Revision1

York ULTRA LOW NOx FURNACE OPERATION AND TROUBLESHOOTING

The following information is not intended to replace the information in the installation insturction for this product. Please review all information that acompanyed the furnace before using the following information to additionally aid you in trobleshooting this product.

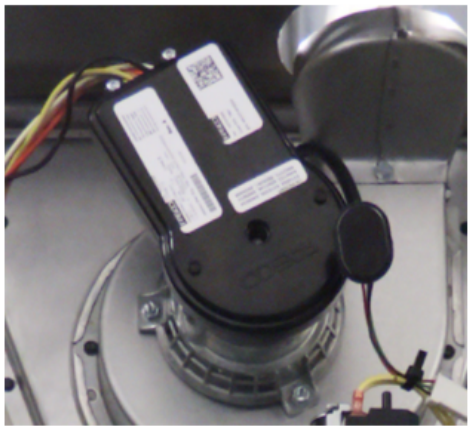
Sequence of Operation Heating

The sequence of operation described here applies to both 80% and 95% AFUE models.

Heating Call

Upon receiving a call for heat, the control verifies limit circuits are closed and the transducer output voltage to the furnace control correlates to that of a 0.00"w.c. vent pressure ~ 0.25 VDC.

0.19vdc



Inducer Assembly

Transducer Verification

After confirming the limits are closed and the vent pressure is 0.0" w.c., the control starts the inducer. The control monitors the transducer output voltage as the inducer ramps up to pre-purge pressure of -0.40"w.c. ~ 1.0 VDC.

If the output value of the transducer does not span its operation range within 90 seconds, the control sets Pressure Span Error, 3 Red Flashes.

1-5-2021

Pre-Purge

After transducer operation verified, the furnace proceeds to pre-purge mode. During pre-purge, the inducer ramps to a achieve a vent pressure of -1.50"w.c. for 30 seconds.

Inducer Cycles Off

After a 30 second pre-purge, the inducer cycles off. Cycling the inducer off allows the igniter to warm uniformly, which optimizes ignition.

Igniter Warm Up

The system then enters the igniter warm-up period. The table below outlines the igniter warm-up times.

Hot Surface Igniter

Attempt	Warm-Up Period
1st	17 Seconds
2nd	18 Seconds
3rd	19 Seconds
4th	20 Seconds

Igniter Warm-Up Times

Trial For Ignition

Following the igniter warm up, the inducer energizes at the "trial for ignition" vent pressure. Once the pressure is achieved, the gas valve opens.

Efficiency	Capacity	Pressure
80%	80,000	-1.20"w.c.
95%	80,000	-1.00"w.c.

Trial For Ignition Vent Pressure

Flame Sense

During an ignition attempt, the furnace control senses flame current. When the control detects 1.0µA (micro-amps) or more, it de-energizes the igniter and proceeds to flame stabilization operation. If a control does not detect a flame signal within 4 seconds, the gas valve and igniter are de-energized. The system then enters a 45 second recycle period. The flame signal testing procedure is explained here.

Flame Sensor

Tech Note

It is normal for the flame current of a Ultra Low NOx furnace to operate higher than expected. Measurements of 10µA is not uncommon.

Flame Stabilization

Once the control confirms the flame presence, the unit enters a Flame Stabilization period which includes an increase in vent pressure. The table here outlines the stabilization time and excepted vent pressure. The blower energizes 30 seconds after the Flame Stabilization period starts. The heating blower on delay is non-adjustable.

Efficiency	Input Capacity	Stabilization Pressure	Stabilization Time
80%	80,000	-1.60	25 seconds
95%	80,000	-1.60”	20 seconds

Flame Stabilization Data

Steady State Operation

Following Flame Stabilization the furnace enters Steady State Operation. The operating conditions of any furnace a dynamic. For example, changes in wind impact the vents system pressure. In most furnaces these changes go unnoticed. Because the Ultra Low NOx furnace is attempting to maintain optimal combustion, it responds to system dynamics.

As the vent pressure changes, the transducer return voltage changes. The control monitors the voltage change and adjust the PWM output to the inducer accordingly. The inducer increases or decreases speed accordingly to maintain vent pressure.

It is normal for the vent pressure and transducer return voltage to vary during operation.

The nominal vent pressure and minimum vent pressures are listed here.

