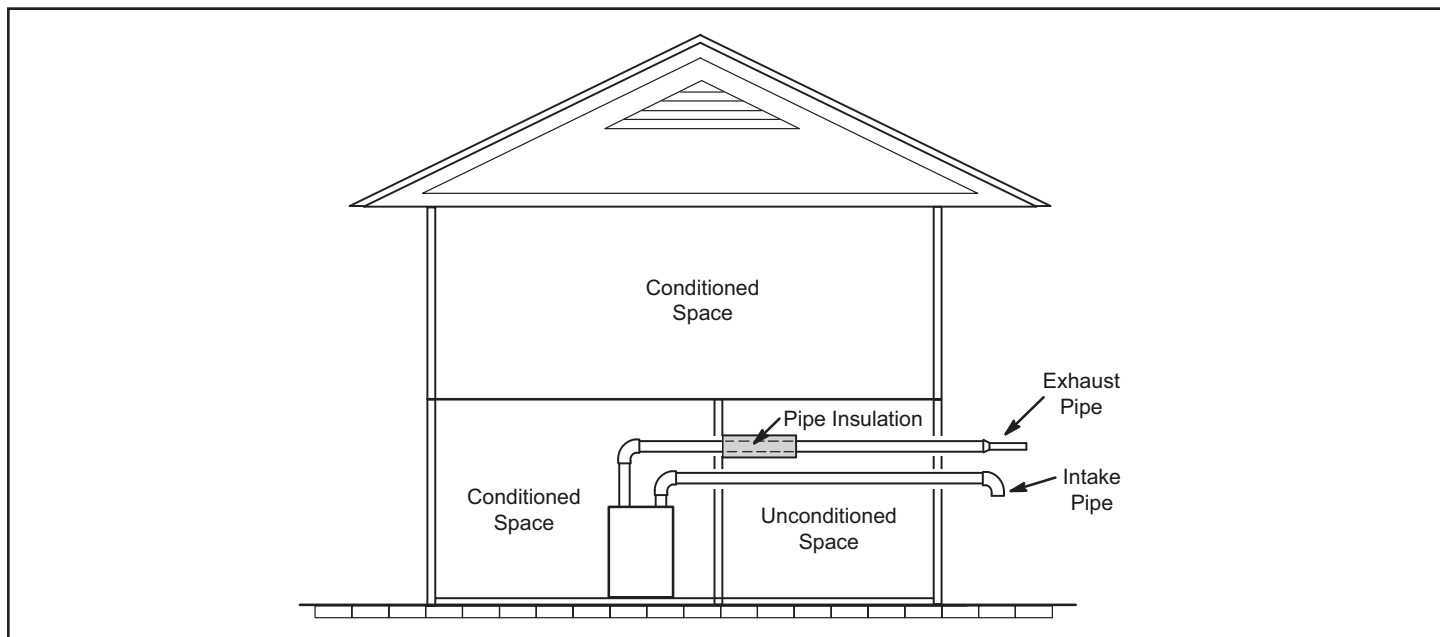
<sup>3</sup> Vent length in table is equivalent length. Each elbow is equivalent to 5ft of straight pipe and should be included when measuring total length.

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

**NOTE** - Maximum uninsulated vent lengths listed may include the termination (vent pipe exterior to the structure ) and cannot exceed 5 linear feet or the maximum allowable intake or exhaust vent length listed in Table 23A or Table 23B.

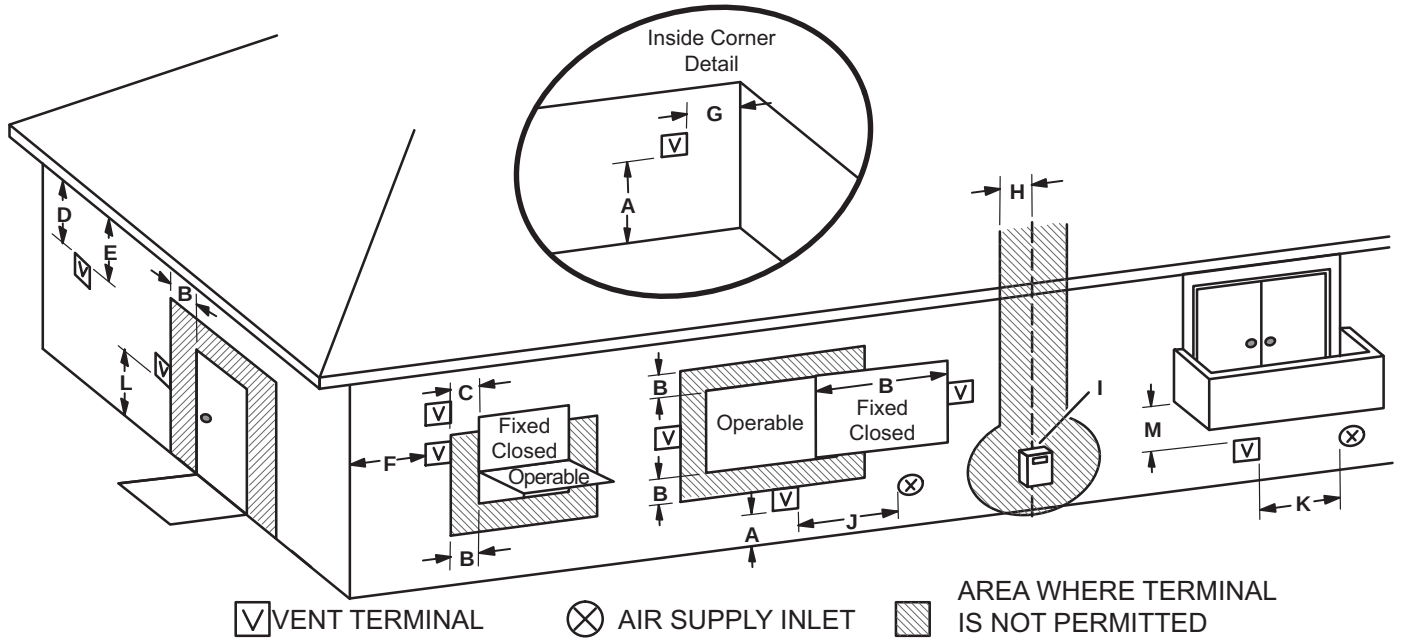
**NOTE** - If insulation is required in an unconditioned space, it must be located on the pipe closest to the furnace. See Figure 34.

**Table 26.**



**Figure 26. Insulating Exhaust Pipe in an Unconditioned Space**

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



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                        | US Installations <sup>1</sup>                                                                                                                                                                                    | Canadian Installations <sup>2</sup>                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Clearance above grade, veranda, porch, deck or balcony                                                                                                 | 12" (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" (305mm) 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)                                                                                                                                                                                                   | 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" (305mm) 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)                                                                                                                                                                                                  | 7 feet (2.1m)                                                                                                                                                         |
| M                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Clearance under veranda, porch, deck or balcony                                                                                                        | *12 inches (305mm)†                                                                                                                                                                                              | 12 inches (305mm)‡                                                                                                                                                    |
| <sup>1</sup> In accordance with the current ANSI Z223.1/NFPA 54 Natural Fuel Gas Code<br><sup>2</sup> In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code<br>† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.<br>‡ 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 27. Vent Termination Clearances  
Direct Vent Installations**

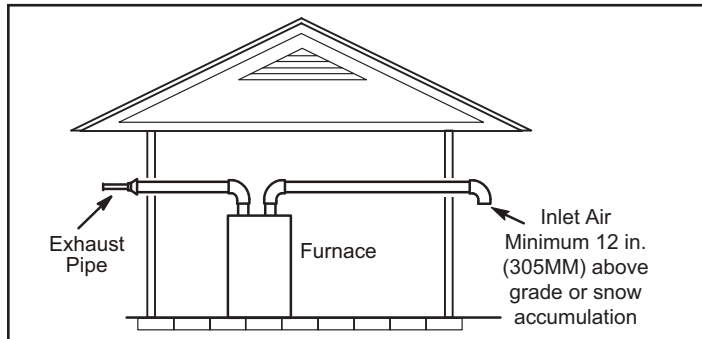
## Details of Intake and Exhaust Piping Terminations for Direct Vent Installations

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

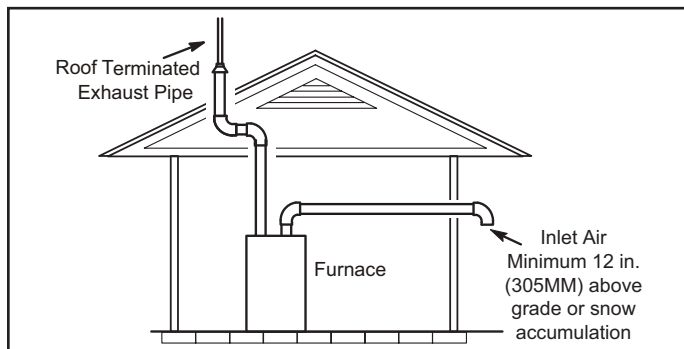
**NOTE:** Flue gas may be slightly acidic and may adversely affect some building materials. If any vent termination is used and the flue gasses may impinge on the building material, a corrosion-resistant shield (minimum 24 inches square) should be used to protect the wall surface. If the optional tee is used, the protective shield is recommended. The shield should be constructed using wood, plastic, sheet metal or other suitable material. All seams, joints, cracks, etc. in the affected area should be sealed using an appropriate sealant. See **Figure 36**.

Intake and exhaust pipes may be routed either horizontally through an outside wall or vertically through the roof. In attic or closet installations, vertical termination through the roof is preferred. **Figure 28** through **Figure 36** 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 28**). You may exit the exhaust out the roof and the intake out the side of the structure (**Figure 29**).



**Figure 28. Exiting Exhaust and Intake Vent (no common pressure zone)**

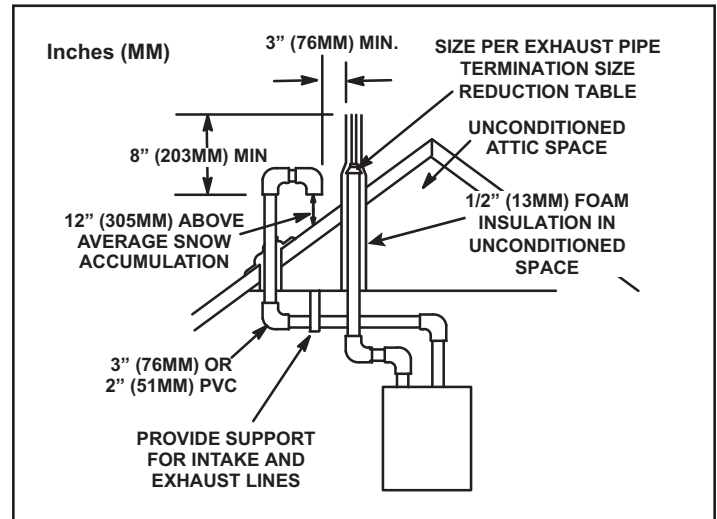


**Figure 29. Exiting Exhaust and Intake Vent (no common pressure zone)**

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

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

3. On roof terminations, the intake piping should terminate straight down using two 90° elbows (**Figure 30**).



**Figure 30. Direct Vent Roof Termination**

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 27**.

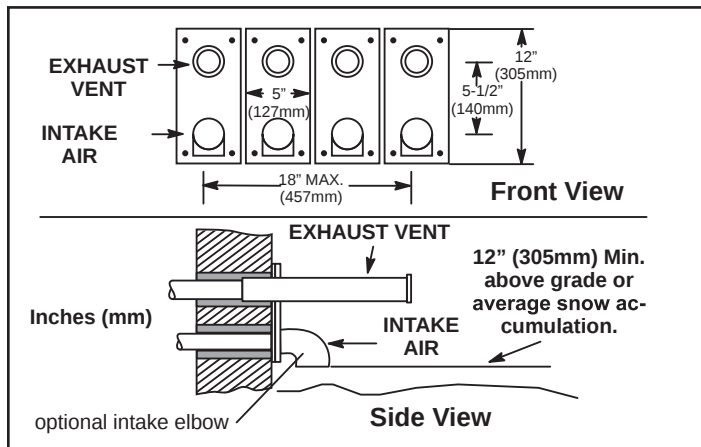
**NOTE:** Care must be taken to avoid recirculation of exhaust back into intake pipe.

**Table 27. Exhaust Pipe Termination Size Reduction**

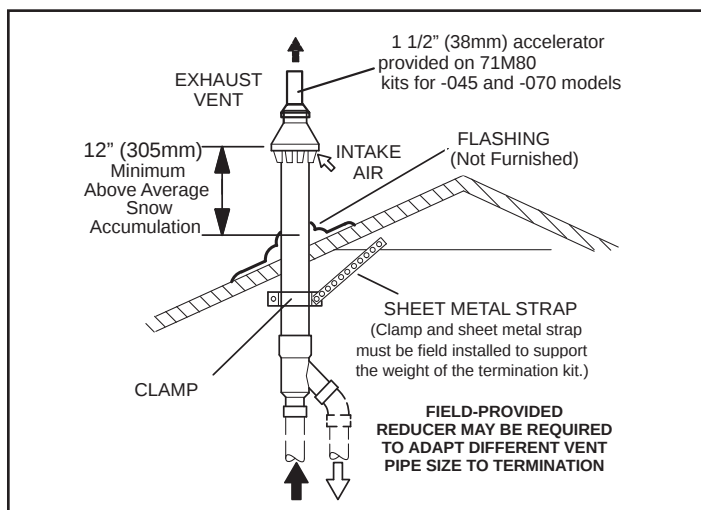
| Model                                                                                                         | Exhaust Pipe Size | Termination Pipe Size |
|---------------------------------------------------------------------------------------------------------------|-------------------|-----------------------|
| *070                                                                                                          | 2", 2-1/2", or 3" | 1-1/2"                |
| *090                                                                                                          |                   | 2"                    |
| 110                                                                                                           |                   |                       |
| * -070 and -090 units with the flush-mount termination must use the 1-1/2" accelerator supplied with the kit. |                   |                       |

5. On field-supplied terminations for side wall exit, exhaust piping may extend a maximum of 12 inches (305MM) for 2" PVC and 20 inches (508MM) for 3" (76MM) PVC beyond the outside wall. Intake piping should be as short as possible. See **Figure 36**.

