Ultra-Low NOx Furnace Troubleshooting

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Most common fault codes explained.

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Tools

You will need to own the following:

Multimeter that is capable of micro amps, amps, volts A/C & D/C, Ohms/Continuity, HZ and Duty Cycle for PWM measurements.

Dual digital Manometer, fresh batteries for your meters.

Tee for Pressure sensor Pressure switch testing. 3/16

Jumpers, 2 lead Test cord at least 30 inches long with 1/4 female ends (The yellow pigtail that comes with condensate pumps works perfect).

5/16 flat blade Stubby screwdriver.

Needle Leads for your multi meter

Note: Do not call Tech Support for assistance if you do not have the above tools for diagnostics.

Tips

Do not rotate the induce draft motor, leave it in the original factory position.

Turning the induce draft motor cuts off the flow of the draft motor significantly and causes problems.

Always disconnect the furnace from the thermostat while troubleshooting and use jumpers to bring on the call.

1 RED FLASH, SYSTEM LOCKOUT, TOO MANY RETRIES

This could mean a bad gas valve, gas supply, bad ignitor, bad flame sensor, wires burnt or melted to previously mentioned components.

Troubleshooting The Gas Supply

Gas supply: Make sure your gas supply is not restricted. You can verify this by using a Manometer on the incoming gas pressure it should be 7-10"wc and maintain this pressure throughout the heating cycle.

The gas pressure should be maintained by the gas meters regulator. if you suspect your gas pressure dropping you can run all the gas appliances, water heater, stove oven etc. The gas company's regulator should be able to keep up with all of them running, if not call your gas supplier.

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Note: The factory recommends hammering the gas line to remove debris Etc., then blowing out the line, or running a dedicated line to the appliance to maintain a steady flow.

Note: The gas valve used in the ULN equipment is a SLOW opening valve, it will take at least 8 seconds to get to full flow.

If your gas pressure is dropping, it will not provide enough fuel for ignition or to maintain enough flame for the flame sensor.

You have 2 seconds to prove the flame.

Ignition Issues and Flame Harmonics could be a sign of Gas supply problems.

The Beckett Burner used in the ULN equipment is a precision component, ensuring your gas supply is stable is Paramount.

The factory only allows a 1/2 inch of pressure drop when the gas valve opens.

Any more than that will create issues, with Harmonics (piercing noise) Ignition (woofing) flame sense issues.

If you find that the pressure is dropping when the gas valve opens, contact the Gas Company to come check their meter for proper operation.

If it is found to be bad, they will replace it. If they find that the meter is doing its job.

You may have a restriction, water in the line Etc. If you can maintain at least 6"s of water column (WC) you can install an external regulator RV48-1/2-512-12A04(field supplied) US Air has this in stock.

You can mount this regulator outside of the furnace, after the drip leg. On a Res-pack, mount the regulator in the controls area, or you can order an outdoor rated regulator which is more expensive.

Use the specs that are coded in the RV48 part number to ensure you get the right internal springs.

Adjusting the Regulator

Install the regulator, before turning the gas on, hook up your manometer to the inlet side of the gas valve, zero out the manometer then turn the gas on. Write down what you see, say 9.0” WC.

We will need gas to flow when adjusting the regulator. Operate the furnace, we will need gas to flow when adjusting the regulator. If the furnace will stay lit, it will make it easier to adjust the regulator, (if not we will need to use the test cord to apply 24vs to the gas valve at the appropriate time).If the furnace is lit and running, look at your manometer and see what the pressure after ignition is say 8"wc. adjust the regulator so your delivery pressure is at 7.5 “wc this lets you know the regulator is working, upon reaching 7.5 “wc you can now increase the pressure to as high as you can maintain say 8 “wc. now you should be able to adjust the delivery pressure to 3.2 “wc.

On occasion, you may need to increase the gas supply up to 4 “wc if necessary to ensure a smooth burn and ignition process, (no woofing).

Note: The above procedure is in Lieu of fixing the gas supply problem. The RV48 is a poor man’s fix, but it works. I recommend you stock one on your truck if installing or servicing ULN products.

Gas Valves

Furnaces: Check to make sure your pigtail connections do not have any broken twisted wires, this could power everything else until the gas valve is energized.

Gas valve opens however no flow, check for an obstruction in the burner tube where the

U-bend goes into the burner (spider web). Make sure your gas pressure is 3.2”wc anything lower than this could cause a failure to ignite.

Testing the gas valve, unfortunately the gas valve cannot be tested using an ohm meter. If you suspect the gas valve might be bad you can test it using the following method.

Make a test cord. I like using pigtails that come with condensate pumps.

Unplug the furnace, remove the 2 yellow wires from the gas valve and secure them so they do not short out.

Put alligator clips on the end of the wires, clip one on to thermostat "C" the other leave loose. The other two leads go on the gas valve. Plug the furnace back in, then give it a call for heat.