Efficiency	Input Capacity	Normal Run Pressure	Minimum Run Pressure
80%	80,000		
95%	80,000		

Run pressure for 80% 80K = 2.10" w.c.
Run pressure for 95% 80K = 2.10" w.c.
Run pressure for 80% 60K = 2.20" w.c.

Normal Operation Data

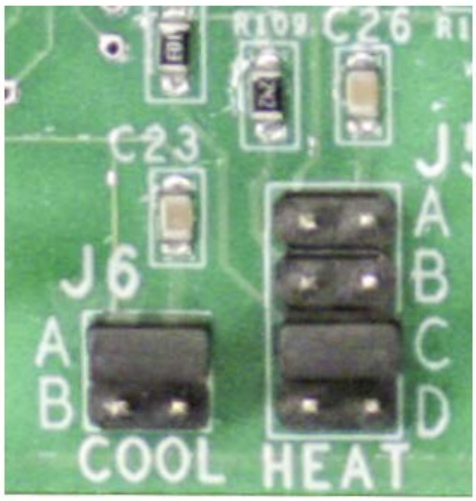
The heat cycle continues as long as heating demand is present. During this time the control monitors the flame current, limit switches, pressure transducer, and any other safety devices. If a fault condition occurs, heating operation stops.

Post Purge

When the heating demand satisfies, the burner cycles off. The inducer remains energized for 30 seconds.

Purge pressure -1.50”wc all models

Inducer Assembly



Blower Off Jumpers

Blower Off

When the heating demand satisfies, the blower continues to operate at the heating speed for the duration of the time selected by the heat blower off delay jumper.

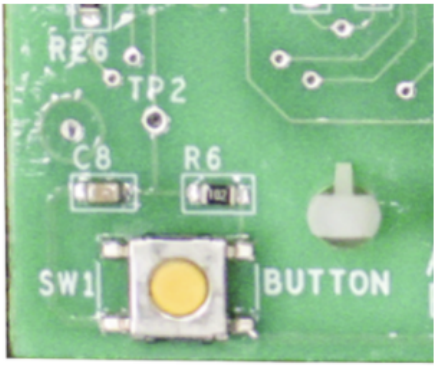
Position A = 60 Seconds
Position B = 90 Seconds
Position C = 120 Seconds*
Position D = 180 Seconds**

* = Factory setting
** = Default if jumper is missing

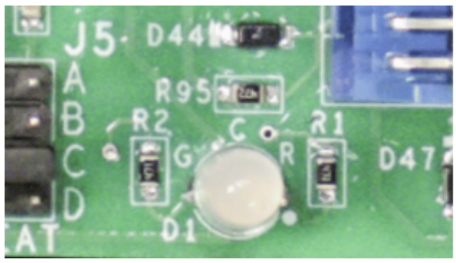
Retrieving Fault History

Fault Code History

The control stores up to five fault codes are stored in a non-volatile memory. Depressing the SW1 button (located in the lower left corner of the control) less than 5 seconds without a thermostat call retrieves the fault code history.



SW1 Button



Fault Code Example

Flash codes associated with each fault displays starting with the most recent. If multiple faults are present, there is a 1½ second delay between codes.

Depressing the SW1 button for 5-10 seconds without a thermostat call clears the fault history.

**Recommend clearing history when done troubleshooting

Tech Note

The control stores faults indefinitely until manually cleared. It is strongly recommended to clear the fault history when servicing the furnace. This prevents storage of faults that are no longer relevant.

Field Test Mode

Field Test Mode forces the control through a series of diagnostic test. These test confirm the control function and the component operation. With power to the control and not thermostat call, depress the SW1 button for 10-15 seconds. This action places the furnace in Field Test Mode. The control ignores a button press longer than 15 seconds.

Field Test Mode

The test sequence is as follows:

- Operates the inducer at heating run speed for the duration of the test
- Energizes the igniter for 15 seconds
- Energizes the blower on "Fan" speed for 10 seconds
- Energizes the blower on "Heat" speed for 10 seconds
- Energizes the blower on "Cool" speed for 10 seconds

When the test is complete, the control returns to Standby Mode. The control ignores any thermostat call until the Field Test sequence completes.

2 Red Flashes
Pressure Sensor Null Error

Pressure Sensor Null Error

Overview

If the control detects pressure other than 0.00"w.c. 0.19v prior to energizing the inducer, a fault is displayed, the ignition sequence stops, and all output de-energizes for five seconds. After five seconds, the control re-evaluates the pressure and proceeds accordingly.