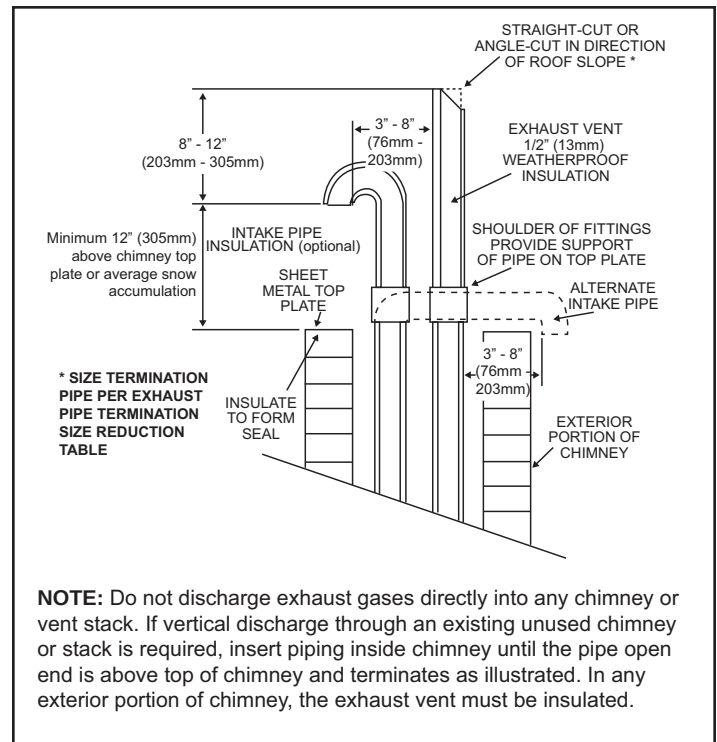
6. On field-supplied terminations, a minimum distance between the end of the exhaust pipe and the end of the intake pipe without a termination elbow is 8" and a minimum distance of 6" with a termination elbow. See **Figure 36**.
7. If intake and exhaust piping must be run up a side wall to position above snow accumulation or other obstructions, piping must be supported. At least one bracket must be used within 6" from the top of the elbow and then every 24" (610mm) as shown in Figure 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 26**. The intake piping may be equipped with a 90° elbow turndown. Using turndown will add 5 feet (1.5m) to the equivalent length of the pipe.
8. A multiple furnace installation may use a group of up to four terminations assembled together horizontally, as shown in **Figure 31**.



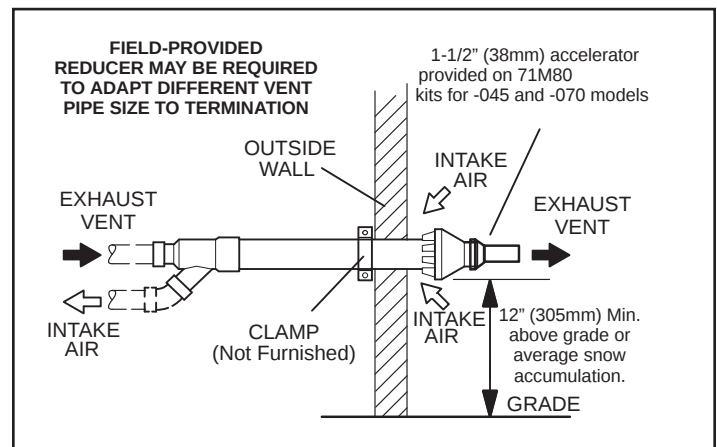
**Figure 31. Optional Vent Termination for Multiple Unit Installation of Direct Vent Wall Termination**



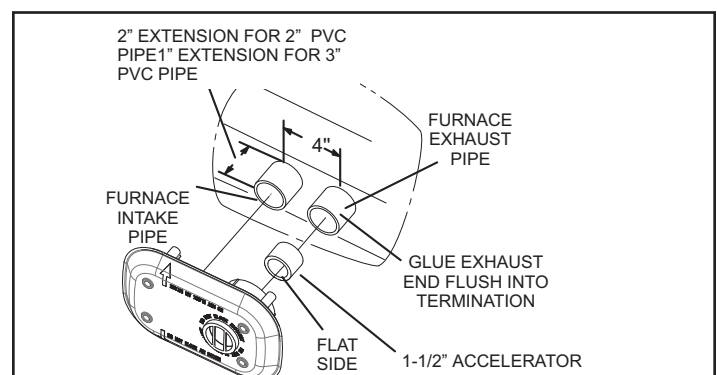
**Figure 32. Direct Vent Concentric Rooftop Termination 71M80, 69M29 or 60L46 (US)**



**Figure 33. Direct Vent Application Using Existing Chimney**



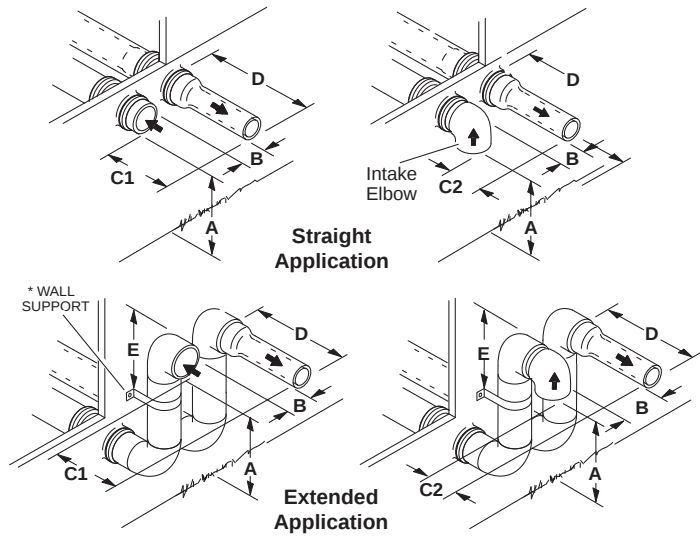
**Figure 34. Direct Vent Concentric Wall Termination 71M80, 69M29 or 60L46 (US)**



**Figure 35. Flush-Mount Side Wall Termination 51W11**

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

**Field Fabricated Wall Termination**

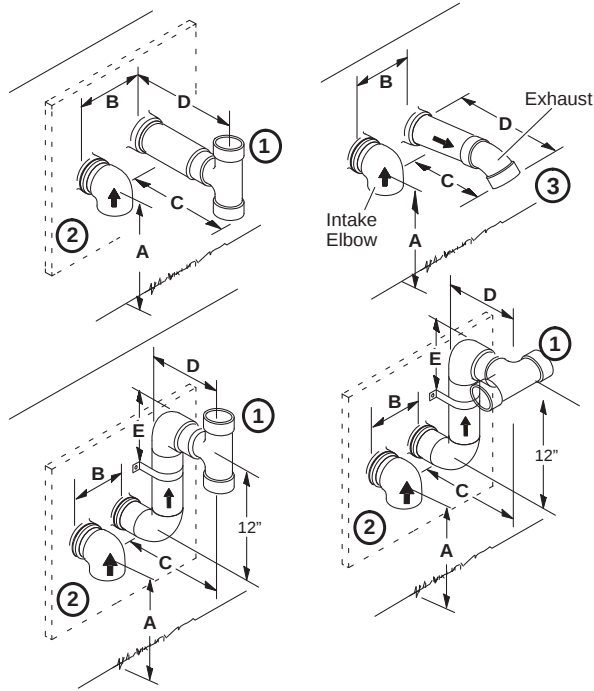


|                                                                         | 2" (51mm) Vent Pipe | 3" (76mm) Vent Pipe |
|-------------------------------------------------------------------------|---------------------|---------------------|
| A - Minimum clearance above grade or average snow accumulation          | 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)         |

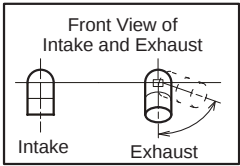
\* Use wall support every 24" (610 mm). Use two wall supports if extension is greater than 24" (610 mm) but less than 48" (1219 mm).

**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)                      |



<sup>1</sup> The Exhaust termination tee should be connected to the 2" or 3" PVC flue pipe as shown in the illustration. In horizontal tee applications there must be a minimum of 3 ft away 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.

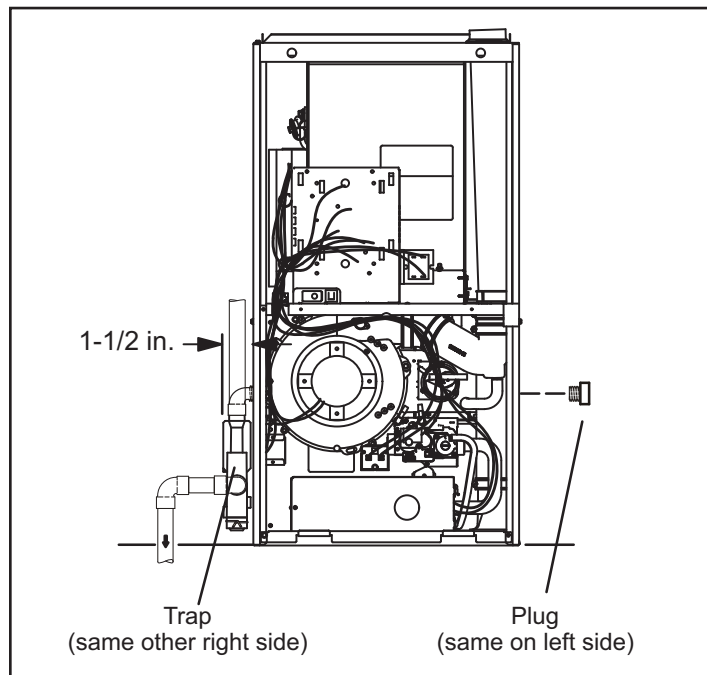
<sup>2</sup> As required. Flue gas may be acidic and may adversely affect some building materials. If a side wall vent termination is used and flue gases will impinge on the building materials, a corrosion- resistant shield (24 inches square) should be used to protect the wall surface. If optional tee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

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

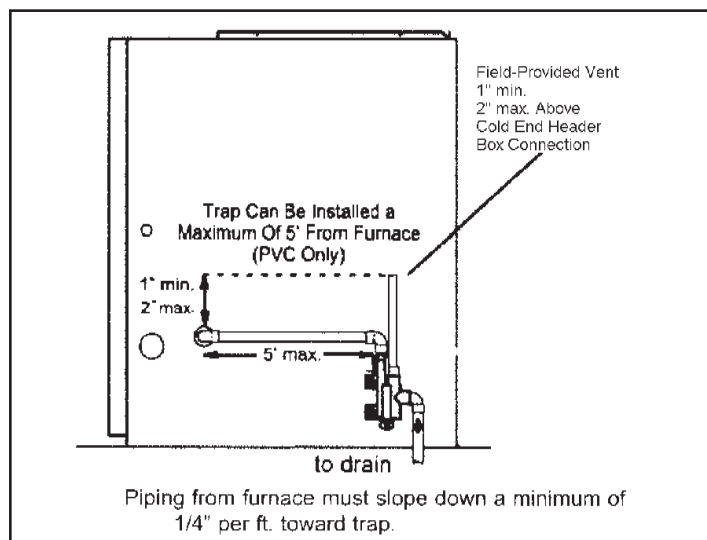
**Figure 36.**

## Condensate Piping

This unit is designed for either right- or left-side exit of condensate piping. Refer to **Figure 37** and **Figure 38** for condensate trap locations.



**Figure 37. Condensate Trap and Plug Locations**



**Figure 38. Condensate Trap Locations  
(Unit shown with right side exit of condensation)**

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.
3. Install the cap over the clean out opening at the base of the trap. Secure with clamp. See **Figure 43** and **Figure 44**.
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.

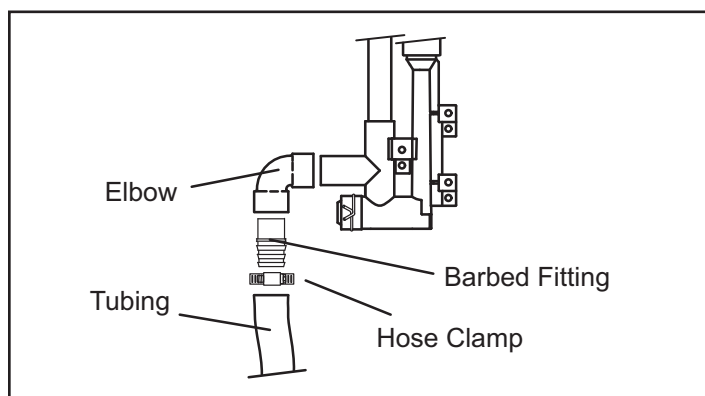
### **! IMPORTANT**

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.

5. **Figure 40** 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 41**.

