13.4 and 15.2 SEER2, 14 and 15/16 SEER Small Package Ultra Low NOx Products
Air Conditioners with Gas Heat
Using R-410A Refrigerant

Service Manual

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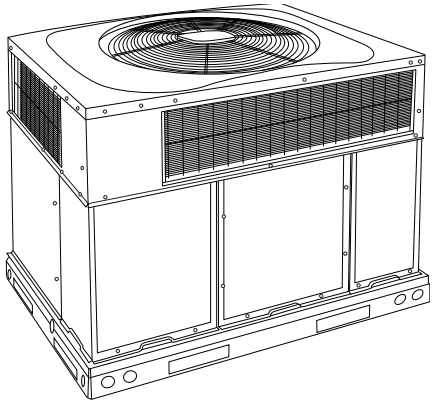

A/C with Gas Heat

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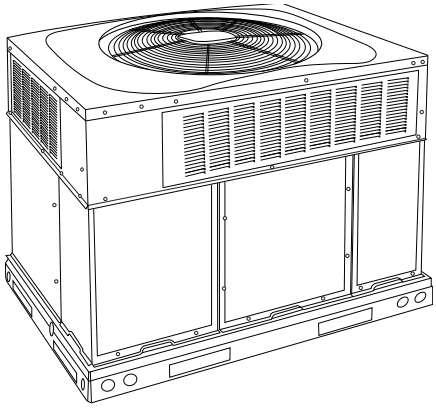

A/C with Gas Heat

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Fig. 1 – A/C with Gas Heat

Safety Considerations

Installation, service, and repair of these units should be attempted only by trained service technicians familiar with standard service instruction and training material.

All equipment should be installed in accordance with accepted practices and unit Installation Instructions, and in compliance with all national and local codes. Power should be turned off when servicing or repairing electrical components. Extreme caution should be observed when troubleshooting electrical components with power on. Observe all warning notices posted on equipment and in instructions or manuals.

⚠ WARNING

UNIT OPERATION AND SAFETY HAZARD

Failure to follow this warning could result in personal injury or equipment damage.

R-410A systems operate at higher pressures than standard R-22 systems. Do not use R-22 service equipment or components on these R-410A units. Ensure service equipment is rated for R-410A.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

When removing access panels (see Fig. 17) or performing maintenance functions inside your unit, be aware of sharp sheet metal parts and screws. Although special care is taken to reduce sharp edges to a minimum, be extremely careful and wear appropriate clothing, safety glasses and gloves when handling parts or reaching into the unit.

⚠ WARNING

PERSONAL INJURY AND PROPERTY DAMAGE HAZARD

For continued performance, reliability, and safety, the only approved accessories and replacement parts are those specified by the equipment manufacturer. The use of non-manufacturer approved parts and accessories could invalidate the equipment limited warranty and result in fire risk, equipment malfunction, and failure. Please review manufacturer's instructions and replacement part catalogs available from your equipment supplier.

Refrigeration systems contain refrigerant under pressure. Extreme caution should be observed when handling refrigerants. Wear safety glasses and gloves to prevent personal injury. During normal system operations, some components are hot and can cause burns. Rotating fan blades can cause personal injury. Appropriate safety considerations are posted throughout this manual where potentially dangerous techniques are addressed.

Follow all safety codes. Wear safety glasses, protective clothing, and work gloves. Have a fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes, the current editions of the National Electrical Code (NEC) NFPA 70 and NFPA 90B-Installation Warm Air Heating and A/C Systems (Residential).

In Canada refer to the current editions of the Canadian Electrical Code CSA C22.1.

Introduction

This document provides required system information necessary to install, service, repair or maintain the small package products (SPP) air conditioners using R-410A refrigerant.

Refer to the unit Product Data/Technical specifications for rating information, electrical data, required clearances, additional component part numbers and related pre-sale data. Installation Instructions are also available per specific models.

Information in this document refers to units produced in 2015 to current.

Installation Guideline

New Construction

Specifications for these units in the new construction market require the unit to be installed outdoors and meet all local code and requirements. Consult the Installation Instructions for any additional installation detail.

Add-On Replacement (Retrofit)

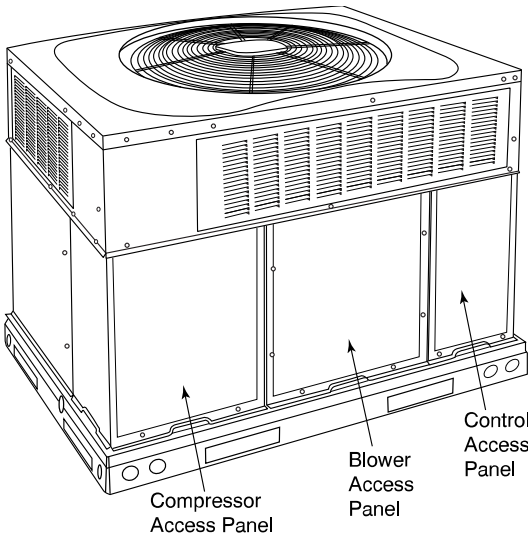
Specifications for these units in the add-on replacement/retrofit market require the unit to be installed outdoors and meet all local codes and requirements. Clearances, power supply, system static needs to be check to ensure that the replacement unit can perform within the design parameter desired specified in the Product Data.

Minimum Return Temperature - Gas Heating Mode

In gas heating mode, this unit is designed for a minimum continuous return-air temperature of 55°F (13°C) db and a maximum continuous temperature of 80°F (27°C) db. Failure to follow these return-air temperature limits may affect reliability of heat exchangers, motors, and other components.

Access Compressor Or Other Internal Cabinet Components

NOTE: Access to most of the components through the front panels of the unit. The top will need to be removed to access the condenser coil.



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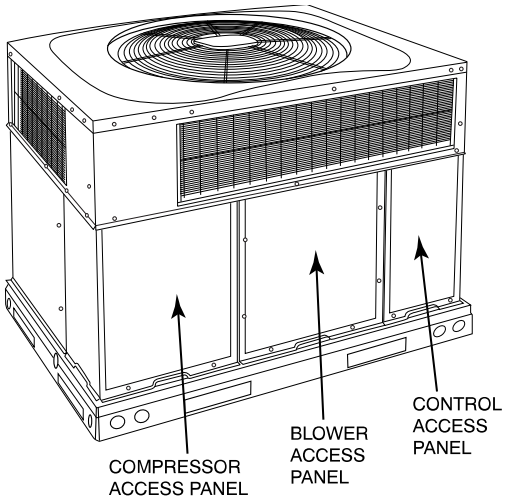

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Fig. 2 – Unit Access Panels

Electrical

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Exercise extreme caution when working on any electrical components. Shut off all power to system prior to troubleshooting. Some troubleshooting techniques require power to remain on. In these instances, exercise extreme caution to avoid danger of electrical shock. ONLY TRAINED SERVICE PERSONNEL SHOULD PERFORM ELECTRICAL TROUBLESHOOTING.

Aluminum Wire

⚠ CAUTION

UNIT OPERATION AND SAFETY HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Aluminum wire may be used in the branch circuit (such as the circuit between the main and unit disconnect), but only copper wire may be used between the unit disconnect and the unit.

Whenever aluminum wire is used in branch circuit wiring with this unit, adhere to the following recommendations.

