



Commercial Ultra High Efficiency Models with Direct Spark Ignition



SERVICE MANUAL

Troubleshooting Guide
and Instructions for Service

(To be performed ONLY by
qualified service providers)

Models Covered by This Manual:

EF120T4003N(A)3
EF120T5003N(A)3

Effective: January, 2019
ECO 8160



As required by the state of California Proposition 65.

Ultra High Efficiency Models with Direct Spark Ignition

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Introduction

The Bradford White EF120T Ultra High Efficiency Water Heater is designed to deliver a remarkable thermal efficiency rating, in a quiet running unit with venting options that allow for installation flexibility. Several technologically advanced design features are incorporated in the design that will require additional knowledge on the part of the qualified service provider. The information in this manual will instruct service and maintenance professionals on the function, proper diagnosis, and repair of the Bradford White EF120T Ultra High Efficiency Water Heater.

The Bradford White EF120T Ultra High Efficiency Water Heater uses a low NOx premix power burner located at the top of the water heater to direct a turbulent flame down into a submerged combustion chamber. This turbulence causes a thorough mixing of gas and air for optimum combustion. The combustion gases then travel through a three pass flue system keeping the gases moving at a high velocity. The combination of high turbulence and velocity results in an optimum transfer of heat from the flue gases into the water.

Burner operation is controlled using an electronic ignition control board. The control board monitors the status of the electronic thermostat, vent temperature limit switch, vent system pressure switch, and a flame sensor to control output voltage to blower motor, spark rod, and gas valve. The control board contains programming which determines the sequence of operation and timings for purge periods, trial for ignition, flame sensing, and lockouts. The control board will also “soft” start and finish the ignition sequence to help increase the longevity of the entire water heater. Additionally, the control board will provide diagnostic information both on the control board and digital display to help in determining the cause of system lockouts.

The contents in this manual are detailed informational tools to assist in the proper diagnosis of the EF120T Ultra High Efficiency Water Heater operational faults. Please read the entire Service Manual, which provides detailed information regarding the EF120T Ultra High Efficiency Water Heater operation and installation specific concerns.

How To Use This Manual

It is intended for this manual to be used by qualified service personnel for the primary purpose of troubleshooting analysis and repair of the EF120T400/500 models. Understanding the sequence of operation section of this manual will contribute greatly to troubleshooting this product.

An "Installation Checklist" is shown towards the end of this manual. Compare the installation against this installation checklist to confirm all requirements are met.

A "Service Report" is shown towards the end of this manual. Completing this form will assist in the troubleshooting efforts. Should you need to call for technical support, please provide the information shown on this form to the support technician to ensure accurate troubleshooting.

Troubleshooting begins with "System Observation" to determine failure mode as indicated by error codes on the system display. Troubleshooting continues with "Failure Modes and Probable Cause," directing the service provider to a series of test procedures to determine root cause of failure. Component replacement procedures directly follow the test procedures for a given component.

In some difficult to diagnose conditions, it may be necessary to isolate the heater from the vent system to determine root cause.

Contact technical support immediately if diagnosis is not determined using the methods described in this service manual.

Tools Required for Service

Manometer: Two types available, a liquid "U" tube type or a digital (magnehelic) type. This device is used to measure gas and/or air pressures and vacuum.

Multi-Meter: A digital type is strongly recommended. This device is used to measure electrical values. The meter you select must have the capability to measure volts AC, volts DC, amps, micro-amps, and ohms.

Thermometer: Used to measure water temperature. An accurate thermometer is recommended.

Water Pressure Gauge: Used to measure water supply pressure. Also used to determine tank pressure by adapting to the drain valve of the heater.

Jumper Leads: A length of wire (12 in. minimum) with an alligator clip at both ends.

