Pensotti ASME Non-Condensing ‘Classic’ Boilers

Troubleshooting Manual

Version 1 - All Models

GRANBY

Pensotti ASME Non-Condensing 'Classic' Boilers

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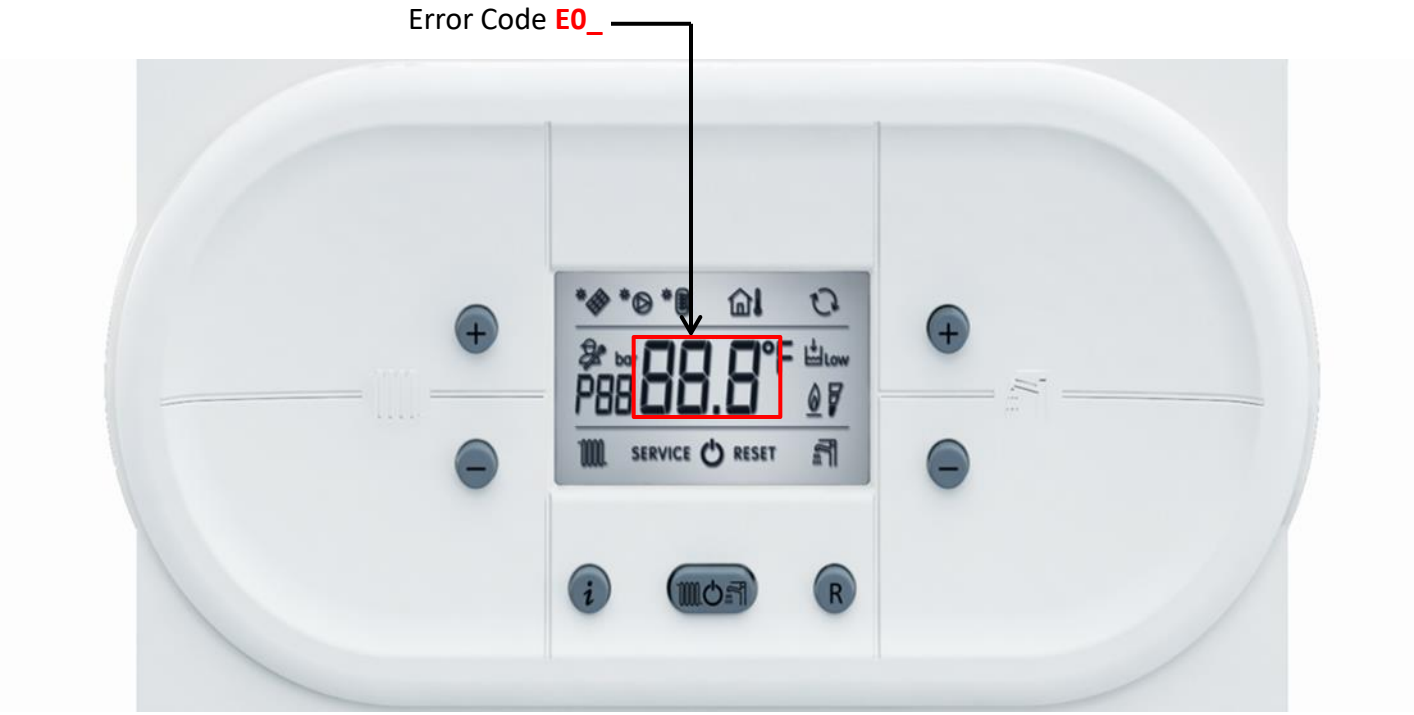
Error Codes

If a problem arises, the self diagnostics of the Pensotti Main PCB will display an error code for a number of internal component problems.

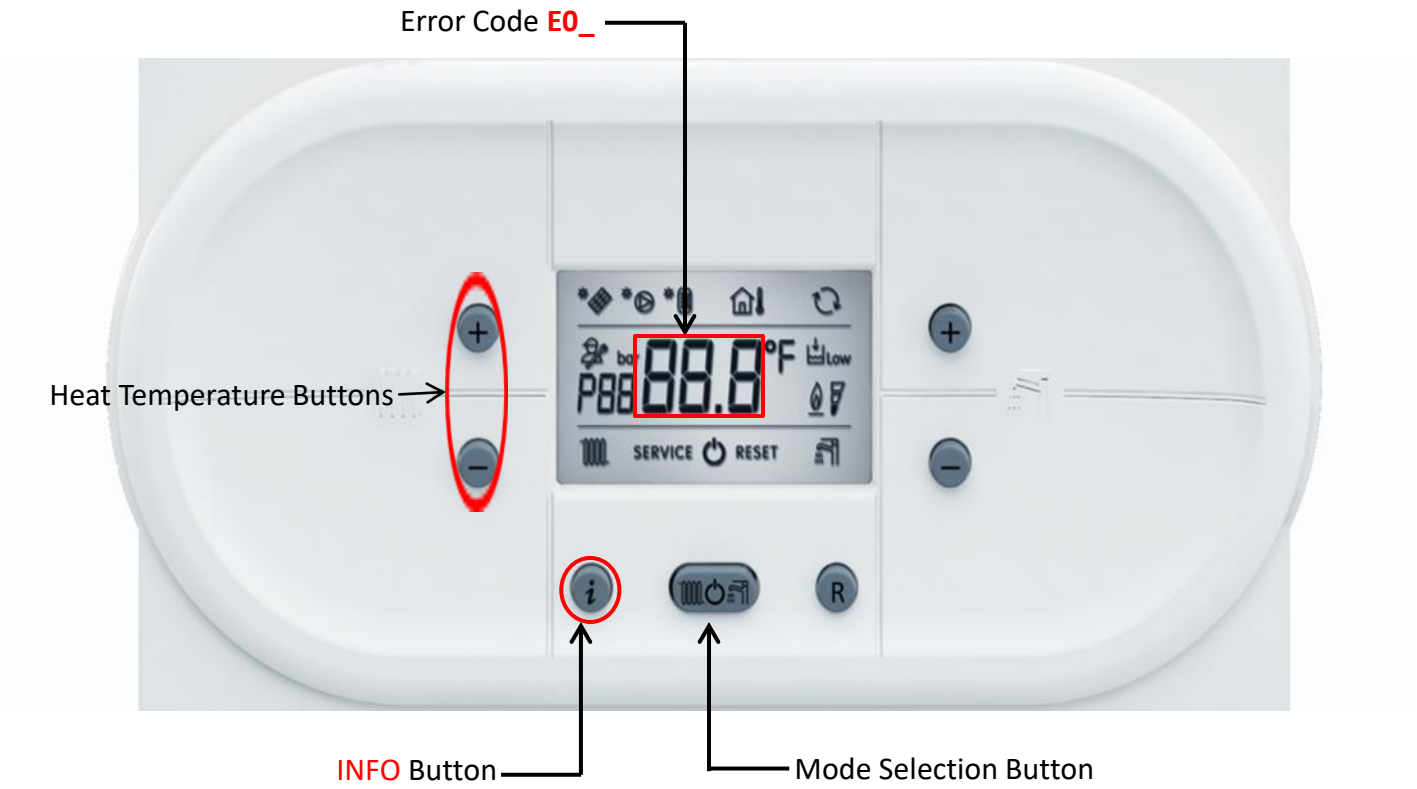


Error Codes

Error Code Displayed	Reset Method
E01 Flame Failure	Manual Reset Button
E02 High Limit Safety Thermostat Circuit Open	Manual Reset Button
E03 Air Pressure Switch Circuit Open	Manual Reset Button
E04 Low Water Pressure – Heating Circuit	Automatic Upon Repair
E05 Heating Sensor Circuit Open or Shorted (NTC)	Automatic Upon Repair
E06 D.H.W. Sensor Circuit Open or Shorted (NTC)	Automatic Upon Repair
E17 Gas Valve Modulator Defective	Manual Reset – Switch Off Power Supply
E18 Inadequate Boiler Water Circulation	Manual Reset – Switch Off Power Supply
E21 PCB Malfunction	Automatic Reset
E22 Parameters Need to be Programmed	Manual Reset – Switch Off Power Supply
E35 Flame Ionization Circuit Malfunction	Manual Reset Button
E40 Power Supply Out of Range	Automatic Upon Voltage Correction

Retrieving Error Code History

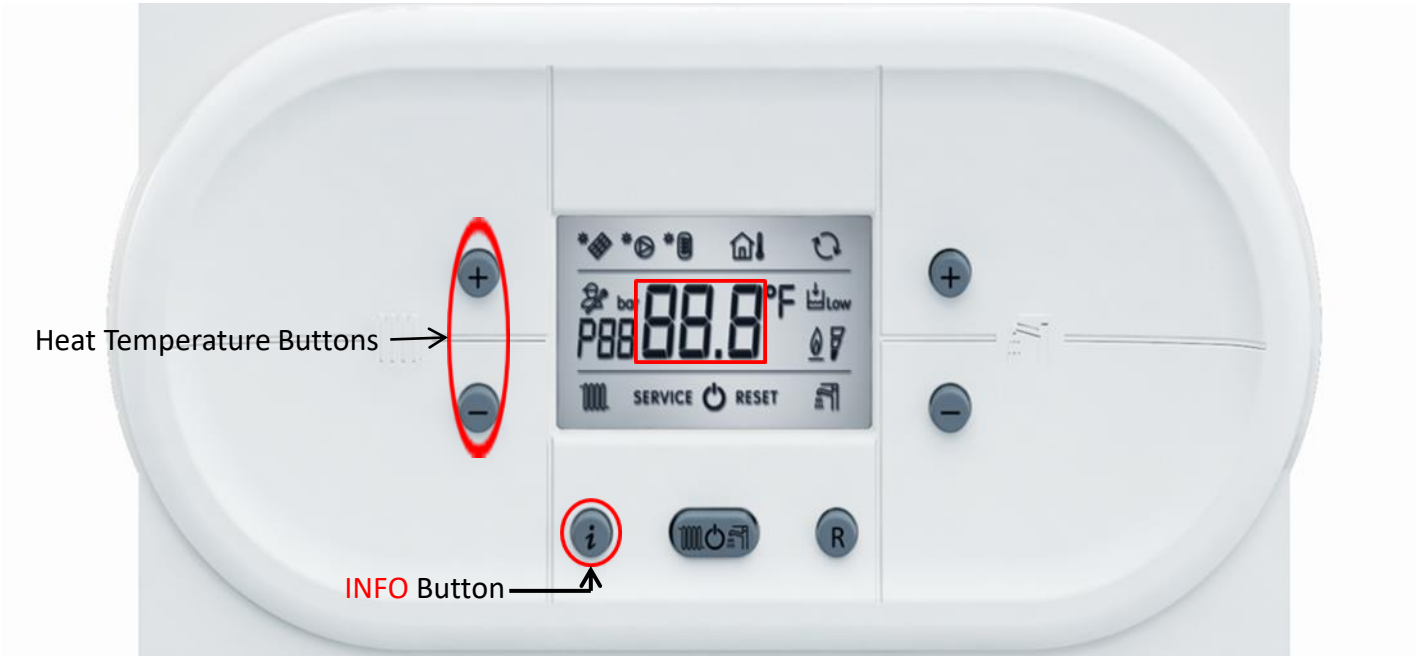
If a problem did arise, and the Error Code had been cleared. The previous 5 error codes generated by the boiler are saved in the Processor and can be displayed by using the INFO (*i*) button .



To access error code history: Turn the boiler off using the Mode Selection button. Press and hold the INFO button for several seconds. The last 5 error codes will now be displayed, starting with the most resent. Scroll through the history using the heat temperature **+** and - buttons. Press the INFO button to escape. See Instruction Manual for additional information.

INFO Menu Display

Pressing the INFO (*i*) button, while the boiler is in an operating mode, will display data that can be helpful when troubleshooting certain problems. Press the Heat Temperature + and – buttons to scroll through the choices.



Parameter	Description
d00	D.H.W. Temperature at the Sensor
d01	Outdoor Sensor Temperature (if installed)
d02	Fan Speed (hz)

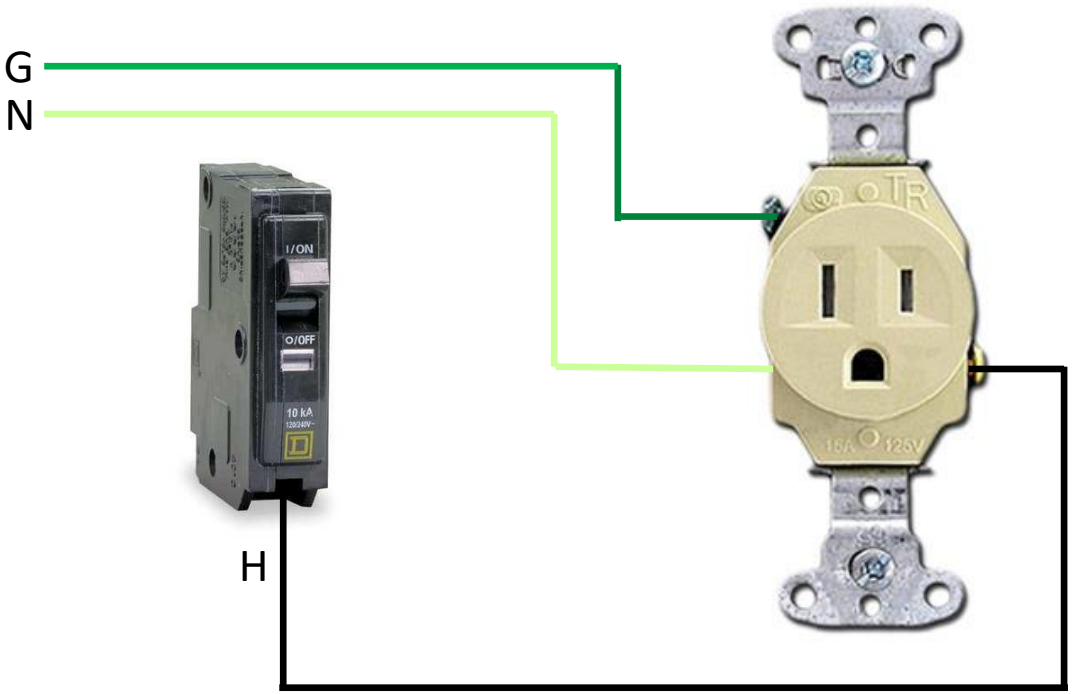
Dedicated Electrical Circuit and Proper Earth Ground

All Pensotti Non-Condensing 'Classic' Boilers <u>Require</u> a Dedicated Circuit and Proper Earth Ground

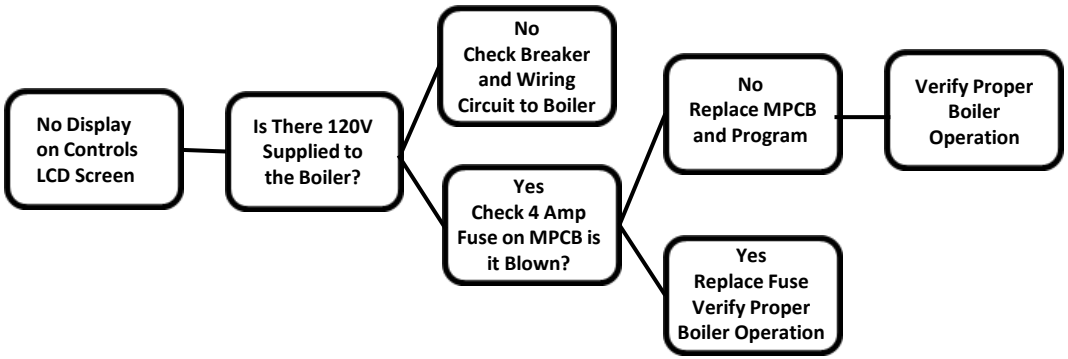
The information contained within this troubleshooting guide is based on the premise that the boiler is properly wired to a dedicated circuit with a reliable earth ground.

Failure to follow these compulsory requirements can lead to unreliable boiler operation and the production of erroneous error codes.

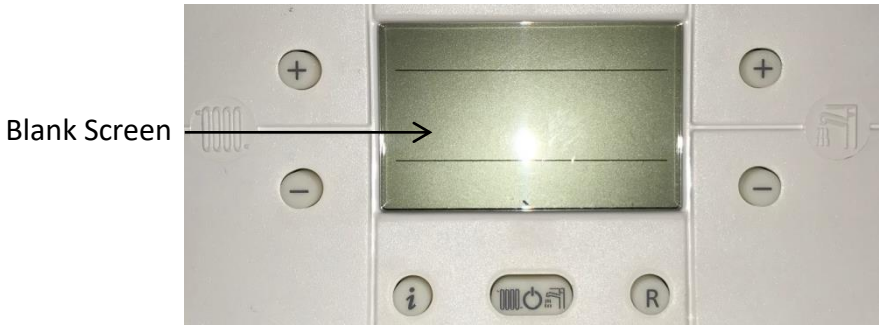
Before beginning any troubleshooting procedure, verify that the aforementioned requirements have been adhered to.



LCD Display Is Blank

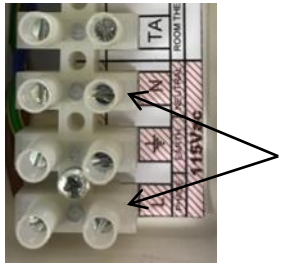


LCD Display Is Blank



Check for power to boiler

- Remove boiler cover
- Remove wiring access cover
- Check for 120V between terminals **L** and **N**. If no power is present, check the buildings wiring circuit to the boiler for an open breaker or switch.