Connections must be made in accordance with the National Electrical Code (NEC), using connectors approved for aluminum wire. The connectors must be UL approved (marked Al/Cu with the UL symbol) for the application and wire size. The wire size selected must have a current capacity not less than that of the copper wire specified, and must not create a voltage drop between service panel and unit in excess of 2% of unit rated voltage. To prepare wire before installing connector, all aluminum wire must be “brush-scratched” and coated with a corrosion inhibitor such as Pentrox A. When it is suspected that connection will be exposed to moisture, it is very important to cover entire connection completely to prevent an electrochemical action that will cause connection to fail very quickly. Do not reduce effective size of wire, such as cutting off strands so that wire will fit a connector. Proper size connectors should be used. Check all factory and field electrical connections for tightness. This should also be done after unit has reached operating temperatures, especially if aluminum conductors are used.

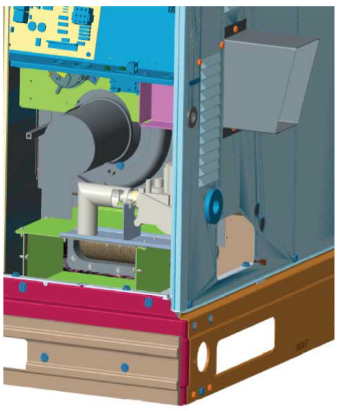
Single Stage Gas Heat

Start-up Heating and Make Adjustments

Complete the required procedures given in the Pre-Start-Up section before starting the unit. Do not jumper any safety devices when operating the unit. Make sure that burner orifices are properly aligned. Unstable operation my occur when the burner orifices in the manifold are misaligned.

Follow the lighting instructions on the heating section operation label (located on the inside of the control access panel) to start the heating section.

NOTE: Make sure that gas supply has been purged, and that all gas piping has been checked for leaks.



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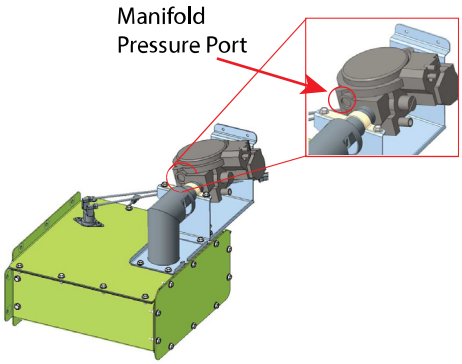
Ultra Low NOx Models

Fig. 3 – Burner Assembly



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Ultra Low NOx Models

Fig. 4 – Monoport Burner

Check Heating Control Ultra Low NOx

Start and check the unit for proper heating control operation as follows (see furnace lighting instructions located on the inside of the control access panel):

1. Place room thermostat SYSTEM switch in the HEAT position and the fan switch is placed in AUTO position.
2. Set the heating temperature control of the thermostat above room temperature.
3. On a call for heating, the inducer motor will start up for a 30 second pre-purge.
4. The control will then check to see the pressure switch closed. Then the main burner should light within 5 sec. of the spark being energized. If the burners do not light, there is a 22-sec. delay before another 5-sec. try. If the burners still do not light, this sequence is repeated. If the burners do not light on the 4th ignition attempt, there is a lockout. To reset the control, break the 24-v power to W.

NOTE: The ULN system will sound different from a traditional furnace that utilizes inshot burners. For the ULN system, the access door is part of the system and must be installed on the unit for any sound evaluations.

5. The evaporator fan will turn on 30 sec. after the flame has been established. The evaporator fan will turn off 90 sec. after the thermostat has been satisfied. Please note that the integrated gas unit controller (IGC) has the capability to automatically reduce the evaporator “ON” delay and increase the evaporator “OFF” delay in the event of high duct static and/or partially-clogged filter.

Check Gas Input

Check gas input and manifold pressure after unit start-up (See Table 3). If adjustment is required proceed as follows:

- The rated gas inputs shown in Table 3 are for altitudes from sea level to 2000 ft (610 m) above sea level. These inputs are based on natural gas with a heating value of 1025 Btu/ft^3 at 0.60 specific gravity.

NOTE: Ultra Low NOx is only available in natural gas only.

IN THE U.S.A.:

For installations below 2,000 ft (610 m), refer to the unit rating plate.

Table 1 – Altitude Derate Multiplier for U.S.A.

Altitude ft*(m)	Percent of Derate	Derate Multiplier Factor†
0-2000 (0-610)	0	1.00

*. Ultra Low NOx only available 0-2000 ft
†. Derate multiplier factors are based on midpoint altitude for altitude range.

When the gas supply being used has a different heating value or specific gravity, refer to national and local codes, or contact your distributor to determine the required orifice size.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in reduced unit and/or component life.

Do Not redrill an orifice. Improper drilling (burrs, out-of-round holes, etc.) can cause excessive burner noise and misdirection of burner flame. If orifice hole appears damaged or it is suspected to have been redrilled, check orifice hole with a numbered drill bit of correct size.

Adjust Gas Input

The gas input to the unit is determined by measuring the gas flow at the meter or by measuring the manifold pressure. Measuring the gas flow at the meter is recommended for natural gas units.

Measure Gas Flow (Natural Gas Units)

Minor adjustment to the gas flow can be made by changing the manifold pressure. The manifold pressure must be maintained between 3.2 and 3.8 IN. W.C.

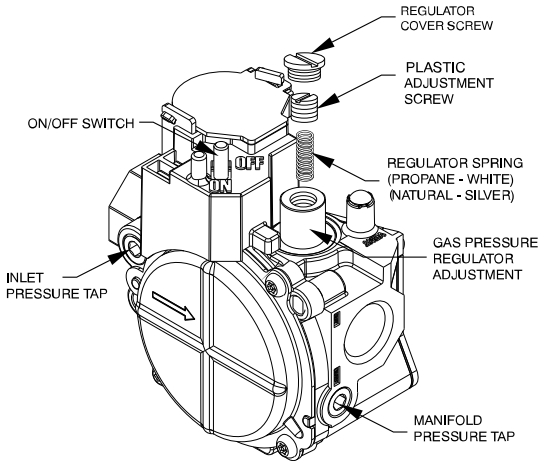

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Fig. 5 – Single-Stage Gas Valve

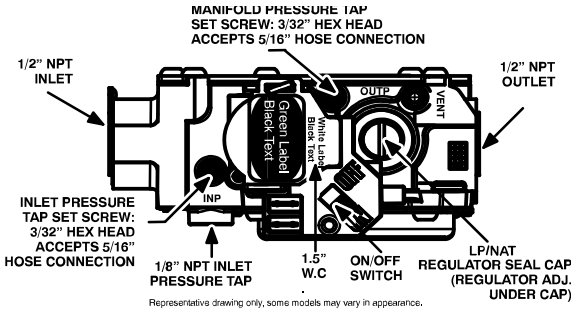

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Fig. 6 – Single-Stage Gas Valve with Tower Pressure Ports

If larger adjustments are required, change main burner orifices following the recommendations of national and local codes.

NOTE: All other appliances that use the same meter must be turned off when gas flow is measured at the meter.