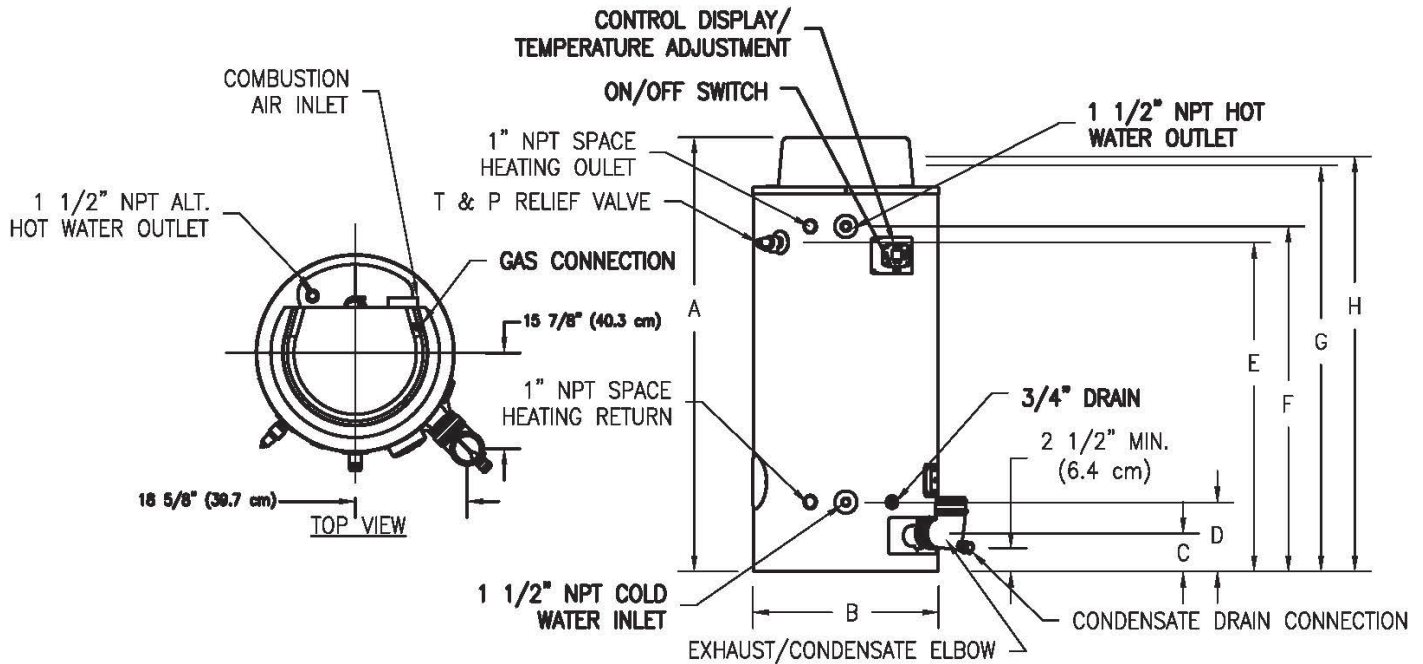
Various Hand Tools: Pipe wrench, channel locks, open end wrench set, 12 in. crescent wrench, Allen wrench set, torx bit set, screw drivers (common & phillips), long reach (12 in.) magnetic tip phillips head screw driver #2 tip, 1/4 in. nut driver, pliers (common & needle nose), socket set including a 1-1/16 deep well socket, wire cutters, wire strippers, wire crimpers, torpedo level, small shop vac, step ladder, and flashlight.

Features

Features of the Honeywell Integrated Control System

- Water heater digital display on control board for setting and displaying the temperature setpoint. Pressing temperature UP and DOWN buttons changes the temperature setpoint. Temperature format may be displayed in °F or °C.
- Single control board with plug-in wiring controls temperature, ignition, and blower operation.
- Plug-in wiring reduces chance of miswiring.
- Burner ignition with direct spark ignition - A high voltage spark jumps from the spark rod to the burner surface to ignite the gas.
- Water heater digital display will show diagnostic codes in the event the water heater needs servicing. Aids in diagnosing and servicing the water heater.
- Water heater digital display can show previous error code history to further aid in servicing the water heater.

Specifications



Dimensions (INCHES)															
Model No.	Input Rate BTU/h	Storage Capacity U.S. Gallons	A Height	B Dia.	C Floor to Vent Outlet	D Floor to Inlet Water Conn.	E Floor to T&P Valve Conn.	F Floor to Outlet Water Conn.	G Floor to Air Intake	H Floor to Gas Conn.	Front Water Conn. Dia.	Space Heating Conn. Dia.	Gas Conn. Dia.	Relief Valve Open	Shipping Weight (LBS)
120T400	399,999	119	77 1/8	33	6 3/4	12 1/4	58 1/2	61 1/4	71	73 3/4	1 1/2	1	1	1	1120
120T500	499,999	119	77 1/8	33	6 3/4	12 1/4	58 1/2	61 1/4	71	74 7/8	1 1/2	1	1	1	1135

Dimensions (MILLIMETERS)															
Model No.	Input Rate KW	Storage Capacity U.S. Liter	A Height	B Dia.	C Floor to Vent Outlet	D Floor to Inlet Water Conn.	E Floor to T&P Valve Conn.	F Floor to Outlet Water Conn.	G Floor to Air Intake	H Floor to Gas Conn.	Front Water Conn. Dia.	Space Heating Conn. Dia.	Gas Conn. Dia.	Relief Valve Open	Shipping Weight (KG)
120T400	117.22	450	1959	838	171	311	1486	1556	1803	1873	38	25	25	25	508
120T500	146.53	450	1959	838	171	311	1486	1556	1803	1902	38	25	25	25	515