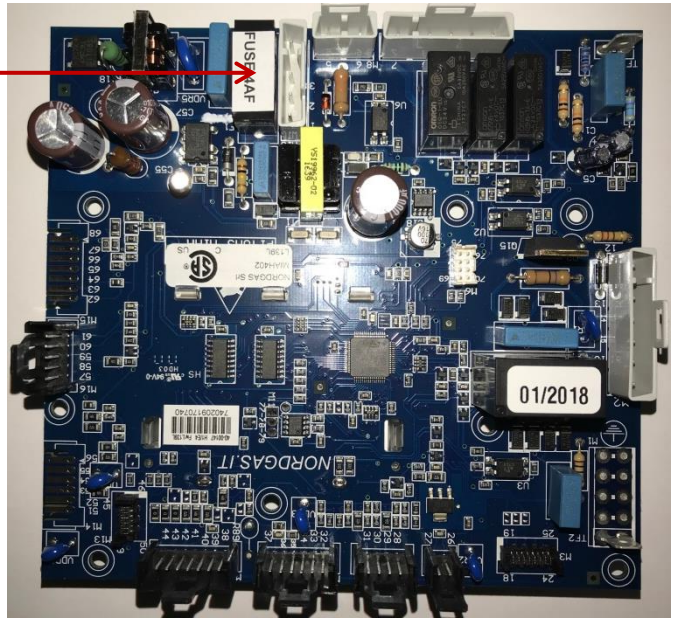


Power at Boiler – Check MPCB Fuse

- Disconnect power to the boiler
- Remove back cover of control panel by removing the four Philip head screws
- Locate 4 amp fuse in the MPCB (refer to picture on page 10) and carefully remove
- Using an Ohms meter, check for continuity across the fuse. If open, defective, swap with an exact replacement
- Reconnect power to the boiler and verify proper boiler operation
- Replace the back cover of the control and secure with the four screws

LCD Display Is Blank

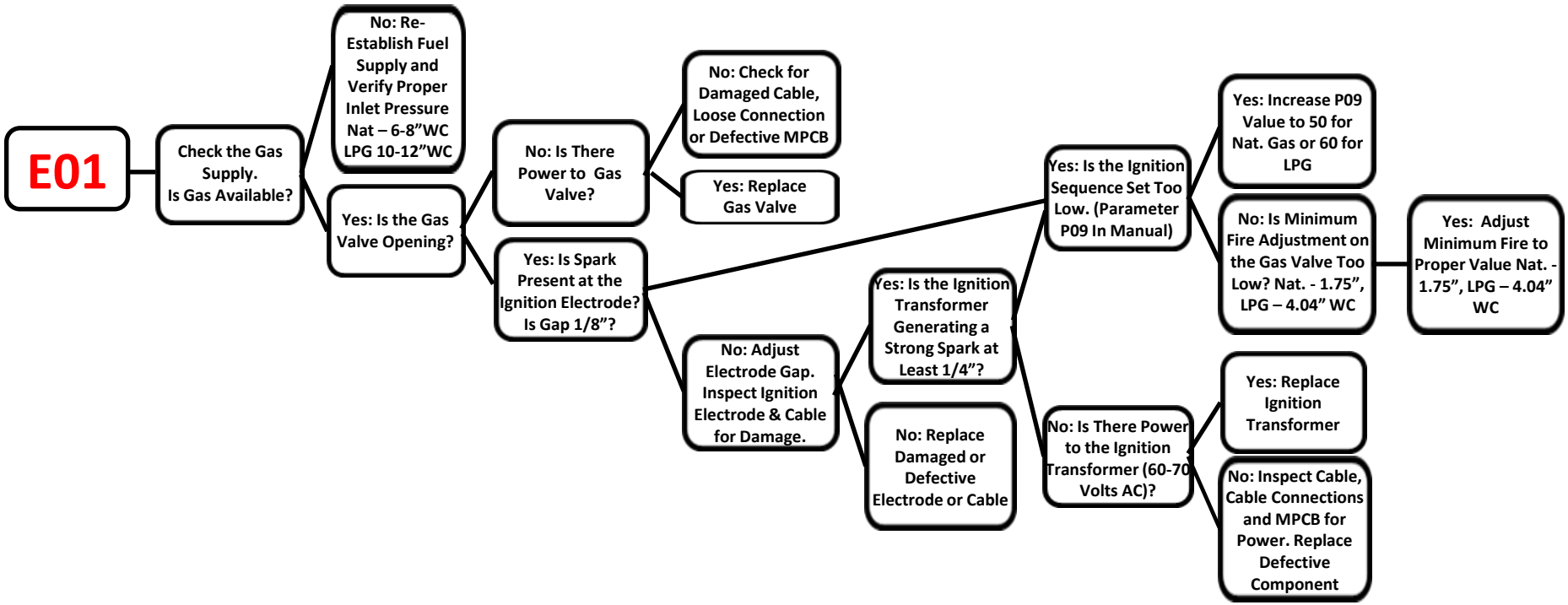
4 Amp Fuse on MPCB



MPCB Defective

- If continuity test verifies the fuse is in good repair, the MPCB is defective
- Disconnect power to the boiler
- Carefully remove the wire cable connections from the MPCB
- Remove the Philip head screws that secure the MPCB to the front cover.
- Secure the MPCB fascia cover and buttons to the front control cover
- Remove the defective MPCB
- Install the new MPCB and connect all the wire cables securely (click into place to secure)
- Verify the MPCB fascia cover and buttons are in place and secure
- Secure the MPCB with the Philip head screws
- Replace the controls back cover and secure with the four Philip head screws
- Reconnect power to the boiler
- Program the parameters to match the boiler model (refer to Instruction Manual Section 5 for information)
- Enable heat and hot water demands, cycle boiler and check for proper operation

E01 Reset – No Ignition

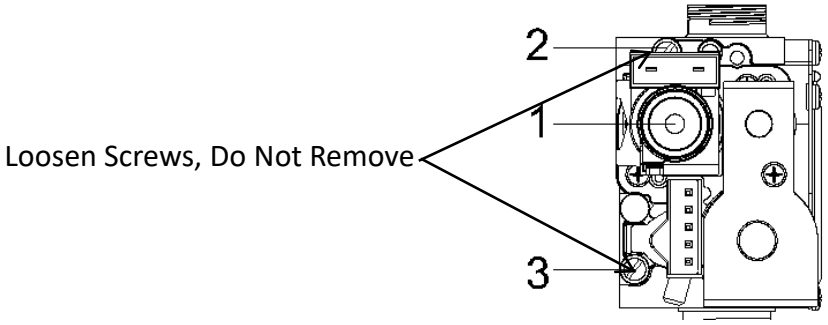


E01 Reset – No Ignition

1. Gas Supply: Gas Inlet Pressure Too Low or Too High (Too High in The Case of LPG Boilers)

Disconnect power to the boiler. Shut off the gas cock. Open, then install a manometer on the inlet side test port (#3) of the gas valve (see drawing). Open gas cock and verify there is enough gas pressure displayed on the manometer. Minimum gas pressure 5”wc, maximum pressure 14”wc. Natural gas 5-8”wc, LPG 10-12”wc. If the gas pressure is out of range check fuel supply and/or regulators, adjust or replace as necessary.

Gas Inlet Pressure In Excess Of 14” WC Will Damage The Gas Valve And Necessitate Its Replacement.



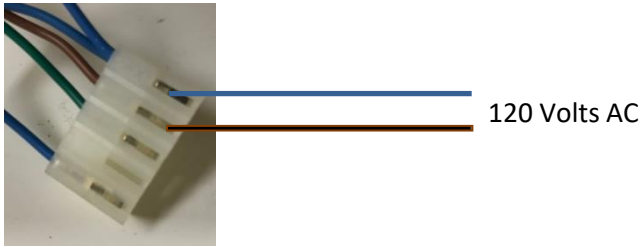
2. Verify Gas Valve Is Opening

With manometer installed on the opened outlet pressure test port (#2) of the gas valve, and the gas cock open, attempt to ignite the boiler. When the boiler begins the ignition sequence, observe the pressure on the manometer. Verify the outlet gas pressure is equal to the minimum pressure indicated in the table below. If no pressure is observed, the gas valve may be defective or it is not being energized electrically.

Gas Data Table		NATURAL GAS		LIQUID PROPANE GAS	
Boiler Fan Speed		min	max	min	max
Gas Pressure	Inches WC	1.74	4	4.04	10.2

3. Is Electrical Power at the Gas Valve During the Ignition Sequence?

Using a multi-meter, verify 120 volts AC is being supplied to the boiler. Test for 120 volts AC between the blue and brown wires at the gas valve cable connector during the ignition sequence (see picture below). If no or low power is detected, verify the cable is in good repair and the connection to the MPCB is tight. If a cable defect is discovered-replace it. If the cable is in good repair, disconnect it from the MPCB and check for 120 volts AC at the M2 Connector on the board. If 120 volts is present, replace the cable. If no or low power is present, replace the MPCB.



E01 Reset – No Ignition

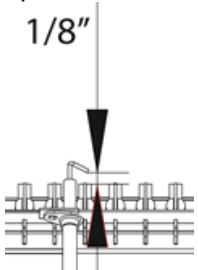
4. The Gas Valve Is Energized But Does Not Open

If the gas valve is energized with 120 volts AC, there is gas pressure at the inlet pressure test port but no pressure at the outlet, the gas valve is defective and will need to be replaced.

- Disconnect power to the boiler
- Shut the gas cock
- Disconnect the power cable and two modulator wires on the gas valve
- Remove the gas line from the gas valve inlet connection
- Disconnect the gas line at the gas valve outlet connection, be careful not to misplace the gasket
- Remove the two Philip head screws securing the gas valve to the metal plate
- Remove the gas valve from the boiler and remove both the inlet manifold (unscrew) and outlet brass manifold (4 screws)
- Apply a small amount of thread sealant to the inlet manifold and install it in the new gas valve
- Using a new gasket, install the outlet manifold on the new gas valve and secure all 4 screws
- Install the new gas valve in the boiler
- Secure to the metal base plate with the two screws
- Reconnect both the inlet and outlet gas lines, open the gas cock and verify the connections are gas tight
- Reconnect the power cable and two modulator wires
- Reconnect the power, operate the burner and adjust both the minimum and maximum gas valve pressures (refer to pages 56-58)
- Verify proper boiler operation

5. Inspect and Adjust Ignition Electrode

Disconnect power to the boiler and shut the gas cock. Remove the combustion chamber door by removing the 6 Philip head screws. Be careful not to damage the refractory attached to the inside of the door. Remove the ignition electrode and inspect the insulator for damage such as cracks or pitting, replace if necessary. (Re)Install the electrode and secure, verify that the gap is 1/8” to the burner. Adjust, if necessary, by gently manipulating the electrode rod with a pair of needle nose pliers with light pressure until the 1/8” gap is achieved. **Do not attempt** to bend the electrode aggressively, it may break. Inspect the high tension cable to the ignition transformer for defects, replace if necessary. Connect the cable to the ignition electrode and slide the insulating boot over the porcelain insulator. Turn the boiler power on, enable a call for heat, during the ignition sequence verify the spark arcs across the gap. Reinstall the combustion chamber door and secure with the 6 screws. Open the gas cock, reconnect the power, enable a call for heat and verify proper boiler operation.



E01 Reset – No Ignition

6. Testing the Ignition Transformer

Disconnect power to the boiler and shut the gas cock. Remove the high voltage lead from the ignition transformer and leave a 3/8” gap between it and the terminal. Reconnect power, turn the boiler on and observe the spark intensity during the ignition sequence. It should appear blue in color and be able to jump at least a ¼” gap. If the spark appears weak, replace the ignition transformer.

3/8” Gap

7. No Spark from the Ignition Transformer

Disconnect power to the boiler and shut the gas cock. Remove the power cable from the ignition transformer. Insert the leads of a multi-meter, set to AC Volts, into the terminal ends of the cable. Turn the boiler on. During the ignition sequence you should have approximately 65 volts. If 65 volts are present, replace the defective ignition transformer.

If no voltage is detected, check for power at the ignition transformer cable connection on the MPCB. If power is present, check the cable for continuity and cable ends for tightness in the terminals. Repair or replace as necessary.

If no voltage is detected at the MPCB terminals during the ignition sequence, replace the MPCB.

65 Volts AC During Ignition Sequence

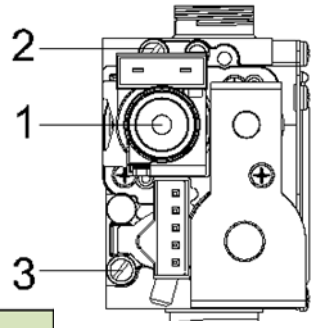
8. Verify Proper Ignition Sequence Value (Parameter P09)

Ignition sequence value is the firing rate, in percentage of maximum Btuh, in which ignition occurs.

Access the parameter menu of the control, refer to chapter 5 of the installation manual, Regulating the Boiler, for instructions. Verify that Parameter P09 is set to a **minimum** value of: Natural Gas – 50%, LPG – 60%. If necessary, adjust the value and save.

E01 Reset – No Ignition

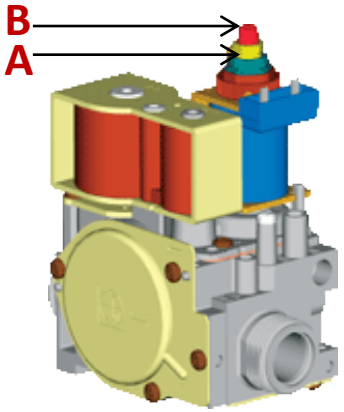
9. Verify Minimum Fire Gas Valve Pressure (Refer to pages 56-58 in This Manual for Additional Information)



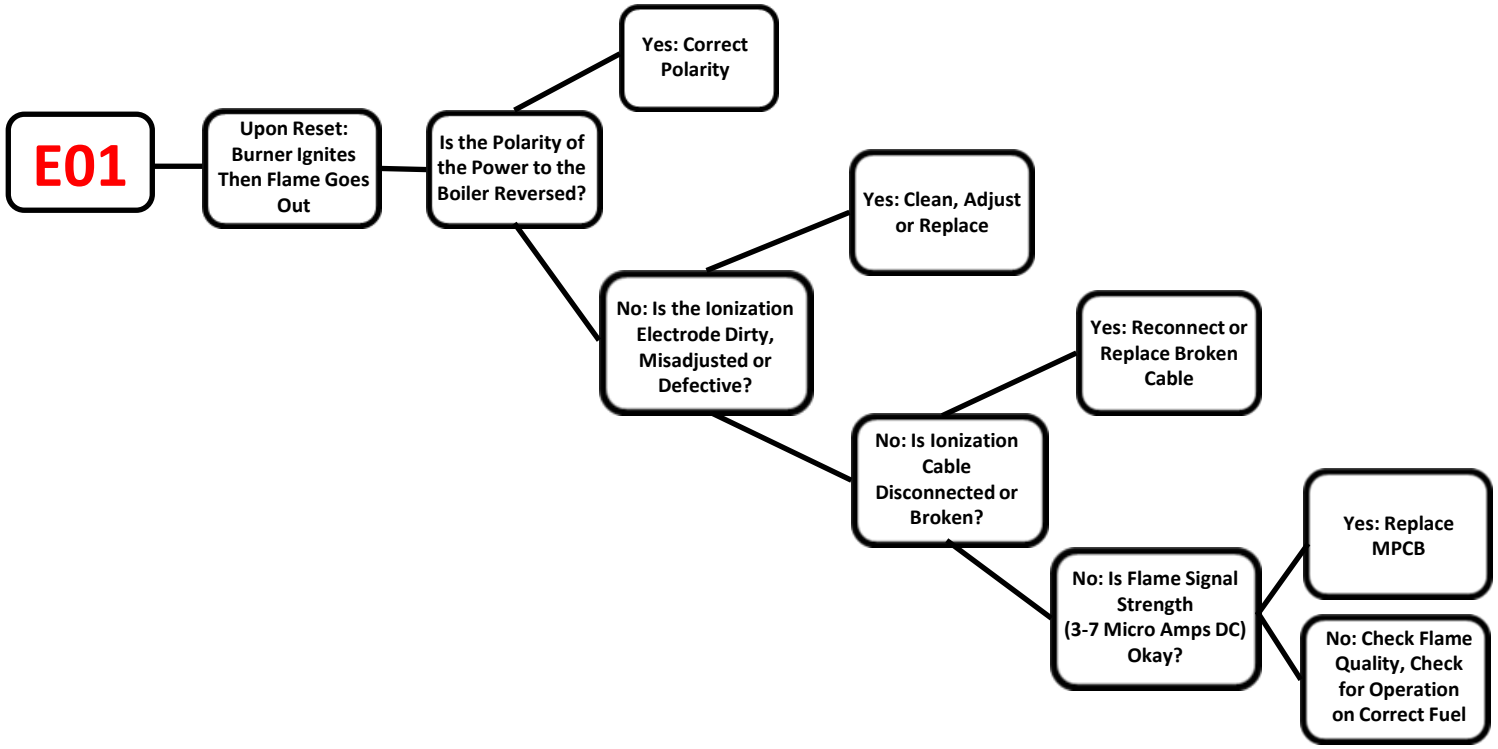
- Disconnect power to the boiler and shut the gas cock.
- Loosen, do not remove, the outlet test port screw #2
- Install manometer
- Open the gas cock
- Remove the clear plastic cover protecting the min and max modulator adjustments #1
- Enable a heat call
- During the ignition sequence observe the pressure value on the manometer
- Compare the value observed to the **minimum** value in the table below:

Gas Data Table		NATURAL GAS		LIQUID PROPANE GAS	
Boiler Fan Speed		min	max	min	max
Gas Pressure	Inches WC	1.74	4	4.04	10.2

- If the actual observed value is less than that in the table, an adjustment is necessary
- Hold the 10mm nut stationary with an open end wrench - **A**
- Insert a slotted screwdriver into the minimum adjustment screw – **B**
- Turn the adjustment screw clockwise approximately 10 degrees (adjustment is very sensitive)
- Observe the pressure value on the manometer (boiler reset may be required to continue/complete adjustment)
- Continue adjusting until the minimum gas valve pressure observed on the manometer is equal to the value indicated in the table
- Once the correct value is reached, remove the screwdriver and 10mm wrench
- Disconnect power to the boiler
- Shut the gas cock
- Remove the manometer
- Tighten the outlet test port screw #2
- Replace the clear plastic cover protecting the modulator adjustments
- Open the gas cock
- Reconnect power to the boiler
- Check for gas leaks
- Verify proper boiler operation



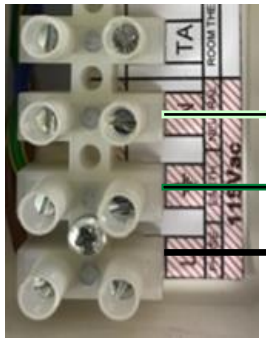
E01 Reset – With Ignition



E01 Reset – With Ignition

1. The Polarity of the Incoming Power to the Boiler is Reversed

All Pensotti gas boilers are polarity sensitive. 120 Volt AC Hot must be connected to L terminal on the power strip, N must be Neutral and the ground terminal must be connected to an earth ground. If L and N are reversed the flame safety circuit will be grounded and unable to detect the presence of a flame. In most cases the improper wiring will be found within the buildings power outlet. **The power outlets circuit must be dedicated to the boiler only**. Other devices connected to the same circuit can effect boiler operation.



2. Ionization Electrode is Dirty or Misadjusted

Disconnect power to the boiler and shut the gas cock. Remove the Ionization electrode and inspect the insulator for damage such as cracks or pitting. Clean the electrode with a soft cloth only. If found to be damaged. Replace the ionization electrode and adjust to the correct gap (see item #5)

3. Inspect Ionization Electrode Cable.

Visually inspect the integrity of the ionization cable. If damaged or broken, replace it. Using an Ohms meter, check the continuity of the cable. If an open circuit is realized, replace the cable. Check the cable ends for a proper fit to both the Ionization electrode and the MPCB. If connections are loose, tighten by squeezing the cable end slightly. Recheck for tightness.

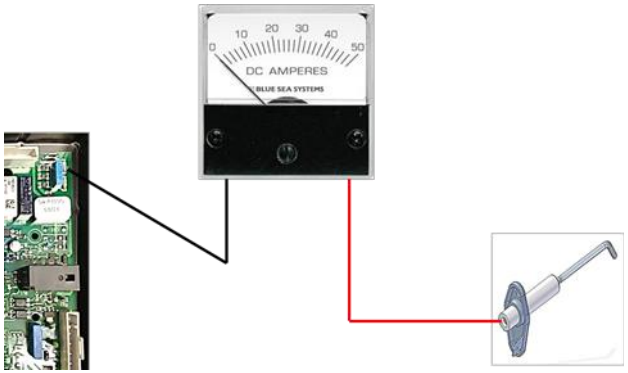
4. Check Flame Signal Strength

Using a **DC microamp meter**, check the flame signal strength. A normal reading is 3-7 microamps. The MPCB will lock out (generate an E01 Fault) with a flame signal of less than .5 microamps.

Turn the boiler off, insert the microamp meter in series between the Ionization Electrode and MPCB. Turn the boiler on and allow it to ignite, observe the reading on the meter for a moment. If using an analog meter and the value drops below 0, reverse the meters test leads. If the reading falls into the normal ranges listed above, and the E01 fault is still generated, the MPCB if defective and will need to be replaced.