Possible Causes & Corrective Actions

The most common causes for this fault:

- Venting issue
- Pressure transducer issue
  - See the Transducer Diagnostics section for more information

3 Red Flashes
Pressure Sensor Span Error

Pressure Span Error

Overview

Upon a thermostat call, the control starts the inducer and monitors the transducer return voltage. If the return voltage does not achieve approximately 1 volts DC (corresponding to -0.40" w.c.) within 90 seconds, this fault occurs.

When the fault is set, the control enters a five minute lockout period. After five minutes the ignition sequence restarts.

Possible Causes & Corrective Actions

The most common causes for pressure span error are:

- Obstructed vent
  - If the furnace vent becomes restricted or blocked, the pressure transducer detects the drop in pressure. The control increases inducer speed in an attempt to maintain vent pressure. If the inducer reaches 100% inducer speed (5,000 RPM) and cannot maintain vent pressure, the control shuts down heating operation.
- Undersized vent
  - Confirm venting complies with unit installation insturctions
- Extreme wind conditions (95%)
  - Vent systems are designed to withstand a 40 mph wind. A non-direct sidewall vent application under extreme conditions the wind force on the vent pipe may be more than the inducer can overcome.
- Failed pressure transducer
  - Refer to the Transducer Diagnostic section for more information

Inducer Motor Diagnostics

The inducer motor is an Electronic Commutated Motor (ECM). Controlled by a Pulse Width Modulated (PWM) signal, the motor varies speed as necessary to maintain specific combustion air requirements.

As with all ECM motors, line voltage is applied anytime the furnace is applied. Line voltage is applied on pins 4 and 2 of the 4 pin connector located in the upper left corner of the furnace control.

The diagnostic procedure is as follows:

1. With power applied to the furnace measure line voltage at pins 2 and 4 of the 4 pin connector
2. Provide a call for heating operation
3. Measure PWM signal as the unit progresses through the ignition sequence

Tech Notes

- The objective of the motors is to maintain a specific combustion airflow based on vent pressure. Due to variations in vent system configuration some applications require a greater motor speed than others. Thus, the PWM signal to the motor is variable.
- If the inducer motor runs at all, it is highly unlikely there is an issue with the motor.
- If the inducer reaches maximum speed (5,000 RPM) and is unable to achieve the required negative vent pressure heating operations cease. The most likely cause is a vent obstruction or improper venting.

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Inducer Motor and Ignitor Voltage Check

115 to 125

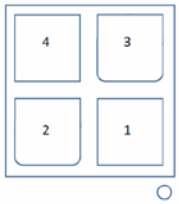
Inducer Assembly

Four Pin Connector

Line Power

Igniter

Inducer



4 – Inducer Neutral (common)
3 – Igniter Neutral (common)
2 – Inducer Power
1 – Igniter Power

The Four Pin Connector provides line power to the HSI and Inducer.

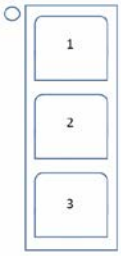
Inducer power it applied anytime power is applied to the furnace.

HSI power is applied on during the HSI Warmup period – described in Heating Sequence of Operation section of the PowerPoint.

Inducer PWM Signal

Three Pin Connector

Inducer PWM



1 – Control Power (20 VDC)
2 – PWM to Motor
3 – RPM Feedback

The Three Pin Connector provided PWM signal to the ECM inducer motor and monitors motor feedback to ensure motor operation.

Important Note: The purpose of the inducer is to maintain a specific vent pressure. Because of variances in venting systems and furnace operation conditions, the PWM signal can vary – even during steady state, normal operation.