Specifications

Power Supply	Dedicated 120 VAC, 60 Hz, (15A GFI recommended)
Gas Supply	Minimum 1 in. NPT (Schedule 40 black iron pipe recommended).
Approved Gas Type	Natural.
Gas Pressure (Nat.)	14" W.C. maximum static, 4.5" W.C. minimum running (recommend 7" W.C. min running)
Venting System	Power vent, balanced direct vent or unbalanced direct vent. See vent tables on page 8.
Approved Venting Materials	PVC and CPVC venting
Minimum Clearance for Servicing	18 in. from top, 24 in. from front, 4 in. sides and rear.
Maximum Water Supply Pressure	150 PSI
Thermostat Sensor	11,900 Ohms @ 70°F, ECO opens @ 207°F Max. Redundant sensor for ECO. Sensor inside well for easy replacement of sensor.
Control Display	Digital display, 24 volts. Temperature range: 100 to 183°F. Used to set tank temperature (°F or °C), show operating status, display error codes, error code history, and limit maximum setpoint temperature.
Control Board	Operates on 24 volt from transformer. Controls tank temperature, ignition functions, combustion blower. See ignition timings in sequence of operation for Integrated Control.
Transformer	120 VAC primary, 24 VAC secondary, 40 VA.
Spark Rod Igniter	0.22 in. nominal gap to the burner surface.
Flame Sensor Output	Minimum 1 micro amp. Typical range 5 to 30 micro amps.
Gas Valve	Negative regulation, 24 VAC, 1/2 in. PSI max., 4.5" W.C. minimum running inlet.
Vent Safety Switch	Normally closed, opens @ 190°F, manual reset.
Blocked Exhaust Vent Pressure	24 VAC, normally closed, opens when pressure increases to +2.70" W.C.
Blower	120 VAC, 60 Hz, 2.5-5.5 amps, full blower RPM
Combustion Levels	CO ₂ : 8-9.5%, CO: less than 0.04% (400 PPM) air free

Specifications

Vent Tables

Balanced Direct Vent Systems SEE APPROVED MATERIALS (found in Installation & Operation Manual)		
Total length of intake piping and exhaust piping added together must NOT exceed "Maximum Combined Length" shown below		
Maximum Combined Length (ft)		
Model Number	4 in	6 in
EF120T400	120 ft	240 ft
EF120T500	120 ft	240 ft

Unbalanced Direct Vent Systems
Air intake **CANNOT** exceed exhaust
by more than 30 ft

Power Vented Systems SEE APPROVED MATERIALS (found in Installation & Operation Manual)		
Total length of exhaust piping must NOT exceed "Maximum Vent Length" shown below		
Maximum Combined Length (ft)		
Model Number	4 in	6 in
EF120T400	120 ft	240 ft
EF120T500	120 ft	240 ft

WARNING

Ensure that the elbows are counted when determining total vent length. See the operation manual and below for more information.

WARNING

The EF120T400/500 model is **NOT** approved for 2 or 3 in diameter vent pipe. Venting with 2 or 3 in pipe may result in damage to the water heater or cause an unsafe condition. **DO NOT** use 2 or 3 in vent or air intake pipe.

Notes:

- 1) Multiply the total number of 90° elbows (intake and exhaust) by 5 ft. **DO NOT** include the 4 in termination fittings or 4 in condensate elbow.
- 2) Multiply the total number of 45° elbows (intake and exhaust) by 2 1/2 ft.
- 3) Add this to the total length of straight pipe - intake and exhaust.
- 4) The sum total of all elbows and straight pipe: intake and exhaust must not exceed maximum lengths from tables above.

Example:

A 4 in balanced direct vent system has 10 ft of straight exhaust pipe and 10 ft of straight intake pipe. It has 1- 90° elbow in the exhaust and 1- 90° elbow in the intake. It has 1- 45° elbow in the exhaust and 1- 45° elbow in the intake.

Therefore:

2- 90° elbows x 5 ft = 10 ft.

2- 45° elbows x 2 1/2 ft = 5 ft.

20 ft of straight pipe + 10 ft + 5 ft = 35 ft.

System is within "Maximum Combined Length" from table above.