**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 39**.



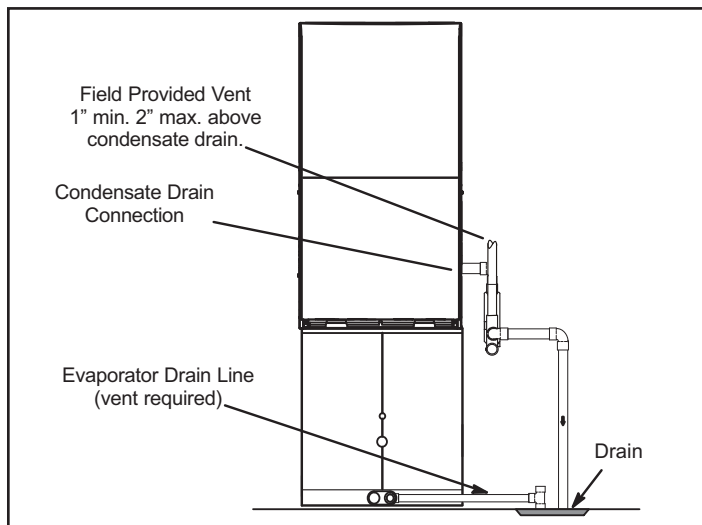
**Figure 39. Field-Provided Drain Components**

### **! CAUTION**

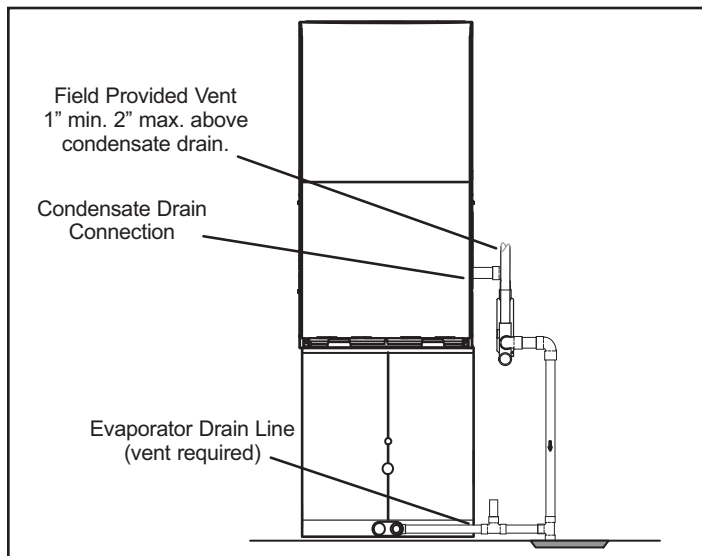
Do not use copper tubing or existing copper condensate lines for drain line.

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

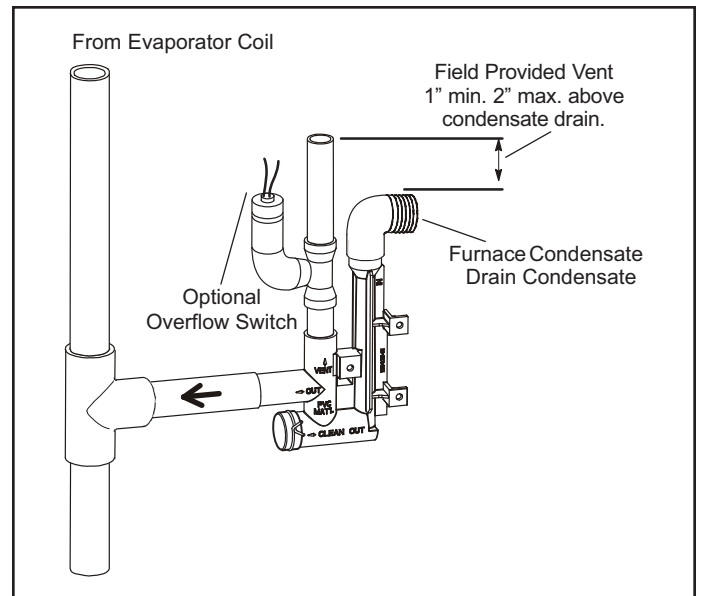
Condensate line must slope downward away from the trap to drain. If drain level is above condensate trap, condensate pump must be used. Condensate drain line should be routed within the conditioned space to avoid freezing of condensate and blockage of drain line. If this is not possible, a heat cable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



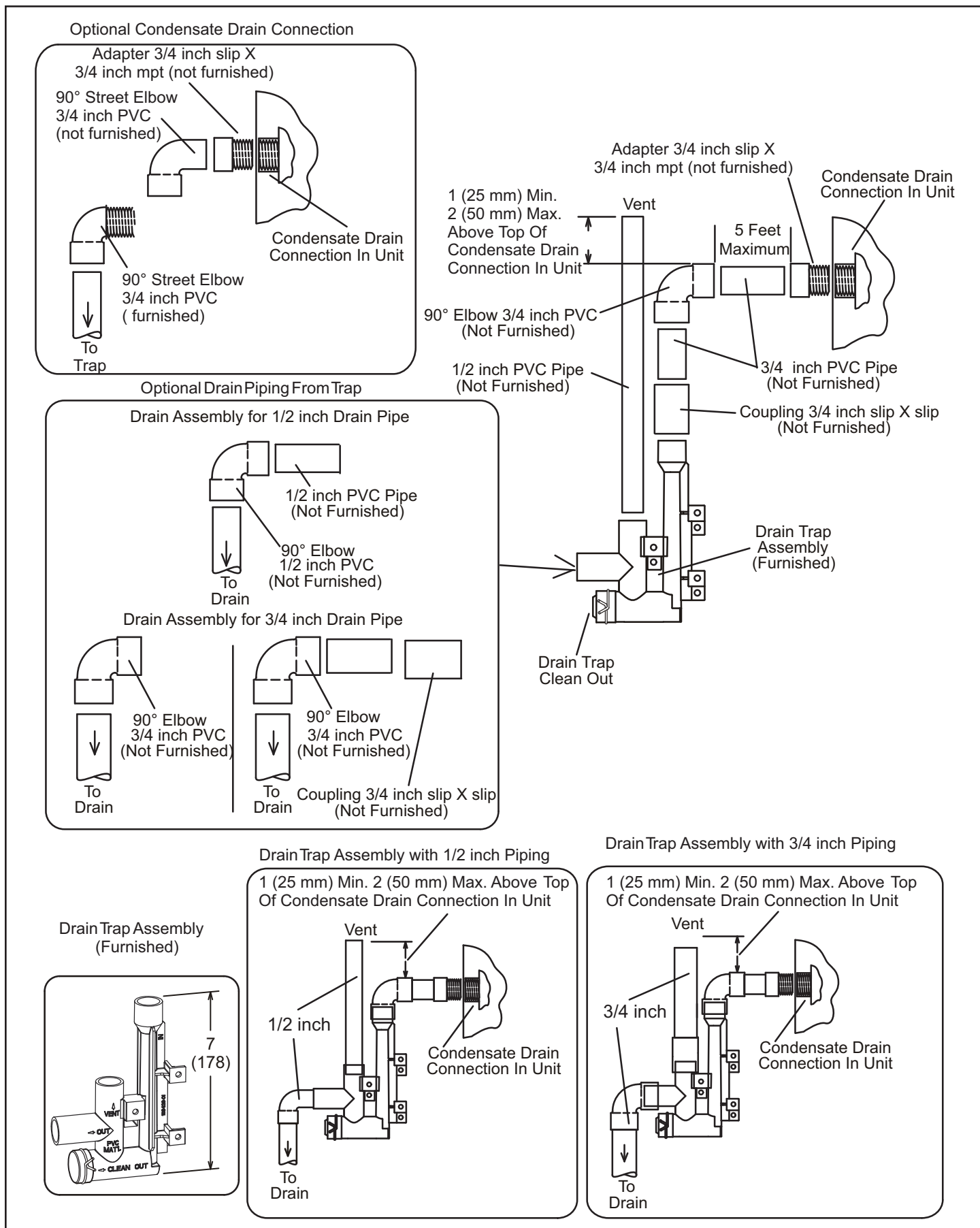
**Figure 40. Unit with Cooling Coil Using Separate Drain**



**Figure 41. Evaporator Coil Using a Common Drain**

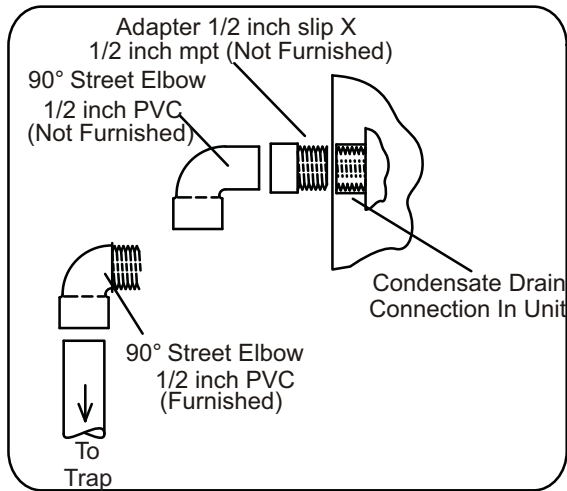


**Figure 42. Condensate Trap With Optional Overflow Switch**



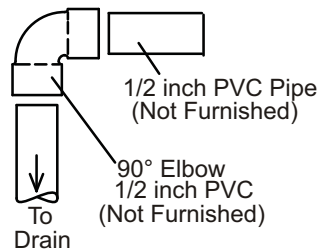
**Figure 43. Trap / Drain Assembly Using 1/2" PVC or 3/4" PVC  
Cold End Header Box with 3/4 Drain Connection**

### Optional Condensate Drain Connection

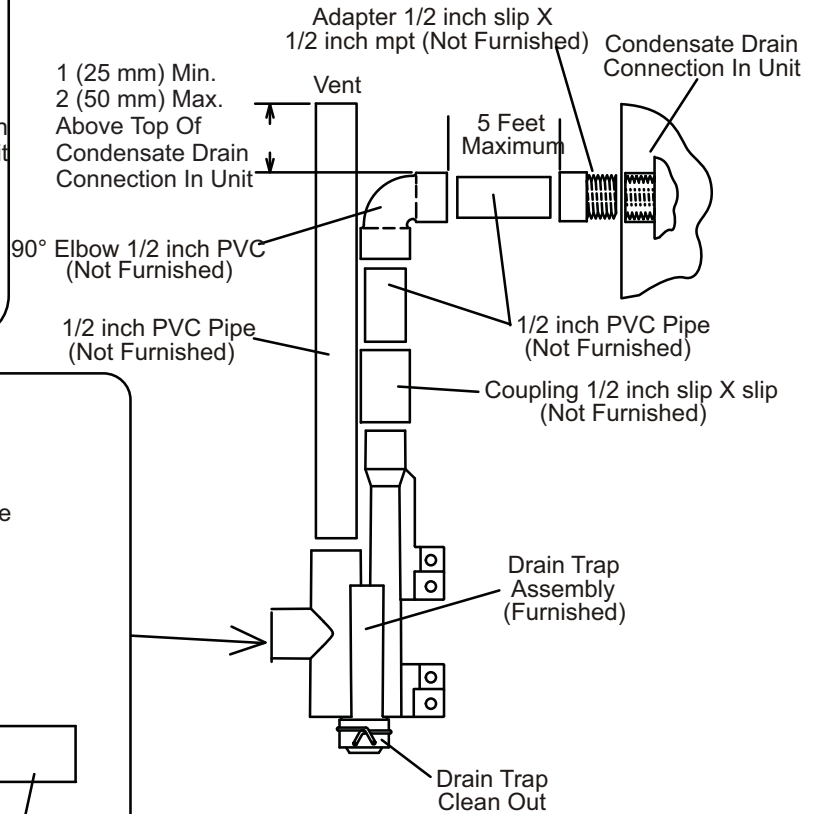
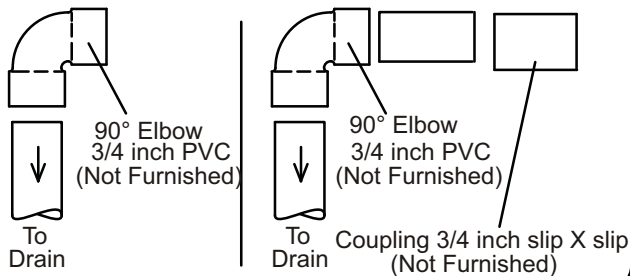


### Optional Drain Piping From Trap

#### Drain Assembly for 1/2 inch Drain Pipe



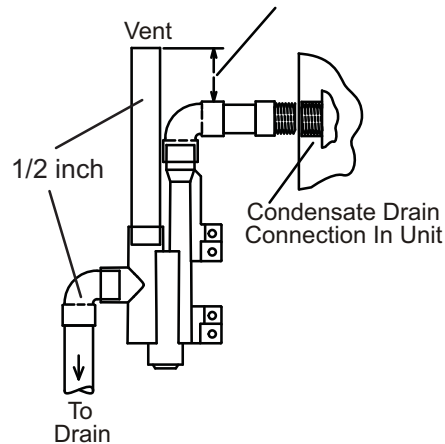
#### Drain Assembly for 3/4 inch Drain Pipe



### Drain Trap Assembly with 3/4 inch Piping

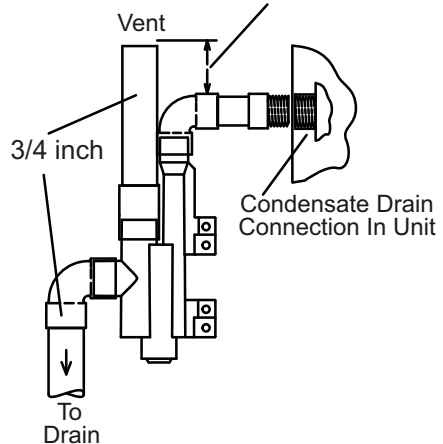
#### Drain Trap Assembly with 1/2 inch Piping

1 (25 mm) Min. 2 (50 mm) Max. Above Top Of Condensate Drain Connection In Unit



#### Drain Trap Assembly with 3/4 inch Piping

1 (25 mm) Min. 2 (50 mm) Max. Above Top Of Condensate Drain Connection In Unit



#### Drain Trap Assembly (Furnished)

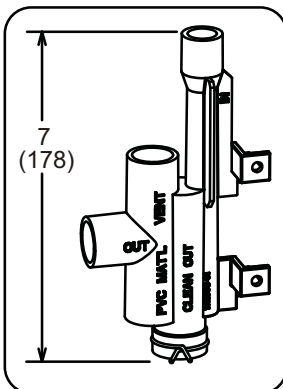


Figure 44. Trap / Drain Assembly Using 1/2" PVC or 3/4" PVC Cold End Header Box with 1/2 Drain Connection

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 47** 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 LGWP1 sensor plug. The Molex plug clip should lock into the Molex connection point for a secured connection, as shown below in **Figure 45**. Verify the connection is free of dust, debris, and moisture.