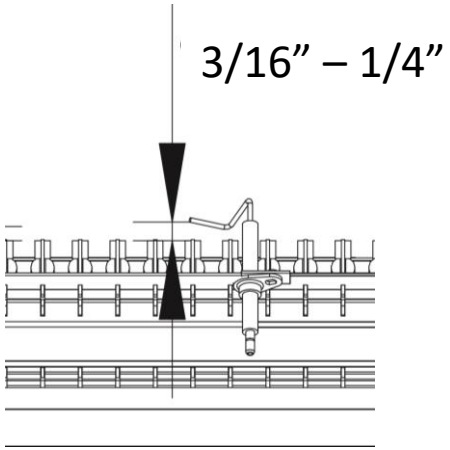
If the flame signal strength is low and all the items 1-4 above have been verified, the ionization electrode gap to the burner surface will need to be measured and adjusted.

E01 Reset – With Ignition



5. Verify the Ionization Electrode Gap

Disconnect power to the boiler and shut the gas cock. Remove the combustion chamber door by removing the 6 Philip head screws, be careful not to damage the refractory attached to the door. Using a ¼" Allen Wrench, gauge the distance between the burner and ionization electrode. Using a pair of needle nose pliers, adjust the electrode as necessary to achieve the proper gap. Be careful not to break the electrode. If a new ionization electrode is installed its' gap will need to be verified and adjusted. Reinstall the combustion chamber door, turn the gas cock on and check for gas leaks and disconnected cables. Turn the boiler on and repeat the microamp test. Verify the proper value (3-7 microamps DC).



E01 Reset – With Ignition

6. Check Flame Quality

If the microamp reading is still low after completing items 4 and 5 above, the flame quality will need to be verified. Check the inlet gas pressure at point #3, Natural Gas – 6-8”WC, LPG 10-12”WC, adjust the gas supply regulator as required. Check the gas outlet pressure at point #2 and verify that the minimum and maximum test pressure values match those in the table below. Refer to pages 56-58 in this manual for additional information.

Gas Data Table		NATURAL GAS		LIQUID PROPANE GAS	
Boiler Fan Speed		min	max	min	max
Gas Pressure	Inches WC	1.74	4	4.04	10.2

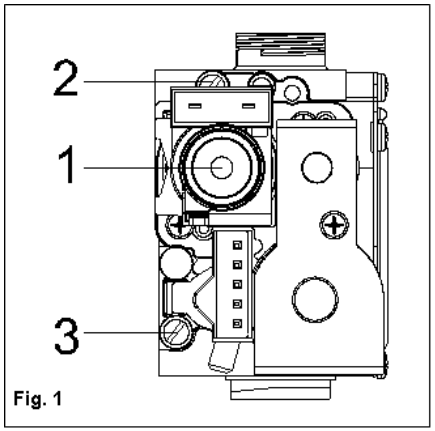
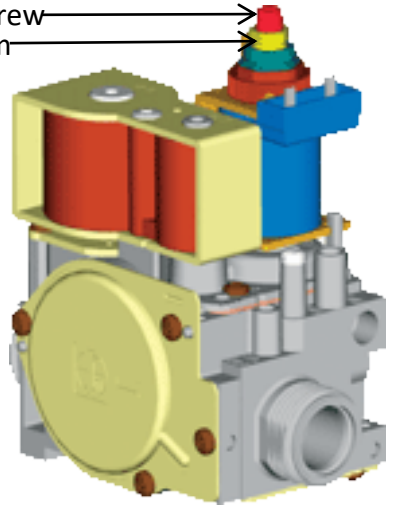


Fig. 1

KEY:

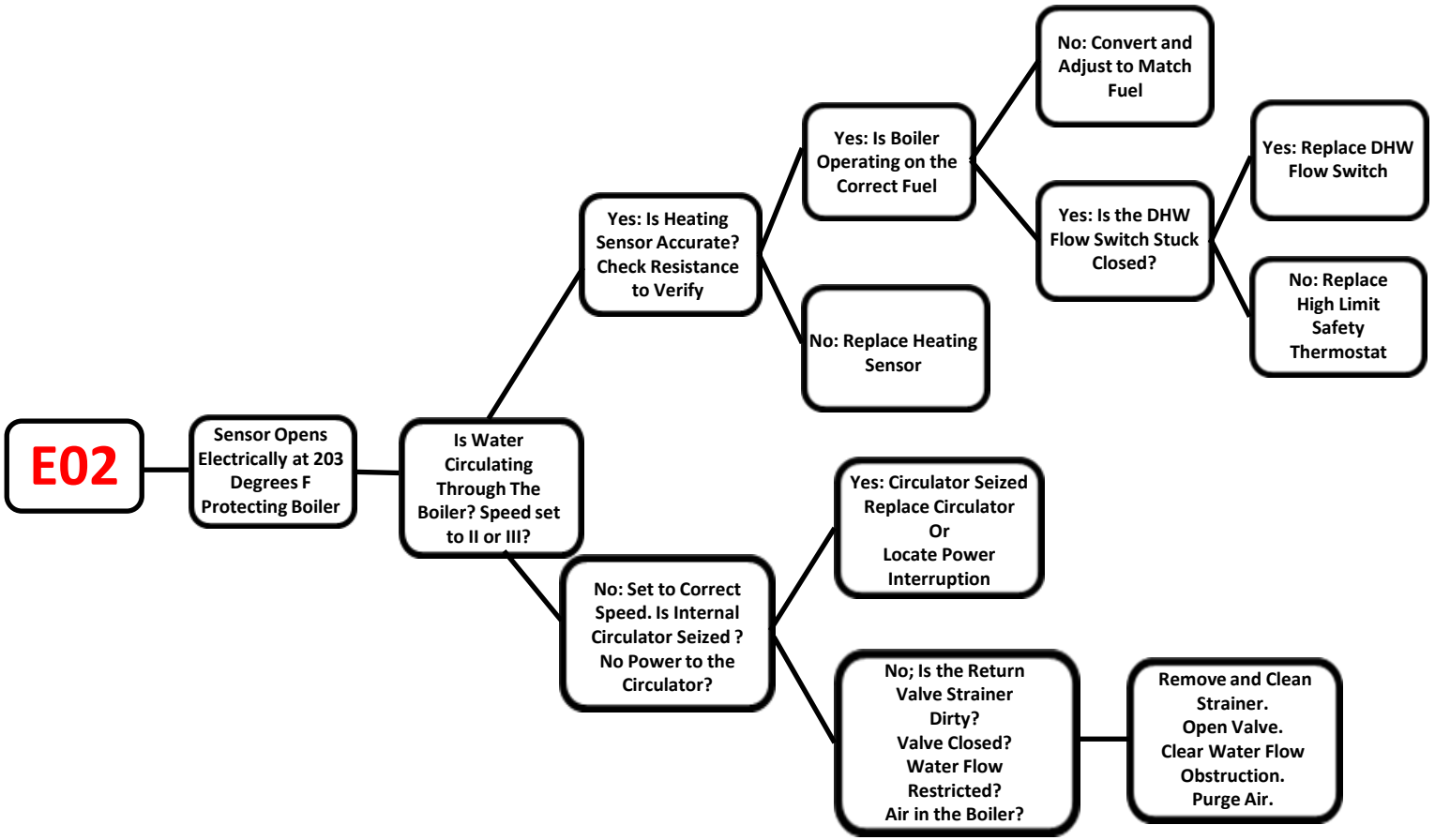
1. MODULATOR
2. GAS PRESSURE POINT - OUTLET
3. GAS PRESSURE POINT – INLET

Minimum Fire Pressure Adjustment Slotted Screw
Maximum Fire Pressure Adjustment Nut 10mm



E02 High Limit Safety Thermostat

Note: Usually, the High Limit Safety fault is the result of a problem and not a defective High Limit Safety Thermostat



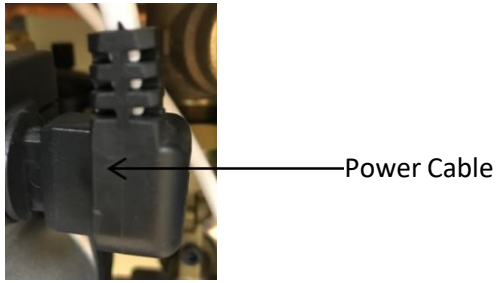
E02 High Limit Safety Thermostat

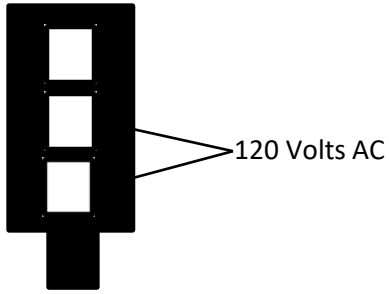
1. No Water Circulation Through Boiler

Verify that the internal circulator is operating correctly during both a heat and domestic hot water call. The circulator will operate immediately upon either demand. If the circulator is not operating check for the proper voltage (120 Volts AC)at the circulator power cable. If no power is measured, check the cable and its connection to the MPCB. If there is power at the MPCB and not at the circulator end of the cable, replace the cable. If no power exists at the MPCB circulator terminals, replace the MPCB.

If power is present at the circulator, but its does not function, test to determine if it is seized. First, disconnect power to the boiler. Secondly, place towels below the circulator and protect the control board from leaking water. Remove the nickel sized plug from the circulator motor and insert a narrow flat screwdriver into the hole. The end of the rotor shaft has an indentation that will accept the screwdriver. Attempt to turn the rotor. If it spins freely, yet the circulator won't function, replace the circulator. If the rotor is stuck , attempt to free it by turning the screwdriver back and forth several times. If it cannot be turned, replace the circulator. If it can be turned, replace the plug, **purge any air from the heat exchanger,** dry the area and remove the towels. Restore power to the boiler and verify proper circulator operation. Speed must be set to II or III.

When performing the screwdriver test, if the circulator spins, but with a lot of effort, or spins easily for part of its rotation then hard, replace the circulator. The circulator will likely be turning off on its internal thermal overload causing intermittent boiler flow issues.





2. Heating Sensor Accuracy (NTC Sensor)

Disconnect power to the boiler and remove the heating sensor from the pipe. Disconnect the two wires and place the sensor in an area in which the ambient temperature can be measured. After allowing adequate time for the sensor temperature to stabilize, check the resistance across the two terminals and record both the Ohms reading and ambient temperature. Use the table on the following page to determine the accuracy of the sensor. If the ohms reading and temperature recorded match the information in the table, the heating sensor is good. If not, replace it.

E02 High Limit Safety Thermostat

Visually inspect the heating sensor. If it is wet, or there are indications that it had been wet, replace it. NTC sensors are very susceptible to water damage. Inspect the o-ring above the sensor where the copper pipe enters the heat exchanger for leakage. Replace the o-ring if indications of a leak exist.

Temp	R NTC	Temp	R NTC	Temp	R NTC	Temp	R NTC	Temp	R NTC	Temp	R NTC
-20	105769	17.5	38780	55.5	15912	93	7196	131	3538	169	1870
-18	100544	19	37079	57	15289	95	6944	133	3428	171	1817
-16.6	95605	21	35463	59	14694	97	6702	134.5	3319	172.5	1766
-14.8	90934	23	33925	61	14126	98.5	6470	136.5	3216	174	1717
-13	86518	25	32461	62.5	13582	100	6247	138	3115	176	1669
-11	82339	27	31069	64.5	13062	102	6033	140	3021	178	1622
-9	78384	28.5	29743	66	12565	104	5828	142	2928	179.5	1577
-7.5	74641	30	28481	68	12090	106	5630	143.5	2839	181.5	1534
-6	71097	32	27279	70	11634	107.5	5440	145.5	2753	183	1491
-4	67739	34	26136	71.5	11199	108.5	5258	147	2669	185	1451
-2	64571	35.5	25044	73.5	10781	111	5082	149	2589	187	1411
0	61563	37	24004	75	10382	113	4933	151	2512	189	1373
1.5	58719	39	23014	77	9999	115	4751	152.5	2437	190.5	1228
3	56016	41	22069	79	9633	116.5	4590	154.5	2365	192	1300
5	53432	43	21168	80.5	9281	118.5	4444	156	2292	194	1266
7	51018	45	20309	82.5	8945	120	4300	158	2229	196	1232
9	48707	46.5	19489	84	8622	122	4161	160	2164	197.5	1199
10	46513	48	18708	86	8313	124	4026	162	2101	199.5	1168
12	44429	50	17959	88	8016	125.5	3897	163.5	2040	201	1137
14	42449	52	17245	89.5	7731	127.5	3773	165	1982	203	1109
16	40568	53.5	16563	91.5	7458	129	3653	167	1925	205	1079

Alternate Test Method

Using an electronic temperature tester with pipe surface sensor, one can verify the accuracy of the heating sensor. Simply attach the test meters sensor to the pipe in the vicinity of the heating sensor. Operate the boiler. Compare the temperature displayed on the boilers LED control against that of the electronic meter. If the temperatures are the same then the heating sensor is good. If there is a several degree difference, replace the heating sensor.

E02 High Limit Safety Thermostat

3. Verify the Boiler is Operating on the Correct Fuel

Verify the boiler is operating on the correct fuel. If not, it may be grossly over-fired. Compare the boiler's label information 'Type of Gas' to the fuel source connected to the boiler, verify they are the same. Check the controls Parameter P01 - 'Selects the Type of Gas Supply' and verify the correct gas is selected (refer to the installation manual sections 5.1 and 5.2). If necessary, correct the value and save. Inspect heat exchanger for cleanliness. Thoroughly brush and vacuum, being careful not to damage the refractory surfaces. Brush and vacuum the gas burners. Verify proper inlet gas pressure, Natural Gas - 6 to 8" WC, LPG - 10 to 12" WC. Verify maximum and minimum gas outlet pressures. Refer to pages 56-58 in this manual for detailed information.

Gas Data Table		NATURAL GAS		LIQUID PROPANE GAS	
Boiler Fan Speed		min	max	min	max
Gas Pressure	Inches WC	1.74	4	4.04	10.2

4. Domestic Hot Water Flow Switch not Operating Properly (Combi, PNCC Boilers Only)

Verify that the burner switches off when there is no demand for domestic hot water. If not the case, remove the micro-flow switch from the housing by removing the two screws. If the burner did not switch off, remove the two black wires of the flow switch from the MPCB. If the burner switched off, replace the flow switch. If the burner remains on, replace the MPCB.

Important: On PCI boilers, the internal indirect water tanks maintain temperature. Be sure to verify the tank is up to temperature when performing the flow switch test.

E02 High Limit Safety Thermostat

5. High Limit Safety Thermostat

Disconnect power to the boiler. Verify that the boiler has cooled. Remove the two wires from the High Limit Safety Switch. By means of an Ohms meter check for continuity across the switch. In the case of no continuity, replace the thermostat.

6. Return Valve Strainer (If Supplied)

Disconnect power to the boiler. Shut off the water supply to the boiler. Isolate the boiler by shutting the heating supply and return valves. Drain the boiler by loosening the fitting between the return valve and boiler. Collect water in a bucket. Remove the strainer access nut and strainer. Clean strainer with warm water and nylon brush. Replace and tighten strainer access nut and the fitting between the return valve an boiler. Turn the water supply on and inspect for leaks. Pressurize the boiler and **purge any air** that may have been introduced. Restore power to the boiler and check for proper operation. **If the return valve is found to be installed on the supply side of the boiler it must be relocated to the return side (below circulator) immediately.**

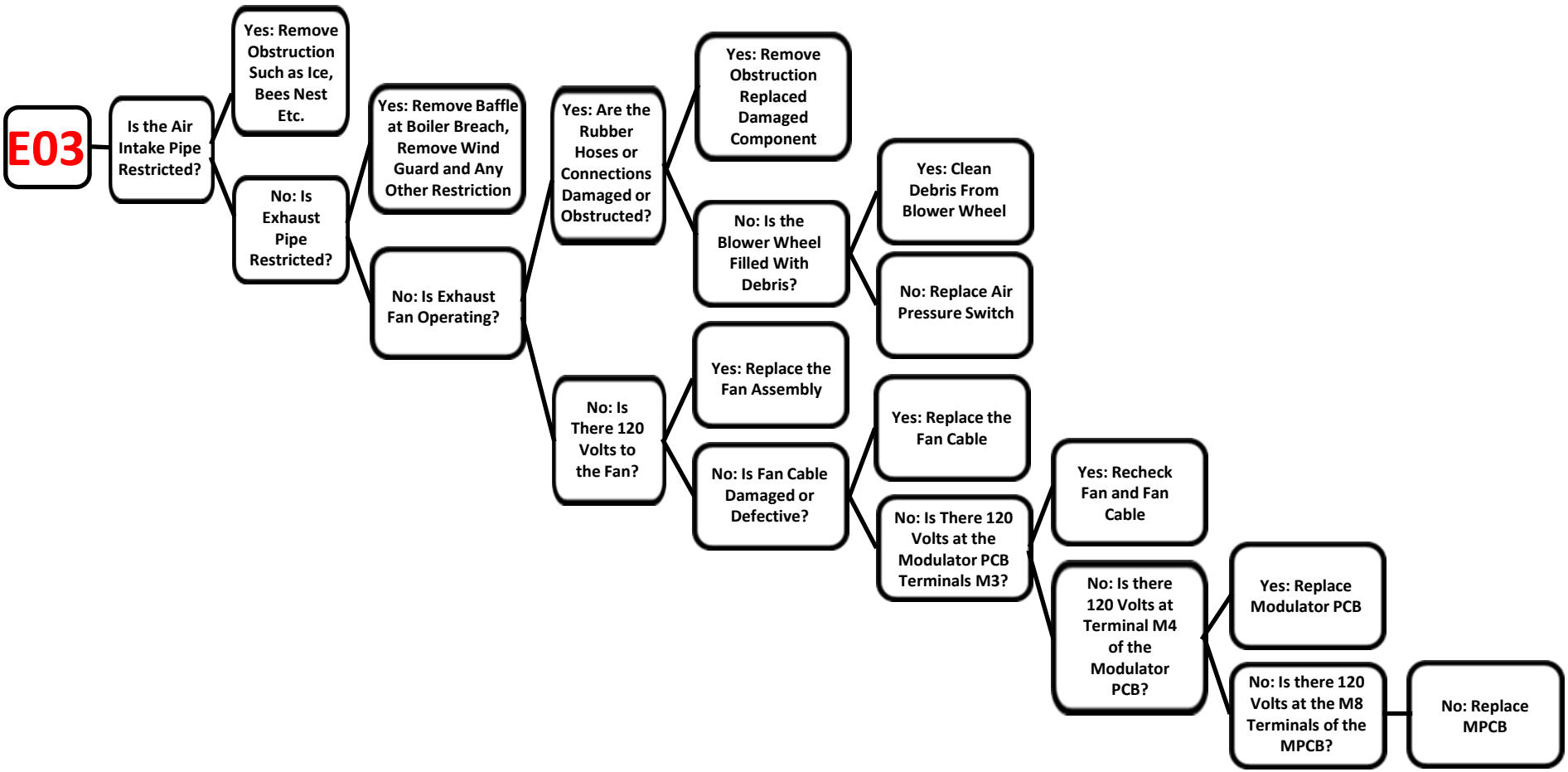
7. Restriction in Boiler Piping

Verify that all valves are in the open position. Sediment collecting devices, such a wye strainers and dirt separators, have been cleaned and inspected.

8. Boiler Obstruction

If boiler is found to be plugged with contaminants and/or scale it will need to be flushed using products suitable for the boilers internal components. Consult the product manufacturer for suitability and directions.

E03 Air Pressure Switch Circuit Open



E03 Air Pressure Switch Circuit Open

Snow accumulation around the vent termination will generate an E03 Error Code. Property owner must be vigilant in keeping this area clear.