Sequence of Operations

1. Thermostat calls for heat.
2. Combustion blower starts at a 3,000 RPM “soft” start light off.
3. Blower pre-purge period of approximately 15 seconds.
4. Ignition control board runs an internal verification safety check for approximately 15 seconds.
5. Trial for ignition (approximately 5 seconds per trial, 3 trials total):
 - a. Flame establishing period (3 seconds), gas valve opens, sparks from spark rod to burner surface to ignite the gas.
 - b. Burner on, flame proving period (2 seconds). Requires a minimum of 1 microamp through the flame sense rod to prove flame.
 - c. If the blocked vent pressure switch contacts (normally closed) are open, then the ignition sequence will not start and error code 67 (pressure switch failed to close/open or vent safety switch failed to close/open) will flash once on the digital display. The unit will then go into pre-purge / “Hold” while the unit is waiting for the issue to be corrected. If the issue continues to occur, the digital display with flash error code 137 (pressure switch is open or vent safety switch is open) while the unit is waiting to restart (5 minutes) the normal sequence of operation.
6. Once the flame signal is verified, the blower will remain at the “soft” start RPM for 5 seconds to stabilize the flame. After this 5 second period the blower will increase RPM to full power.
7. Steady state operation– Burner continues to operate until:
 - a. Thermostat circuit opens, gas valve closes, blower continues to operate for 30 second post-purge period.
 - b. If the blocked vent pressure switch contacts (normally closed) open while the burner is on, then the gas valve closes, and the unit will retry a normal sequence of operation. If issue remains on restart the unit will go into recycle as described in 5c.
8. As the temperature of the water increases towards the set point of the thermostat, the RPM of the blower will reduce (“soft” off) until the thermostat set point is reached. This reduction of the blower’s RPM will vary with the rate of change between the thermostat temperature and set point. For example: The faster the temperature climbs towards the thermostat set point, the larger the reduction of blower RPM will take place. The lowest RPM setting the blower will drive to is the “soft” start light off level of approximately 3,000 RPM.
9. Thermostat satisfied.
10. Gas valve closes, burner is extinguished.
11. Blower post purge for 30 seconds at maximum RPM.

Troubleshooting

System Observation for 120T400/500 Models with Direct Spark Ignition

Water Heater Fault: Water heater does not operate.

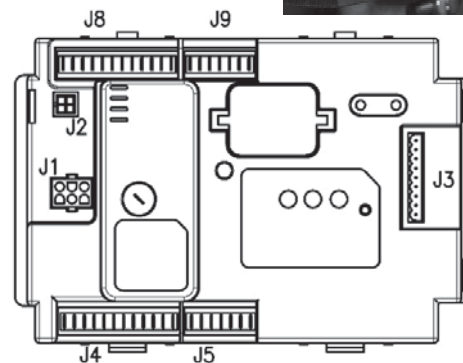
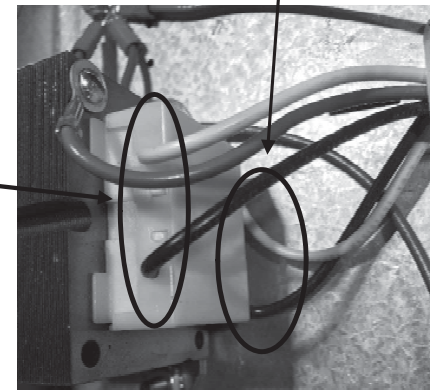
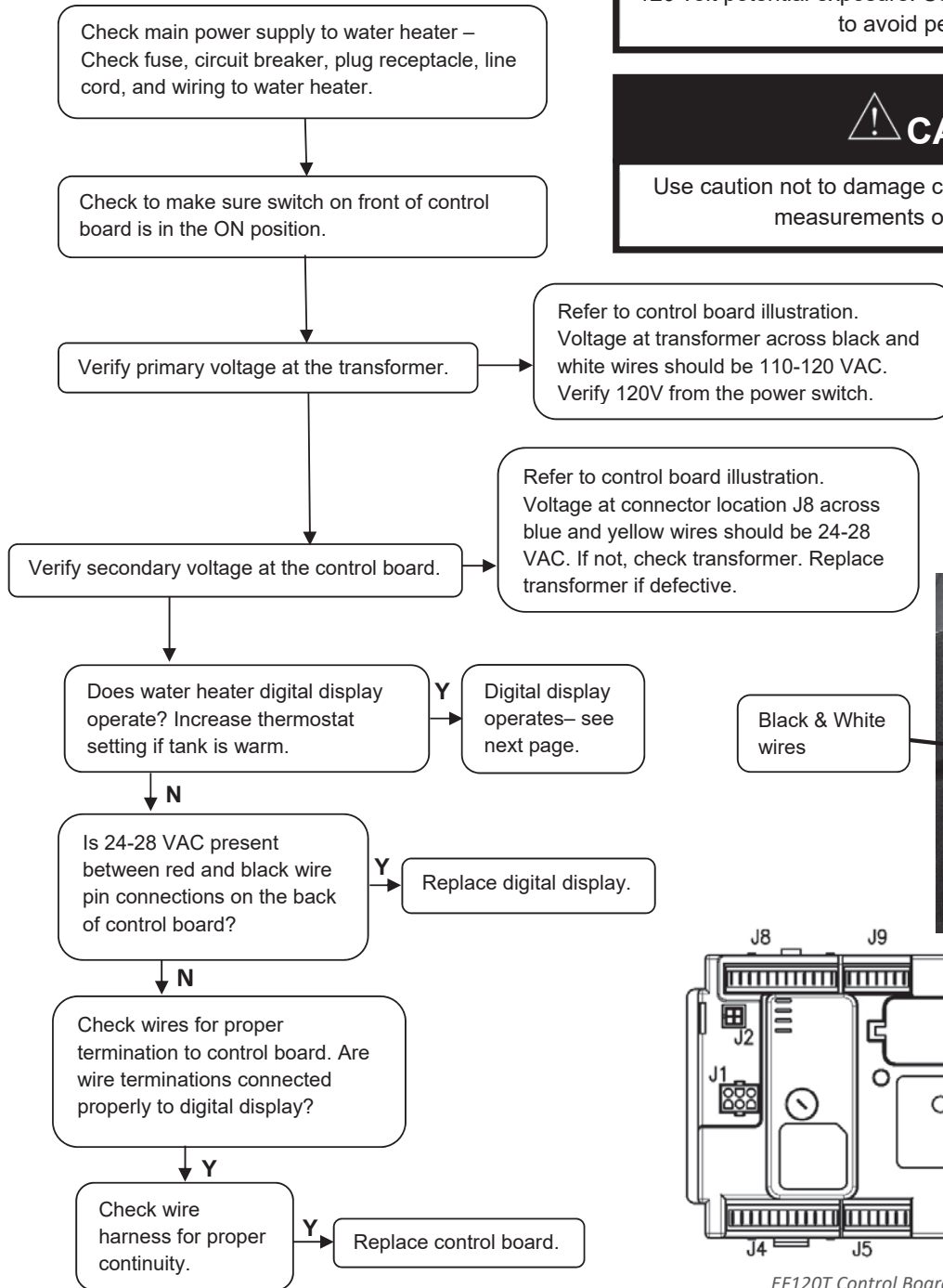
Display Error Code: Water heater digital display does not operate - blank display.