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

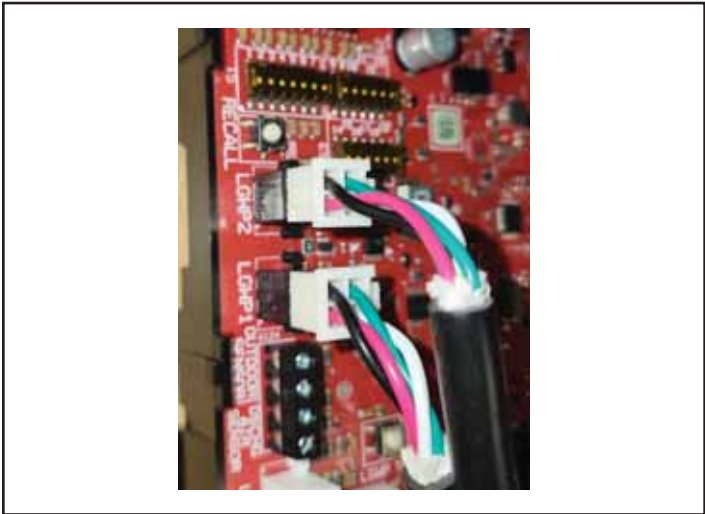


Figure 45. Modulating Furnace Control

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 46** and **Table 28**.

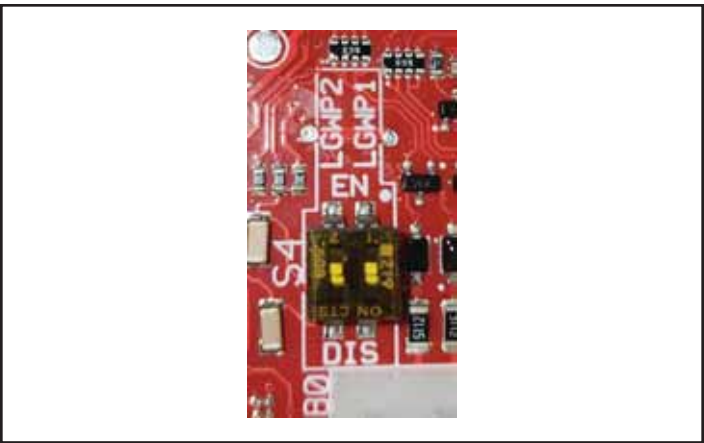


Figure 46.

Table 28. DIP Switch Settings

| Configuration                                                 | LGWP 1  | LGWP 2  |
|---------------------------------------------------------------|---------|---------|
| One (1) sensor, connected to SENSOR 1 plug                    | Enable  | Disable |
| Two (2) sensors, connected to SENSOR 1 plug and SENSOR 2 plug | Enable  | Enable  |
| No sensor R410A or heat only applications                     | Disable | Disable |
| Invalid Configuration                                         | Disable | Enable  |

In single sensor configurations, the sensor must be connected to the LGWP1 plug. Configurations other than the ones shown in **Table 28** will cause a servicing fault.

Each DIP switch corresponds to a sensor position (i.e., DIP switch LGWP1 to LGWP1 sensor plug; and DIP switch LGWP2 to LGWP2 Sensor plug). The default factory switch positions are set toENABLED.

The furnace control board software reads the ENABLE position as an active sensor. A sensor should be present for the corresponding sensor connector. Setting the DIP switch to DISABLE position 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 requirement listed in Refrigeration Detection Sensor kit (27V53). See **Figure 47** 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 Disable 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 set point 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 Page 17 for Integrated control diagnostic codes.

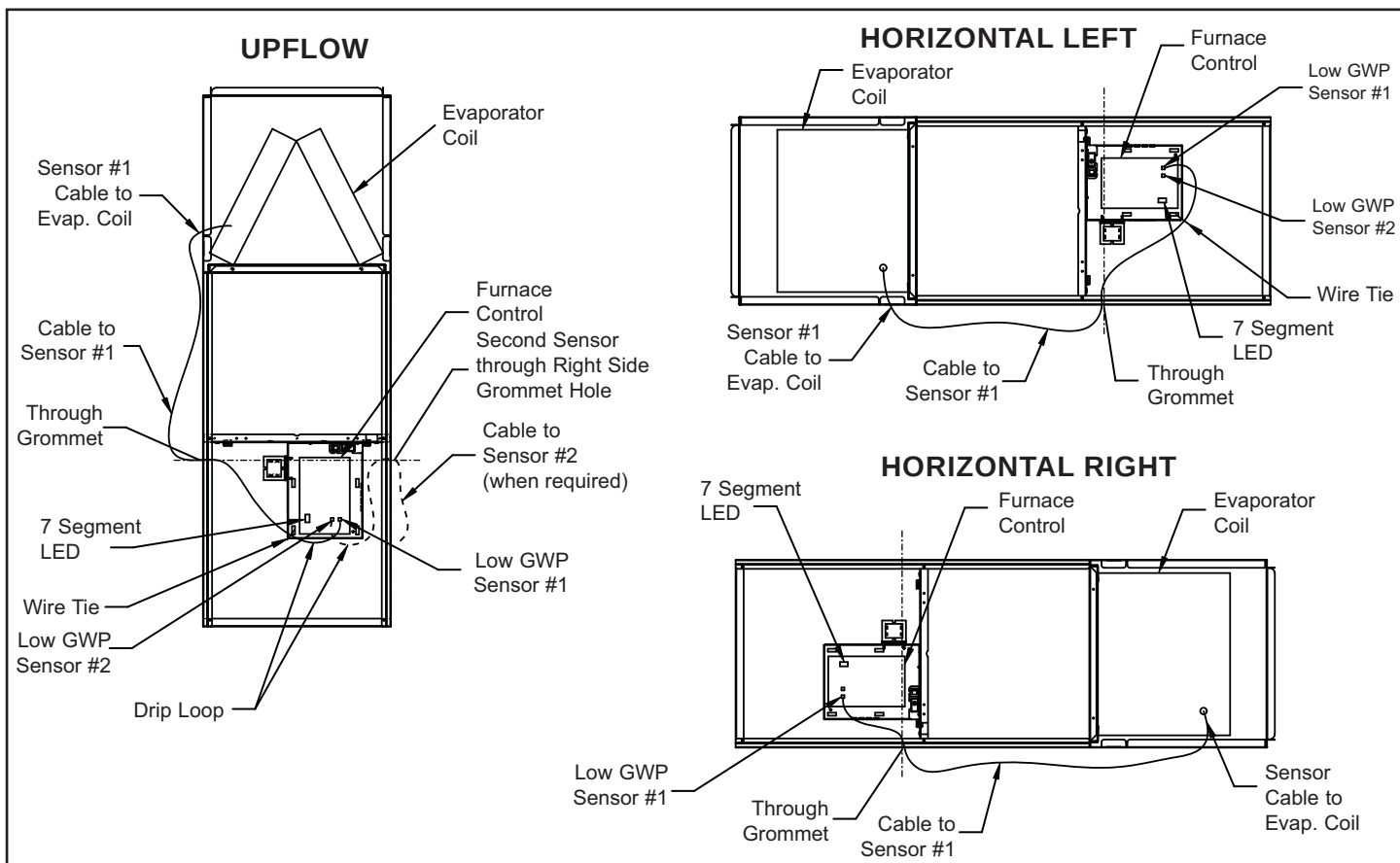


Figure 47.

## 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 29** lists the functions of the Test button during each mode of operation.

**Table 29. LGWP Test Button Function**

| 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 troubleshoot-ing and resolving a fault condition. If the fault is not resolved, the furnace control board will enter the Fault mode again |

## LGWP Test Button - Additional Functions

**Table 30** 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.

**Table 30. Additional Button Functions**

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

**External Alarm** - (For applications with external alarms wired directly to the furnace control board)

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

## THERMOSTAT COMPATIBILITY

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

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

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

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

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

## START UP PROCEDURE

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

### Cooling Demand

1. Prompt a cooling demand at the thermostat.
2. Press the LGWP Test button on the furnace control board. The system then executes a leak detection response.
3. Observe the following sequence:
  - a. The LED indicator for leak detection. See page 18 for Integrated 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 to initiate the simulated Leak Detection mode.
3. Observe the following sequence:
  - a. The LED indicator for leak detection. See **INTEGRATED CONTROL DIAGNOSTIC CODES** on **Page 17**.
  - b. The blower powers up.
  - c. The gas burners power down.
  - d. The outdoor compressor powers down.
4. Press the LGWP Test button to terminate the simulated Leak Detected mode upon test completion.

The installation of the Refrigerant Detection System is complete after both sequences are completed successfully.

## 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.

### WARNING

Do not use this furnace if any part has been underwater. A flood-damaged furnace is extremely dangerous. Attempts to use the furnace can result in fire or explosion. Immediately call a qualified service technician to inspect the furnace and to replace all gas controls, control system parts, and electrical parts that have been wet or to replace the furnace, if deemed necessary.

### WARNING

Danger of explosion.



Can cause injury or product or property damage. Should the gas supply fail to shut off or if overheating occurs, shut off the gas valve to the furnace before shutting off the electrical supply.

### CAUTION

Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch.

### 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\*\*\*M\*\*R is equipped with a gas control switch. Use only your hand to move the switch. Never use tools. If the the switch will not move by hand, replace the valve. Do not try to repair it. Force or attempted repair may result in a fire or explosion.

### Placing the Furnace into Operation

NF97D\*\*\*M\*\*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 sufficient water to ensure proper condensate drain operation.

### WARNING

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

### Gas Valve Operation

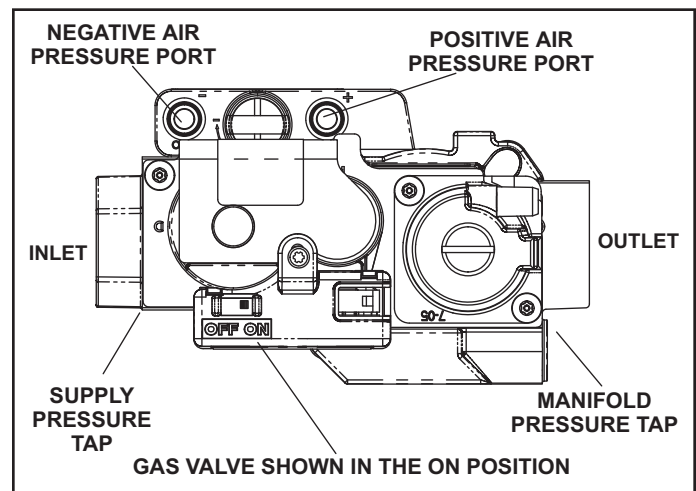


Figure 48. Gas Valve

1. **STOP!** Read the safety information at the beginning of this section.
2. Set the thermostat to the lowest setting.
3. Turn off all electrical power to the unit.

4. This furnace is equipped with an ignition device which automatically lights the burners. Do not try to light the burners by hand.
  5. Remove the upper access panel.
  6. Move gas valve switch to OFF. See **Figure 48**.
  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 48**.
  9. Replace the upper access panel.
  10. Turn on all electrical power to the unit.
  11. Set the thermostat to desired setting.
- NOTE:** When unit is initially started, steps 1 through 11 may need to be repeated to purge air from gas line.
12. If the appliance will not operate, follow the instructions "Turning Off Gas to Unit" and call your service technician or gas supplier.

### Turning Off Gas to Unit

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

### Failure to Operate

If the unit fails to operate, check the following:

1. Is the thermostat calling for heat?
2. Are access panels securely in place?
3. Is the main disconnect switch closed?
4. Is there a blown fuse or tripped breaker?
5. Is the filter dirty or plugged? Dirty or plugged filters will cause the limit control to shut the unit off.
6. Is gas turned on at the meter?
7. Is the manual main shut-off valve open?
8. Is the internal manual shut-off valve open?
9. Is the unit ignition system in lockout? If the unit locks out again, inspect the unit for blockages.
10. Is blower harness connected to integrated control? Furnace will not operate unless harness is connected.

### Safety or Emergency Shutdown

Turn off unit power. Close manual and main gas valves.

### Extended Period Shutdown

Turn off thermostat or set to "UNOCCUPIED" mode. Close all gas valves (both internal and external to unit) to guarantee no gas leak into combustion chamber. Turn off power to

unit. All access panels and covers must be in place and secured.