Proceed as follows:

1. Turn off gas supply to unit.
2. Manifold pressure connections
   a. For Ultra Low NOx units with standard gas valve, remove manifold pressure tap cover using an allen wrench. (See Fig. 5.) Install barbed pressure tap and hose to connect to manometer. Turn on gas supply to unit.
   b. For gas valve with tower pressure ports, loosen set screw on manifold tower pressure tap no more than one full turn counter-clockwise with a 3/32-in. hex wrench. (see Fig. 6.) Connect manometer by sliding 5/16-in connecting hose over the manifold tower pressure port. Turn on gas supply to unit.
3. Record number of seconds for gas meter test dial to make one revolution.
4. Divide number of seconds in Step 3 into 3600 (number of seconds in one hr).
5. Multiply result of Step 4 by the number of cubic feet (cu ft) shown for one revolution of test dial to obtain cubic feet (cu ft) of gas flow per hour.
6. Multiply result of Step 5 by Btu heating value of gas to obtain total measured input in Btuh. Compare this value with heating input shown in Table 3 (Consult the local gas supplier if the heating value of gas is not known).

EXAMPLE: Assume that the size of test dial is 2 cu ft, one revolution takes 88 sec, and the heating value of the gas is 1050 Btu/ft^3. Proceed as follows:

1. 88 sec. to complete one revolution.
2. 3600 ÷ 88= 40.9.
3. 40.9 x 2 = 81.8 ft^3 of gas flow/hr.
4. 81.8 x 1050 = 85,900 Btuh input.

If the desired gas input is 89,000 Btuh, manifold pressure must be increased.

Observe manifold pressure and proceed as follows to adjust gas input:

1. Remove regulator cover screw over plastic adjustment screw on gas valve (See Fig. 5 and Fig. 6).
2. Turn plastic adjustment screw clockwise to increase gas input, or turn plastic adjustment screw counterclockwise to decrease input (See Fig. 5 and Fig. 6). Manifold pressure must be between 3.2 and 3.8 IN. WC.

NOTE: Manifold pressure must be checked with the access door on.

⚠ WARNING

FIRE AND UNIT DAMAGE HAZARD

Failure to follow this warning could result in personal injury or death and/or property damage.

Unsafe operation of the unit may result if manifold pressure is outside this range.

3. Replace regulator cover screw on gas valve (See Fig. 5 and Fig. 6).
4. Turn off gas supply to unit.
5. Remove manometer from pressure tap
   a. For Ultra Low NOx units with standard gas valve, remove manometer hose and barbed pressure tap. Replace pressure tap cover using allen wrench (See Fig. 3.)
   b. For gas valve with tower pressure port, remove connecting hose. Tighten set screw clockwise on manifold pressure port using a 3/32-in hex wrench. (See Fig. 6.)
6. Turn on gas to unit and check for leaks.

Table 2 – High Altitude Compensation, Natural Gas - Single Phase and Three Phase (Series K and Later) Models

Nameplate Input (Btu/hr)	Rated Heating Input (Btu/hr), Natural Gas at Installation Altitude Above Sea Level, U.S.A.*				
	0 to 2000 ft (0-610 m)	2001 to 3000 ft*† (611 to 914 m)	3001 to 4000 ft† (915 to 1219 m)	4001 to 5000 ft† (1220 to 1524 m)	5001 to 6000 ft† (1524 to 1829 m)
45000	45000	-	-	-	-
60000	60000				
89000	89000	-	-	-	-

*. In the U.S.A., the input rating for altitudes above 2000 ft (610m) must be reduced by 4% for each 1000 ft (305 m) above sea level.
†. Ultra Low NOx is only available 0-2000 ft

Table 3 – Heating Inputs

Heating Input (BTUH)	Number of Orifices	Gas Supply Pressure (IN. W.C.)				Manifold Pressure (IN. W.C.)	
		Natural		Propane*			
		Min	Max	Min	Max	Natural	Propane*
Ultra Low NOx							
45,000	1	5.0	13.0	N/A	N/A	3.2~3.8	N/A
60,000	1	4.5	13.0	N/A	N/A	3.2~3.8	N/A
89,000	1	5.0	13.0	N/A	N/A	3.2~3.8	N/A

*. When a unit is converted to propane, different size orifices must be used. See separate, natural-to-propane conversion kit instructions.

Table 4 – Natural Gas Orifice Sizes and Manifold Pressure Single Phase Models, All Three Phase ULN Models, and Three Phase (series K and Later) Models

Nameplate Input, High Stage (Btu/hr)		Altitude of Installation (Ft. Above Sea Level) U.S.A.				
		0 to 2000	2001 to 3000*	3001 to 4000*	4001 to 5000*	5001 to 6000*
Ultra Low NOx						
45000	Orifice No. (Qty)	.125 (1)	-	-	-	-
	Manifold Press.	3.2~3.8	-	-	-	-
60000	Orifice No. (Qty)	28 (1)	-	-	-	-
	Manifold Press.	3.2~3.8	-	-	-	-
89000	Orifice No. (Qty)	18 (1)	-	-	-	-
	Manifold Press.	3.2~3.8	-	-	-	-

*. Ultra Low NOx is only available 0-2000 ft

Table 5 – Inducer Speed - Voltage Check Chart

Inducer Operation Speeds: -15, -16, -65, and -66 Ignition Boards												
	Pre-Purge to Ignition				Post-Ignition Warm-Up (Approx. 10 seconds)				Steady-State			
Ignition Tries	Speed	Multimeter Connection 1	Multimeter Connection 2	Voltage (VAC)	Speed	Multimeter Connection 1	Multimeter Connection 2	Voltage (VAC)	Speed	Multimeter Connection 1	Multimeter Connection 2	Voltage (VAC)
1 & 2	Medium	Inducer - Violet	Inducer - Yellow	208/230	Medium	Inducer - Violet	Inducer - Yellow	208/230	High	Inducer - Violet	Inducer - Yellow	208/230
		Inducer - Red	Inducer - Yellow	104/115		Inducer - Red	Inducer - Yellow	104/115		Inducer - Red	Inducer - Yellow	208/230
3 & 4	Low	Inducer - Violet	Inducer - Yellow	104/115	Medium	Inducer - Violet	Inducer - Yellow	208/230	High	Inducer - Violet	Inducer - Yellow	208/230
		Inducer - Red	Inducer - Yellow	208/230		Inducer - Red	Inducer - Yellow	104/115		Inducer - Red	Inducer - Yellow	208/230