1. **Verify the Air Intake Pipe is Not Obstructed**

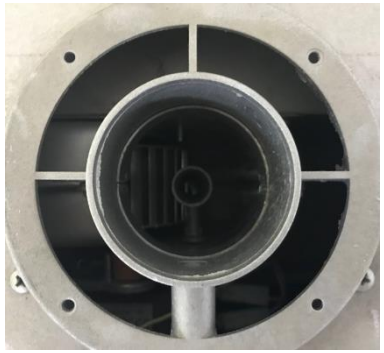
Conduct a visual inspection of the air intake pipe, remove any obstruction from the system (disassembly of the pipe may be required). During severely cold weather verify the air intake grille has not frosted over, restricting combustion air into the pipe.

2. **Verify the Exhaust Pipe is Not Obstructed**

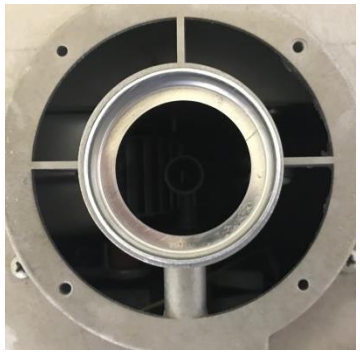
Conduct a visual inspection of the exhaust pipe, remove any obstruction from the system (disassembly of the pipe may be required).

3. **Remove Baffle at Boiler Exhaust Collar**

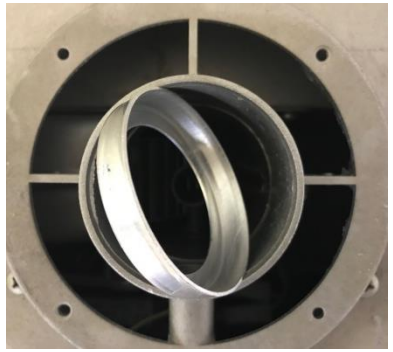
Remove the vent adapter from the top of the boiler by removing the 4 screws in the flange. Lift the adapter off the collar of the boiler to inspect for a baffle (vent pipe may need to be removed to assist in removal of the vent adapter). Refer to the pictures below. If baffle exists, remove it. Using a screwdriver, pry the baffle up and then out of the exhaust collar. Discard, it is not required.



No Baffle



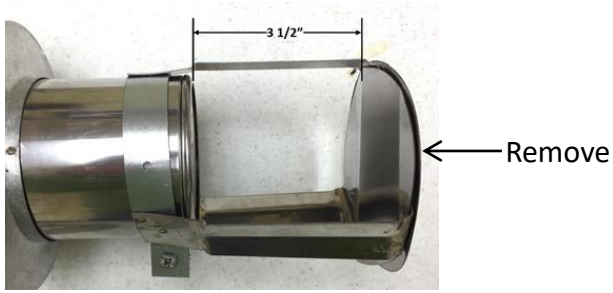
Baffle



Baffle Removed

4. **Remove Wind Guard**

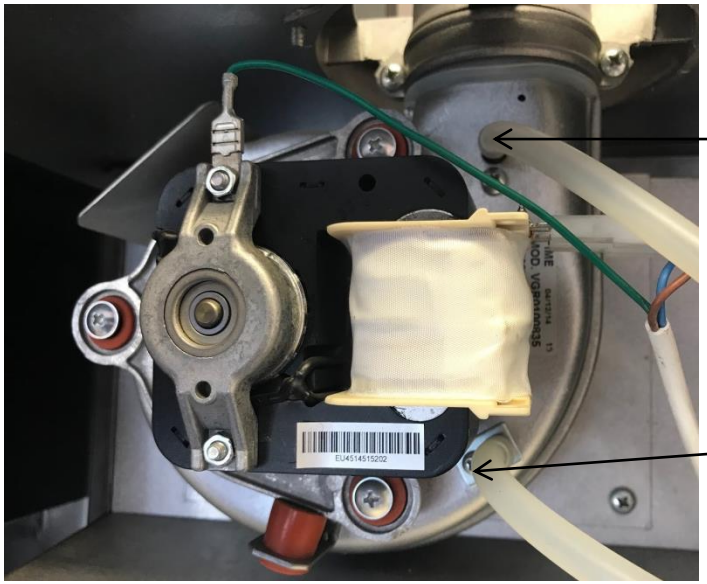
If wind guard is installed, remove and discard it. It is no longer required.



E03 Air Pressure Switch Circuit Open

5. Exhaust Fan Operates - Inspect Pressure Switch Tubing

With power to the boiler disconnected, verify that the two rubber tubes connecting the air pressure switch to the fan are not damaged or obstructed. Remove each tube, one at a time, and blow through them to assure they are not plugged. Reconnect the tube to the connection at the fan and blow through the tube again to verify the tube venturi connection is unobstructed. Repeat with the second tube. If an obstruction is discovered in a tube, remove it with compressed air. If an obstruction is located in a venturi connection, the connection will need to be removed to be cleaned and inspected (see picture below).Reassemble all components, reconnect tubes, reconnect power to the boiler, enable a heat call and verify proper operation.



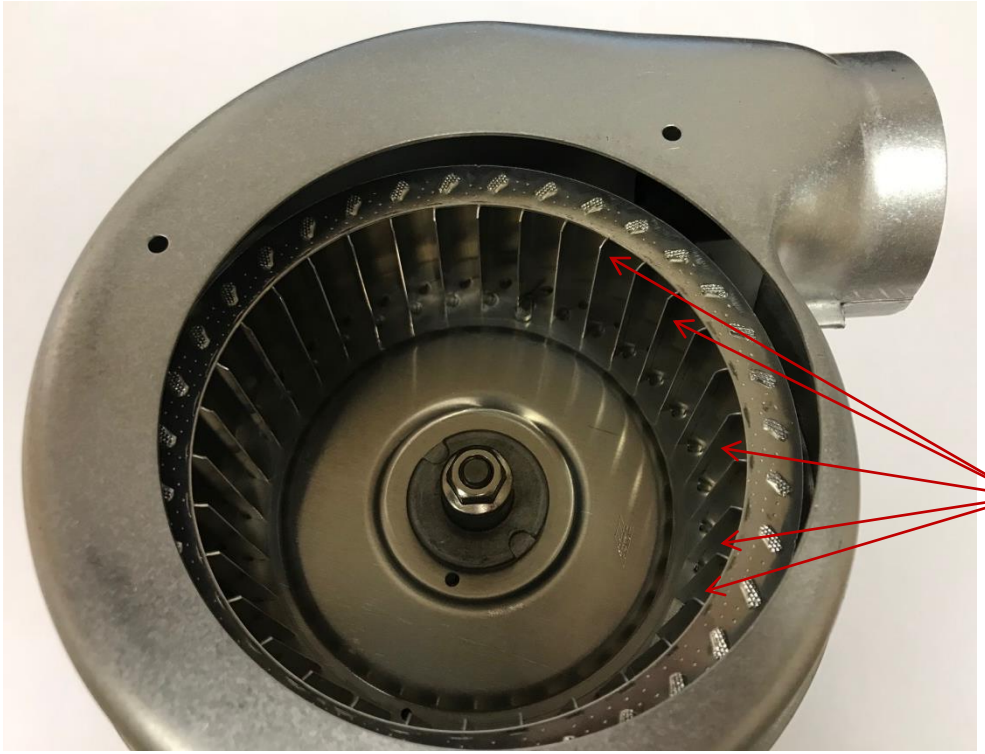
To remove this connection, the vent adapter on top of the boiler must be removed. Hold the venturi in place through the 3” exhaust pipe opening and remove the Philips head retaining screw. Lift the venturi out through the exhaust pipe opening and clean. Be careful not increase the orifice sizes within the venturi when cleaning. Inspect and replace if damaged.

This connection can be detached by removing the Philips head screw and pulling the connection out of the fan with a twisting motion. Inspect and replace if damaged.

6. Inspect Fan Blower Wheel for Debris

Disconnect power to the boiler. Remove the vent adapter from the top of the boiler by removing the four screws. Move the vent material to enable oneself to look into the fan outlet to inspect the blower wheel. If deemed dirty or questionable, clean the debris from each blower wheel paddle with a nylon brush. See page 29 for detailed instructions for fan removal. Vacuum any accumulated debris from the fan. Reinstall the fan, reassemble the vent pipe and secure the vent adapter. Reconnect power to the boiler, enable a call for heat and verify proper boiler operation.

E03 Air Pressure Switch Circuit Open



Inspect the Blower Wheel Paddles
for the Accumulation of Debris

7. Replace Air Pressure Switch

Disconnect power to the boiler. While noting their locations, remove the two wires from the air pressure switch. While noting the location of the two rubber tubes, remove them from the switch. Remove the switch from its mounting bracket and replace. Reconnect the wires and tubes to their original locations. Incorrectly wired terminals or reversed tube connections will cause improper boiler operation. Reconnect power to the boiler, enable a call for heat and verify proper operation.

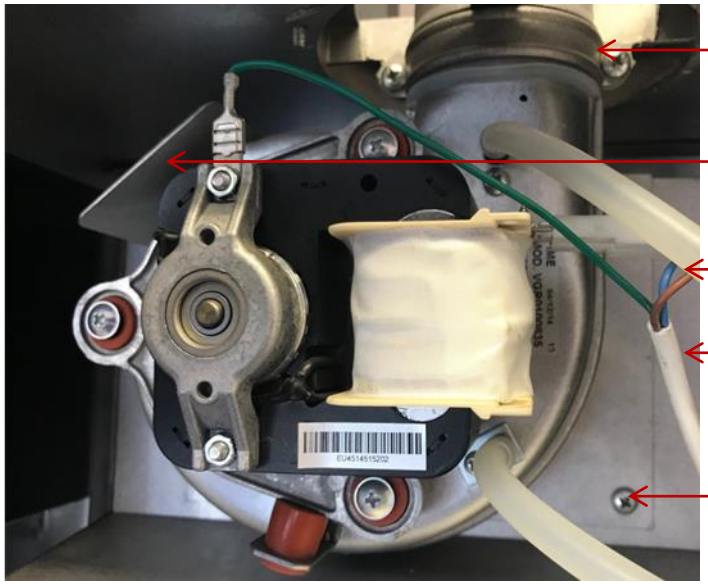
E03 Air Pressure Switch Circuit Open

8. Fan Not Operating - Check For Power at the Fan

Using a voltage meter, verify 120 volts AC is present at the fan motor terminals (brown and blue). If power is present and the fan is not operating, replace the fan assembly.

- Disconnect power to the boiler
- Remove vent adapter from the top of the boiler
- Disconnect wires to the fan motor
- Remove the two rubber tubes from the fan assembly (note each tubes location)
- Remove the two Philip head screws from the vent collar connection and remove the collar clamp, save
- Remove the top left Philip head screw securing the fan assembly to the boiler, remove deflector plate and save
- Remove the three remaining Philip head screws while holding the fan assembly in place
- Remove the fan assembly from the boiler
- Remove and save the rubber exhaust collar gasket
- Install the rubber exhaust collar gasket on the replacement fan assembly
- Install the new fan assembly in the boiler
- Verify the fan is installed correctly, deflector plate is in place, vent adapter has been reinstalled and vent pipe is good order.
- Reconnect power wires and ground
- Reconnect rubber tubes to their proper locations
- Reconnect power, enable a call for heat or hot water, and verify proper boiler operation

E03 Air Pressure Switch Circuit Open



9. Fan Cable – No Power to the Fan

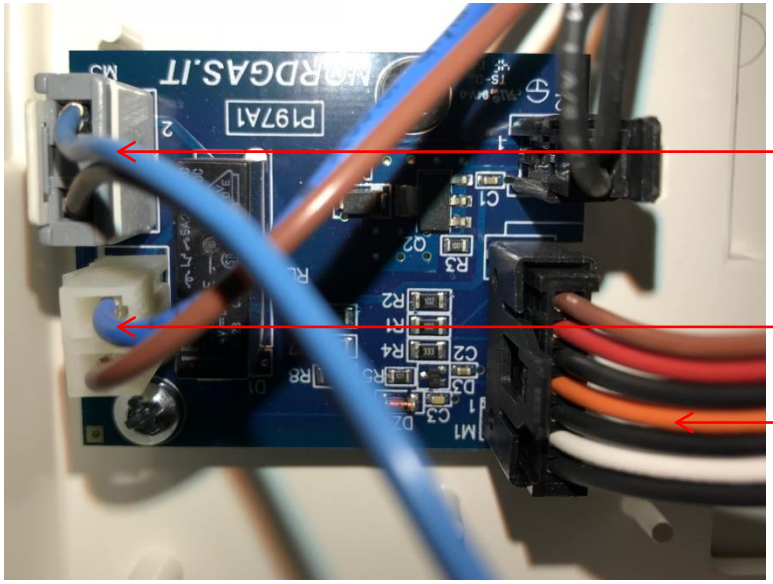
Disconnect power to the boiler. Conduct a visual inspection of the fan power cable, especially in the area of the combustion chamber. Verify the cable is not damaged. Further verify the cables' integrity by conducting an ohms test of the cable wires. If the cable is found to be damaged, replace it. Remove the controls' back cover and check the fan cable connection to the modulator board (terminal M3), verify the connection is good. If the connection is sound, remove the cable from the board, reconnect power to the boiler, enable a heat call, and check for 120 Volts at the M3 terminals. If power is present, recheck the fan cable and its' connections.

If there is no power at M3, check terminals at M4 for 120 Volts. If power is present at M4, replace the modulator board. Disconnect power to the boiler, remove the defective board and install the replacement. Reconnect power to the boiler, enable a heat call, and verify proper boiler operation.

If there is no power at terminal M4 Inspect the cable between this terminal and the M8 terminal on the MPCB. If found to be damaged, disconnect the power to the boiler and replace the cable. Reconnect power, enable a call for heat, and verify proper boiler operation.

E03 Air Pressure Switch Circuit Open

If the cable between terminals M4 of the modulator board and M8 of the MPCB is found to be in good repair, check for 120 Volts at terminal M8 of the MPCB. If there is no power present at this terminal, when a heat call is enabled, Replace the MPCB, program the parameters to match the boiler model..

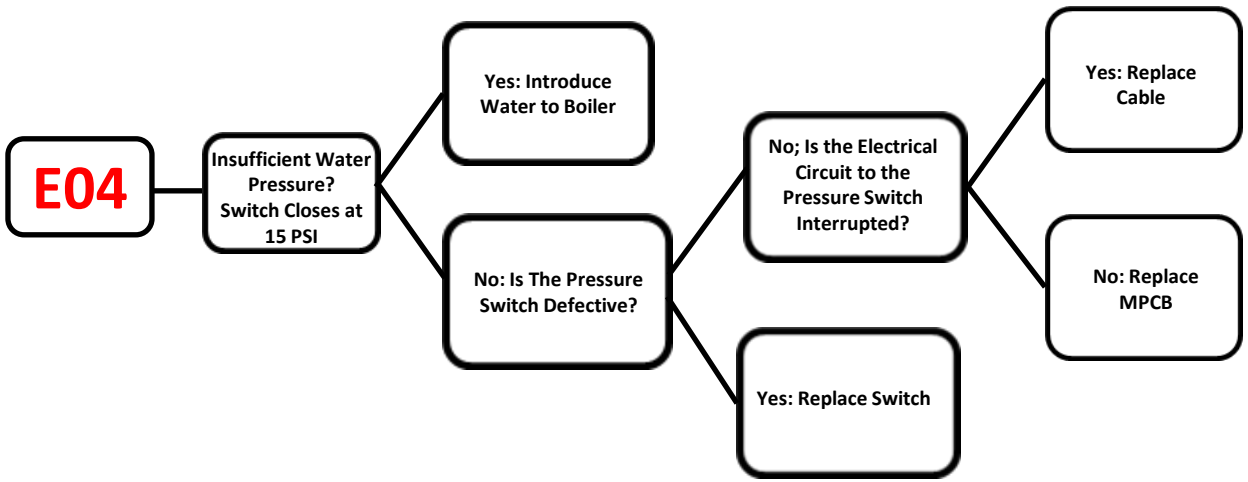


Modulator PCB

10. Communication Loss

On rare occasions the communication between the MPCB and the Modulator PCB, through the 7 wire cable can be interrupted. This interruption will cause an E03 error code. If testing of a replacement Modulator PCB indicates power at the M4 terminal but still no power at the M3 terminal for the fan cable, check the connections and integrity of the 7 wire communication cable. If the cable and connections are found to be in good repair the MPCB will need to be replaced. Program the parameters within the new MPCB to match the boiler model.

E04 Low Water Pressure – Heating Circuit



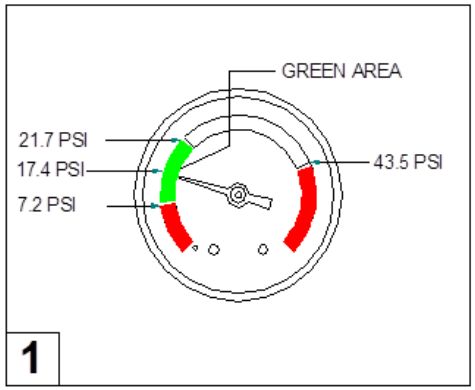
E04 Low Water Pressure – Heating Circuit

1. Insufficient Water Pressure in the Heating Circuit

The pressure switch will close electrically at approximately 15 psi. Introduce water through the pressure reducing valve until the pressure switch makes an audible click (switch closing) and E04 error code is disabled on the LED screen. Increasing the automatic fill pressure on the pressure reducing valve may be necessary.

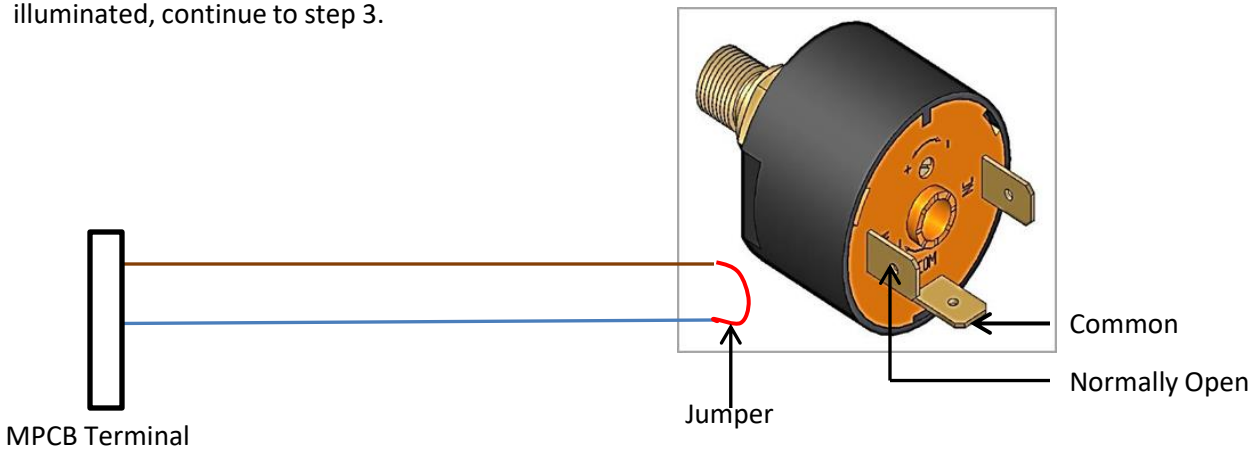
Common causes of water pressure drop:

- Water leaks
- Air vent leaks
- Expansion tank air low or depleted (air pressure 15-17 psi)



2. Defective Pressure Switch

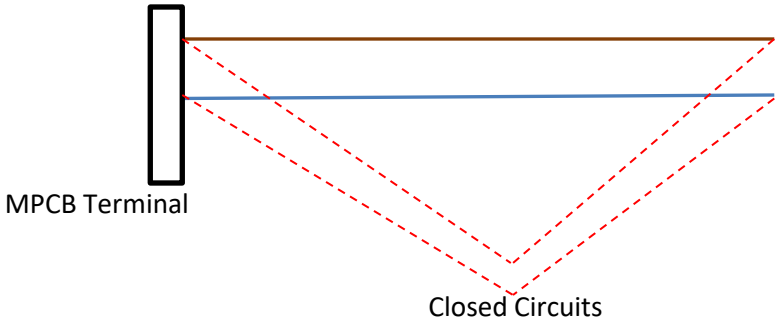
Disconnect power to the boiler. Disconnect the cable from the pressure switch. Using a piece of insulated wire jump the two cable ends together. Restore power to the boiler. If the E04 error code is no longer displayed replace the pressure switch. If the E04 error remains illuminated, continue to step 3.