WARNING

120 volt potential exposure. Use caution making voltage checks to avoid personal injury.

CAUTION

Use caution not to damage connectors when making voltage measurements or jumping terminals.



EF120T Control Board Schematic

Troubleshooting



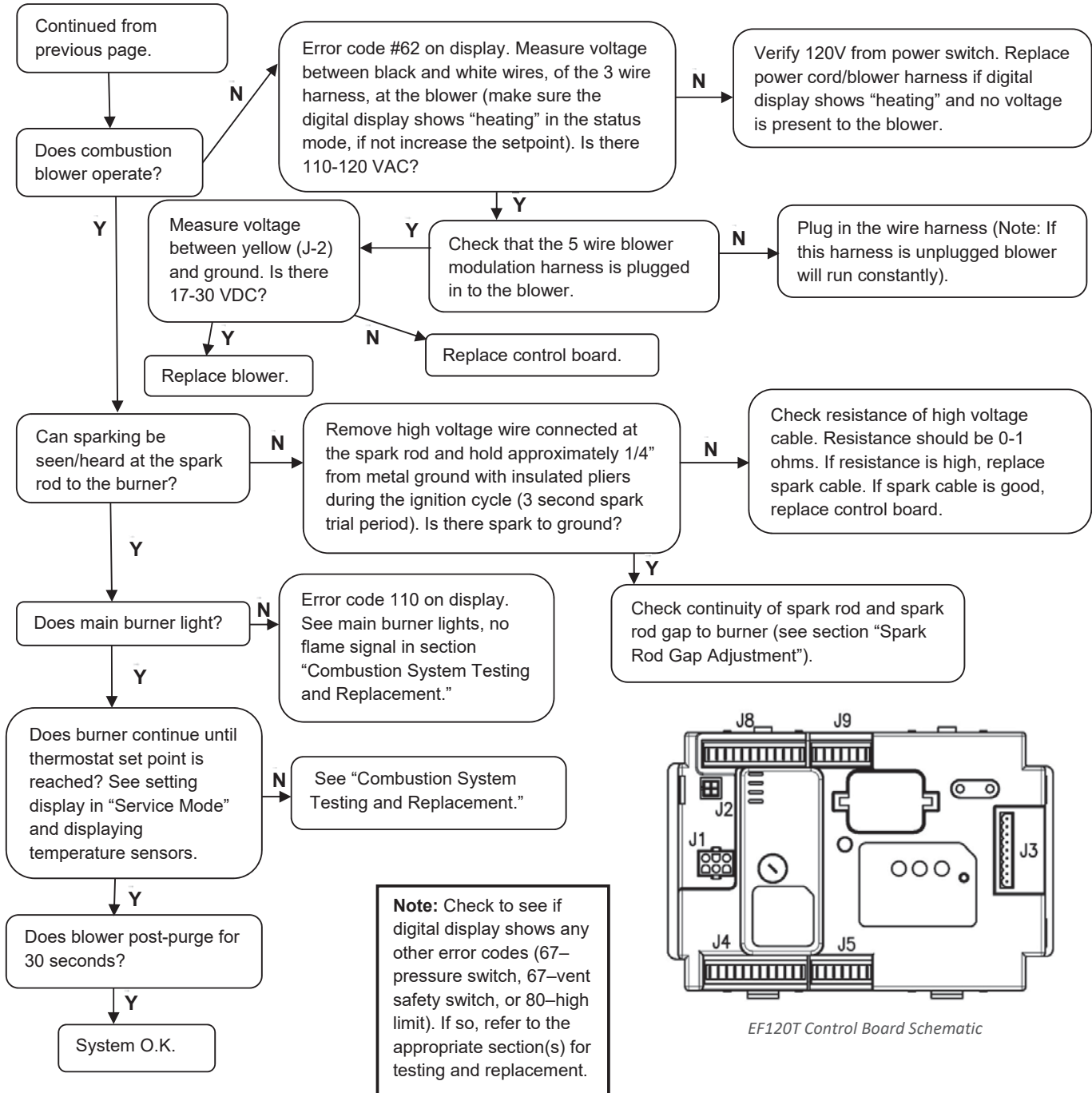
CAUTION

Use caution not to damage connectors when making voltage measurements or jumping terminals.



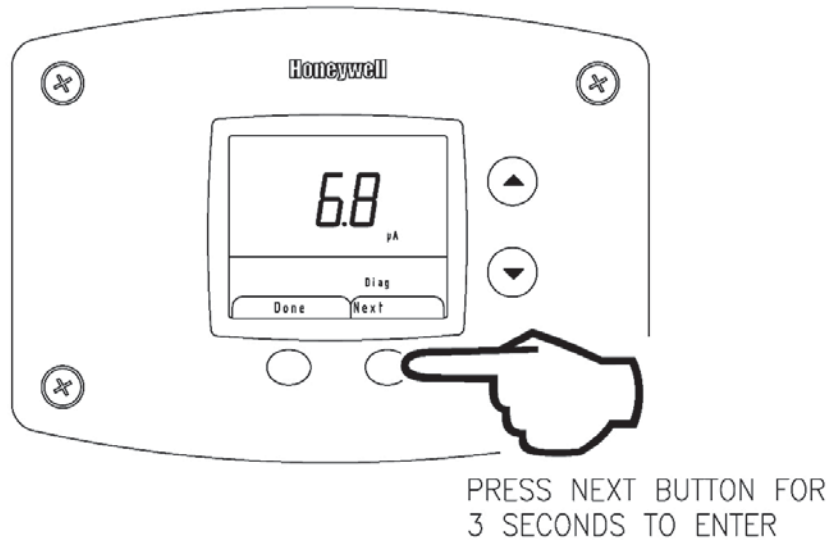
WARNING