## Heating System Service Checks

### CSA Certification

All units are CSA design certified without modifications. Refer to the NF97D\*\*\*M\*\*R Installation Instruction.

### Gas Piping

#### **⚠ CAUTION**

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

#### **⚠ 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.

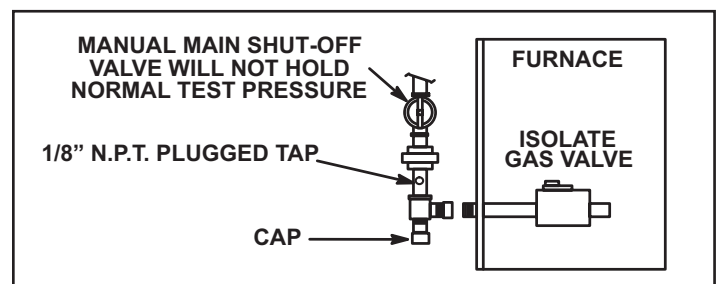
Compounds used on gas piping threaded joints should be resistant to action of liquefied petroleum gases.

### 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 0.5psig (14" W.C.). See **Figure 49**.



**Figure 49.**

When checking piping connections for gas leaks, use preferred means. Kitchen detergents can cause harmful corrosion on various metals used in gas piping. Use of a specialty Gas Leak Detector is strongly recommended.

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

### Testing Gas Supply Pressure

When testing supply gas pressure, connect test gauge to supply pressure tap on the gas valve. Check gas line pressure with unit firing at maximum rate. Low pressure may result in erratic operation or underfire. High pressure can result in permanent damage to gas valve or overfire. See **Table 31** for operating pressure at unit gas connection (line).

On multiple unit installations, each unit should be checked separately, with and without units operating. Supply pressure must fall within range listed in **Table 32**.

**Table 31.**

| All Units           | Natural    | LP          |
|---------------------|------------|-------------|
| Line Pressure w.c." | 4.5 - 10.5 | 11.0 - 13.0 |

### Check Manifold Pressure (Figure 50)

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

1. Remove the threaded plug from the outlet side of the gas valve and install a field-provided barbed fitting. Connect measuring device "+" connection to barbed fitting to measure manifold pressure.
2. Tee into the gas valve regulator vent hose and connect test gauge "-" connection.
3. Start unit on low heat (35% rate) and allow 5 minutes for unit to reach steady state.
4. While waiting for the unit to stabilize, notice the flame. Flame should be stable and should not lift from burner. Natural gas should burn blue.
5. After allowing unit to run for 5 minutes, record manifold pressure and compare to value given in Table 28.
6. Repeat steps 3, 4 and 5 on high fire.
7. Shut unit off and remove manometer as soon as an accurate reading has been obtained. Take care to remove barbed fitting and replace threaded plug.
8. Start unit and perform leak check. Seal leaks if found.



**CAUTION**

Do not attempt to make adjustments to the gas valve.

### Operating Pressure Signal (Delta P) Measurement (Figure 51)

Operating pressure signal can be taken while the manifold pressure check is taken (using two measuring devices). Or, taken after the manifold pressure measurement is complete.

1. Tee into the negative line between the gas valve and pressure switch and connect to measuring device negative "-".
2. Tee into the positive line between the gas valve and pressure switch and connect to measuring device positive "+".
3. Start unit on low heat (35% rate) and allow 5 minutes for unit to reach steady state.
4. After allowing unit to stabilize for 5 minutes, record operating pressure signal and compare to value given in **Table 36**.
5. Repeat steps 3 on 4 high heat.

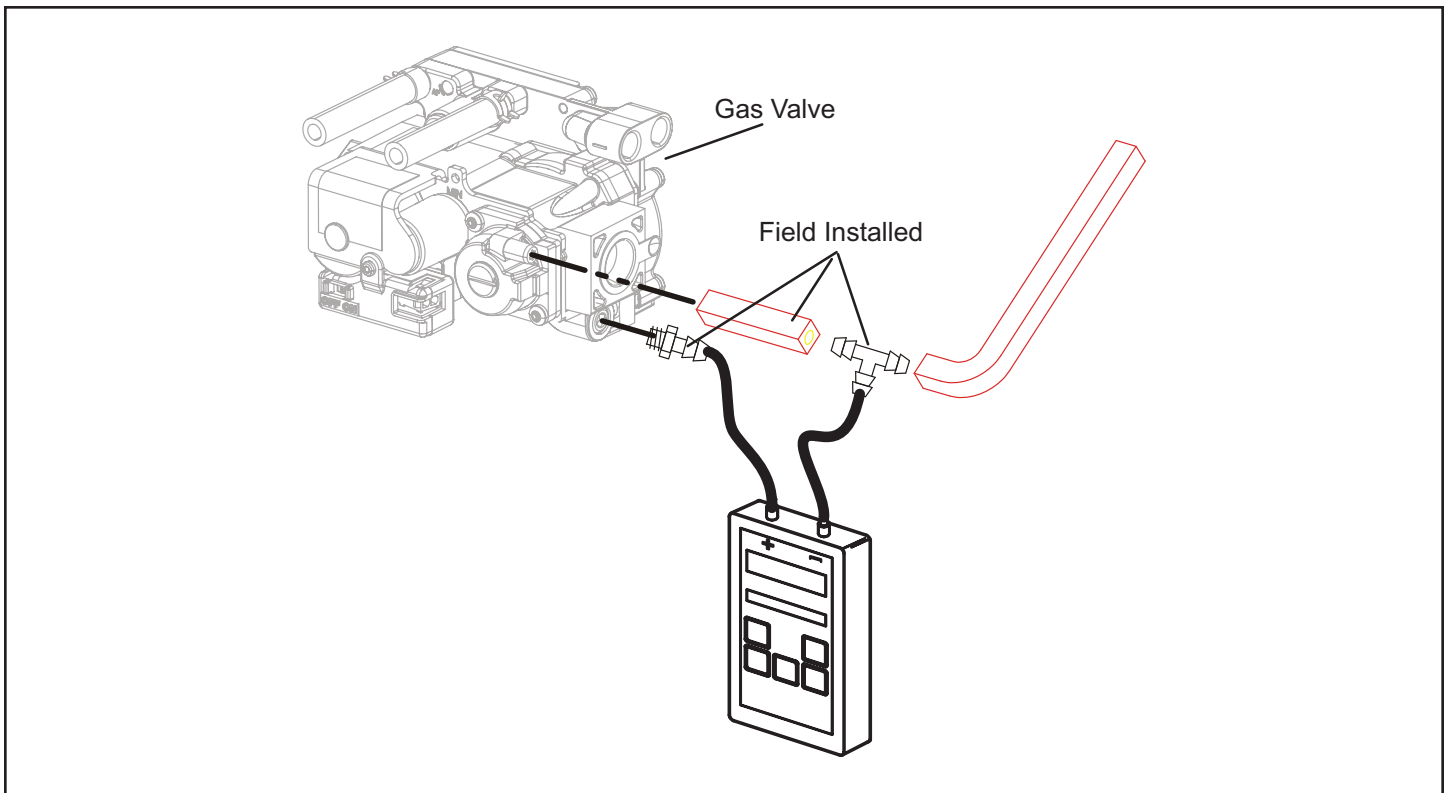
### Proper Gas Flow (Approximate)

Furnace should operate at least 5 minutes before checking gas flow. Determine time in seconds for two revolutions of gas through the meter. (Two revolutions assures a more accurate time.) Divide by two and compare to time in **Table 32**. If manifold pressure matches **Table 36** and rate is incorrect, check gas orifices for proper size and restriction.

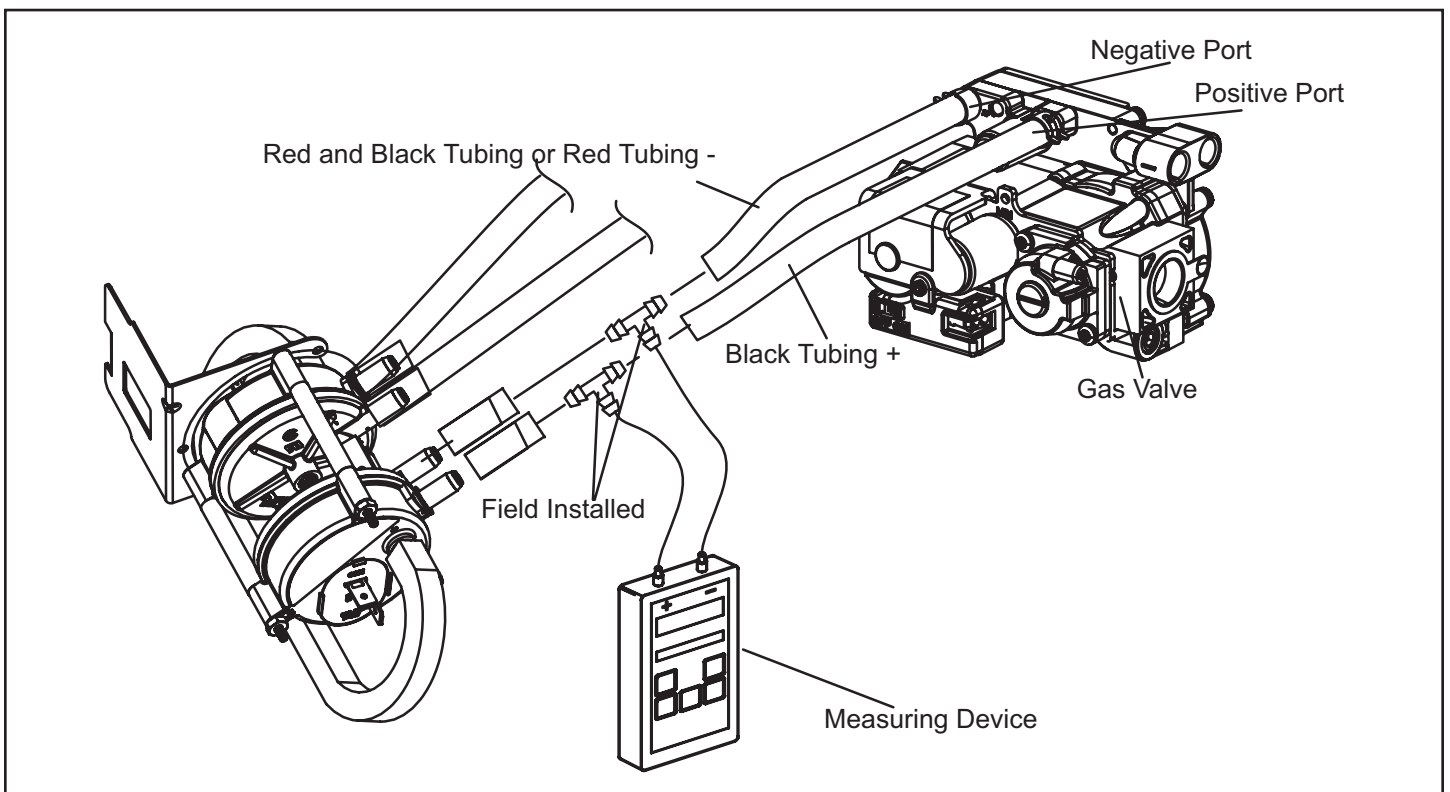
**NOTE:** To obtain accurate reading, shut off all other gas appliances connected to meter.

**Table 32. Gas Meter Clocking Chart**

| Model                    | Seconds for One Revolution |              |                     |              |
|--------------------------|----------------------------|--------------|---------------------|--------------|
|                          | Natural                    |              | LP                  |              |
|                          | 1 cu ft Dial               | 2 cu ft Dial | 1 cu ft Dial        | 2 cu ft Dial |
| -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 |              |



**Figure 50. Manifold Pressure Measurement**



**Figure 51. Operating Signal (Delta P) Measurement**

## Proper Combustion

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

**Table 33. High Fire**

| Unit | CO <sub>2</sub> % for Nat | CO <sub>2</sub> % for L.P. |
|------|---------------------------|----------------------------|
| All  | 7.6 - 8.6                 | 9.1 - 10.0                 |

**Table 34. Low Fire**

| Unit | CO <sub>2</sub> % for Nat | CO <sub>2</sub> % for L.P. |
|------|---------------------------|----------------------------|
| 070  | 5.7                       | 7.2 - 8.2                  |
| 090  | 5.3 - 6.3                 | 6.8 - 7.8                  |
| 110  |                           |                            |

## High Altitude

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

NF97D\*\*\*M\*\*R units require no manifold pressure adjustments for operation at altitudes up to 10,000 feet (3048m) above sea level. Units installed at altitude of 7,501 to 7,500 feet (2287 to 3048m) require a pressure switch change per **Table 35**. **Table 35** also lists gas conversion kit requirements at all altitudes.