E04 Low Water Pressure – Heating Circuit

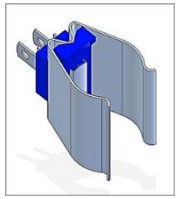
3. Defective Pressure Switch Cable

Disconnect power to the boiler. Using an Ohms meter verify the continuity of the two wires from the MPCB to the Pressure switch.

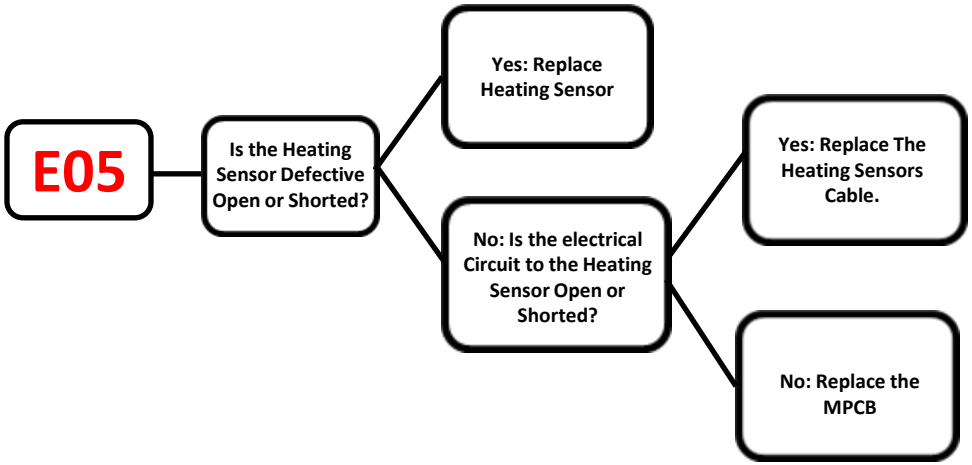


If one or both of the wires have an open circuit, replace the cable. If the two wires are found to be in good repair, replace the MPCB.

E05 Heating Sensor Circuit



The E05 error code is enabled by either an open or shorted circuit to the NTC Heating Sensor



E05 Heating Sensor Circuit

1. Heating Sensor is Defective

Disconnect power to the boiler. Disconnect the cables from the heating sensor. Using an Ohm meter, check the resistance across the sensor. If the resistance if found to be infinity (open circuit) or closed (shorted circuit) replace the heating sensor. If the ohms meter is measuring a resistance you can verify the accuracy of the heating sensor by using the table below. Measure the temperature which the sensor is detecting, locate that temperature on the table and verify that the Ohms reading coincides. If a wide variance is detected, replace the heating sensor. Once the defect is corrected the E05 error code will automatically reset.

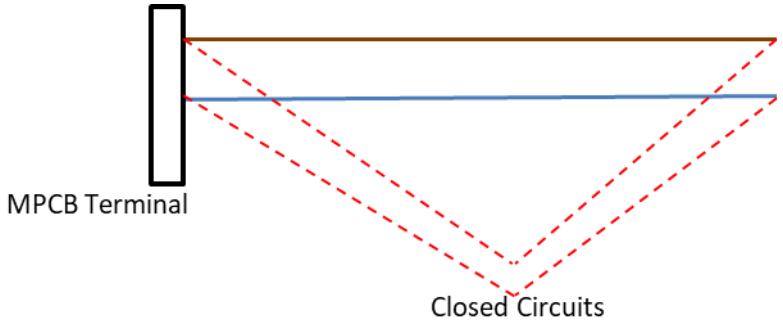
Visually inspect the heating sensor. If it is wet, or there are indications that it had been wet, replace it. NTC sensors are very susceptible to water damage. Inspect the o-ring above the sensor where the copper pipe enters the heat exchanger for leakage. Replace the 0-ring if indications of a leak exist.

Temp	R NTC	Temp	R NTC	Temp	R NTC	Temp	R NTC	Temp	R NTC	Temp	R NTC
-20	105769	17.5	38780	55.5	15912	93	7196	131	3538	169	1870
-18	100544	19	37079	57	15289	95	6944	133	3428	171	1817
-16.6	95605	21	35463	59	14694	97	6702	134.5	3319	172.5	1766
-14.8	90934	23	33925	61	14126	98.5	6470	136.5	3216	174	1717
-13	86518	25	32461	62.5	13582	100	6247	138	3115	176	1669
-11	82339	27	31069	64.5	13062	102	6033	140	3021	178	1622
-9	78384	28.5	29743	66	12565	104	5828	142	2928	179.5	1577
-7.5	74641	30	28481	68	12090	106	5630	143.5	2839	181.5	1534
-6	71097	32	27279	70	11634	107.5	5440	145.5	2753	183	1491
-4	67739	34	26136	71.5	11199	108.5	5258	147	2669	185	1451
-2	64571	35.5	25044	73.5	10781	111	5082	149	2589	187	1411
0	61563	37	24004	75	10382	113	4933	151	2512	189	1373
1.5	58719	39	23014	77	9999	115	4751	152.5	2437	190.5	1228
3	56016	41	22069	79	9633	116.5	4590	154.5	2365	192	1300
5	53432	43	21168	80.5	9281	118.5	4444	156	2292	194	1266
7	51018	45	20309	82.5	8945	120	4300	158	2229	196	1232
9	48707	46.5	19489	84	8622	122	4161	160	2164	197.5	1199
10	46513	48	18708	86	8313	124	4026	162	2101	199.5	1168
12	44429	50	17959	88	8016	125.5	3897	163.5	2040	201	1137
14	42449	52	17245	89.5	7731	127.5	3773	165	1982	203	1109
16	40568	53.5	16563	91.5	7458	129	3653	167	1925	205	1079

E05 Heating Sensor Circuit

2. Defective Sensor Cable

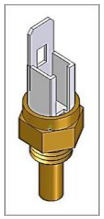
Disconnect power to the boiler. Disconnect the cable s from the heating sensor. Verify the continuity of the cables from the MPCB to the sensor terminals. If the circuit is closed on both cables then they are good. If the circuit is open on either cable, the cable is defective. Replace the cable, reconnect the heating sensor and the E05 error code will automatically reset.



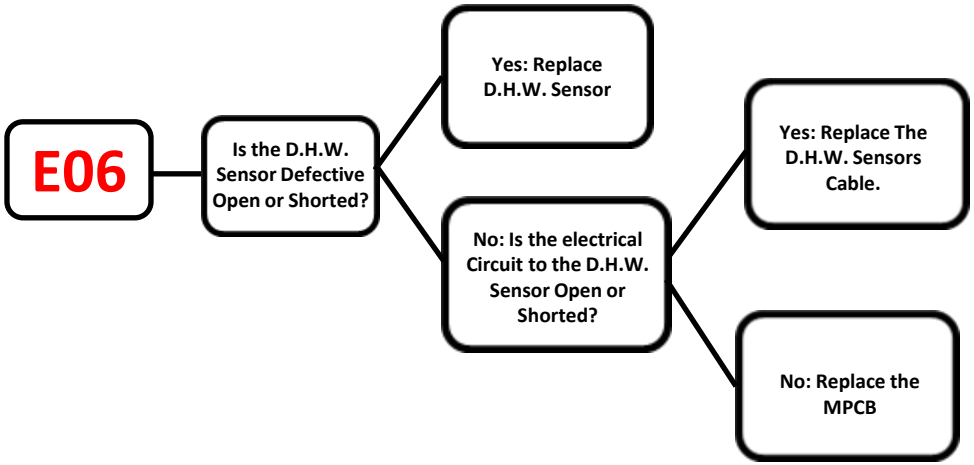
3. Defective MPCB

If both the heating sensor and cables tests verify proper operation, replace the MPCB.

E06 Domestic Hot Water Sensor Circuit



The E06 error code is enabled by either an open or shorted circuit to the NTC Domestic Hot Water Sensor



E06 Domestic Hot Water Sensor Circuit

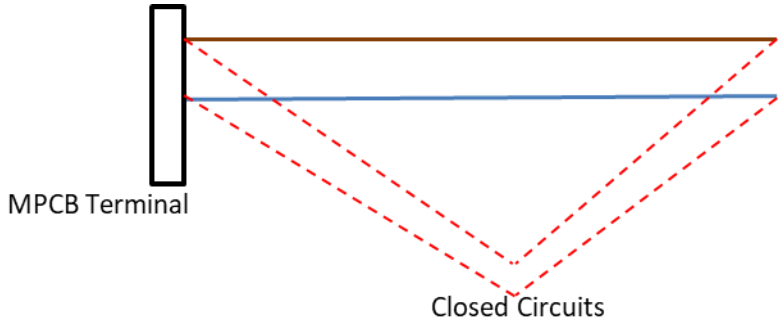
1. D.H.W. Sensor is Defective (PNCC Model Sensors are Wet Well – Draining of the DHW Within the Boiler is Required for Replacement)
Disconnect power to the boiler. Disconnect the cables from the D.H.W. sensor. Using an Ohm meter check the resistance across the sensor. If the resistance if found to be infinity (open circuit) or closed (shorted circuit) replace the D.H.W. sensor. If the ohms meter is measuring a resistance, you can verify the accuracy of the heating sensor by using the table below. Measure the temperature which the D.H.W. sensor is detecting, locate that temperature on the table and verify that the Ohms reading coincides. If a wide variance is detected, replace the sensor. Once the defect is corrected the E06 error code will automatically reset.
Visually inspect the D.H.W. sensor. If it is wet, or there are indications that it had been wet in the past, replace it. NTC sensors are very susceptible to water damage.

Temp	R NTC	Temp	R NTC	Temp	R NTC	Temp	R NTC	Temp	R NTC	Temp	R NTC
-20	105769	17.5	38780	55.5	15912	93	7196	131	3538	169	1870
-18	100544	19	37079	57	15289	95	6944	133	3428	171	1817
-16.6	95605	21	35463	59	14694	97	6702	134.5	3319	172.5	1766
-14.8	90934	23	33925	61	14126	98.5	6470	136.5	3216	174	1717
-13	86518	25	32461	62.5	13582	100	6247	138	3115	176	1669
-11	82339	27	31069	64.5	13062	102	6033	140	3021	178	1622
-9	78384	28.5	29743	66	12565	104	5828	142	2928	179.5	1577
-7.5	74641	30	28481	68	12090	106	5630	143.5	2839	181.5	1534
-6	71097	32	27279	70	11634	107.5	5440	145.5	2753	183	1491
-4	67739	34	26136	71.5	11199	108.5	5258	147	2669	185	1451
-2	64571	35.5	25044	73.5	10781	111	5082	149	2589	187	1411
0	61563	37	24004	75	10382	113	4933	151	2512	189	1373
1.5	58719	39	23014	77	9999	115	4751	152.5	2437	190.5	1228
3	56016	41	22069	79	9633	116.5	4590	154.5	2365	192	1300
5	53432	43	21168	80.5	9281	118.5	4444	156	2292	194	1266
7	51018	45	20309	82.5	8945	120	4300	158	2229	196	1232
9	48707	46.5	19489	84	8622	122	4161	160	2164	197.5	1199
10	46513	48	18708	86	8313	124	4026	162	2101	199.5	1168
12	44429	50	17959	88	8016	125.5	3897	163.5	2040	201	1137
14	42449	52	17245	89.5	7731	127.5	3773	165	1982	203	1109
16	40568	53.5	16563	91.5	7458	129	3653	167	1925	205	1079

E06 Domestic Hot Water Sensor Circuit

2. Defective Sensor Cable

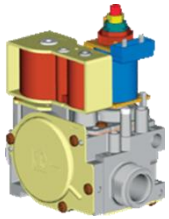
Disconnect power to the boiler. Disconnect the cable s from the D.H.W. sensor. Verify the continuity of the cables from the MPCB to the sensor terminals. If the circuit is closed on both cables then they are good. If the circuit is open on either cable, the cable is defective. Replace the cable, reconnect the D.H.W. sensor and the E06 error code will automatically reset.

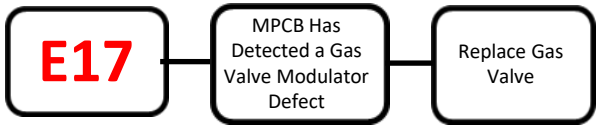


3. Defective MPCB

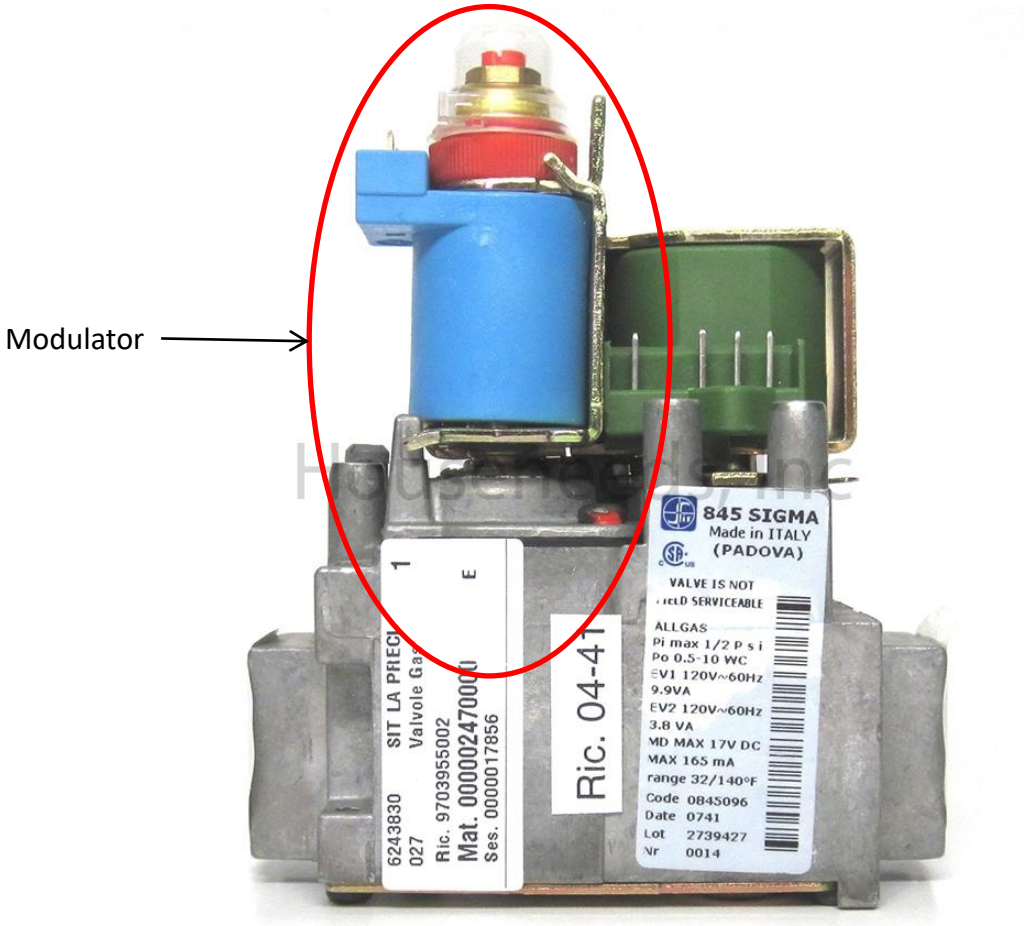
If both the D.H.W. sensor and cables tests verify proper operation. Replace the MPCB.

E17 Gas Valve Modulator Failure





E17 Gas Valve Modulator Failure



E17 Gas Valve Modulator Failure

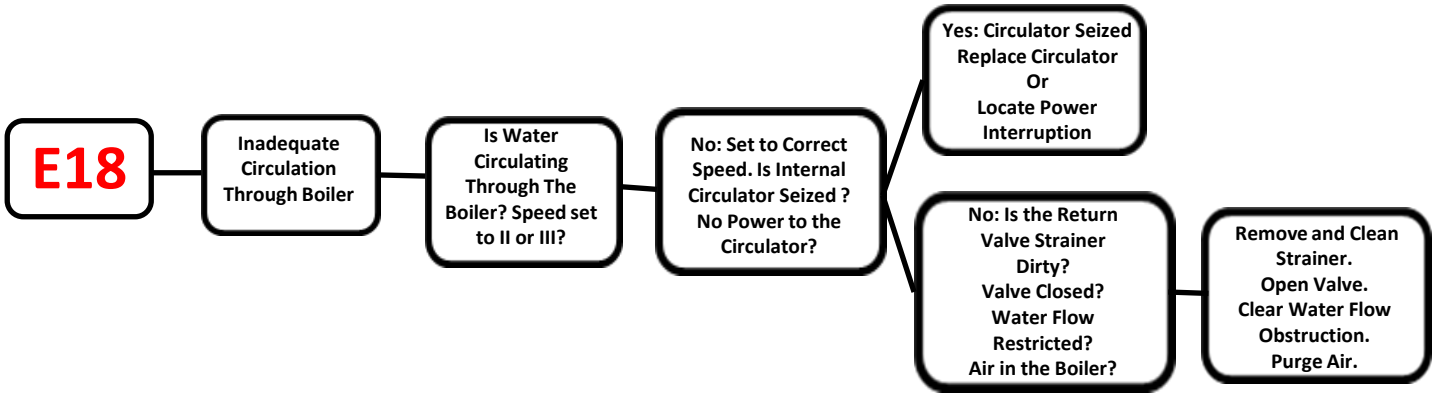
Gas Valve Modulator Failure – Replace Gas Valve

The MPCB has detected a defect with the gas valve modulator. The complete gas valve will need to be replaced.