120 volt potential exposure. Use caution making voltage checks to avoid personal injury.



Troubleshooting

Step 1: Press and hold the lower right button under “Next” in the lower right display for at least 3 seconds.

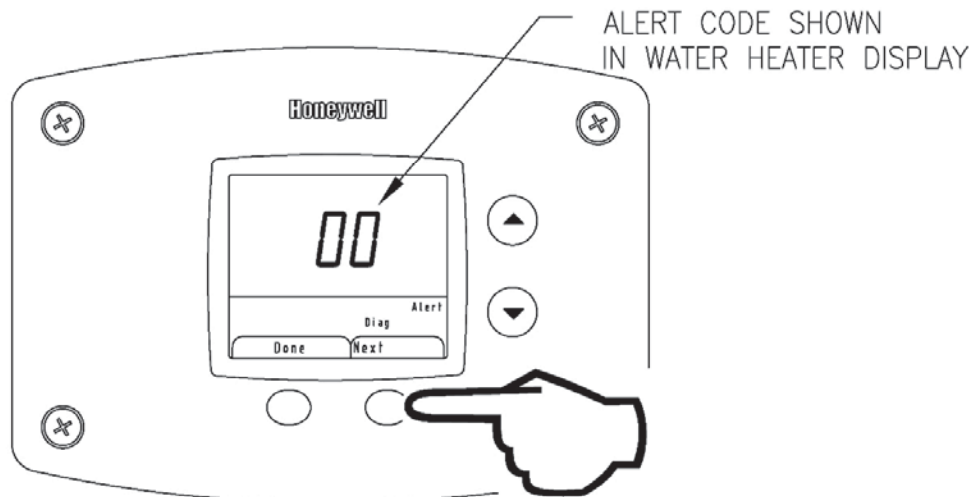


WARNING

The following procedure is for service and installation personnel only. Resetting lockout conditions without correcting the malfunction can result in a hazardous condition.