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

**Table 35. Conversion Kit Requirements**

| Model Input Size | LP/Propane Kit        | High Altitude Pressure Switch Kit |                               |
|------------------|-----------------------|-----------------------------------|-------------------------------|
|                  | 0 - 10,000 (0-3048 m) | 0 - 7,500 (0 - 2286 m)            | 7,501 - 10,000 (2287 - 3048m) |
| 70               | 68W77                 | Not required                      | 14T67                         |
| 90               |                       |                                   |                               |
| 110              |                       |                                   |                               |

**Table 36. Manifold and Operating Signal Pressures in inches 0-7500 ft (0-2286 m)**

| Firing Rate | Manifold Pressure Nat Gas |        |      | Manifold Pressure LP/Propane |        |      | Operating Pressure Signal (Delta P) |        |      |
|-------------|---------------------------|--------|------|------------------------------|--------|------|-------------------------------------|--------|------|
|             | Min                       | Normal | Max  | Min                          | Normal | Max  | Min                                 | Normal | Max  |
| 35%         | 0.4                       | 0.6    | 0.95 | 1.2                          | 1.6    | 2.8  | 0.25                                | 0.30   | 0.35 |
| 70%         | 1.7                       | 1.9    | 2.1  | 5.1                          | 5.5    | 5.9  | 0.60                                | 0.65   | 0.70 |
| 100%        | 3.2                       | 3.5    | 3.8  | 9.5                          | 10.0   | 10.5 | 1.10                                | 1.15   | 1.20 |

**NOTE:** The values given in table are measurements only. The gas valve should NOT be adjusted.

**NOTE:** A natural to LP/propane gas changeover kit (Table 28) is necessary to convert this unit. Refer to the changeover kit installation instructions for the conversion procedure.

## Typical Operating Characteristics

### Blower Operation and Adjustment

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

### Temperature Rise

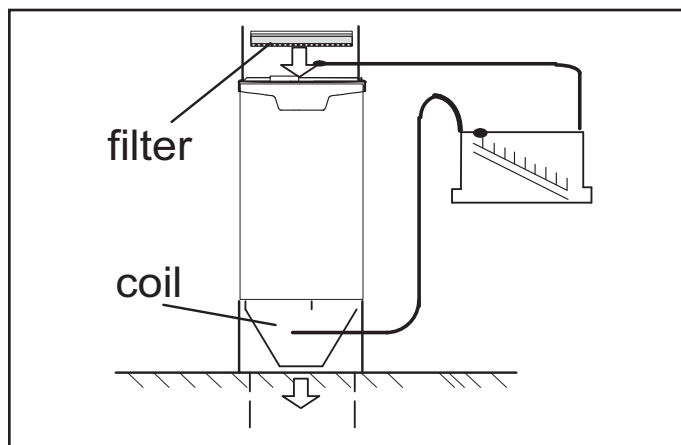
Temperature rise for NF97D\*\*\*M\*\*R units depends on unit input, blower speed, blower horsepower and static pressure as marked on the unit rating plate. The blower speed must be set for unit operation within the range of "TEMP. RISE °F" listed on the unit rating plate.

To measure temperature rise:

1. Place plenum thermometers in the supply and return air plenums. Locate supply air thermometer in the first horizontal run of the plenum where it will not pick up radiant heat from the heat exchanger.
2. Set thermostat for heat call. Unit must operate on second-stage heat. If using a single-stage thermostat furnace must fire at least 10 minutes before switching to second-stage heat.
3. After plenum thermometers have reached their highest and steadiest readings, subtract the two readings. The difference should be in the range listed on the unit rating plate. If the temperature is too low, decrease blower speed. If temperature is too high, first check the firing rate. Provided the firing rate is acceptable, increase blower speed to reduce temperature.

### External Static Pressure

1. Tap locations shown in Figure 49.



**Figure 52. Static Pressure Test**

2. Punch a 1/4" diameter hole in supply and return air plenums. Insert manometer hose flush with inside edge of hole or insulation. Seal around the hose with permagum. Connect the zero end of the manometer to the discharge (supply) side of the system. On ducted systems, connect the other end of manometer to the return duct as above.
3. With only the blower motor running and the evaporator coil dry, observe the manometer reading. Adjust blower motor speed to deliver the air desired according to the job requirements.
4. External static pressure drop must not be more than 0.8" W.C. in the heating mode and must not exceed 1.0" W.C. in the cooling mode.
5. Seal the hole when the check is complete.

## Maintenance



### WARNING

#### ELECTRICAL SHOCK, FIRE, OR EXPLOSION HAZARD.

Failure to follow safety warnings exactly could result in dangerous operation, serious injury, death or property damage.

Improper servicing could result in dangerous operation, serious injury, death, or property damage. Before servicing, disconnect all electrical power to furnace.

When servicing controls, label all wires prior to disconnecting. Take care to reconnect wires correctly. Verify proper operation after servicing.

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

#### Blower

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



### WARNING

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

#### Filters

All NF97D\*\*\*M\*\*R filters are installed external to the unit. Filters should be inspected monthly. Clean or replace the filters when necessary to ensure proper furnace operation. All NF97D\*\*\*M\*\*R units use a 16 x 25 x1 filter.



### 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 against the data given in the appropriate Product Specifications.

## 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



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.



### WARNING

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

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

Motor Nameplate \_\_\_\_\_ Actual \_\_\_\_\_

### Condensate Hose Screens (Figure 53)

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.

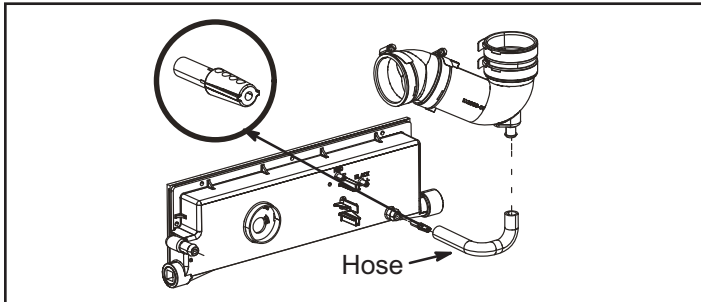


Figure 53. Condensate Hose Screens

### Winterizing and Condensate Trap Care

1. Turn off power to the unit.
2. Have a shallow pan ready to empty condensate water.
3. Remove the drain plug from the condensate trap and empty water. Inspect the trap then reinstall the drain plug and refill trap with water.

### Cleaning the Heat Exchanger and Burner

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

1. Turn off electrical and gas supplies to the furnace.
  2. Remove the furnace access panels.
  3. Disconnect the 2-pin plug from the gas valve.
  4. Remove gas supply line connected to gas valve. Remove the burner box cover 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. 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.
8. Loosen the clamps to the flexible exhaust coupling.
  9. Disconnect condensate drain line from the cold end header box.

10. Disconnect condensate drain tubing from flue collar. Remove screws that secures the flue collar into place. Remove flue collar. It may be necessary to cut the exiting exhaust pipe for removal of the fitting.
11. Mark and disconnect all combustion air pressure tubing from cold end header collector box.
12. Mark and remove wires from pressure switches. Remove pressure switches. Keep tubing attached to pressure switches.
13. Disconnect the 4-pin 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.
14. Remove electrical junction box from the side of the furnace.
15. Remove cold end header box.
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 and bottom which secure vestibule panel and heat exchanger assembly to cabinet. Remove two screws from blower rail which secure bottom heat exchanger flange. Remove heat exchanger from furnace cabinet.
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 resting on the support located at the rear of the cabinet. Remove the indoor blower to view this area through the blower opening.
23. Re-secure the supporting screws along the vestibule sides and bottom 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.
28. Reinstall the cold end header box.
29. Reinstall the combustion air inducer. Reconnect the 4-pin plug to the wire harness.

30. Reinstall pressure switches and reconnect pressure switch wiring.
31. Carefully connect combustion air pressure switch hosing from pressure switches to proper stubs on cold end header collector box.
32. Reinstall condensate trap.
33. Use securing screws to reinstall flue collar to the top cap on the furnace. Reconnect exhaust piping and exhaust drain tubing.
34. Replace flexible exhaust adapter tee on combustion air inducer and flue collar. Secure using two existing hose clamps.
35. Reinstall burner box assembly in vestibule area.
36. Reconnect flame roll-out switch wires.
37. Reconnect sensor wire and reconnect 2-pin plug from ignitor.
38. Secure burner box assembly to vestibule panel using four existing screws. Make sure burners line up in center of burner ports.
39. Reinstall gas valve manifold assembly. Reconnect gas supply line to gas valve.
40. Reinstall burner box cover.
41. Reconnect 2-pin plug to gas valve.
42. Replace the blower compartment access panel.
43. Refer to instruction on verifying gas and electrical connections when re-establishing supplies.
44. 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.
45. Replace heating compartment access panel.

### **Cleaning the Burner Assembly**

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.
4. Disconnect the gas supply line from the gas valve. Remove gas valve/manifold assembly.
5. Mark and disconnect sensor wire from the sensor. Disconnect 2-pin plug from the ignitor at the burner box.
6. Remove four screws which secure burner box assembly to vest panel. Remove burner box from the unit.
7. 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.
8. Reconnect the sensor wire and reconnect the 2-pin plug to the ignitor wiring harness.
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. Reinstall the gas valve manifold assembly. Reconnect the gas supply line to the gas valve. Reinstall the burner box cover.
11. Reconnect 2-pin plug to gas valve.
12. Replace the blower compartment access panel.
13. Refer to instruction on verifying gas and electrical connections when re-establishing supplies.
14. 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.
15. Replace heating compartment access panel.

# Wiring and Sequence of Operation

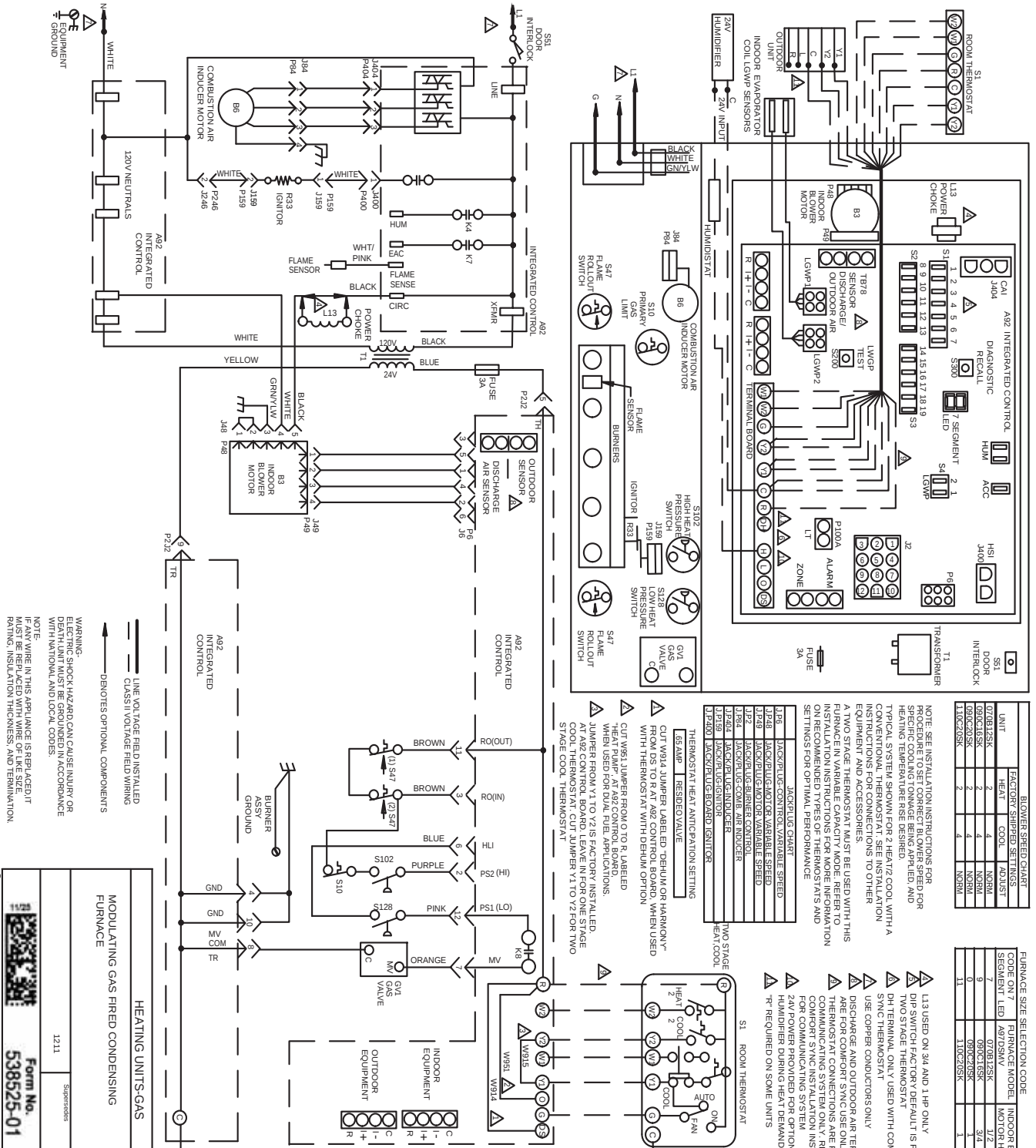


Figure 54. Typical Field Wiring Diagram for Standard Non-Communicating Thermostat

## Sequence of Operation

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

### Applications Using a Two-Stage Thermostat

#### A - Heating Sequence -- Control Thermostat Selection DIP switch in "Variable Capacity" Position

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 ignition speed, which is approximately the same as the inducer speed at 70 percent firing rate.
2. Once the control receives a signal that the low-fire pressure switch has closed, the combustion air inducer begins a 15-second pre-purge in ignition speed.
3. After the pre-purge is complete, a 20-second initial ignitor warm-up period begins. The combustion air inducer continues to operate at the ignition speed.
4. After the 20-second warm-up period has ended, the gas valve is energized and ignition occurs. At the same time, the control module begins an indoor blower 45-second ON-delay. When the delay ends, the indoor blower motor is energized at a speed that matches the firing rate. After the 10-second ignition stabilization delay expires, the inducer speed is adjusted to the appropriate target rate. If the furnace is operating in the initial heating cycle after power-up, the initial firing rate will be approximately 35 percent. The firing rate on subsequent cycles will be automatically adjusted by the integrated control based on thermostat cycles. The firing rate will vary and will range from 35 percent to 90 percent. The furnace will continue this operation as long as the thermostat has a first-stage heating demand.
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 either increases the firing rate to 70 percent (if the current rate is at or below 60 percent) or increases the firing rate by 10 percent (if the current rate is above 60 percent). If the call for heat continues 5 minutes beyond this initial upstage, the rate will be increased by 10 percent every 5 minutes until the call for heat is satisfied or the furnace reaches 100 percent rate. As the firing rate increases, the indoor blower motor is adjusted to a speed which is appropriate for the target rate.
6. If second-stage heat demand is satisfied, but first stage is still present, the furnace will continue to operate at the present firing rate until the heat cycle ends.