Using an amp meter check the amps going to the ignitor. When the amps reach .50, the ignitor is hot enough to ignite the gas. When the ignitor is hot enough, grab thermostat "R" with the other alligator clip. If the gas valve opens and flows, it's good.

For package units use the same procedure except you do not need an amp meter as you should be able to hear the ignitor sparking.

Flame sensor

Note: on the PCG4ULN Res-Pac’s. The flame sensor could be touching the insulation; you will need to trim the insulation away from behind the Flame Senser. Remember to turn the power off before trimming the insulation.

Symptoms of the flame sensor touching the insulation: no flame circuit, intermittent operation, works between 9AM and 10PM. This is caused by the vestibule (back wall) flexing ever so slightly taking away the flame signal.

Flash code 5 flame present with gas valve off. may or may not run the inducer full blast.

Make sure the wires are secure, (Caution the flame sensor is powered by line voltage). check for continuity on the wire. perform flame rectification test. reading should be about 17-25uA.

If you need to clean the sensor, use steel wool. Sand cloth could insulate the rod with Silica.

Furnace Ignitor, when the hot surface ignitor is working properly it should draw about .46 or greater amps.

Ground:

Verify you have a good ground. The easiest way to check is to purchase a GFI circuit checker from Home Depot Etc.

Note: On Res-Pac Three Phase units.

On occasion you will run into a B-Phase Delta. For these power systems it may be necessary to find the grounding leg.

If your unit fires but won't stay lit, you may have one of the power supplies mentioned above.

To Identify a B Phase Delta supply:

On a 208–230-volt system, measure from phase to phase, example: L1 to L2 240v measured L2 to L3 240v measured, L3 to L1 240v is measured.

Now measure L1 to Ground, 240v measured, L2 to ground 0 volts measured, L3 to ground 240 Volts measured. This is a B-Phase delta power supply.

If the unit will not stay lit, move L1 to L2, L2 to L3. L3 to L1 and try it, if it stays lit stop, you found the proper phasing for ground reference for the flame current, if not move it one more time. L1 to L2, L2 to L3, L3 to L1

You are not affecting the rotation phasing as long as you move all three phases as indicated. Your compressor and motor will still be turning in the same direction.

Note: You have a 1 in 3 chance of landing ground when you hook up the power.

2 RED FLASHES, PRESSURE SENSOR ZERO ERROR INCORRECT PRESSURE

Replace sensor/transducer/pressure sensor. If the code repeats after replacement, call me.

The sensor used on all but the 5-ton 95 percent is 0-2" wc, part number S1-02435922000 on part (531536) 95 percent sensor part number 0-4”wc, is S1-02551762000. (5761636)

Do not use competitors’ sensors.

For Transducer Diagnostics see Troubleshooting ULN REV A

Note: there is a new part number for the 2 “wc transducer part number S1-02554196002, I would recommend using this one as the old part number is having issues from time to time.

3 RED FLASHES, PRESSURE SENSOR SPAN ERROR/INCORRECT PRESSURE.

Flash code 3 pressure sensor span error/incorrect pressure.

Note: On **Commercial** ULN package units, if your gas delivery pressure is to low it could cause a 3 flash, Increase gas valve delivery pressure to 3.75"- 4" wc.

This code could be caused by multiple issues.

If the 3 flashes happen immediately, I suspect the inducer motor to be the trouble, however it could be caused by the board, loose index chip, pressure sensor, wiring harness.

If you suspect the inducer, you can do this simple test. The inducer motor has 5 wires going to it.

High voltage Black & White, Low voltage, orange and tan (ground for PWM, VDC); Yellow is your PWM signal. Measuring Volts DC between Orange and Tan you should read around 20 volts DC. If you get around 20 volts DC, order a replacement IDM (Induced Draft Motor), but do not install it. Simply plug it in and call for heat if the code goes away, proceed with installation. If it does not call me.

If the code happens after the inducer starts, check for a bad inducer wheel, debris or obstructions in the vent motor or blocked flue.

On 95 percent furnaces, the external condensate trap must be installed. Failure to do so will result in code 3 due to the water not draining from the collector pan.

4 RED FLASHES, High limit switch open.

Make sure the blower motor is turning the right direction,

The factory default speed setting is medium low (Yellow wire), The factory expects the installing contractor to do a temp rise measurement and adjust the speed settings accordingly.

Red = low (fan), yellow = med low, grey= medium, blue = med-hi, blk = high. you can tie the heat and cool tabs using the black wire for heating and cooling if needed.

Check for restricted or collapsed ducts, dirty filters, closed supply vents, high return air temperatures.

5 RED FLASHES, Flame present with gas valve off

This could mean the gas valve is stuck open, or the board could have sensed a flame when the unit shut down (momentarily).

On package units, check to make sure the flame sensor is not touching the insulation on the vestibule.

6 RED FLASHES, <u>Furnaces</u>

Auxiliary limit open.

Note: on occasion the 95% 3-ton furnaces can trip the limit in a horizontal application, you can increase the auxiliary limit on burner from 130 degrees to 160 degrees using part number S1-02551465000.