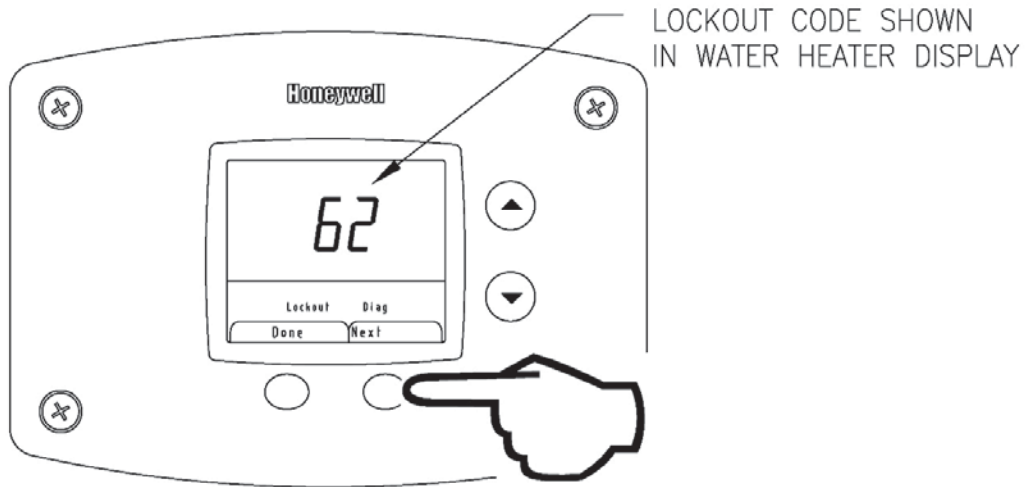
Step 2: The digital display will show the flame sense current in microamps when the burner is operating.

Step 3: Press the lower right “Next” button and the digital display will flash and show the number of any Alert codes. If alerts are present and the unit is not operating, refer to proper service procedures in this manual.

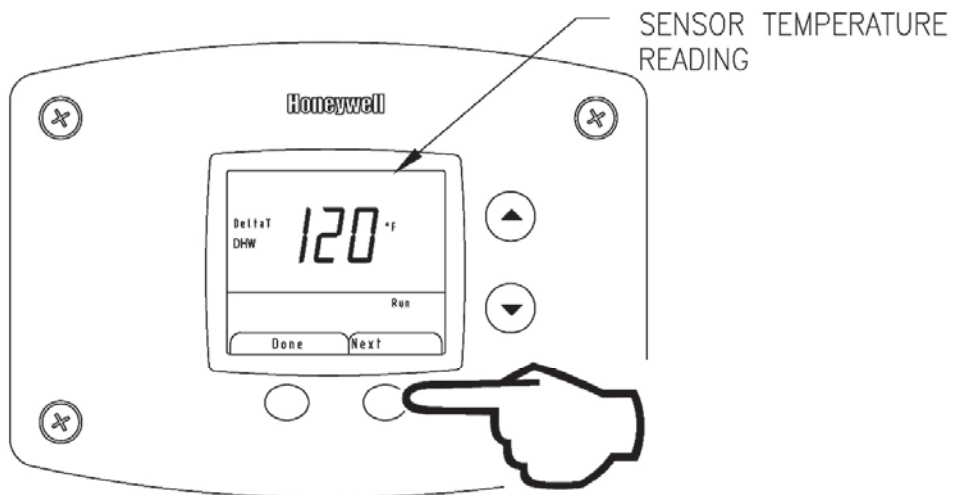


Troubleshooting

Step 4: Press lower right “Next” button and the digital display will flash and show the number of any Lockout codes.



Step 5: Press lower right “Next” button and the digital display will show the temperature sensor reading.



Step 6: Press lower right “Next” button and the digital display will show the manual firing rate adjustment. This function is not currently used. Any adjustment made has no effect.

Step 7: End of screens in Diagnostic Mode. Press “Done” button on lower left to exit Diagnostic Mode back to DHW setpoint in the User Mode.

NOTICE

The screens will stay in the Diagnostic Mode for 12.5 minutes after the last button press for viewing unless “Done” button is pressed to exit Diagnostic Mode.

Troubleshooting

DIAGNOSTIC ERROR CODES AND TROUBLESHOOTING PROCEDURES FOR EF120T400/500 MODELS WITH HONEYWELL LOW FIRE START CONTROL SYSTEM