Table 6 – Inducer Speed - Voltage Check Chart

Time from end of last heating call to new heating call	Inducer Operation Speeds: -10, -12, -62, and -77 Ignition Boards												
	Pre-Purge to Ignition					Post-Ignition Warm-Up (Approx. 10 seconds)				Steady-State			
	Ignition Tries	Speed	Multimeter Connection 1	Multimeter Connection 2	Voltage (VAC)	Speed	Multimeter Connection 1	Multimeter Connection 2	Voltage (VAC)	Speed	Multimeter Connection 1	Multimeter Connection 2	Voltage (VAC)
>5 minutes	1 & 2	Low	Inducer - Violet	Inducer - Yellow	104/115	Medium	Inducer - Violet	Inducer - Yellow	208/230	High	Inducer - Violet	Inducer - Yellow	208/230
			Inducer - Red	Inducer - Yellow	208/230		Inducer - Red	Inducer - Yellow	104/115		Inducer - Red	Inducer - Yellow	208/230
	3 & 4	Medium	Inducer - Violet	Inducer - Yellow	208/230	Medium	Inducer - Violet	Inducer - Yellow	208/230	High	Inducer - Violet	Inducer - Yellow	208/230
			Inducer - Red	Inducer - Yellow	104/115		Inducer - Red	Inducer - Yellow	104/115		Inducer - Red	Inducer - Yellow	208/230
<5 minutes	1 & 2	Medium	Inducer - Violet	Inducer - Yellow	208/230	Medium	Inducer - Violet	Inducer - Yellow	208/230	High	Inducer - Violet	Inducer - Yellow	208/230
			Inducer - Red	Inducer - Yellow	104/115		Inducer - Red	Inducer - Yellow	104/115		Inducer - Red	Inducer - Yellow	208/230
	3 & 4	Medium	Inducer - Violet	Inducer - Yellow	208/230	Medium	Inducer - Violet	Inducer - Yellow	208/230	High	Inducer - Violet	Inducer - Yellow	208/230
			Inducer - Red	Inducer - Yellow	104/115		Inducer - Red	Inducer - Yellow	104/115		Inducer - Red	Inducer - Yellow	208/230

NOTE: For installations below 2,000 ft (610 m), refer to the unit rating plate for proper propane conversion kit. For installations above 2,000 ft (610 m), contact your distributor for proper propane conversion kit.

Check Burner Flame

Refer to the Maintenance section for information on burner removal. The burner flame on Ultra Low NOx models can't be checked. Ultra Low NOx models are not allowed to be converted to propane.

Normal Operation

An LED (light-emitting diode) indicator is provided on the integrated gas unit controller (IGC) to monitor operation. The IGC is located by removing the control access panel (see Fig. 17). During normal operation, the LED is continuously on (See Table 7 for error codes).

Heating Sequence for -10, -12, -62, and -77 Ignition Boards (prior August 2022) (Refer toTable 6 for inducer speed operation and voltage)

On a call for heating, terminal W of the thermostat is energized, starting the induced-draft motor for a 30 second pre-purge at low inducer speed. When the pressure switch senses that the induced-draft motor is moving sufficient combustion air, the burner sequence begins. This function is controlled by the integrated gas unit controller (IGC).

After 30 sec of pre-purge is complete, the pressure switch checks for sufficient combustion. Then, the gas valve energizes and the system attempts to ignite with igniter being energized. The igniter energizes for 5 sec and integrated gas controller (IGC) allows system to sense flame for 2 sec at the end of 5 sec of ignition trial. On first successful ignition, system stays at the low inducer speed for 10 sec and ramps up to an intermediate speed for approximately 10 sec and gradually ramps up to the high inducer speed for steady-state operation. The system uses the same logic for 2nd ignition trial. Please note there may be a slight rumble for a short period when lighting off on low inducer speed. This is not a cause for concern. If a 3rd or 4th ignition attempt is needed, the inducer speed is increased to the intermediate speed. In case the 4th attempt fails, the system will lock out for 1 hr. After 1 hr. lock out period, the system starts with normal operating sequence. Once flame is established and proven successfully, indoor (evaporator) fan motor is energized after 30 seconds. When the thermostat is satisfied and W is de-energized, the pre-mix burner will stop firing and the indoor (evaporator) fan motor shuts off after a 90 second time-off delay. Please note that the IGC has the capability to automatically decrease the indoor (evaporator) fan motor "ON" delay and increase the indoor (evaporator) fan motor "OFF" delay in the event of high duct static and/or partially-clogged filter.

If the time between heating calls is 5 minutes or less, subsequent ignitions will be conducted with the inducer on the intermediate inducer speed. If the time between heating calls is 5 minutes or more, the first two ignition attempts will be on the low inducer speed, while the 3rd and 4th attempts (if needed) would be on the intermediate inducer speed.

When the thermostat is satisfied and W is de-energized, the pre-mix burner will stop firing and the indoor (evaporator) fan motor shuts off after a 90 second time-off delay. Please note that the IGC has the capability to automatically decrease the indoor (evaporator) fan motor "ON" delay and increase the indoor (evaporator) fan motor "OFF" delay in the event of high duct static and/or partially-clogged filter.

Heating Sequence for -15, -16, -65, and -66 Ignition Boards (August 2022 and later) (Refer to Table 5 for inducer speed operation and voltage.)

Heating Sequence for -15,-16,-65, and -66 Ignition Boards On a call for heating, terminal W of the thermostat is energized, starting the induced-draft motor for a 30 second pre-purge at intermediate speed. When the pressure switch senses that the induced-draft motor is moving sufficient combustion air, the burner sequence begins. This function is

controlled by the integrated gas unit controller (IGC). After 30 sec of pre-purge is complete, the pressure switch checks for sufficient combustion. Then, the gas valve energizes and the system attempts to ignite with igniter being energized. The igniter energizes for 5 sec and integrated gas controller (IGC) allows system to sense flame for 2 sec at the end of 5 sec of ignition trial. On first successful ignition, system stays at the intermediate inducer speed for 10 sec and gradually ramps up to the high speed for steady-state operation. The system uses the same logic for 2nd ignition trial. If a 3rd or 4th ignition attempt is needed, the inducer speed is decreased to the low speed. On a successful light on the 3rd or 4th attempt, the inducer speed is increased to the intermediate speed for about 10 seconds and then gradually ramps up to the high speed for steady-state operation. Please note there may be a slight rumble for a short period when lighting off on low inducer speed. This is not a cause for concern. In case the 4th attempt fails, the system will lock out for 1 hr. After 1 hr. lock out period, the system starts with normal operating sequence. Once flame is established and proven successfully, indoor (evaporator) fan motor is energized after 30 seconds.

When the thermostat is satisfied and W is de-energized, the pre-mix burner will stop firing and the indoor (evaporator) fan motor shuts off after a 90 second time-off delay. Please note that the IGC has the capability to automatically decrease the indoor (evaporator) fan motor "ON" delay and increase the indoor (evaporator) fan motor "OFF" delay in the event of high duct static and/or partially-clogged filter.

Limit Switches

Normally closed limit switch (LS) completes the control circuit. Should the leaving-air temperature rise above the maximum allowable temperature, the limit switch opens and the control circuit "breaks." Any interruption in the control circuit instantly closes the gas valve and stops gas flow to the burners. The blower motor continues to run until LS resets.

When the air temperature at the limit switch drops to the low-temperature setting of the limit switch, the switch closes and completes the control circuit. The direct-spark ignition system cycles and the unit returns to normal heating operation.

Table 7 – LED Indications

Status Code	LED Indication
Normal Operation*	On
No Power or Hardware Failure	Off
Check fuse, low voltage circuit	1 Flash
Limit Switch Fault	2 Flashes
Flame Sense Fault	3 Flashes
Four Consecutive Limit Switch Faults	4 Flashes
Ignition Lockout Fault	5 Flashes
Pressure Switch Fault	6 Flashes
Burner Thermal Switch Fault (Ultra Low NOx)	7 Flashes
Internal Control Fault	8 Flashes
Temporary 1 hr auto reset†	9 Flashes

*. LED indicates acceptable operation. Do not change ignition control board.
†. This code indicates an internal processor fault that will reset itself in one hr. Fault can be caused by stray RF signals in the structure or nearby. This is a UL requirement.