7. When the demand for first- and second-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 20-second post-purge period.
8. When the combustion air post-purge period is complete, the inducer is de-energized. The indoor blower is de-energized at the end of the off delay.

### Applications Using a Single-Stage Thermostat

#### B - Heating Sequence -- Control Thermostat Selection DIP switch in "Single-Stage" Position

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 the ignition speed, which is approximately the same as the inducer speed at 70 percent firing rate.
2. Once the control receives a signal that the low-fire pressure switch has closed, the combustion air inducer begins a 15-second pre-purge at the ignition speed.
3. After the pre-purge is complete, a 20-second initial ignitor warm-up period begins. The combustion air inducer continues to operate at the ignition speed.
4. After the 20-second warm-up period has ended, the gas valve is energized and ignition occurs, which initiates a 10-second ignition stabilization delay. At the same time, the control module sends a signal to begin an indoor blower 45-second ON-delay. When the delay ends, the indoor blower motor is energized at a speed which is appropriate for the firing rate. After the 10-second ignition stabilization delay expires, the inducer speed is adjusted to 35 percent speed. The integrated control also initiates a second-stage on delay (factory-set at 7 minutes; adjustable to 12 minutes).
5. If the heating demand continues beyond the secondstage on delay, the integrated control energizes the combustion air inducer at 70 percent speed. The indoor blower motor is adjusted to a speed which matches the target rate. A fixed, 10-minute third-stage on delay is initiated.
6. If the heating demand continues beyond the thirdstage on delay, the integrated control energizes the inducer at high speed. The indoor blower motor is adjusted to a speed which is appropriate for the target rate.
7. When the thermostat heating demand is satisfied, the gas valve is de-energized and the combustion air inducer begins a 20-second post-purge. The field-selected indoor blower off delay begins.
8. When the combustion air post-purge period is complete, the inducer is de-energized. The indoor blower is de-energized at the end of the off delay.

## **Applications Using a Two-Stage Thermostat**

### **C - Heating Sequence -- Control Thermostat Selection DIP switch 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 ignition speed, which is approximately the same as the inducer speed at 70 percent firing rate.
2. Once the control receives a signal that the low-fire pressure switch has closed, the combustion air inducer begins a 15-second pre-purge at the ignition speed.
3. After the pre-purge is complete, a 20-second initial ignitor warm-up period begins. The combustion air inducer continues to operate at the ignition speed.
4. After the 20-second warm-up period has ended, the gas valve is energized and ignition occurs. At the same time, the control module sends a signal to begin an indoor blower 45-second ON-delay. When the delay ends, the indoor blower motor is energized at a speed that matches the firing rate. After the 10-second ignition stabilization delay expires, the inducer speed is adjusted to the appropriate target rate. The inducer will remain at the 70 percent speed as long as the thermostat has a first-stage heating demand.
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 and on all subsequent calls for heat in the same heating cycle, the integrated control energizes the combustion air inducer at high speed. The control also checks the high-fire pressure switch to make sure it is closed. As the inducer speed is increased to high, the indoor blower motor is adjusted to a speed which is appropriate for the target rate.
7. When the demand for high-fire (second stage) heat is satisfied, the gas valve is de-energized and the fieldselected indoor blower off delay begins. The combustion air inducer begins a 20-second post-purge period.
8. When the combustion air post-purge period is complete, the inducer is de-energized. The indoor blower is de-energized at the end of the off delay.

## Field Wiring Applications with Conventional Thermostat

| Thermostat                                                                                                                                                              | DIP Switch Settings and On-Board Links |                                         |                                       |                                | Wiring Connections                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|-----------------------------------------|---------------------------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                         | DIP Switch 1                           | W915<br>(Y1 to Y2)<br>Two-Stage Cooling | W914<br>(DS to R)<br>Dehumidification | W951<br>(O to R)<br>Heat Pumps |                                                                                                                                                                     |
| <b>1 Heat / 1 Cool</b><br><b>NOTE:</b> Use DIP switch 3 to set second-stage heat ON delay.<br>OFF - 7 minutes<br>ON - 12 minutes                                        | ON                                     | Intact                                  | Intact                                | Intact                         | <div style="display: flex; justify-content: space-around; font-size: 0.8em;"> <span>T'STAT</span> <span>CONTROL TERM. STRIP</span> <span>OUTDOOR UNIT</span> </div> |
| <b>1 Heat / 2 Cool</b><br><b>NOTE:</b> Use DIP switch 3 to set second-stage heat ON delay.<br>OFF - 7 minutes<br>ON - 12 minutes                                        | ON                                     | Cut                                     | Intact                                | Intact                         | <div style="display: flex; justify-content: space-around; font-size: 0.8em;"> <span>T'STAT</span> <span>CONTROL TERM. STRIP</span> <span>OUTDOOR UNIT</span> </div> |
| <b>1 Heat / 2 Cool with t'stat with dehumidification mode</b><br><b>NOTE:</b> Use DIP switch 3 to set second-stage heat ON delay.<br>OFF - 7 minutes<br>ON - 12 minutes | ON                                     | Cut                                     | Cut                                   | Intact                         | <div style="display: flex; justify-content: space-around; font-size: 0.8em;"> <span>T'STAT</span> <span>CONTROL TERM. STRIP</span> <span>OUTDOOR UNIT</span> </div> |

\* "R" required on some units.

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

**Table 37. Field Wiring**

| Thermostat                                                                               | DIP Switch Settings and On-Board Links |                                         |                                       |                                | Wiring Connections                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------------------------------------------------------------------|----------------------------------------|-----------------------------------------|---------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                          | DIP Switch 1                           | W915<br>(Y1 to Y2)<br>Two-Stage Cooling | W914<br>(DS to R)<br>Dehumidification | W951<br>(O to R)<br>Heat Pumps |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 2 Heat / 2 Cool                                                                          | OFF                                    | Cut                                     | Intact                                | Intact                         | <div> <div>T'STAT</div> <div> <div>W2</div> <div>W1</div> <div>R</div> <div>G</div> <div>C</div> <div>Y2</div> <div>Y1</div> </div> <div> <div>CONTROL<br/>TERM. STRIP</div> <div> <div>DS</div> <div>W2</div> <div>W1</div> <div>R</div> <div>G</div> <div>C</div> <div>Y2</div> <div>Y1</div> <div>O</div> </div> </div> <div> <div>OUTDOOR<br/>UNIT</div> <div> <div>*R</div> <div>C</div> <div>Y2</div> <div>Y1</div> </div> </div> </div> |
| 2 Heat / 2 Cool<br>with t'stat with<br>dehumidification<br>mode                          | OFF                                    | Cut                                     | Cut                                   | Intact                         | <div> <div>T'STAT</div> <div> <div>D</div> <div>W2</div> <div>W1</div> <div>R</div> <div>G</div> <div>C</div> <div>Y2</div> <div>Y1</div> </div> <div> <div>CONTROL<br/>TERM. STRIP</div> <div> <div>DS</div> <div>W2</div> <div>W1</div> <div>R</div> <div>G</div> <div>C</div> <div>Y2</div> <div>Y1</div> </div> </div> <div> <div>OUTDOOR<br/>UNIT</div> <div> <div>*R</div> <div>C</div> <div>Y2</div> <div>Y1</div> </div> </div> </div> |
| 2 Heat / 1 Cool                                                                          | OFF                                    | Intact                                  | Intact                                | Intact                         | <div> <div>T'STAT</div> <div> <div>W2</div> <div>W1</div> <div>R</div> <div>G</div> <div>C</div> <div>Y</div> </div> <div> <div>CONTROL<br/>TERM. STRIP</div> <div> <div>DS</div> <div>W2</div> <div>W1</div> <div>R</div> <div>G</div> <div>C</div> <div>Y2</div> <div>Y1</div> <div>O</div> </div> </div> <div> <div>OUTDOOR<br/>UNIT</div> <div> <div>*R</div> <div>C</div> <div>Y1</div> </div> </div> </div>                              |
| * "R" required on some units.<br>** Connect W1 to W1 ONLY if using defrost tempering kit |                                        |                                         |                                       |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                |

Table 37. Field Wiring

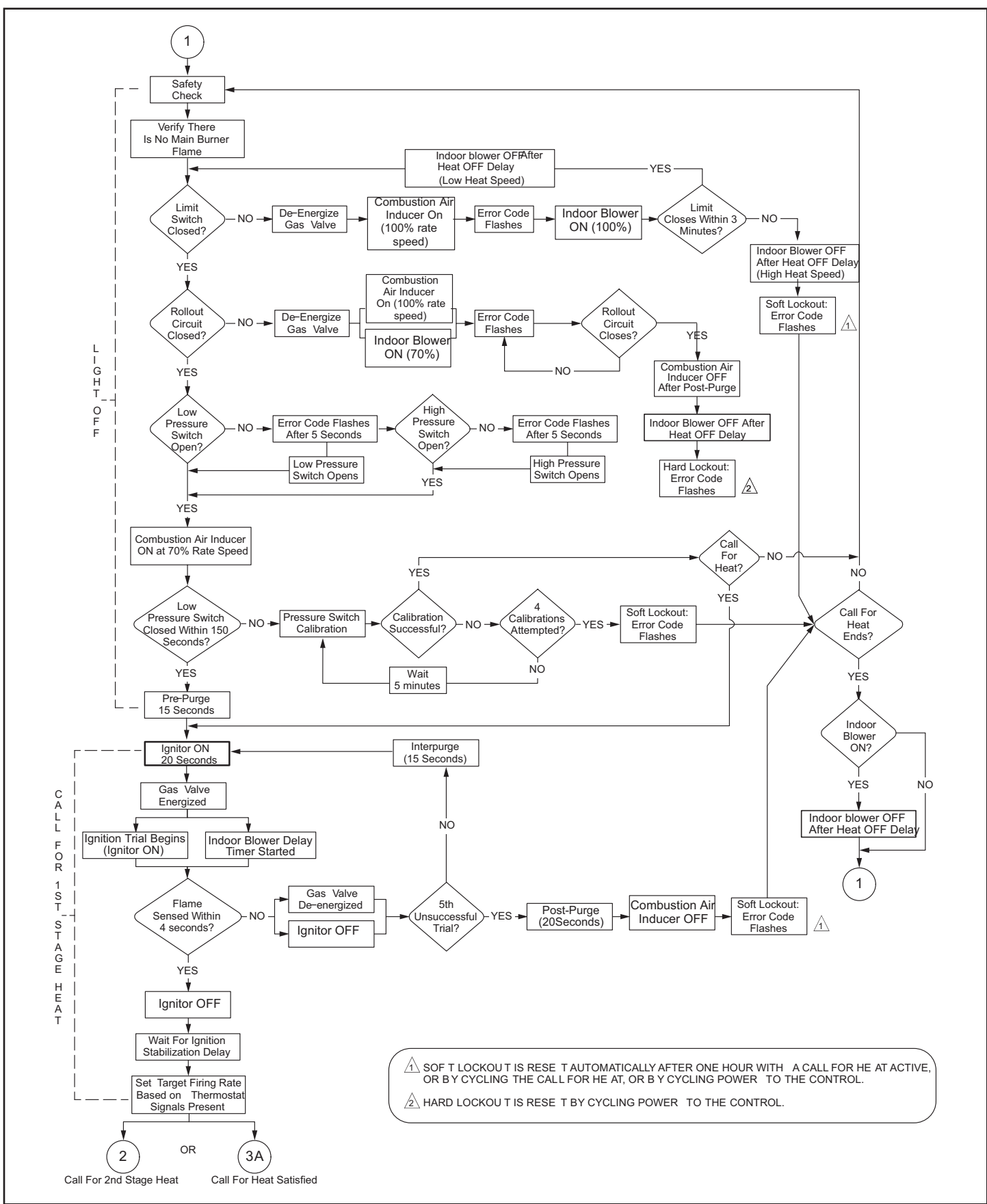
| Thermostat                                                              | DIP Switch Settings and On-Board Links |                                         |                                       |                                | Wiring Connections                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------|----------------------------------------|-----------------------------------------|---------------------------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                         | DIP Switch 1                           | W915<br>(Y1 to Y2)<br>Two-Stage Cooling | W914<br>(DS to R)<br>Dehumidification | W951<br>(O to R)<br>Heat Pumps |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Dual Fuel Single-Stage Heat Pump<br>Capable of 2-stage gas heat control | OFF                                    | Intact                                  | Intact                                | Cut                            | <div> <div>T'STAT</div> <div> <div>R</div> <div>H</div> <div>W2</div> <div>W1</div> <div>O</div> <div>L</div> <div>Y1</div> <div>Y2</div> <div>G</div> <div>D</div> <div>B</div> <div>C</div> <div>T</div> <div>T</div> </div> <div> <div>CONTROL TERM. STRIP</div> <div> <div>R</div> <div>W2</div> <div>W1</div> <div>O</div> <div>●</div> <div>Y1</div> <div>G</div> <div>DS</div> <div>Y2</div> <div>C</div> </div> </div> <div> <div>HEAT PUMP</div> <div> <div>R</div> <div>67M41**</div> <div>W1</div> <div>O</div> <div>L</div> <div>Y</div> <div>C</div> </div> <div> <div>outdoor sensor</div> </div> </div> </div>                                       |
| Dual Fuel Two-Stage Heat Pump<br>Capable of 2-stage gas heat control    | OFF                                    | Cut                                     | Intact                                | Cut                            | <div> <div>T'STAT</div> <div> <div>R</div> <div>H</div> <div>W2</div> <div>W1</div> <div>O</div> <div>L</div> <div>Y1</div> <div>Y2</div> <div>G</div> <div>D</div> <div>B</div> <div>C</div> <div>T</div> <div>T</div> </div> <div> <div>CONTROL TERM. STRIP</div> <div> <div>R</div> <div>W2</div> <div>W1</div> <div>O</div> <div>●</div> <div>Y1</div> <div>G</div> <div>DS</div> <div>Y2</div> <div>C</div> </div> </div> <div> <div>HEAT PUMP</div> <div> <div>R</div> <div>67M41**</div> <div>W1</div> <div>O</div> <div>L</div> <div>Y1</div> <div>Y2</div> <div>C</div> </div> <div> <div>Y2 out blue</div> <div>outdoor sensor</div> </div> </div> </div> |

\* "R" required on some units.