*The vent blower PWM signal ground is Tan, The vent blower PWM signal is Yellow

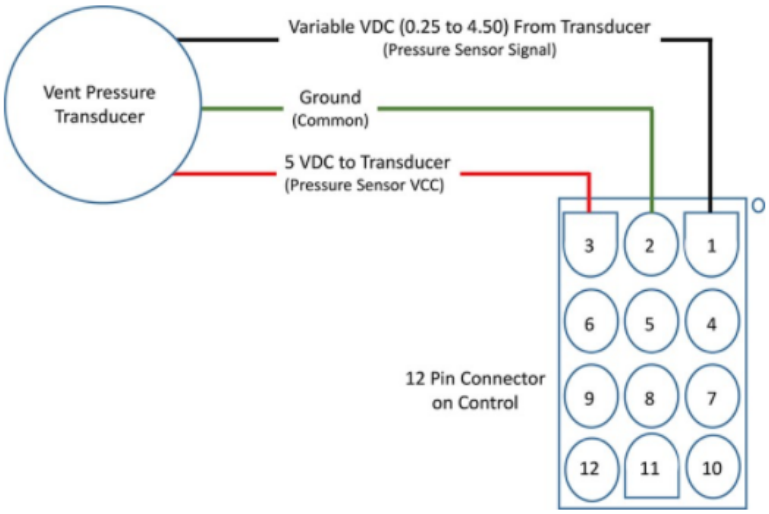
We have no PWM chart for the combustion blower motor on this furnace. If PWM is 0 motor should be OFF. If you think about it, the furnace is commanding a certain vent pressure as reported by the pressure transducer. The higher the vent pressure needs to be, the higher PWM signal will be sent to the blower motor.

Transducer Diagnostics

Diagnosing the transducer requires knowledge of the furnace operation, a manometer, a barbed "tee", a length of 1/4" tubing, and a voltmeter with "needle" leads.

The procedure is as follows:

- Disconnect furnace power
- Tee a manometer into the tubing connecting the transducer to the inducer assembly
- Reapply power to the furnace
- Without a thermostat call, measure the control voltage to the transducer between pins 3 (VCC) and 2 (Ground) of the 12 pin connector. The output voltage should be ~ 5 VDC.
- The voltage from the transducer to the furnace control should be ~ 0.25 VDC as measured between pin 1 (PSS) and pin 2 (Ground) of the 12 pin connector.
- Provide a heating call and monitor the pressure and voltages as the furnace cycles through its ignition sequence. The tables below provides the various pressures and voltages expected during the ignition sequence.



Transducer Wiring

Tech Notes

- The use of traditional meter leads may result in an erroneous voltage reading and/or damage to the connector. "Needle" leads provide reliable measurements without causing damage to the 12 pin connector.
- If 5 VDC is not present at pins 2 and 3, confirm 24 VAC to the control (pins 10 & 11). Also, confirm the 3 amp fuse is not open and there are no faults present

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Transducer Diagnostics

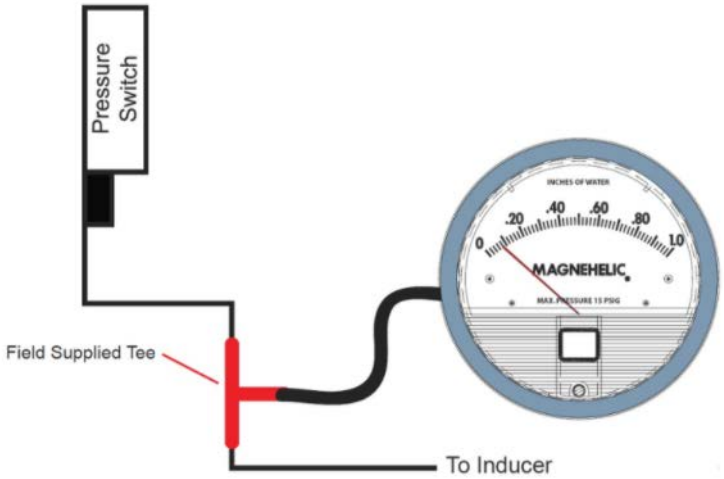
Null pressure should be 0”wc and voltage for 2" transducer at 0”wc is .19 VDC.

4" transducer at 0”wc is .44 VDC.

Note:Info below for TL8E and TL9E furnaces

Pre-purge pressure on all models is 1.50" w.c.

Flame Stabilization Pressure and Time and all three new ID plugs is 1.60" w.c. and 25 seconds with the exception of the 95% 80K plug it is 20 seconds. Normal Operation Pressures:
Run pressure for 80% 80K = 2.10" w.c.
Run pressure for 95% 80K = 2.10" w.c.
Run pressure for 80% 60K = 2.20" w.c.



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Transducer Diagnostics

Expected Pressure and Output Voltages

IMPORTANT NOTE

TL9E100 series furnaces use a 4" pressure transducer. All other models use a 2" pressure transducer.