NOTES:
When W is energized the burners will remain on for a minimum of 60 sec.
If more than one error code exists they will be displayed on the LED in sequence.

Burner Thermal Switch (Ultra Low NOx)

The Burner Thermal Switch (BTS) is used on ULN units and is located on the top of the burner box. This switch functions the same as a rollout switch on traditional inshot butner systems with the same Fault Code (7 flashes) on the IGC board.

Gas Heating Fan Speed Set-up (Single Phase Models and Ultra Low NOx 3 Phase):

To change the gas heating speed:

1. Remove existing speed tap wire from the "HEAT" terminal on the IGC.
2. Connect the desired speed tap wire on the "HEAT" terminal on the IGC board. Make sure that the speed chosen delivers temperature rise within the rise range listed on the unit.

Induced Draft (combustion air) Blower Assembly

The induced-draft blower assembly consists of the inducer motor, the blower housing, and the induced-draft blower wheel.

Range of inducer pressure tap pressures for operations points is shown in Table 8. To check pressures, insert "T" connector between inducer pressure tap and pressure switch. (See Fig. 7.) Connect manometer to remaining end of "T" using enough hose to route outside of the unit. Install access panel and start unit up.

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Fig. 7 – T Connector

NOTE: When measuring cold inducer pressure tap readings prior to ignition, it is important that the unit is completely cooled down before measurement. Heat assembly temperatures must be within 2°F of local ambient temperature. Any residual heat left will affect the measurement.

The steady state readings may be taken as soon as 10 minutes after ignition to allow the system to warm up.

Clean the inducer wheel periodically to assure proper airflow and heating efficiency. Inspect blower wheel every fall before the heating season.

To inspect blower wheel:

1. Shut off power to the unit and close the manual shut off valve on the gas supply line to the unit.
2. Remove 2 screws holding the flue hood (Fig. 8) and remove the flue hood.
3. Remove flue baffle using a 5/16-in. ratchet to remove the 2 screws, being careful not to drop the 2 screws into the inducer housing.
4. Wearing gloves, inspect the inducer wheel blades for cleanliness by slowly spinning the wheel down using a screwdriver and observing with a flashlight. If debris is evident on the blades, take a small vacuum hose to the blades. Once you have cleaned 40 blades, the process is complete.
5. Re-connect the flue baffle using the 2 screws and 5/16-in. ratchet, being careful not to drop the screws into the housing.
6. Re-connect flue hood (Fig. 8) using the 2 screws removed.
7. Turn power back onto unit and open gas supply shutoff valve.

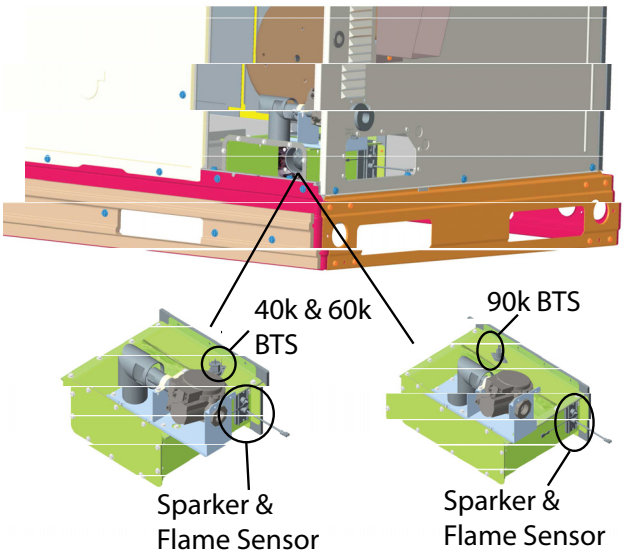

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Fig. 8 – Burner Thermal Switch (BTS) (Ultra Low NOx)

Inducer Draft Blower Assembly Removal

1. Turn off gas supply and disconnect gas line from unit, allow 3 minutes cool-down.
2. Turn off electrical power to unit and disconnect high and low voltage connections to the unit lockout tagout unit.
3. Remove front access panel.
4. Disconnect gas supply pipe from gas valve.
5. Remove flue hood.
6. Remove right side panel of unit (heat exchanger side).

Do these steps first to avoid shavings entering new inducer assembly motor.

7. Disconnect Pressure Tap Hose from the inducer assembly.
8. Disconnect Inducer Motor plug connector from the harness.
9. ULN units must not have the burner box removed from the heat exchanger panel.

A210076

Fig. 9 – Removing Mounting Screw from Gas Manifold

10. Disconnect BTS switch quick connects.
11. Disconnect flame sensor quick connect and sparker quick connect. Note that the quick connects for ULN are not near the sparker and flame sensor brackets.
12. Disconnect quick connect plugs from Gas Valve.
13. Remove 2 screws from behind Heat Shield and 1 screw under control board panel (Fig. 10 and Fig. 11).

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Fig. 10 – Removing Screws Behind Heat Shield

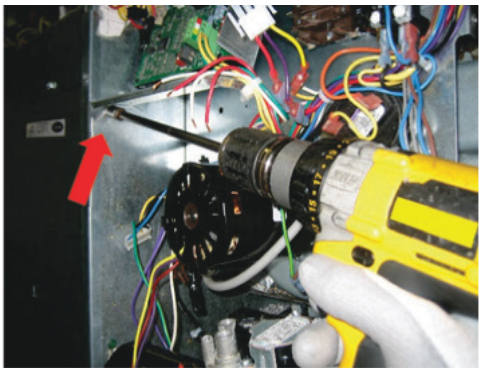

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Fig. 11 – Removing Screw Under Control Board Panel

14. Gently pull Heat Shield / Control Panel bracket down and forward. Then rotate control panel bracket to the left. Secure assembly to screw hole on front panel with wire tie or similar fastener (Fig. 12).

Use caution when moving control panel to avoid damage to controls or wire harness while moving assembly.

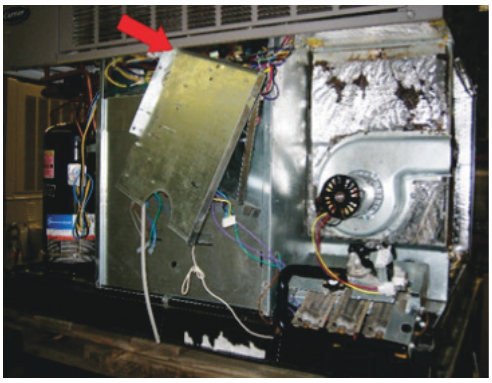

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Fig. 12 – Securing Assembly to Screw Hole

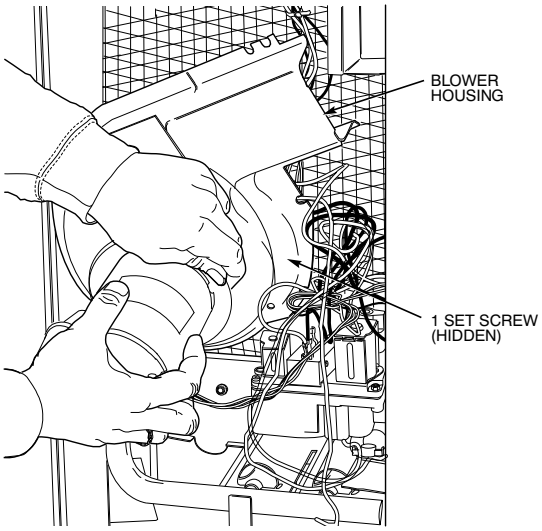

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Fig. 13 – Removing Inducer Assembly

15. Remove 5 screws holding Inducer Assembly (see Fig. 13) and remove assembly.

16. At this point flue passages and the inducer assembly may be inspected by following the procedure in the Flue Gas Passageways section.