- Disconnect electrical power to the boiler
- Shut the gas cock off
- Flip the control panel down to access the gas valve
- Disconnect the gas line from the inlet of the gas valve
- Remove the two Philip head screws retaining the gas valve to the metal base
- Disconnect the gas line from the outlet of the gas valve by loosening the nut – retain the gasket within this connection
- Disconnect the power cable and two modulator wires
- Remove the gas valve from the boiler
- Remove the inlet connection manifold by unscrewing it from the valve - retain
- Remove the outlet manifold by removing the four Philip head screws – retain
- Place the new gas valve on a clean working surface
- Apply a light coat of approved thread sealant to the inlet connection manifold and install it in the new gas valve, do not over-tighten
- Using a new gasket, install the outlet manifold and secure with the four screws, tighten
- Install the new gas valve in the boiler and secure to the metal base with the two screws
- Apply a light coat of approved thread sealant to the inlet manifold connection and reconnect the gas line
- Install the gasket on the outlet manifold pipe connection and reconnect the pipe , tighten the nut
- Connect the power cable and two modulator wires
- Open the gas cock and check the inlet pipe connection for leaks
- Reconnect electrical power and enable a call for heat
- Verify that the boiler ignited and check the gas valve outlet connection and pipe for leaks
- Adjust the **minimum** and **maximum** fire gas pressures, refer to pages 56-58 for detailed instructions
- Verify proper boiler operation

Gas Data Table		NATURAL GAS		LIQUID PROPANE GAS	
Boiler Fan Speed		min	max	min	max
Gas Pressure	Inches WC	1.74	4	4.04	10.2

E18 Inadequate Boiler Water Circulation

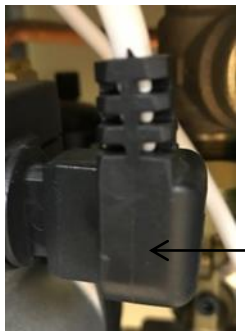


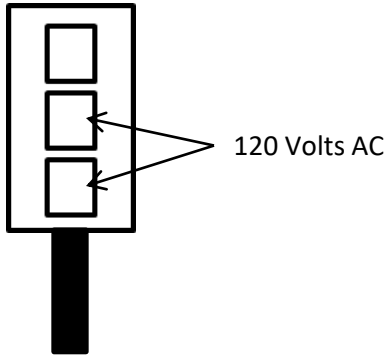
E18 Inadequate Boiler Water Circulation

1. No or Reduced Water Circulation Through Boiler

Verify that the internal circulator is operating correctly during both a heat and domestic hot water demand. Verify that the speed switch is set to either II or III. The circulator will operate immediately upon either demand. If the circulator is not operating check for the proper voltage (120 Volts AC)at the circulator power cable. If no power is measured, check the cable and its connection to the MPCB. If there is power at the MPCB and not at the circulator end of the cable, replace the cable. If no power exists at the MPCB circulator terminals, replace the MPCB.

If power is present at the circulator, but its doesn't function, test to determine if it seized. First, disconnect power to the boiler. Secondly, place towels below the circulator and protect the control board from leaking water. Remove the nickel sized plug from the circulator motor and insert a narrow flat screwdriver into the hole. The end of the rotor shaft has an indentation that will accept the screwdriver. Attempt to turn the rotor. If it spins freely, yet the circulator won't function, replace the circulator. If the rotor is stuck , attempt to free it by turning the screwdriver back and forth several times. If it cannot be turned, replace the circulator. If it can be turned, replace the plug, **purge any air from the heat exchanger,** dry the area and remove the towels. Restore power to the boiler and verify proper circulator operation. Speed must be set to II or III.





When performing the screwdriver test, if the circulator spins, but with a lot of effort, or spins easily for part of its rotation then hard, replace the circulator. The circulator will likely be turning off on its internal thermal overload causing intermittent boiler flow issues.

E18 Inadequate Boiler Water Circulation

2. Return Valve Strainer (If Supplied)

Disconnect power to the boiler. Shut off the water supply to the boiler. Isolate the boiler by shutting the heating supply and return valves. Drain the boiler by loosening the fitting between the return valve and boiler. Collect water in a bucket. Remove the strainer access nut and strainer. Clean strainer with warm water and nylon brush. Replace and tighten strainer access nut and the fitting between the return valve an boiler. Turn the water supply on and inspect for leaks. Pressurize the boiler and **purge any air** that may have been introduced. Restore power to the boiler and check for proper operation. **If the return valve is found to be installed on the supply side of the boiler it must be relocated to the return side (below circulator) immediately.**

3. Boiler Obstruction

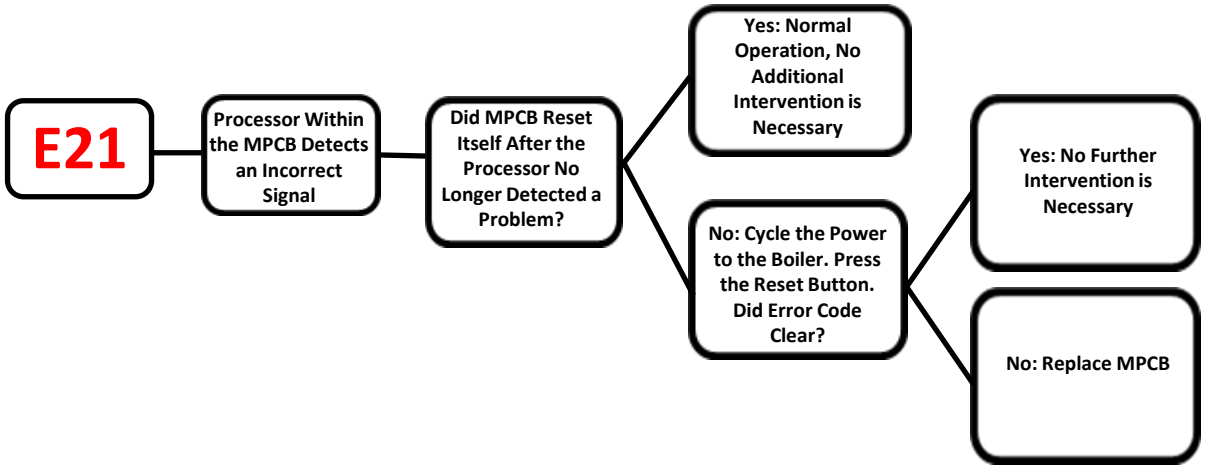
If boiler is found to be plugged with contaminants and/or scale it will need to be flushed using products suitable for the boilers internal components. Consult the product manufacturer for suitability and directions.

4. Restriction in Boiler Piping

Verify that all valves are in the open position. Sediment collecting devices, such a wye strainers and dirt separators, have been cleaned and inspected.

Return Valve With Strainer (If Supplied)

E21 MPCB Malfunction



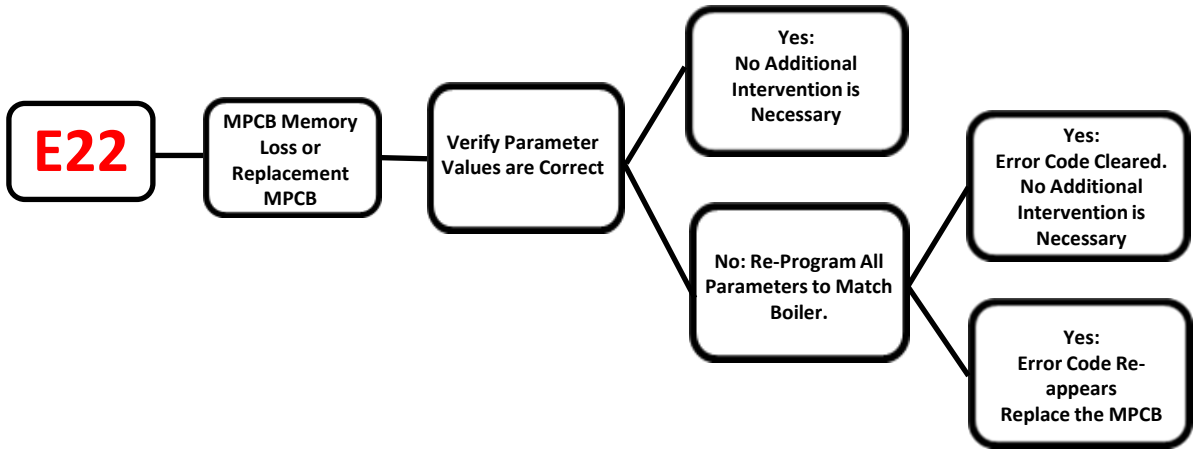
1. Typical Scenario

This error code typically goes undetected because the MPCB will automatically reset after the microprocessor detects that the information which enabled the error code has returned to normal. This process, typically, takes just several minutes.

2. Error Did Not Reset After Several Minutes

If the Error code has not automatically reset after several minutes, press the reset button. If pressing the reset button is not successful, cycle the power on and off to the boiler. If cycling the power proves unsuccessful, replace the MPCB.

E22 Parameters Need To Be Programmed



1. Loss of Microprocessor Memory

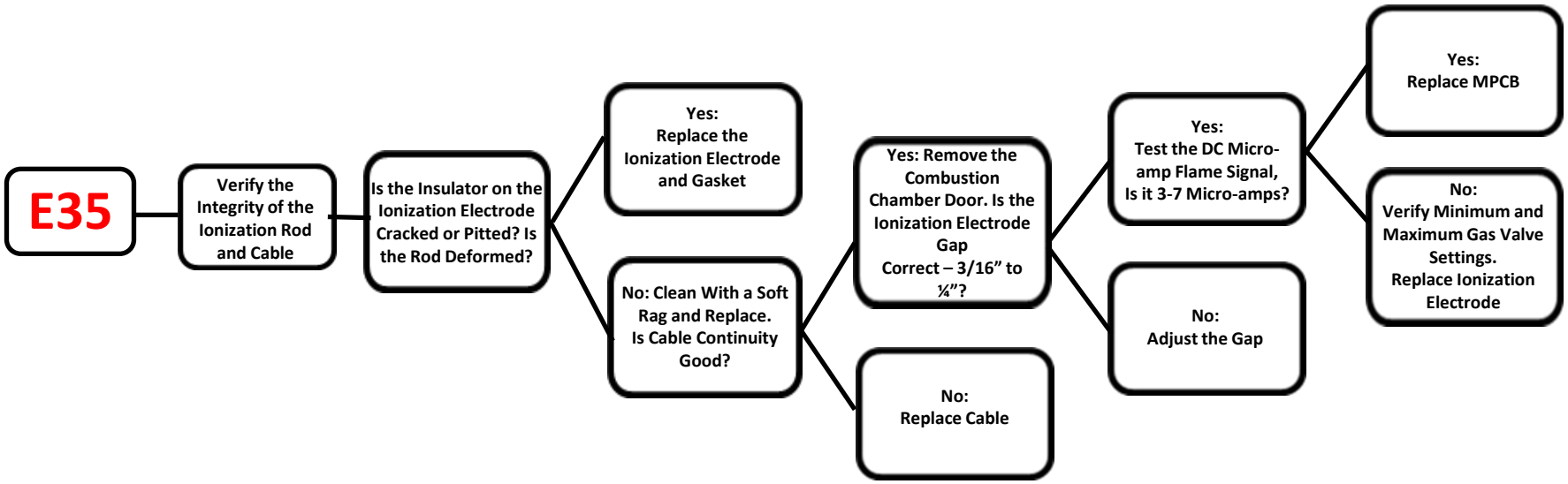
To reset the error code, cycle the power to the boiler on and off. Press the reset button.

Open the parameters value menu and verify the proper value for each parameter matches the boiler. Refer to the installation manual, section 5, 'regulating the appliance', for instructions. When completed, exit the parameters value menu and operate boiler. Verify proper operation.

2. E22 Error Code Re-appears

Replace the MPCB and program the parameters to match the boiler.

E35 Flame Ionization Circuit Malfunction



E35 Flame Ionization Circuit Malfunction

1. Verify The Condition of the Ionization Electrode

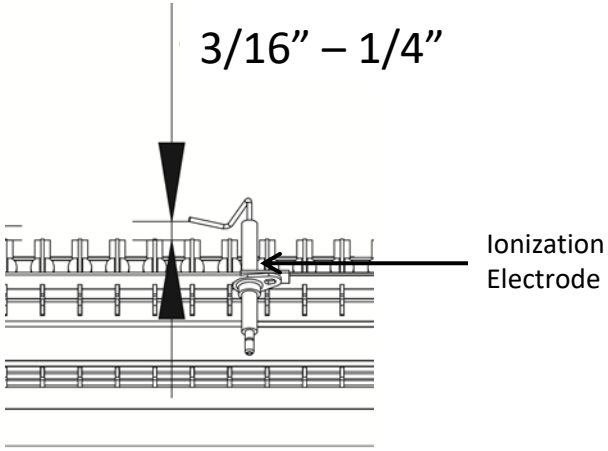
Disconnect power to the boiler. Shut off the gas cock. Remove the combustion chamber access cover by removing the six Philip head screws. Be careful not to damage the refractory on the inside of the cover. Disconnect the cable to the ionization electrode. Remove the single Philip head screw securing the ionization electrode and remove it from the burner assembly. Inspect the electrode rod for deformity and the insulator for cracks and pitting. If damaged it must be replaced. If undamaged, clean it with a soft rag only and re-install.

2. Ionization Electrode Cable

Disconnect power to the boiler. Shut off the gas cock. Inspect the cable for cracks or cuts to the insulation and the integrity of the cable end connectors. If damaged, replace it. If found to be undamaged, check the continuity of the cable with an Ohms meter to guaranty the cables integrity. If defective, replace it. Insure the cable ends provide a secure connection.

3. Ionization Electrode Gap

If the Ionization electrode and cable are not broken, the electrode gap will need to be verified. With the electrical power disconnected and the gas cock still shut off, use a ¼" Allen Wrench to gauge the distance between the electrode and surface of the burner. If necessary, gently adjust the gap using a pair of needle nose pliers, being careful not to break the electrode. When finished, reconnect the ionization cable, reinstall the combustion chamber access cover and secure with the six screws. Turn the electrical power on and open the gas cock. Establish a call for heat and verify proper boiler operation.

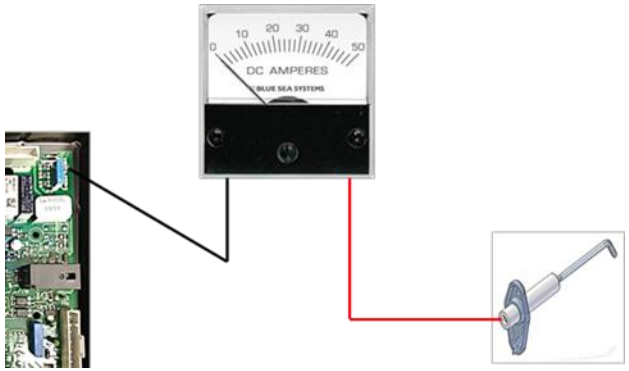


E35 Flame Ionization Circuit Malfunction

4. Check Flame Signal Strength

Disconnect power to the boiler. Using a DC micro-amp meter, check the flame signal strength. A normal reading is 3-7 micro-amps. The MPCB will lock out (generate an E01 Fault) with a flame signal of less than .5 micro-amps.

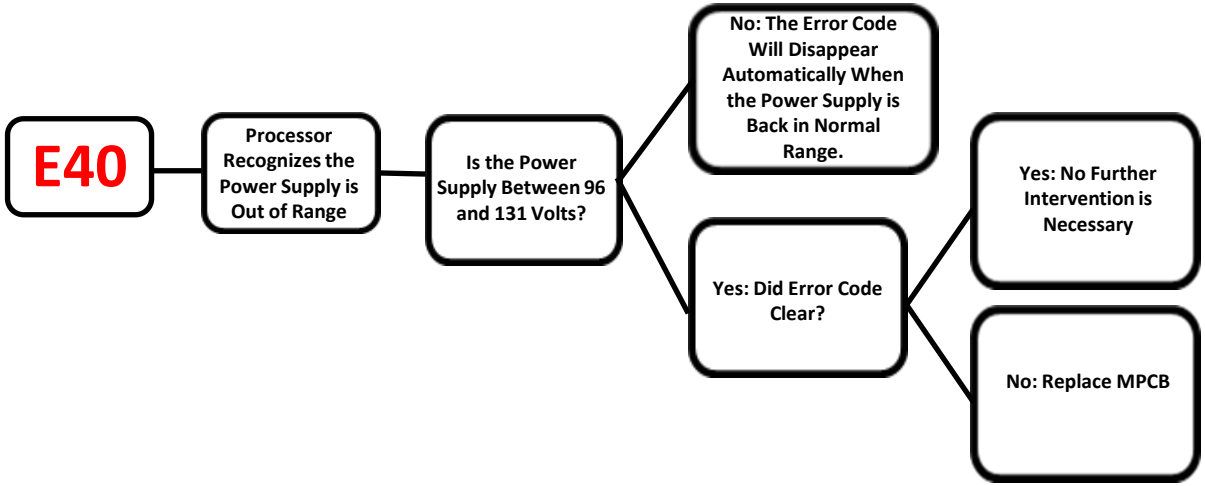
Insert the micro-amp meter in series between the Ionization Electrode and MPCB. Turn the boiler on and allow it to ignite, observe the reading on the meter for a moment. If using an analog meter and the value drops below 0, reverse the meters test leads. If the reading falls below the normal range listed above, replace the ionization electrode.



5. MPCB

If the micro-amp reading falls into the normal range, but the E35 error code is still being generated, replace the MPCB.

E40 Power Supply Out Of Range



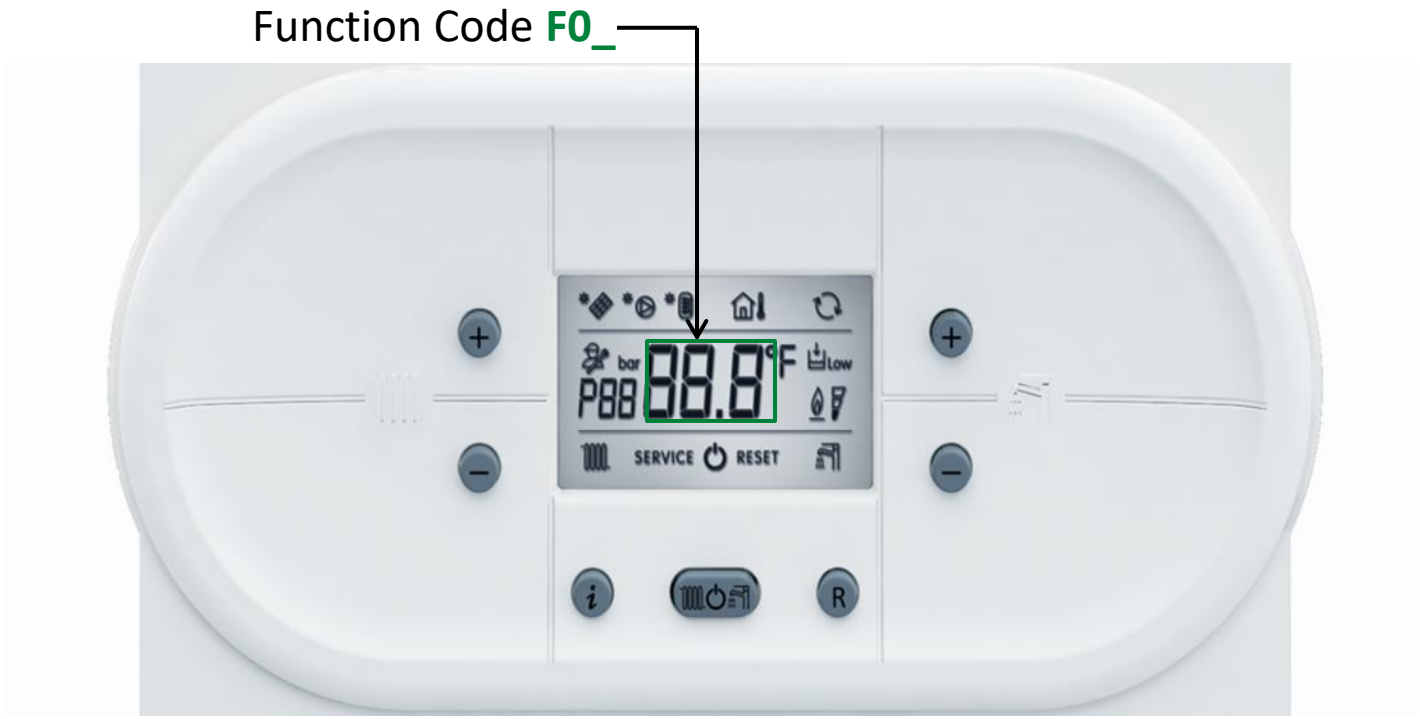
1. Power Supply

Using a multi-meter, measure the AC voltage supply to the boiler. Normal operating range for the MPCB is 96-131 volts. If the voltage is out of range, contact a licensed electrician to remedy the problem. Once the voltage is restored to the normal range, the error code will automatically reset.