2 INCH TRANSDUCER		4 INCH TRANSDUCER		4 INCH TRANSDUCER	
PRESSURE	VDC	PRESSURE	VDC	PRESSURE	VDC
0	0.19	0	0.44	2.3	2.809
0.05	0.28675	0.05	0.4915	2.35	2.8605
0.1	0.3835	0.1	0.543	2.4	2.912
0.15	0.48025	0.15	0.5945	2.45	2.9635
0.2	0.577	0.2	0.646	2.5	3.015
0.25	0.67375	0.25	0.6975	2.55	3.0665
0.3	0.7705	0.3	0.749	2.6	3.118
0.35	0.86725	0.35	0.8005	2.65	3.1695
0.4	0.964	0.4	0.852	2.7	3.221
0.45	1.06075	0.45	0.9035	2.75	3.2725
0.5	1.1575	0.5	0.955	2.8	3.324
0.55	1.25425	0.55	1.0065	2.85	3.3755
0.6	1.351	0.6	1.058	2.9	3.427
0.65	1.44775	0.65	1.1095	2.95	3.4785
0.7	1.5445	0.7	1.161	3	3.53
0.75	1.64125	0.75	1.2125	3.05	3.5815
0.8	1.738	0.8	1.264	3.1	3.633
0.85	1.83475	0.85	1.3155	3.15	3.6845
0.9	1.9315	0.9	1.367	3.2	3.736
0.95	2.02825	0.95	1.4185	3.25	3.7875
1	2.125	1	1.47	3.3	3.839
1.05	2.22175	1.05	1.5215	3.35	3.8905
1.1	2.3185	1.1	1.573	3.4	3.942
1.15	2.41525	1.15	1.6245	3.45	3.9935
1.2	2.512	1.2	1.676	3.5	4.045
1.25	2.60875	1.25	1.7275	3.55	4.0965
1.3	2.7055	1.3	1.779	3.6	4.148
1.35	2.80225	1.35	1.8305	3.65	4.1995
1.4	2.899	1.4	1.882	3.7	4.251
1.45	2.99575	1.45	1.9335	3.75	4.3025
1.5	3.0925	1.5	1.985	3.8	4.354
1.55	3.18925	1.55	2.0365	3.85	4.4055
1.6	3.286	1.6	2.088	3.9	4.457
1.65	3.38275	1.65	2.1395	3.95	4.5085
1.7	3.4795	1.7	2.191	4	4.56
1.75	3.57625	1.75	2.2425		
1.8	3.673	1.8	2.294		
1.85	3.76975	1.85	2.3455		
1.9	3.8665	1.9	2.397		
1.95	3.96325	1.95	2.4485		
2	4.06	2	2.5		
2.05	4.15675	2.05	2.5515		
2.1	4.2535	2.1	2.603		
2.15	4.35025	2.15	2.6545		
2.2	4.447	2.2	2.706		
2.25	4.54375	2.25	2.7575		

Ignition Issues

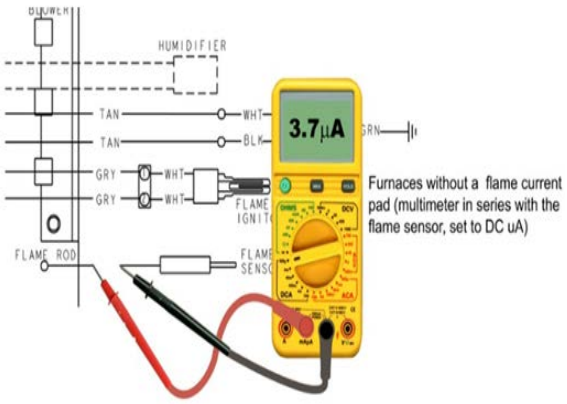
Rough Ignition or No Ignition

The reasons for no ignition and rough ignition are very similar. They are discussed together to avoid repetitiveness. Assuming the gas valve is in the ON position and the gas stop is open, the most common reasons for rough or no ignition are:

- Residual air in the gas line
  - Failure to properly purge air from the gas line results in rough ignition or no ignition
- Low inlet gas pressure
  - The minimum inlet gas pressure is 7" w.c.
- Manifold gas pressure issue
  - If rough ignition or no ignition is observed, adjusting the manifold pressure may correct this issue. The manifold pressure range is 3.0" - 4.0" w.c. **DO NOT exceed these ranges.**
- Obstructed burner
  - An obstructed burner (e.g., drywall dust) can not be successfully cleaned. It must be replaced.