    NOTE: The first pass of the firing tube flue passages can't be inspected on ULN units.

17. If only the inducer wheel or motor is being replaced, refer to Fig. 14 for proper spacing between inducer housing and inducer wheel. Not following this could result in the inducer wheel hitting the housing or vestibule plate.

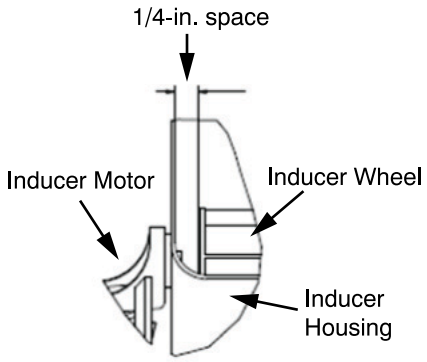

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Fig. 14 – Inducer Wheel Spacing Position

Table 8 – ULN Inducer Pressure Tap Operation Ranges

ULN Inducer Pressure Tap Operation Range (0-2000ft)		
Ignition Board Part Numbers: LH33WP010, -12, -62, -77		
Heat Assembly Size	Cold Inducer Pressure Tap Reading Before First Ignition (IN. W.C.)*	Pressure Tap Reading at Steady State (IN. W.C.)‡
40k	0.25-0.36	0.58-1.00
60k	0.36-0.68	0.88-1.44
90k	0.77-0.93	1.91-2.56
ULN Inducer Pressure Tap Operation Range (0-2000ft)		
Ignition Board Part Numbers: LH33WP015, -16, -65, -66		
Heat Assembly Size	Cold Inducer Pressure Tap Reading Before First Ignition (IN. W.C.)*	Pressure Tap Reading at Steady State (IN. W.C.)‡
40k	0.50-0.92	0.58-1.00
60k	0.48-0.71	0.88-1.44
90k	0.87-1.25	1.91-2.56

* - Heat Assembly Temperature within 2º F of Ambient Temperature
‡ - Steady State Measured after 10 minutes of Gas Heat Operation

18. Re-install inducer assembly with 5 screws from step 15 insuring that insulated foil blanket is properly located behind new housing.
19. Reinstall Heat shield / Control Panel using caution to not pinch wires or damage the circuit board.
20. Replace quick connects connectors to Rollout Switch or BTS switch and Gas Valve.
21. Reconnect quick connects to sparker and flame sensor.
22. Reconnect pressure tap hose to inducer assembly.
23. Check all connections.
24. Replace right side panel (Fig. 15.)
25. Reconnect gas supply piping to gas valve.
26. Replace flue hood.

A210081

Fig. 15 – Replacing Right Side Panel

27. Reconnect gas supply and check for leaks using soap solution.

28. Reconnect high and low voltage connections to the unit.
29. Reset power and gas.
30. Test unit, recycle unit and check for proper operation.
31. Replace front access panel.

Flue Gas Passageways

To inspect the flue collector box and upper areas of the heat exchanger:

1. Remove the induced draft blower assembly according to directions in the Induced Draft Blower Assembly section.
2. Remove the 11 screws holding the flue collector box cover (See Fig. 16) to the heat exchanger assembly. Inspect the heat exchangers.
3. Clean all surfaces, as required, using a wire brush.

Limit Switch

Remove blower access panel (see Fig. 17). Limit switch is located on the fan partition.

Burner Ignition

If lockout occurs, unit may be reset by either momentarily interrupting power supply to unit or by turning selector switch to OFF position at the thermostat.

The combined flame sensor/sparker is located on the right side of the burner box. The flame sensor/sparker is accessible for service by removing the cover in the right side panel. The burner thermal switch (BTS) is located on the top of the burner box. For 40k and 60k heat sizes, the BTS switch is accessible through the cover in the right side panel. For 90k heat sizes, the BTS switch is accessible by removing the control access panel.

⚠ WARNING

FIRE, EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death or property damage.

Do not purge gas supply into the combustion chamber. Do not use a match or other open flame to check for gas leaks.

Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

Ultra Low NOx Burner Baffle Inspection/Cleaning (See Fig. 16.)

If the inlet side of the burner is required to be inspected and cleaned for trouble shooting, the design allow accessing the burner without removing the burner box from the heat exchanger assembly. This can be done by removing the screws from the front cover of the burner box and loosening the screws on each side of the top cover to allow easy removal of baffle from the burner box. Once the baffle is removed the inlet side of the burner can be accessed and cleaned.

NOTE: This is NOT recommended to perform on yearly maintenance inspections, only allowed for trouble shooting the burner box assembly for any blockage.

NOTE: Burner/heat exchanger assembly

Due to the design, and to prevent damage to components, this is considered as one assembly and cannot be disassembled. This assembly is available to order though Replacement Components.

⚠ WARNING

FIRE, EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death or property damage.

Do not purge gas supply into the combustion chamber. Do not use a match or other open flame to check for gas leaks.

Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

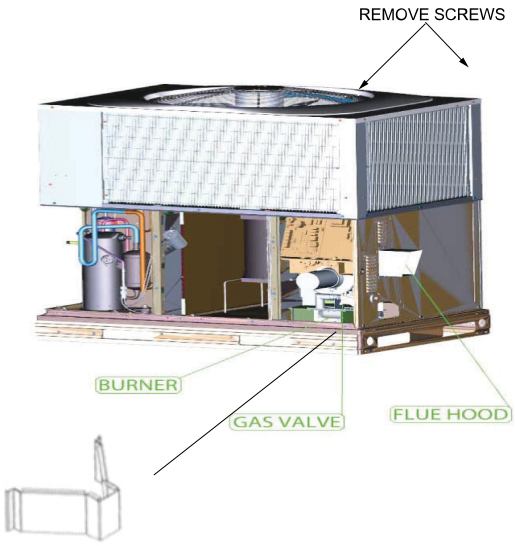

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Fig. 16 – Blower Housing and Flue Collector Box

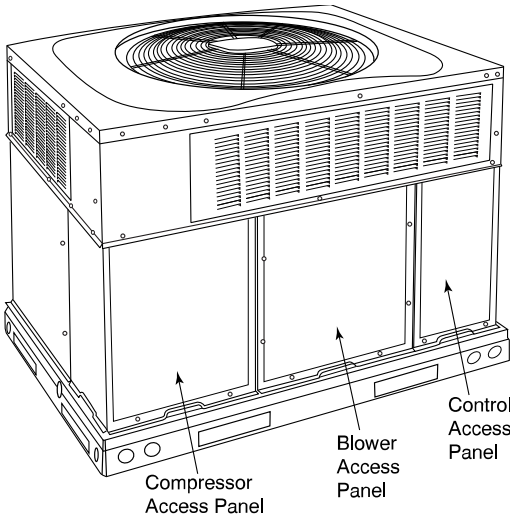

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Fig. 17 – Unit Access Panels