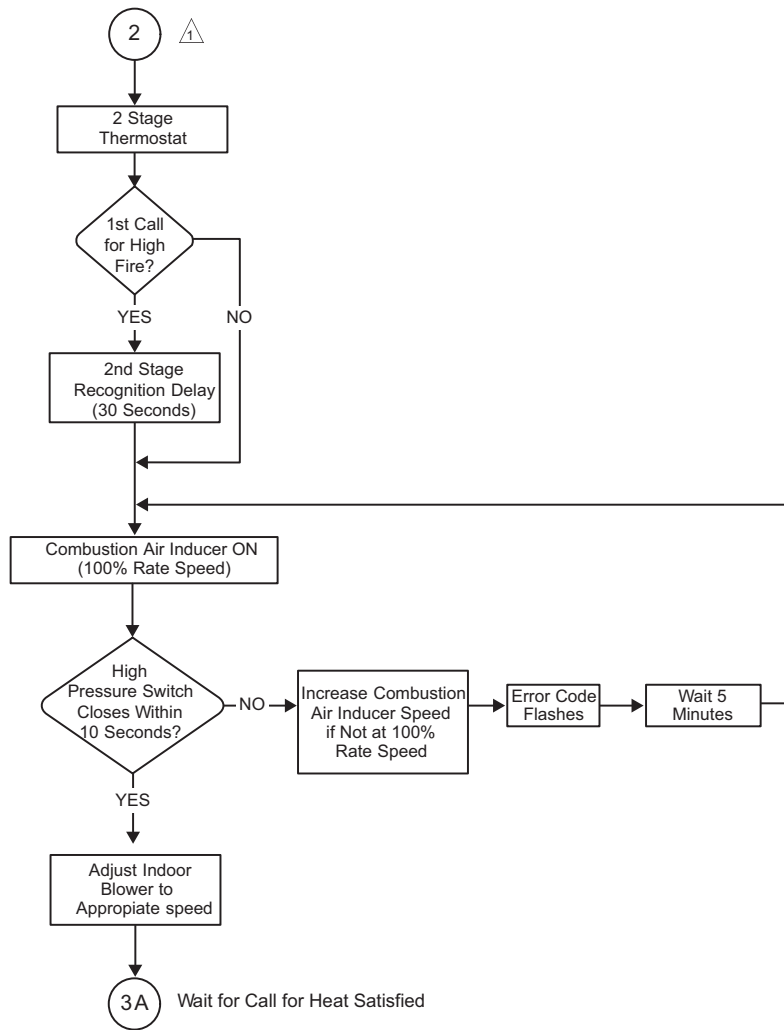
\*\* Connect W1 to W1 ONLY if using defrost tempering kit

Table 37. Field Wiring

## Sequence of Operation and Troubleshooting Flow Chart



### Figure 55. Ignition and Call for Low Fire with Two-Stage Thermostat



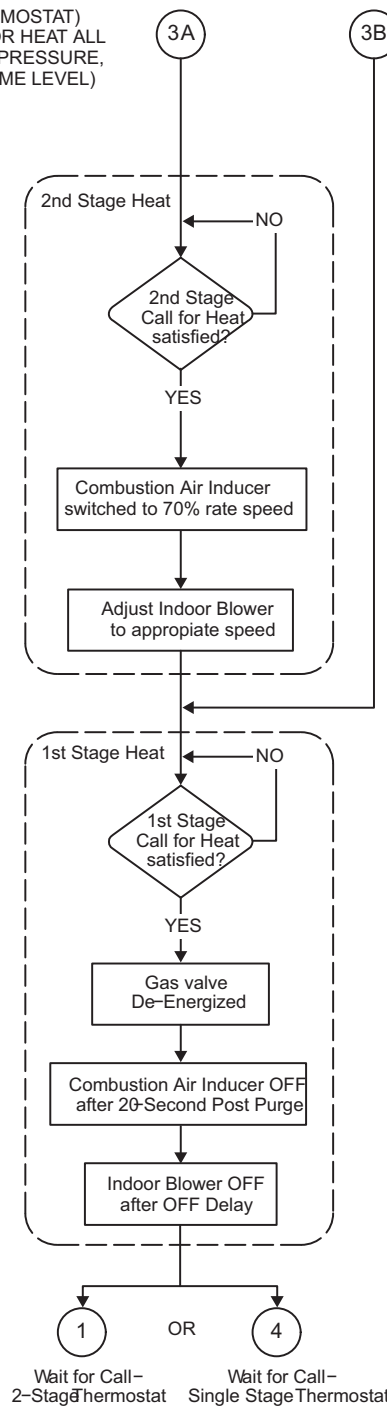
△1 System will always light at 70% even if 2nd stage call for heat is in place

△2 If the high pressure switch does not close within 5 attempts, the system will operate at low fire for the remainder of the call for heat at request

**Figure 56. Call for High Fire with Two-Stage Thermostat**

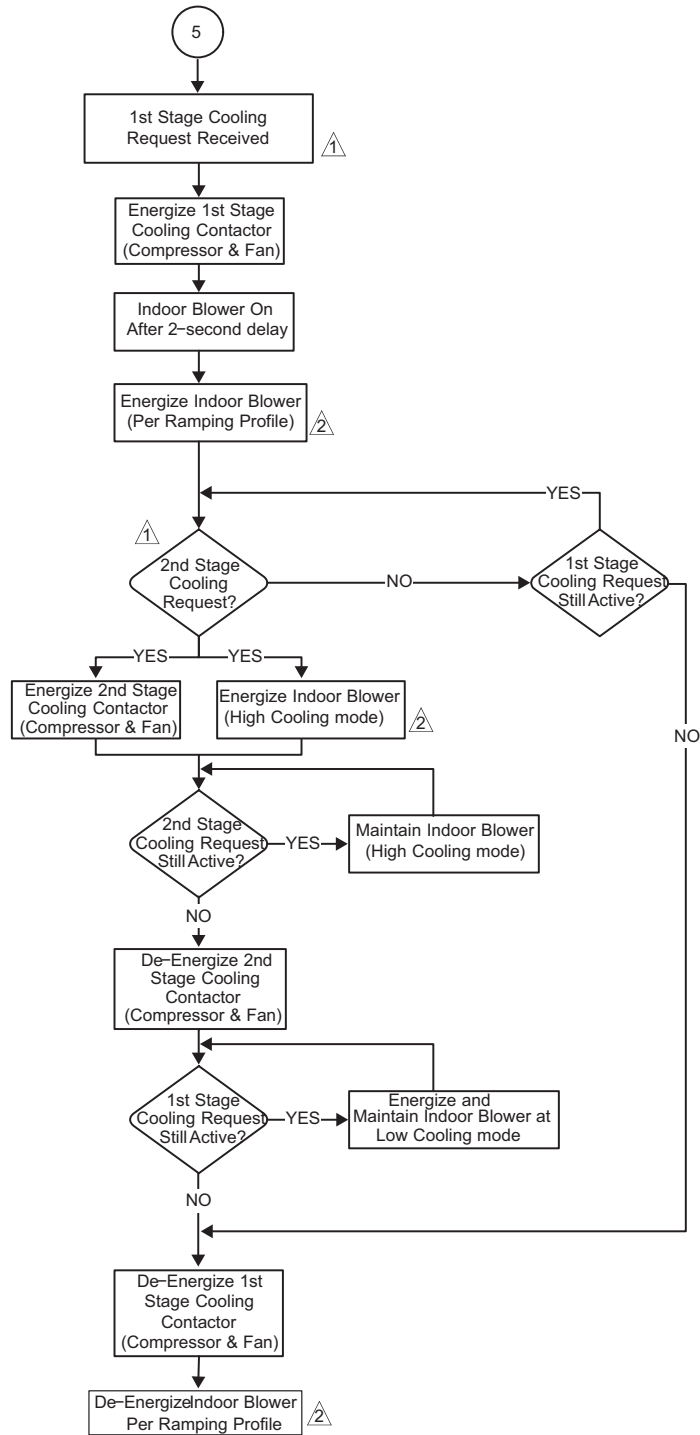
RUN MODE (2 STAGE THERMOSTAT)  
1ST OR 2ND STAGE CALL FOR HEAT ALL  
INPUTS MONITORED (LIMIT, PRESSURE,  
CALL FOR HEAT / COOL, FLAME LEVEL)

RUN MODE (SINGLE STAGE THERMOSTAT)  
ALL INPUTS MONITORED (LIMIT, PRESSURE,  
CALL FOR HEAT / COOL, FLAME LEVEL)



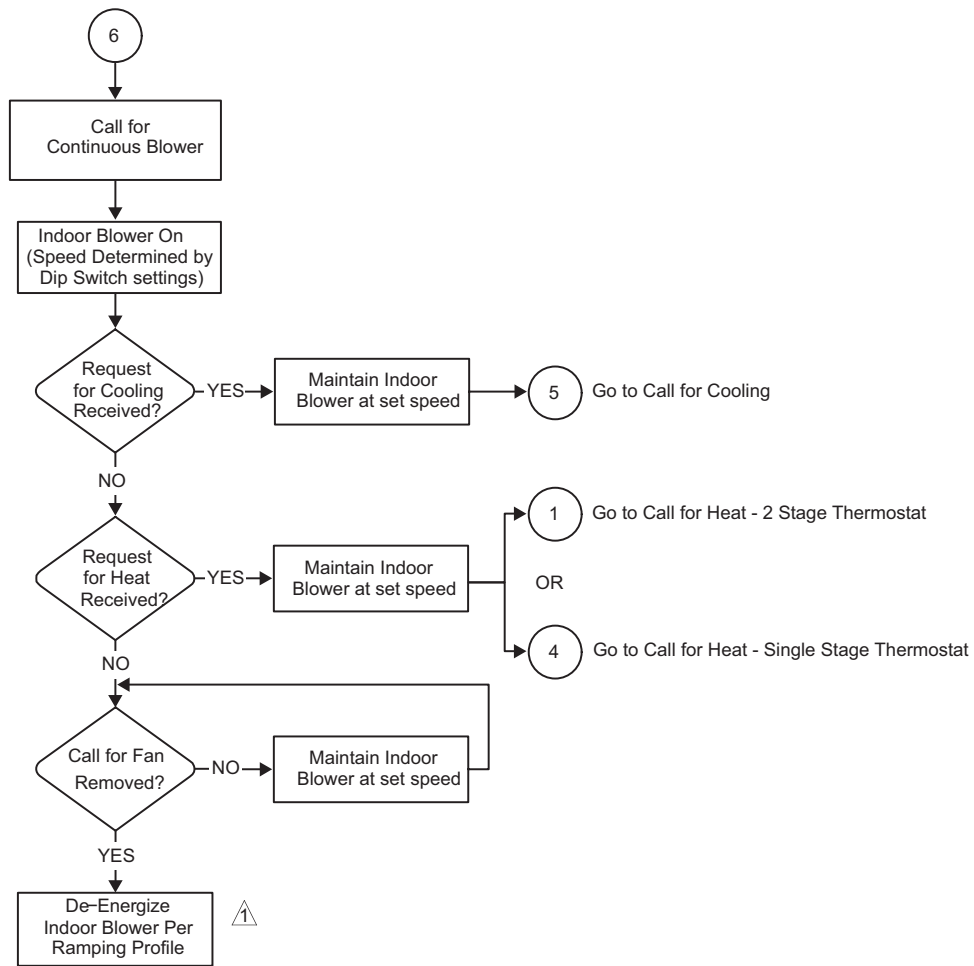
**Figure 57. Call for Heat Satisfied**





- △ 1 2nd stage cooling operation requires a 2-stage thermostat, a 2-stage cooling system and jumpers W915 must be cut. The control will not respond to a 2nd stage cooling request unless a 1st stage cooling request is active
- △ 2 Indoor blower cooling mode and high cooling mode have a specific ON, OFF and speed ramping profiles. The specific profile is selected using the DIP switches on the control.

**Figure 59. Call for Cooling**



⚠ Indoor blower low cooling mode and high cooling mode, have specific ON/OFF and speed ramping profiles. The specific profile is selected using the dip switches on the control.

**Figure 60. Continuous Low Speed Indoor Blower Sequence of Operation**



**GE APPLIANCES**

All specifications and illustrations subject  
to change without notice and without  
incurring obligations.

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