If gas flow is verified but No ignition occurs also check to see if hot surface ignitor is working

IGNITION CONTROL FLAME SENSE LEVELS
Normal flame sense current is approximately
3.7 microamps DC (µa)
Low flame signal warning starts at 1.5 microamps.
Low flame signal control lockout point is
0.1 microamps DC (µa)



NOTE:
Residential Furnaces
120 flame sensor voltage
3 to 4 plus Micro Amps

Commercial and residential Package
208 - 240 flame sensor voltage
15 - 21 Micro Amps

Verify Inlet Pressure Before and After Gas Valve As Well As Outlet Gas Pressure During and After Lighting

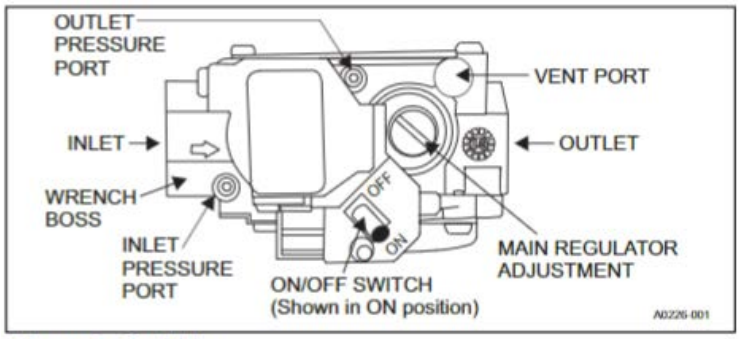
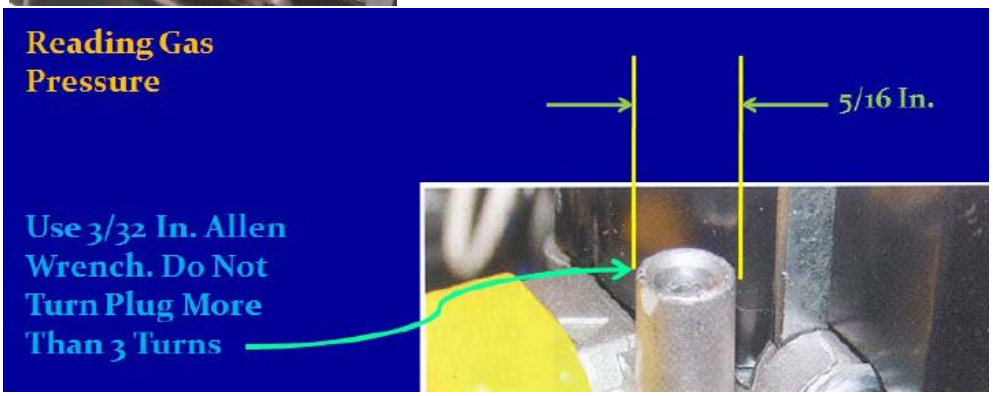


Figure 8: Gas Valve



IMPORTANT: If gas valve regulator is turned in (clockwise), manifold pressure increases. If screw is turned out (counter clockwise), manifold pressure decreases.

Table 9: Inlet Gas Pressure Range

INLET GAS PRESSURE RANGE		
	Minimum*	Maximum
Natural Gas	4.5 in. W.C. (1.12 kPa)	10.5 in. W.C. (2.61 kPa)

IMPORTANT: The inlet gas pressure operating range table specifies what the minimum and maximum gas line pressures must be for the furnace to operate correctly. The gas line pressure **MUST BE** a minimum of:

- 7 in. W.C. (1.74 kPA)

This is in order to obtain the BTU input specified on the rating plate and/or the nominal manifold pressure specified in these instructions and on the rating plate.

Table 10: Nominal Manifold Pressure

NOMINAL MANIFOLD PRESSURE	
Natural Gas	3.5 in. W.C. (0.87 kPa)

See Notes on Falling Page

Gas Manifold Pressure History

Note: When this furnace design was first introduced we found that the gas manifold pressure had to be adjusted down (lowered) to reduce or eliminate the burner Harmonics associated with this burner design. The burner orifice and board ID plug program was redesign to allow the gas manifold pressure to be set at 3.5" wc pressure with a + or - adjustment from there may be needed depending on the specific gravity and heating value of the natural gas in the area installed. It should not be necessary to lower to 2.8" to 3" wc with serial numbers starting with W2G... and forward.