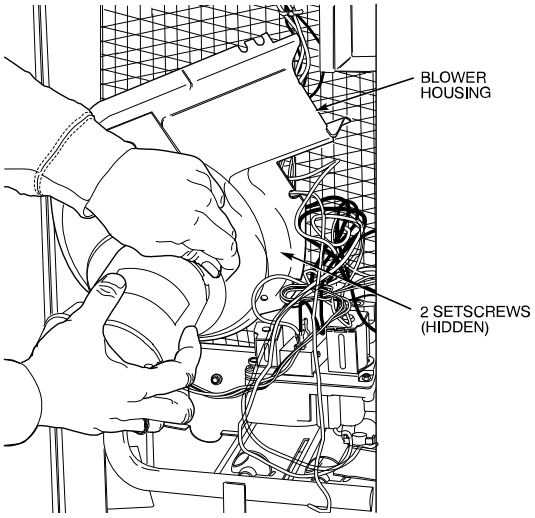

Fig. 18 – Removal of Motor and Blower Wheel

Care and Maintenance

To assure high performance and minimize possible equipment malfunction, it is essential that maintenance be performed periodically on this equipment. The frequency with which maintenance is performed is dependent on such factors as hours of operation, geographic location, and local environmental conditions.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in equipment damage or death.

Disconnect all electrical power to unit before performing any maintenance or service on outdoor unit. Remember to disconnect power supply to air handler as this unit supplies low-voltage power to the outdoor unit. Lock out and tag switch with suitable warning label.

The minimum maintenance that should be performed on the gas heating portion of this equipment is as follows:

1. Check fan motor and blade for cleanliness each month during cooling season and clean as necessary.
2. Check electrical connections for tightness and controls for proper operation each cooling season and service as necessary.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Because of possible damage to the equipment or personal injury, maintenance should be performed by qualified personnel only.

Electrical Controls and Wiring

1. Disconnect power to unit.
2. Check all electrical connections for tightness. Tighten all screws on electrical connections. If any connections appear to be burned or smoky, disassemble the connection, clean all parts and stripped wires, and reassemble. Use a new connector if old one is burned or corroded, and crimp tightly.
3. Reconnect electrical power to unit and observe unit through 1 complete operating cycle.
4. If there are any discrepancies in operating cycle, troubleshoot to find cause and correct.

Table 9 – RC Part Numbers

CRITICAL PARTS	40K	60K	90K
Burner baffle	345597-404	345597-404	345597-405
BTS	HH18HA235	HH18HA235	HH18HA612
Orifice	LH32RF125=.1250=1/8”	LH32RF140=.1405 =#28	LH32RF169 = #18
Flue baffle	20MM stamped	20MM stamped	20MM stamped
Gas Valve	EF32CW032	EF32CW033	EF32CW033
Gas Manifold	343555-401	343555-401	343555-402
Flue box cover	321 stamped	321 stamped	321 stamped
Inducer motor	HC14CR238	HC14CR235	HC14CR236
Inducer wheel	LA21WB002	LA21WB002	LA21WB002
Inducer housing	346242-701	346242-701	346242-701
Pressure switch	HK06WC061	HK60WC061	HK60WC061
LS1	VARIES	VARIES	VARIES
LS2	HH18HA211	Small Chassis Only: HH18HA211	NA
Ignitor/flame sensor	345810-402*	345810-402*	345810-402*

* For service replacement of 345810-401, use 345810-402. For 345810-402 route the sparker wire underneath the burner box and back to the sparker.

Table 10 – Troubleshooting Guide–Heating Ultra Low NOx

SYMPTOM	CAUSE	REMEDY
Burners will not ignite	Water in gas line	Drain. Install drip leg.
	No power to furnace	Check power supply fuses, wiring or circuit breaker.
	No 24-v power supply to control circuit	Check transformer. NOTE: Some transformers have internal over-current protection that requires a cool-down period to reset.
	Mis-wired or loose connections	Check all wiring and wire nut connections
	Misaligned spark electrodes	Check flame ignition and sense electrode positioning. Adjust as necessary.
	No gas at main burner	1. Check gas line for air. Purge as necessary. NOTE: After purging gas line of air, wait at least 5 minutes for any gas to dissipate before attempting to light unit. 2. Check gas valve.
	EMI Interference from sparker wire turning inducer motor off.	Separate sparker wire from inducer motor wires with a minimum proximity of 1-in.
Inadequate heating	Dirty air filter	Clean or replace filter as necessary
	Gas input to furnace too low	Check gas pressure at manifold match with that on unit nameplate. Verify proper gas orifice size. Inspect gas orifice for blockage (spider webs, etc.).
	Unit undersized for application	Replace with proper unit or add additional unit
	Restricted airflow	Clean or replace filter. Remove any restriction.
	Limit switch cycles main burners	Check rotation of blower, temperature rise of unit. Adjust as necessary.

Table 11 – Troubleshooting Guide–LED Status Codes Ultra Low NOx

SYMPTOM	CAUSE	REMEDY
No Power or Hardware failure (LED OFF)	Loss of power to control module (IGC)*.	Check 5-amp fuse son IGC*, power to unit, 24-v circuit breaker, and transformer. Units without a 24-v circuit breaker have an internal overload in the 24-v transformer. If the overload trips, allow 10 minutes for automatic reset.
Check fuse, low voltage circuit (LED 1 flash)	Fuse is blown or missing or short circuit in secondary (24VAC) wiring.	Replace fuse if needed. Verify no short circuit in low voltage (24 VAC wiring).
Limit switch faults (LED 2 flashes)	High temperature limit switch is open.	Check the operation of the indoor (evaporator) fan motor. Ensure that the supply-air temperature rise is in accordance with the range on the unit nameplate. Clean or replace filters.
Flame sense fault (LED 3 flashes)	The IGC* sensed flame that should not be present.	Reset unit. If problem persists, replace control board.
4 consecutive limit switch faults (LED 4 flashes)	Inadequate airflow to unit.	Check the operation of the indoor (evaporator) fan motor and that supply-air temperature rise agrees with range on unit nameplate information.
Ignition lockout fault (LED 5 flashes)	Unit unsuccessfully attempted ignition for 15 minutes.	Check ignitor and flame sensor electrode spacing, gaps, etc. Inspect ignitor wire; ensure ignitor wire routed clear from inducer motor wires. Ensure that fame sense and ignition wires are properly terminated. Verify that unit is obtaining proper amount of gas. Verify that the intake tube, perforated holes on the burner box top, and the burner box baffle are aligned.
Pressure Switch fault (LED 6 flashes)	Open pressure switch.	Verify wiring connections to pressure switch and inducer motor. Inspect ignitor wire; ensure ignitor wire routed clear from inducer motor wires. Verify pressure switch hose is tightly connected to both inducer housing and pressure switch. Verify inducer wheel is properly attached to inducer motor shaft. Verify inducer motor shaft is turning.
Burner Thermal Switch (BTS) fault (Ultra Low NOx {ULN}) (LED 7 flashes)	BTS has opened.	BTS will automatically reset, but IGC* will continue to lockout unit. Check gas valve operation. Verify gas orifice(s) properly sized for application.Ensure that induced-draft blower wheel is properly secured to motor shaft. Verify that the intake tube, perforated holes on the burner box top, and the burner box baffle are aligned. Reset unit at unit disconnect. Allow a 5 minute cool down period between calls for heat.
Internal control fault (LED 8 flashes)	Microprocessor has sensed an error in the software or hardware.	If error code is not cleared by resetting unit power, replace the IGC*.
Temporary 1 hr auto reset[1] (LED 9 flashes)	Electrical interference impeding IGC software	Reset 24-v. to control board or turn thermostat off, then on again. Fault will automatically reset itself in one (1) hour.