2. Power Supply Within Normal Range

If the power supply is within the normal range and the error code has not automatically reset after several minutes, press the reset button. If pressing the reset button is not successful, cycle the power on and off to the boiler. If cycling the power proves unsuccessful, replace the MPCB.

F0_ Function Codes



A Function Code (F0_) displayed on the control **is not** an indication of a boiler fault. Its providing notification that one of the Function Modes is activated, either manually or automatically.

F0_ Function Codes

Function Code	Description	Enabled	Disabled
F07	Flue Test	Manually	Manually/Automatically
F08	Frost Protection-Heating Circuit	Automatically	Automatically
F09	Frost Protection-D.H.W. Circuit	Automatically	Automatically
F28	Legionella Protection	Automatically	Automatically

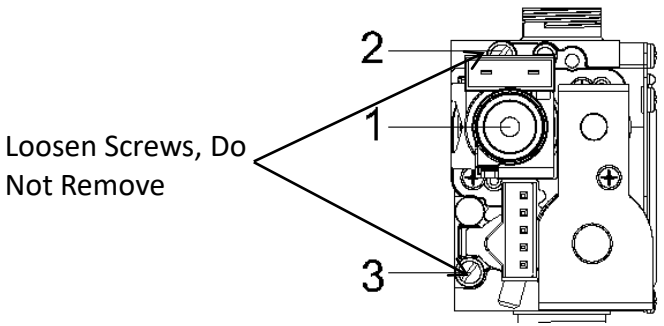
F0_ Function Codes

Code	Description
F07	**Flue Test Function:** Pressing the 'R' button for 7 seconds enables this test mode. The flue test function operates the boiler at high fire for 15 minutes without burner modulation. This function is primarily used for combustion testing. It can be disabled by waiting the 15 minutes or by turning the boiler off with the power-mode selection button. The most recent versions of the MPCB allows you to choose both high or low fire flue tests. Once in the Flue Test mode, pressing the Heating + button activates high fire, pressing the Heating – button activates low fire.
F08	**Frost Protection-Central Heating:** This function is automatically enabled when the heating sensor detects a temperature of 41 degree F. The boiler operates at low fire with the diverter valve in the heating position. The function is automatically disabled when the temperature detected by the heating sensor reaches 86 degree F. (**Protects boiler only**)
F09	**Frost Protection-D.H.W.:** This function is automatically enabled when the D.H.W. sensor detects a temperature of 39 degrees F. The boiler operates at low fire with the diverter valve in the D.H.W. position. The function is disabled when the D.H.W. sensor detects a temperature of 46 degree F, or the heating sensor detects 86 degrees F. (**Protects boiler only**)
F28	**Legionella Protection:** D.H.W. storage boilers only. Enabled on a 7 day cycle. It brings the water temperature of the D.H.W storage tank up to 140 degrees F, regardless of the tanks set point. Function can be permanently disabled within parameter P15.

Minimum and Maximum Fire Gas Pressure Adjustment

Procedure

An accurate, electronic manometer is required to complete these actions



1. **Verify Proper Gas Supply Pressure**

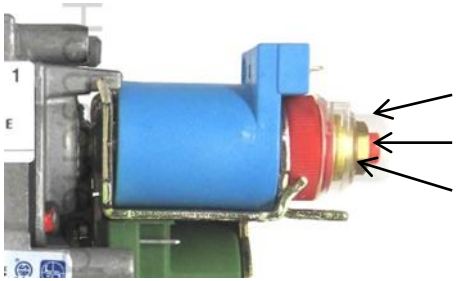
- Disconnect electrical power to the boiler
- Shut the gas cock
- Flip the control panel down to access the gas valve
- Loosen the screw at test port #3 on the gas valve
- Connect manometer
- Open the gas cock
- Turn up all heating thermostats to enable a call for heat
- Reconnect electrical power to the boiler
- If necessary, enable the boiler heat mode using the mode selector button
- Allow boiler to ignite and then operate for several seconds
- Press, for a second or two, then release the 'R' button to enable F07, flue test function (F07 will appear in the screen). Boiler will modulate to high fire automatically
- Observe the " WC pressure on the manometer
- Required gas supply pressures: Natural Gas - 6-8" WC, LPG – 11" WC
- If necessary, adjust gas supply regulator to realize the proper pressure
- Turn the boiler off with the mode selection button
- Observe the 'Static' pressure value on the manometer
- Maximum 'Static' pressures: Natural – 9" WC, LPG – 14" WC
- If "static' pressure is at or above these values, with the proper running pressure, gas supply regulator may be defective, the gas line is undersized, or a restriction in the gas line exists – correct problem before proceeding
- **'Static' pressure in excess of 14" WC will necessitate the replacement of the gas valve for safety reasons**
- Repeat the 'Static' pressure test to verify the pressure remains below the maximum value
- Once all the test results fall within the correct range, turn the boiler off using the mode selection button
- Shut the gas cock
- Remove the manometer and tighten the test port screw and verify it's leak free
- Prepare to conduct the next test: maximum fire gas pressure value

Minimum and Maximum Fire Gas Pressure Adjustment

Procedure

2. Maximum Fire Gas Pressure Adjustment (Requires 10mm Wrench)

- Loosen screw in test port #2
- Connect manometer
- Open gas cock
- Remove clear plastic cap protecting the minimum adjustment screw and maximum adjustment nut – this must be reinstalled when finished



- Turn boiler on using the mode selector button and enable the heat mode (thermostats are still turned up)
- Boiler ignites, allow it to operate for several seconds
- Press, for a second or two, and release the 'R' button to activate F07 (F07 will appear on the screen), boiler will modulate to high fire automatically
- Observe the " WC gas pressure on the manometer
- Verify that the gas pressure matches the maximum fire value for the proper gas in the table below

Gas Data Table		NATURAL GAS		LIQUID PROPANE GAS	
Boiler Fan Speed		min	max	min	max
Gas Pressure	Inches WC	1.74	4	4.04	10.2

- If the value differs, using the 10MM wrench, turn the brass nut in small increments to adjust. Clockwise to increase, counter-clockwise to reduce
- Verify the pressure matches the value in the table
- Prepare to perform the minimum fire gas pressure test

Minimum and Maximum Fire Gas Pressure Adjustment

Procedure

3. Minimum Fire Gas Pressure Adjustment (Requires 10mm Wrench and Slotted Screwdriver)

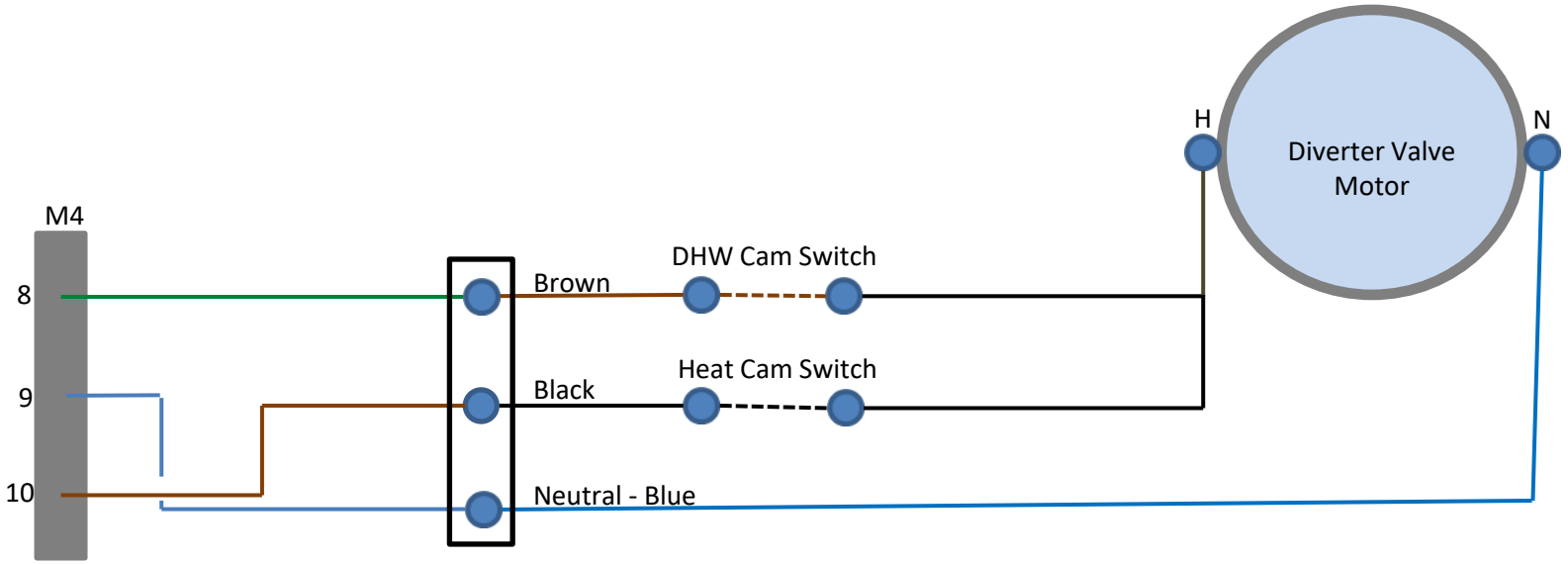
- With the boiler still operating in the F07 mode, remove one of the single black wires connected to the blue modulator valve (do not allow the freed wires' end to contact any metal object)
- Boiler will slowly modulate to minimum fire
- Once the pressure stabilizes, observe the " WC value on the manometer
- Verify the minimum fire pressure, for the proper gas, matches the value in the table below

Gas Data Table		NATURAL GAS		LIQUID PROPANE GAS	
Boiler Fan Speed		min	max	min	max
Gas Pressure	Inches WC	1.74	4	4.04	10.2

- If the value differs, using the 10MM wrench to hold the brass nut stationary , use the slotted screwdriver to adjust the minimum fire gas pressure. Turn the screw in very small increments to adjust. Clockwise to increase, counter-clockwise to reduce
- Verify the pressure matches the value in the table
- Once verified, replace the clear plastic protective cap (failure to do so will adversely affect boiler operation)
- Turn the boiler off using the mode selector button
- Reconnect the single black wire to the blue modulator
- Remove the manometer from the pressure test port
- Tighten the pressure test port screw and verify its leak free
- Return the control panel to its normal position
- Turn the boiler on using the mode selection button, enable the required modes, and verify proper boiler operation
- Return heating thermostats to their original settings

Diverter Valve Operation

The diverter valve directs the boiler water to either the heating circuit or domestic hot water production circuit.
When a demand is enabled, the MPCB will send 120 volts AC to either the heat circuit (black wire) or D.H.W. circuit (brown wire) of the diverter valve motor. Once the motor is in the proper position, a cam lobe on the motor shaft will open a micro-switch stopping the motor in the correct position. **The diverter valve does not have end switches to enable burner operation after it has turned to the proper position.** Operation of the circulator and burner is enabled through the MPCB.



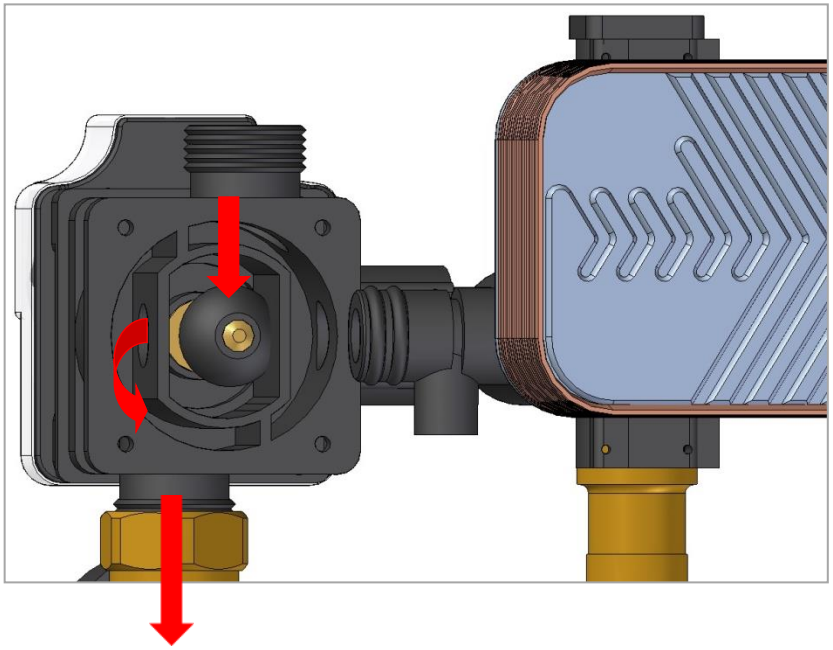
Heat Sequence:
Upon a call for heat; power is delivered from terminal #10 on the MPCB, through the cable, to the black wire of the diverter valve and through the closed heat cam switch. The motor rotates to the heat position until lobe on the motor shaft contacts the heat cam micro-switch, opening it, stopping the motor.

D.H.W. Sequence:
Upon a call for D.H.W.; power is delivered from terminal #8 on the MPCB, through the cable, to the brown wire of the diverter valve and through the closed D.H.W. cam switch. Motor rotates to the D.H.W. position until the lobe on the motor shaft contacts the D.H.W. cam micro-switch, opening it, stopping the motor.

Diverter Valve Operation

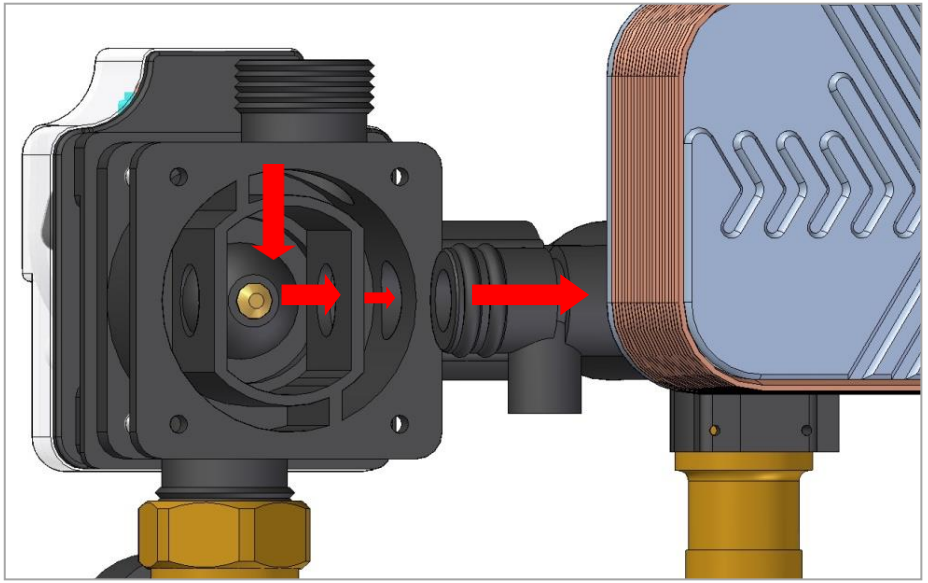
Internal Boiler Water Flow Path through the Diverter Valve

Boiler Water Heating Flow Path



To Boiler Heating Circuit Supply

Boiler Water D.H.W. Flow Path



To Brazed Plate Heat Exchanger
or Indirect Water Heater

Diverter Valve Operation

Diverter valve operation can be observed through the aid of the position indicator located behind the motor.

1. **Check for Correct Operation**
   Disconnect power to the boiler. Swing control panel down. Removal of the right hand side panel will assist in accessing the diverter valve. Locate the valve and remove the clear plastic cover by removing the single Philips head screw, then pull the cover off the valve.
   Re-establish power to the boiler. Enable both heat and D.H.W. calls. Locate and observe the position indicator. Using the mode selection button on the control panel, cycle the boilers operation from heat to hot water. Observe indicator location when the motor stops. Indicator should be in the position illustrated in Fig. 1. Now, cycle the boiler from D.H.W. to heat. Again, observe the indicators position when the motor stops. Indicator should be in the position shown in Fig. 2. If so, the diverter valve is operating correctly.
2. **Incorrect Operation, Noisy**
   If diverter does not operate as described above, or is found stuck between the heat and D.H.W. positions. If the valve is noisy as it turns, or a clicking noise is heard from the motor, replace the diverter valve motor actuator assembly.

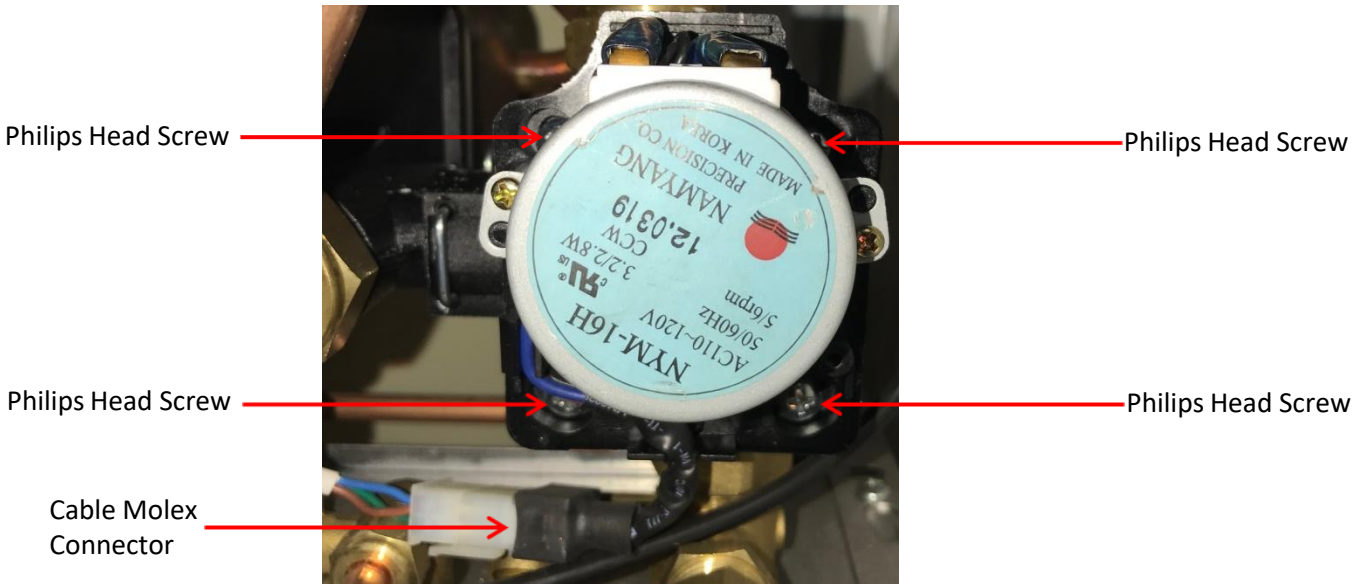
Fig. 1 - Position Indicator – D.H.W. Production

Fig. 2 - Position Indicator – Heat Production

Diverter Valve Operation

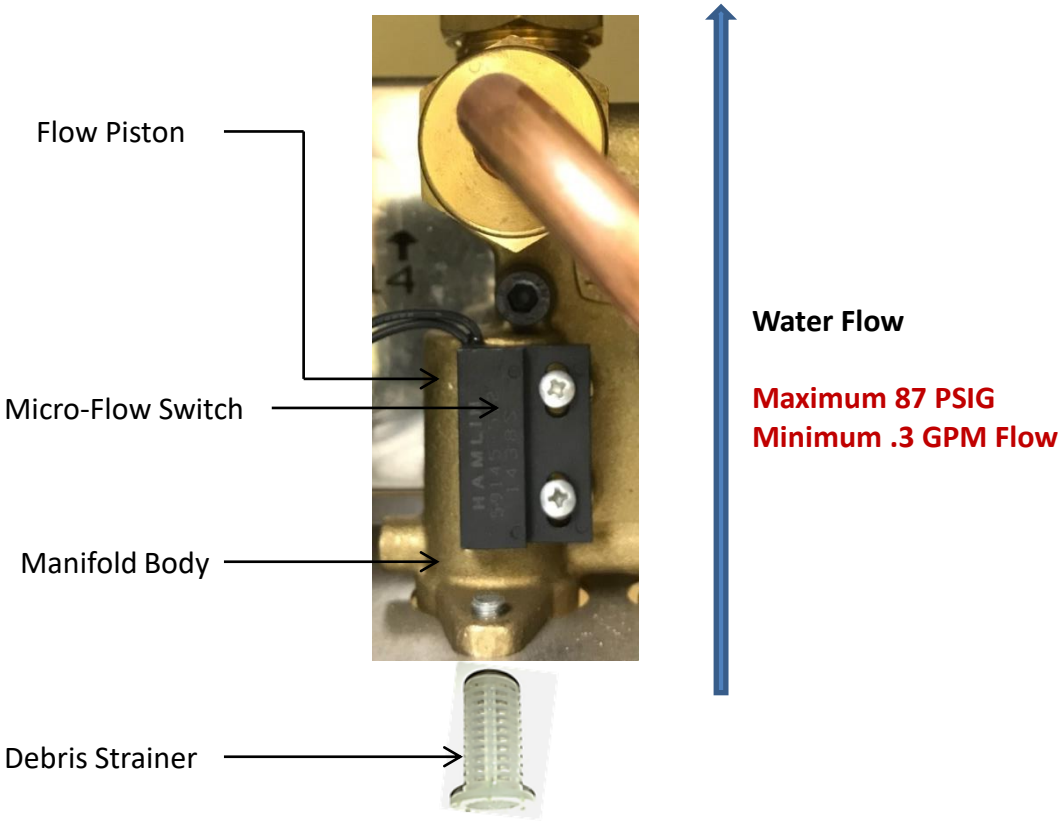
3. **Valve Continually Rotates (No Hot Water, Quick Intermittent Hot Water, Quick Intermittent Burner Cycling)**
   If the diverter valve is found to be continually rotating, a micro-switch has failed in the closed position. The diverter valve motor actuator assembly will need to be replaced.