If needed furnaces with serial number prior to this can be updated with the following orifice and ID plug. Obtain these parts through US Air Conditioning Distributors branch parts department. See the following for part numbers by model number.

Orifice change on the 80% and 95%, 60K and 80K models.
ID Plug change on the 80% and 60K and 80K models.
ID Plug change on the 95%, 80K model.

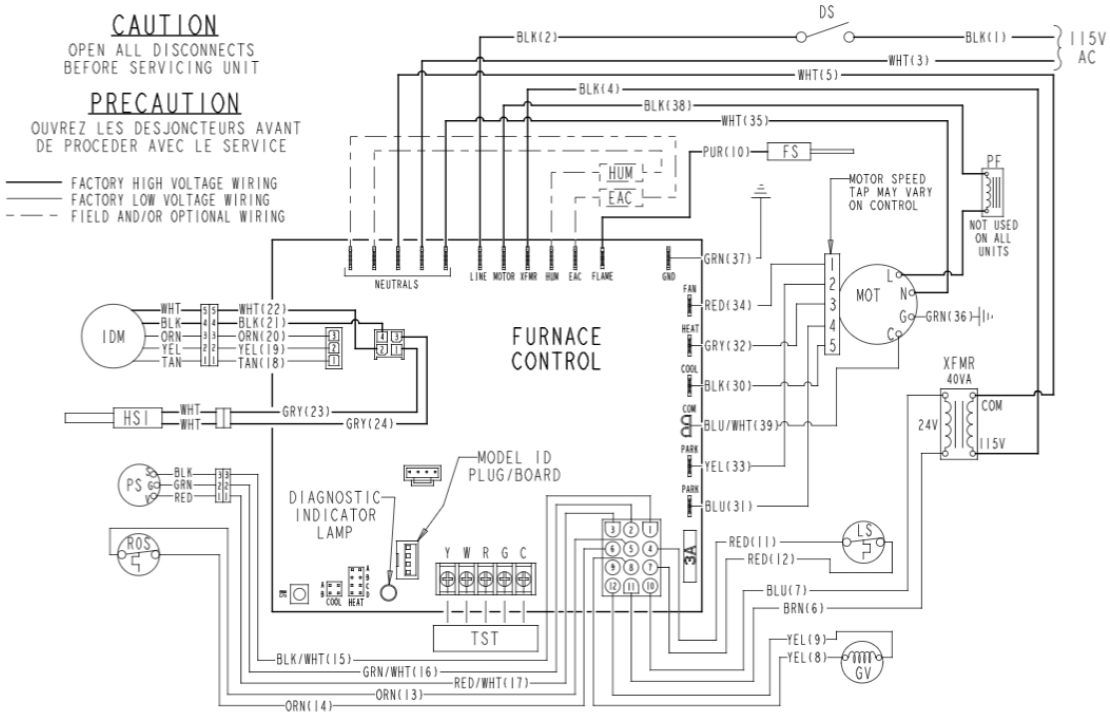
According to field collected data, TL9E080C16UH11 models require repair. For furnace repair, order and use the following:
S1-02927783000 Orifice, gas, #19 ULN
S1-02551471002 Plug, ID, 80K 95% ULN

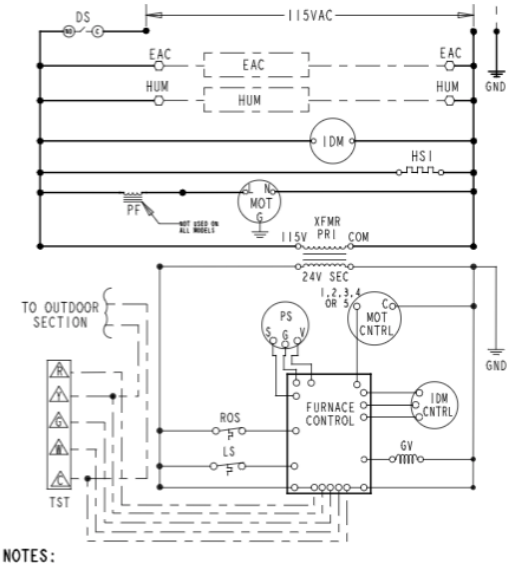
Models TL8E060A12UH11, TL8E080C16UH11, and TL9E060B12UH11 will be fix on fail only. For furnace repair, order and use the following:

TL8E060A12UH11 TL9E060B12UH11
S1-02927782000 Orifice, gas #27 ULN S1-02927782000 Orifice, gas #27 ULN
S1-02551482002 Plug, ID, 60K 80% ULN ID PLUG DOES NOT CHANGE.