***WARNING ⚠:** If the IGC must be replaced, be sure to ground yourself to dissipate any electrical charge that my be present before handling new control board. The IGC is sensitive to static electricity and my be damaged if the necessary precautions are not taken.

IMPORTANT: Refer to Table 10-Troubleshooting Guide-Heating for additional troubleshooting analysis.

LEGEND

IGC—Integrated Gas Unit Controller

LED—Light-Emitting Diode

NOTE: Refer to Table 7 to verify inducer motor is correct part number.

Table 12 – Noise Troubleshooting Chart

Noise	Condition	Possible Solutions
Flutter/Rumble	Slightly lean combustion mixture.	Slight start-up noise is no cause for concern.
		Place access door on unit.
		Increase manifold pressure up to 3.8"wc.
Huffing	Lean combustion mixture.	Place access door on unit.
		Check gas input rate. If rate is low, adjust manifold pressure up to 3.8"wc. If still low, check for obstructions to gas flow.
		Check gas orifice for obstructions (spider web, etc.) and clean out. If orifice is clear, check inlet piping connections for blockage.
		Verify inducer motor is correct for input size. Inducer motor from a higher input size, will create a lean condition.
Pop noise	Flashback	Check for leakage around the burner box (Gaskets to seal front cover, sparker/flame sensor, and inlet baffle). Tighten screws and/or replace gasket(s) as needed.
	Delayed Ignition	Check all items under "Lean combustion mixture"
		Verify sparker/flame sensor assembly is screwed in tightly to the burner box for good ground path.
		Verify spark gap on sparker does not exceed 3/16".
Inducer noise	Inducer RPM levels vary by input, with higher input units running at higher RPM's.	Verify inducer motor is correct for input size.

SPP ULN START-UP CHECKLIST

ULTRA LOW NOX: MANUFACTURER RESERVES THE RIGHT TO CHANGE, AT ANY TIME, SPECIFICATIONS, AND DESIGNS WITHOUT NOTICE AND WITHOUT OBLIGATIONS. START-UP CHECKLIST (REMOVE AND STORE IN JOB FILES).

PRELIMINARY INFORMATION

MODEL NO._____ SERIAL NO._____

VERIFY THAT ALL PACKING MATERIALS HAVE BEEN REMOVED FROM UNIT _____

REMOVE ALL SHIPPING HOLD DOWN BOLTS AND BRACKETS PER INSTALLATION INSTRUCTIONS _____

CHECK ALL ELECTRICAL CONNECTIONS AND TERMINALS FOR TIGHTNESS _____

CHECK GAS PIPING FOR LEAKS (WHERE APPLICABLE) _____

CHECK THAT INDOOR (EVAPORATOR) AIR FILTER IS CLEAN AND IN PLACE _____

VERIFY THAT UNIT INSTALLATION IS LEVEL _____

CHECK FAN WHEEL, AND PROPELLER FOR LOCATION IN HOUSING/AND SET SCREW TIGHTNESS _____

INSPECT TUBING _____

ELECTRICAL SUPPLY VOLTAGE _____ VAC

GAS INLET PRESSURE_____IN. W.C. (No gas appliances on)

ORIFICE # _____

ALTITUDE ABOVE SEA LEVEL _____ FT.

OPERATIONAL TEST

NOTE: COLD INDUCER PRESSURE TEST REQUIRES UNIT TO BE IN A COLD CONDITION (ALL GAS COMPONENT TEMPERATURES WITHIN 2°F OF AMBIENT TEMPERATURE).

- CONFIRM ORANGE IGNITION WIRE IS SEPARATED FROM INDUCER WIRING _____
- CONFIRM BURNER COMPARTMENT DOOR ON FOR INDUCER CHECK _____
- COLD INDUCER PRESSURE TAP READING JUST PRIOR TO IGNITION _____ IN. W.C.
- INDUCER PRESSURE TAP READING AT STEADY STATE OPERATION (>10 minutes after ignition) _____ IN. W.C.
- GAS MANIFOLD PRESSURE READING AT STEADY-STATE OPERATION (>10 minutes after ignition) _____ IN. W.C.
- GAS RATE CHECK (MAKE SURE ALL OTHER GAS APPLIANCES ARE OFF):

1. IF GAS METER HAS A 2 CUBIC FEET DIAL:
   a. CLOCK TIME FOR 1 COMPLETE REVOLUTION _____ SEC.
   b. CUBIC FEET OF GAS PER HOUR = 3600 X 2 / "A" = _____ CFH
   c. OBTAIN HEATING VALUE OF GAS FROM LOCAL GAS SUPPLIER _____ BTU/CUBIC FT.
   d. BTUH = "B" X "C" = _____ BTUH
2. IF GAS METER IS DIGITAL:
   a. CLOCK TIME FOR 2 CUBIC FEET OF GAS _____ SEC.
   b. CUBIC FEET OF GAS PER HOUR = 7200 / "F" = _____ CFH
   c. OBTAIN HEATING VALUE OF GAS FROM LOCAL GAS SUPPLIER _____ BTU/CUBIC FT.
   d. BTUH = "G" X "H" _____ BTUH
3. ADJUST MANIFOLD PRESSURE TO MATCH RATING PLATE VALUE +/- 2%
4. MANIFOLD PRESSURE AFTER ADJUSTMENT (IF PERFORMED) _____ IN. W.C.

- TURN ON ALL GAS APPLICANCES AND RECORD INLET GAS PRESSURE _____ IN. W.C.
- MANIFOLD PRESSURE AFTER ADJUSTMENT _____
- TEMPERATURE RISE CHECK:

1. CHECK SUPPLY AIR TEMPERATURE* _____ °F
2. CHECK RETURN AIR TEMPERATURE _____ °F
3. TEMPERATURE RISE (SUPPLY TEMP. MINUS RETURN TEMP.) _____ °F
4. UNIT EXTERNAL STATIC PRESSURE _____ IN. W.C.
5. BLOWER SPEED SELECTED FOR HEATING:
   a. IF SINGLE STAGE COOLING, COLOR OF WIRE ON "HEAT" ON IGC _____ (Blue, Pink, Red, or Orange)
   b. IF TWO STAGE COOLING, SPEED SELECTION NUMBER FOR HEATING _____ (5, 6, 7, OR 8)

- MEASURE UNIT CURRENT _____ AMPS

- REMOVE CALL FOR HEAT. ALLOW 5 MINUTES FOR COOL DOWN (DO **NOT** CYCLE POWER!). CALL FOR HEAT AGAIN TO CHECK START UP OPERATION. ANY FAULTS? _____

NOTE: SUPPLY AIR TEMPERATURE MUST BE MEASURED OUT OF THE LINE OF SIGHT OF THE GAS HEAT EXCHANGER, AS CLOSE TO THE SUPPLY OUTLET AS POSSIBLE. IDEAL LOCATION IS 20 IN. PAST FIRST TURN.