

## Ultra-Low NOx Furnace Troubleshooting

Most common fault codes explained.

By Eddie M Lopez

### 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

Tee for tubing Pressure sensor testing. 3/16

Jumpers,

### Tips

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

Turning the inducer 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 Gas Supply

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

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

This is because the gas valve's pressure regulator "rides with the supply".

in other words, if you have, as an example 9.00" of water column and when the gas valve opens the incoming pressure drops to 8".

if your gas valve was set to 3.5 at 9" when the pressure drops to 8", the gas valve regulator will drop to 2.5.

causing ignition issues and possible flame harmonics.

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 you can set an external regulator (field supplied), outside of the furnace

set to 6"s. This will stabilize the incoming pressure to a solid 6" then you can verify the output of 3.5"s of water column.

The above procedure is in Lew of fixing the gas supply problem.

For gas valves, check to make sure pigtail connections to your power supply, broken twisted wires, this could power everything else until the gas valve is energized.

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" 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.

We have seen where the furnace works during the day but not at night or in the morning, suspect that you may have a restriction in your line. you may need to go to the customers house when the event is occurring.

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 3.5, 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 the pigtailed wires that come with the 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,

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 17uA.  
If you need to clean the sensor, use steel wool. Sand cloth could insulate the rod with Silica.

Ignitor, when the ignitor is working properly it should draw about .50 amps.

Ground

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

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 S1-0243592200 on part (531536)  
95 percent sensor part number 0-4' WC, is S1-02551762000. (5761636)  
Do not use competitors' sensors.

3 RED FLASHES, PRESSURE SENSOR SPAN ERROR/INCORRECT PRESSURE. Flash code 3 pressure sensor span error/incorrect pressure.

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, index chip, pressure sensor, wiring harness.

On Commercial package units, if your gas pressure is too low it could cause a 3 flash, Increase gas valve delivery pressure to 3.75" WC.

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, but do not install it. simply plug it in and call for heat if the code goes away, proceed with install. 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 trap must be installed. Failure to do so will result in a code 3 due to the water not draining from the collector pan.

4 RED FLASHES, High limit switch open.

Make sure the 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.

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, Auxiliary limit open.

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 3.5"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.

RAPID RED FLASHES, Incorrect line voltage polarity

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

STEADY RED FLASHES,

Replace 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 in 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.

\*See section above regarding Troubleshooting Gas supply.

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 3.5, however adjusting the gas pressure between 3-4 is acceptable. If after verifying the index chip and orifice are correct and the problem remains. Replace the gas valve if that does not fix it call me.

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 al ULN furnace's part number S1-03103762000

Control board for all package units, part number S1-03103765000

Adaptor kit for testing manifold pressure F92-1003

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