4. **Diverter Valve Motor Actuator Replacement**
   Disconnect power to the boiler. Shut off the gas and water supply to the boiler. Isolate the boiler from the heating circuit piping and drain the water completely. Using dry rags, protect the adjacent components from water leakage. Separate the power cable from the diverter valve at the Molex connector. Using a long Philips head screwdriver, remove the four screws securing the motor actuator assembly to the valve body. Gently twist and pull the motor actuator assembly from the body absorbing any water that may not have drained out. Remove the red o-ring from the valve body and discard. Install the new red o-ring on the new motor actuator assembly and lubricate it with a small amount of water based lubricant. Install the replacement assembly into the valve body and verify the o-ring is properly seated. Secure with the four Philips head screws. Attach the wire cable to the new actuator assembly. Fill the boiler with water and **purge all accumulated air**. Re-open any valves that were closed to isolate the boiler. Inspect for and repair any water leaks. Reconnect power to the boiler and open the gas cock. Operate the boiler and verify proper operation (paragraph 1).



No Hot Water - Domestic Hot Water Flow Switch Operation

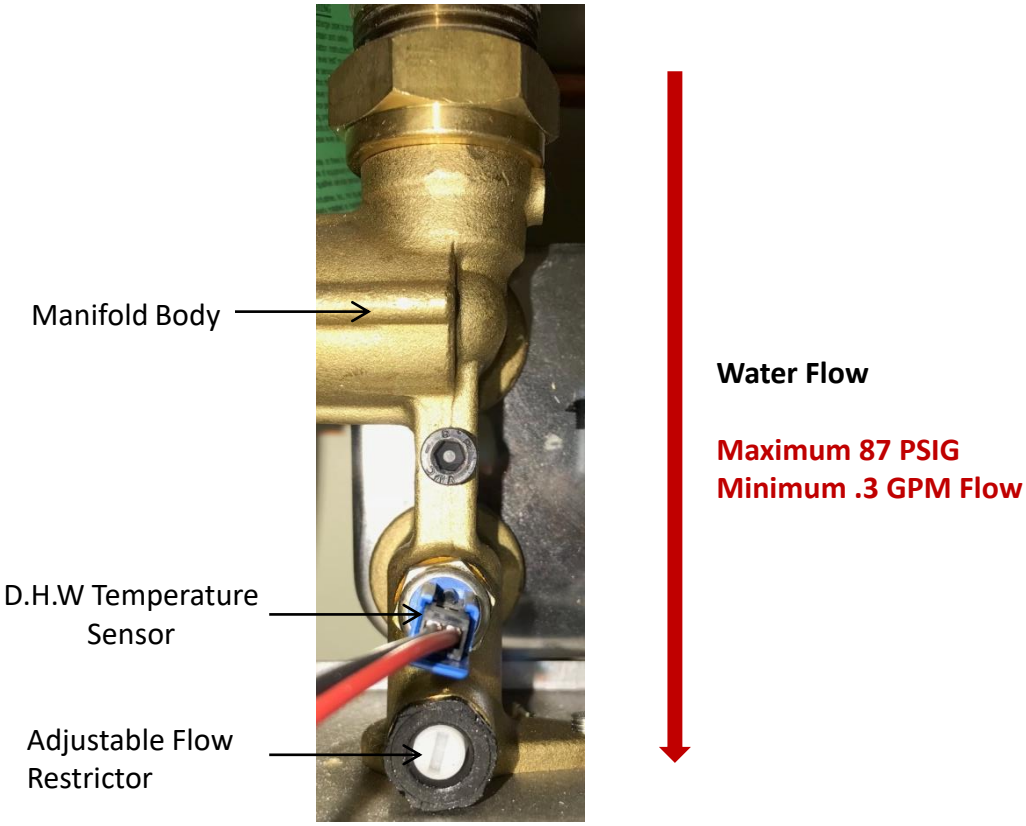
PNCC 'Combi' Model



Cold Water Manifold Assembly

No Hot Water - Domestic Hot Water Flow Switch Operation

PNCC 'Combi' Model

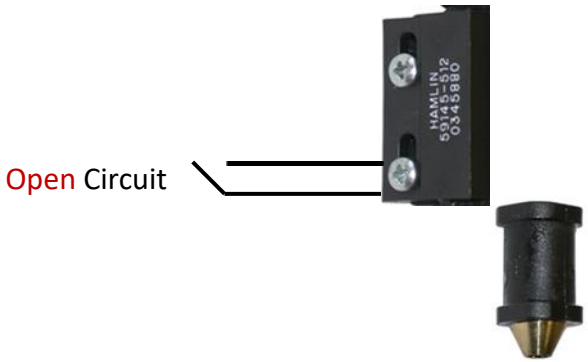


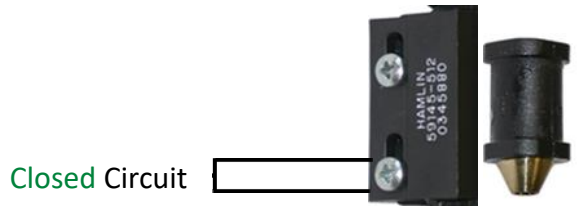
Hot Water Manifold Assembly

No Hot Water - Domestic Hot Water Flow Switch Operation

PNCC 'Combi' Model

- Flow piston is magnetized
- Sealed Micro-flow switch closes by magnetic force when the flow piston is moved adjacent to the switch





Sequence of Operation (PNCC Models – PNCH Models Do Not Incorporate a D.H.W. Flow Switch)

1. Boiler is energized
2. Domestic hot water is enabled on the control
3. Hot and cold water shut off valves are open
4. Cold water debris strainer is clean
5. A hot water faucet is opened
6. Cold water enters the manifold and lifts the Flow Piston
7. Piston positions itself adjacent to the sealed Micro-flow switch
8. Magnetic force closes the micro-switch and enables D.H.W. within the MPCB
9. Circulator in enabled, diverter valve moves to the D.H.W. position
10. If the D.H.W. temperature set point is above the temperature of the potable water at the D.H.W. temperature sensor; burner fires and modulates as necessary. When the D.H.W reaches or exceeds the temperature of the potable water set point; burner is disabled. Burner is enabled once again when temperature of the potable water at the D.H.W. sensor drops below set point.
11. Hot water faucet is closed
12. Flow piston drops, magnetic force is removed and the micro-switch opens. D.H.W. is disabled within the MPCB
13. Circulator continues to operate for 1 ½ minutes to purge heat from the primary heat exchanger.
14. If 'Domestic Hot Water Priority' parameter is enabled, heat will be held off for 90 seconds after a D.H.W. call ends.

- If, during a call for D.H.W., the water temperature in the primary heat exchanger reaches 180 degrees F (+-), the burner will shut off on limit. Only to recycle once the temperature drops a few degrees at the heating sensor.

No Hot Water - Domestic Hot Water Flow Switch Operation

PNCC 'Combi' Model

Using a magnet to verify proper micro-flow switch operation:

- Disconnect power to the boiler
- Remove the two Philip head screws that secure the micro-flow switch to the manifold
- Carefully move the micro-flow switch to an accessible location
- Reconnect power to the boiler
- Place a magnet adjacent to the micro-flow switch, if D.H.W. is enabled (faucet flashes on the screen) the micro-flow switch and MPCB are in proper working order. If the burner will not fire and the D.H.W. set point is above the actual water temperature, verify the accuracy of the D.H.W. sensor (see page 67).

No Hot Water - Domestic Hot Water Sensors

PNCC

PNCH

Hot Water Sensors

1. PNCC: See illustration above. 10K, NTC sensor (thermistor). This model is screwed into a wet well and senses temperature by being immersed in the water. Replacement requires the domestic hot water circuit to be drained.
2. PNCH: See illustration above. 10K, NTC sensor (thermistor). Sensor with wire cable. This sensor is inserted into the temperature well of an indirect water heater.

NTC thermistors are resisters with a negative temperature coefficient, which means the resistance decreases with increasing temperature and vice-versa. 10K thermistors have 9,999 Ohms of resistance at 77 degrees F.

Temp	R NTC	Temp	R NTC	Temp	R NTC	Temp	R NTC	Temp	R NTC	Temp	R NTC
-20	105769	17.5	38780	55.5	15912	93	7196	131	3538	169	1870
-18	100544	19	37079	57	15289	95	6944	133	3428	171	1817
-16.6	95605	21	35463	59	14694	97	6702	134.5	3319	172.5	1766
-14.8	90934	23	33925	61	14126	98.5	6470	136.5	3216	174	1717
-13	86518	25	32461	62.5	13582	100	6247	138	3115	176	1669
-11	82339	27	31069	64.5	13062	102	6033	140	3021	178	1622
-9	78384	28.5	29743	66	12565	104	5828	142	2928	179.5	1577
-7.5	74641	30	28481	68	12090	106	5630	143.5	2839	181.5	1534
-6	71097	32	27279	70	11634	107.5	5440	145.5	2753	183	1491
-4	67739	34	26136	71.5	11199	108.5	5258	147	2669	185	1451
-2	64571	35.5	25044	73.5	10781	111	5082	149	2589	187	1411
0	61563	37	24004	75	10382	113	4933	151	2512	189	1373
1.5	58719	39	23014	77	9999	115	4751	152.5	2437	190.5	1228
3	56016	41	22069	79	9633	116.5	4590	154.5	2365	192	1300
5	53432	43	21168	80.5	9281	118.5	4444	156	2292	194	1266
7	51018	45	20309	82.5	8945	120	4300	158	2229	196	1232
9	48707	46.5	19489	84	8622	122	4161	160	2164	197.5	1199
10	46513	48	18708	86	8313	124	4026	162	2101	199.5	1168
12	44429	50	17959	88	8016	125.5	3897	163.5	2040	201	1137
14	42449	52	17245	89.5	7731	127.5	3773	165	1982	203	1109
16	40568	53.5	16563	91.5	7458	129	3653	167	1925	205	1079

No Hot Water - Domestic Hot Water Sensors

No Hot Water:
NTC sensors may, over time, become inaccurate. They are also susceptible to water damage at their wire terminal connections.
As such, an inaccurate sensor may adversely affect boiler operation. **Only a D.H.W. sensor with either an open or shorted circuit will enable the error code - E06**

- **PNCH Models:** If a defective domestic hot water sensor is sending a false high temperature reading to the MPCB, higher than the hot water set point adjustment, the MPCB will not enable the domestic hot water circuit. Faucet will not flash, circulator and burner will not operate.
- **PNCC Models:** If a defective domestic hot water sensor is sending a false high temperature reading to the MPCB, high than the hot water set point adjustment, the MPCB will be enabled by the domestic hot water flow micro-switch. Circulator will operate, diverter valve will rotate if necessary, but the burner will not fire.

Verify NTC Accuracy:
- **Inaccurate D.H.W. sensors can also result in lower than desired water temperature**
- Disconnect power to the boiler
- Disconnect the cable at D.H.W. sensor, figure 1, or at the MPCB for sensor in figure 2
- Measure the temperature at the sensor using an accurate electronic thermometer and record. If an electronic thermometer is not available, remove the sensor and place it in the air for several minutes to allow it acclimate to the temperature. Determine the room temperature in the vicinity of the sensor and record.
- Connect an ohms meter across the two wire terminals on the sensor in figure 1 or across the two wire leads to the sensor in figure 2. Record the ohms resistance.
- Using the resistance/temperature table on page 66, determine the accuracy of the sensor. If the recorded values do not match those in the table, replace the D.H.W. Sensor.
- If the values match and the micro-flow switch operates properly, replace and program the MPCB.

Fig 1

Fig 2

Domestic Hot Water Production

PNCC models, combination heat and D.H.W. boilers, have limited hot water production based on the Btu output of the boiler. The amount of hot water available from these units can be calculated using the following formula:

Btu Output of the Boiler/Temperature Rise of the Water/500 = GPM

Example:

- PNCC 32 N Boiler Btu Output = 92,000 @ 85% Efficient
- Temperature Rise Desired = 70 Degrees F (50 Degree cold to 120 Degree hot)

92,000/70/500 = 2.62 GPM Maximum Available

Not Enough Hot Water or Water is Not Hot Enough:

Before deciding that a boiler is operating incorrectly, verify that the D.H.W. demand is not greater than the boilers capacity.

1. Determine the flow rate of the faucet in question by determining how long it takes to fill a one gallon container.
2. Measure the cold waters' temperature entering the domestic water circuit of the boiler
3. Use the following formula to determine the maximum D.H.W. temperature the boiler is capable of delivering

Examples:

- PNCC 32 N Boiler – Btu Output = 92,000
- Measured hot water flow from kitchen faucet = 2.25 GPM
- Incoming cold water temperature = 45 Degrees F

92,000/2.25 GPM/500 = 82 Degree F Temperature Rise
45 Degree Cold Water + 82 Degree Rise = 127 Degree F. Maximum Water Temperature Available at the Faucet

- PNCC 32 N Boiler – Btu Output = 102,000
- Measured hot water flow from tub fill = 5 GPM
- Incoming cold water temperature = 45 Degrees F

92,000/5 GPM/500 = 37 Degree F Temperature Rise
45 Degree Cold Water + 37 Degree Rise = 82 Degree F. Maximum Water Temperature Available at the Tub Fill

Domestic Hot Water Production

As seen from the examples; the greater the GPM flowrate, the lower the delivered hot water temperature. The lower the GPM flowrate the higher the delivered hot water temperature. Through use of the preceding formulas, one can determine if a hot water problem is the result of 'over-drawing' the boilers D.H.W. capability or a component problem.

Reference GPM Table:

PNC-32C Pensotti NAT				
	Combustion Efficiency			
	80%	83%	85%	87%
Temp Rise	GPM DHW			
60	2.93	3.04	3.11	3.19
61	2.88	2.99	3.06	3.13
62	2.83	2.94	3.01	3.08
63	2.79	2.89	2.96	3.03
64	2.75	2.85	2.92	2.99
65	2.7	2.81	2.87	2.94
66	2.66	2.76	2.83	2.9
67	2.62	2.72	2.79	2.85
68	2.58	2.68	2.75	2.81
69	2.55	2.64	2.71	2.77
70	2.51	2.6	2.67	2.73
71	2.47	2.57	2.63	2.69
72	2.44	2.53	2.59	2.65
73	2.41	2.5	2.56	2.62
74	2.37	2.46	2.52	2.58
75	2.34	2.43	2.49	2.55
76	2.31	2.4	2.46	2.51
77	2.28	2.37	2.42	2.48
78	2.25	2.34	2.39	2.45
79	2.22	2.31	2.36	2.42
80	2.2	2.28	2.33	2.39
81	2.17	2.25	2.3	2.36
82	2.14	2.22	2.28	2.33
83	2.12	2.2	2.25	2.3
84	2.09	2.17	2.22	2.27
85	2.07	2.14	2.2	2.25
86	2.04	2.12	2.17	2.22
87	2.02	2.09	2.14	2.2
88	2	2.07	2.12	2.17
89	1.97	2.05	2.1	2.15
90	1.95	2.02	2.07	2.12
91	1.93	2	2.05	2.1
92	1.91	1.98	2.03	2.08
93	1.89	1.96	2.01	2.05
94	1.87	1.94	1.98	2.03

PNC-32C Pensotti LPG				
	Combustion Efficiency			
	80%	83%	85%	87%
Temp Rise	GPM DHW			
60	2.66	2.77	2.80	2.90
61	2.62	2.72	2.78	2.85
62	2.58	2.68	2074	2.81
63	2.54	2.63	2.70	2.76
64	2.50	2.60	2.65	2.72
65	2.46	2.55	2.61	2.68
66	2.42	2.51	2.58	2.64
67	2.39	2.48	2.54	2.60
68	2.35	2.44	2.50	2.56
69	2.32	2.40	2.46	2.52
70	2.29	2.37	2.42	2.50
71	2.25	2.34	2.40	2.45
72	2.22	2.31	2.36	2.42
73	2.19	2.27	2.32	2.38
74	2.16	2.24	2.29	2.35
75	2.13	2.21	2.26	2.32
76	2.11	2.18	2.23	2.29
77	2.07	2.16	2.20	2.26
78	2.05	2.13	2.18	2.23
79	2.02	2.10	2.15	2.20
80	2.00	2.08	2.12	2.18
81	1.98	2.05	2.09	2.15
82	1.95	2.02	2.07	2.12
83	1.93	2.00	2.04	2.10
84	1.90	1.98	2.02	2.07
85	1.88	1.95	2.00	2.05
86	1.86	1.93	1.97	2.02
87	1.84	1.91	1.95	2.00
88	1.82	1.87	1.93	1.98
89	1.80	1.86	1.91	1.96
90	1.78	1.84	1.88	1.93
91	1.76	1.82	1.86	1.91
92	1.74	1.80	1.85	1.89
93	1.72	1.78	1.83	1.87
94	1.70	1.77	1.80	1.85