TL8E080C16UH11
S1-02927783000 Orifice, gas, #19 ULN
S1-02551470002 Plug, ID, 80K 80% ULN

WIRING DIAGRAM - TL8E*/TL9E*





NOTES:
1. If any of the original wire as supplied with the furnace must be replaced, it must be replaced with wiring having a temperature rating of at least 221°F(105°C).
2. Connectors suitable for copper conductors only.

NOTES:
1. Si l'un des fils d'origine fourni avec ce four doit filage doit être remplace, il doit etre remplace avec le fil ayant un degré de température d'au moins 221°F(105 °C).
2. Seulement des marettes pour fil de cuivre.

NOTE TO SERVICERS

Blower motor speed connections shown are typical, but may vary by model and application.

DIAGNOSTIC CODES

FLASHES	CONDITION
STEADY ON GREEN	NORMAL OPERATION, NO TST CALLS
1 GREEN FLASH	NORMAL OPERATION WITH TST CALL FOR HEAT
2 GREEN FLASH	NORMAL OPERATION WITH TST CALL FOR COOLING
3 GREEN FLASH	NORMAL OPERATION WITH TST CALL FOR CONTINUOUS FAN
LED STEADY OFF	NO POWER OR BLOWN FUSE
STEADY ON RED	CONTROL FAILURE
1 RED FLASH	SYSTEM LOCKOUT, TOO MANY RETRIES
2 RED FLASHES	PRESSURE SENSOR ZERO ERROR INCORRECT PRESSURE
3 RED FLASHES	PRESSURE SENSOR SPAN ERROR INCORRECT PRESSURE
4 RED FLASHES	HIGH LIMIT SWITCH OPEN
5 RED FLASHES	FLAME PRESENT WITH GAS VALVE OFF
6 RED FLASHES	AUXILIARY LIMIT SWITCH OPEN
7 RED FLASHES	GAS VALVE SHORT CIRCUIT
1 AMBER FLASH	LOW FLAME CURRENT
2 AMBER FLASHES	ID PLUG FAILURE
3 AMBER FLASHES	CONTROL FUSE OPEN
RAPID RED FLASHES	INCORRECT LINE VOLTAGE POLARITY

LEGEND

DS - DOOR SWITCH
EAC - ELECTRONIC AIR CLEANER
FS - FLAME SENSOR
GV - GAS VALVE
HSI - HOT SURFACE IGNITOR
HUM - HUMIDIFIER
IDM - INDUCED DRAFT MOTOR
LS - LIMIT SWITCH
MOT - BLOWER MOTOR
PF - POWER FACTOR CHOKE
PS - PRESSURE SENSOR
ROS - ROLLOUT/AUXILIARY SWITCH
TST - THERMOSTAT
XFMR- TRANSFORMER

LEGENDE

DS - COMMUTATEUR DE PORTE
EAC - FILTRE ELECTRIQUE
FS - CAPTEUR DE FLAMME
GV - ROBINET DE GAZ
HSI - IGNITION DE SURFACE CHAUD
HUM - HUMIDIFICATEUR
IDM - VENTILATEUR DE COMBUSTION
LS - COMMUTATEUR DE LIMITE
MOT - BLOWEUR MOTEUR
PF - TRANSFORMEUR DE FACTEUR DE PUISSANCE
PS - CAPTEUR DE PRESSION
ROS - COMMUTATEUR DE ROULEMENT
TST - THERMOSTAT
XFMR- TRANSFORMEUR

FAULT CODE RETRIEVAL

NOTICE-Only a qualified service technician should use this feature. Fault code retrieval functions will work only if there is no active thermostat signals. To retrieve fault codes, push and release SW button on control board. The LED will flash the last five fault codes beginning with the most recent. If there are no fault codes in memory, the LED will give two green flashes. To clear the fault code memory press and hold the SW button until the LED flashes rapid green.

5894245-UWD-A-0220

**Recommend clearing history when done troubleshooting