On both 80 and 95 percent furnaces this could be caused by a dirty burner or blocked mesh in the burner.

On 95 percent furnaces try moving the pressure sensor hose from the collector to the inducer port.

This also could occur if the speed of the inducer motor is not correct. typically, on 95 percent furnaces.

On a 95 percent furnace, make sure your delivery gas manifold pressure is 3.2"wc. Then move the pressure transducer hose location from the collector to the inducer port, cap the collector port.

This increases the speed of the inducer motor, eliminating the error code and sometimes quieting the flame harmonic noise.

In some cases, moving the hose will cause the burner to not light (woof, woof sound).

If this happens, put the hose back to its original position and call me.

6 RED FLASHES, Res-Pac's

BURNER PRESSURE SWITCH OPEN:

This was not an issue with the PCG4's however the 2025 R454 models PG3 ULN it is.

I am currently working with the factory for a resolution.

In the meantime, tee into the hose for the pressure switch, the BPS is set at a fixed -.85 however the negative portion is not used. The pressure switch will open at .85" wc positive pressure.

After teeing into the line, you may see a momentary pressure of 1.00" wc after ignition this is enough to activate the switch, if you see the 1.00" wc. You can use Supco's Universal pressure switch part number NS2000003, set it just above the pressure you are seeing on your manometer. example if you see a momentary reading of 1" wc, adjust the switch to 1.05" wc so the unit can heat.

RAPID RED FLASHES

Incorrect line voltage polarity

Reverse the secondary wires if that does not clear the code. put them back to how they were and switch L1 & L2.

STEADY RED FLASHES,

Replace the board.

GAS VALVE LEAKING FROM U TUBE:

On occasion it is possible to have gas leaking from the U-tube as it goes into the burner.

This is caused by two possible problems.

The first being that the gas valves threads do not allow the Orifice to screw deep enough into the gas valve. This causes the U tube to not fully seat into the burner causing it to leak.

Visually inspect the distance between the orifice and the gas valve, it should be about 3/16 of an inch. almost touching the green ground screws.

A sure sign of the orifice not seating in the gas valve, is the U tube will almost be touching the side wall.

If you find that the orifice is indeed not fully threading into the valve, take your orifice with you when you get the new valve and see if it threads deeper than the defective one.

The second problem could be that the U tube is misaligned when going into the burner.

To Realign follow the procedure below:

First, loosen the U tube nut going into the Orifice, next relax the four screws holding the gas valve mounting plate.

Next ensure the U tube is seated in as far as it can go into the burner (you will be able to tell/feel when it is seated properly).

Using your index finger to keep the tube seated in place, you can use your thumb and remaining fingers to tighten the U tube nut to the orifice, finger tight.

You can now tighten the four screws holding the gas valve mounting plate (like tightening lug nuts on a tire) and then tighten the U tube nut to the orifice, and leak check.

After doing the above procedure you should be able to get your finger in between the U tube and the right wall.

FLAME HARMONICS:

On occasion the ULN furnace can produce a horrible noise that seems to pierce thru walls, your body and on to the neighbors' ears.

Note: This applies to the early models of ULN furnaces.

By 2022 all furnaces were upgraded to the new ID chips and orifices, Res-packs were not affected.

This phenomenon can be caused by an incorrect index chip and or orifice see chart below:

TL9E060 Id Plug 5528280 orifice .144 TL8E060 Id Plug 5894122 orifice .144

TL9E080 Id Plug 5894195 orifice .166 TL8E080 Id plug 5894182 orifices .166.

TL9E100 Id Plug 5528282 orifice .182 TL8E100 Id Plug 5528279 orifice .182

PCG4A50 ID Plug 5996829 orifice .136 PCG4B65 Id Plug 5996822 orifice .154

The gas pressure setting should be 3.2, however adjusting the gas pressure between 3-4 is acceptable.

If after verifying the index chip and orifice are correct and the problem remains. see Trouble Shooting the Gas Supply above.

On a 95 percent furnace, especially the three ton in a horizontal position, after verifying the correct Id chip and Orifice. Move the grey pressure sensor hose from the collector to the induced draft motor port.

adjust the gas valve to 3.5.

On occasion, the inducer motor can produce a whine.

If the whine is loud, replace the inducer motor.

If you're not sure if the inducer or gas valve is making the noise, turn the gas off to the furnace and see if the noise continues.

Part numbers:

Gas Valve for all ULN part number S1-02551463000

80 percent inducer Part number S1-02649699000

95 percent inducer Part number S1-02649700000

PCG4A/B inducer part number S1-02649702000

Pressure sensor 0-2 WC all but 5-ton 95% Part number s1-02435922000

Pressure sensor 0-4'wc 95% 5-ton part number S1-02551762000

Control board all **ULN Furnace's** part number S1-03103762000

Control board for all **ULN Package** units, part number S1-03103765000

Adaptor kit for testing manifold pressure **F92-1003**