Error Code	Definition of Code	Cause of Problem and Actions Taken to Correct
No code – blank display		• Check power supply to the water heater. • Make sure water heater is plugged in and the breaker is on. • Check if there is 120 volts power supply to the LINE connections on the control board. • If 120 volts is present, check for 24 volts output to SECONDARY terminals on the control board. • Check for loose wires, defective transformer. • Check wire harness connections from digital display to the control board.
3-48, 58-60	Internal faults	• Verify wiring to the control board with wiring diagram. • Check power supply to make sure voltage and frequency is correct. • Check for 24 volts from the transformer to the control board. • Reset control board by interrupting power or pressing the reset button on the control board.
49	Voltage too low or high	• Check the control board and digital display connections. • Check the control board power supply and make sure that frequency, voltage and VA meet the specifications. See Service Procedure X: Transformer Replacement.
53	Reverse Polarity	• Check the control board and digital display connections. • Check the control board power supply and make sure that frequency, voltage and VA capacity of the transformer meet specifications. • Check to make sure the wiring connections on the control board from terminals J4-10 and J8-2 are connected together.
62	Fan speed not proved	• Check the blower modulation wire harness connection from the blower to the control board at J2 connection. • Make sure the pin terminals make solid contact. • Measure the resistance of each wire in the wire harness from the terminal ends. • Replace wire harness if defective. • Check if there are 17-30 volts DC between the yellow and green wires on the blower 5 wire harness.
67	ILK off (Interlock off)	• Check wiring to the normally closed blocked vent pressure switch and vent limit switch (service panel near vent outlet connection). • Use a voltmeter to find out if the pressure switch or high limit switch has opened. • If so, determine the cause (blocked vent terminal, clogged condensate drain, high temperature in compartment). • If limit switches are closed, check wiring for shorts. • Measure continuity. • If limit switches and wiring check O.K., replace control board.

Troubleshooting

80	High limit (overheat condition)	• Check the wiring from the sensor to the control board. • Measure the resistance of each outside wire to the center wire (resistance chart found on page 19). • If either outside wire has a much different resistance reading, replace the sensor. • Make sure the sensor is securely held inside the well with the clip. • If the problem persists and the sensor and wiring check O.K., then replace the control board.
93	DHW/Temp sensor fault	• Check the sensor wire harness from the sensor to the control board. • Make sure there are no loose connections to the control board. • Check the resistance reading from each of the outside wires to the center (common) wire (resistance chart found on page 19). • If the ohm readings are not within 5°F, replace the sensor. • Replace the control board if the problem persists and the sensor and wire connections are not defective.
105	Flame detected out of sequence	• Check to see if flame is present inside the combustion chamber before or after the ignition cycle. • If so, check to make sure the gas valve is wired correctly. • Check for voltage at the gas valve connection. • Replace the gas valve if defective. • If no flame is visible outside of the ignition sequence/run cycle, then make sure the flame sensor is wired to the correct terminal. • Make sure the ignition cable is not crossing the flame sensor wire or ignition ground wires, and that there is no moisture on the flame sensor. • If problem persists and all other checks have been verified, replace the control board.
110	Ignition failure occurred	• Burner failed to light or stay lit after 3 retries. • Hold condition – will reattempt ignition after 15 minute waiting period. • Check gas valve wiring and gas valve operation during the ignition cycle. • If burner lights but quickly goes out, check the flame sensor wire or the flame sensor. • If the flame sensor rod is badly corroded with deposits, clean with sandpaper or replace. • Check the inlet gas supply to make sure the pressure is sufficient and does not drop after the gas valve opens. • Make sure the combustion blower is operating during the ignition and run cycle. • Check the venting system to make sure the inlet and exhaust terminals and venting system is not blocked.
122	Light-off rate proving failed	• If blower speed is not verified from the PWM (Pulse Width Modulation) signal within 5 minutes, the previously described error code 62 changes from a hold condition to this lockout code condition. • Check the harness and pin terminals for a good connection to the control board. • Replace the blower or control board if the wire harness is good.
123	Purge rate proving failed	• Check wiring and correct any potential wiring errors. • Check VFD's (Variable-speed fan drive) ability to change speeds. • Change the VFD • If the fault persists, replace the module.
137	ILK open (interlock open)	• Check if blocked vent pressure switches or vent limit switch are open. • If all switches check O.K., replace control board.

Service Procedure I:

Thermostat Circuit Testing and Replacement

IMPORTANT NOTE: This procedure assumes a cool tank.

Condition: Water heater not operating. Digital display shows error code 93 (sensor reading faulty).

Unplug or disconnect electrical power to the water heater.

Check continuity of wire harness to sensor. Resistance of harness should be close to 0 ohms. Replace wire harness if high resistance is measured (over .5 ohms). Check wires for intermittent connections, shorts, frayed insulation. Replace if necessary.

If wire harness is O.K., check sensor resistance detailed in "Appendix A: Sensor Resistance at Various Temperatures" at the end of the thermostat testing and replacement section. Replace sensor if needed.

Turn power ON to water heater. Run water heater through heating cycle and verify proper operation. Sensor temperature can be viewed when burner shuts off (see section on viewing the digital display in "Service Mode").

Condition: Water heater not operating. Digital display shows error code 80 high water temperature (over 200°F).

!WARNING!
DO NOT reset the digital display from the hard lockout state without correcting the cause of the overheating condition.

Turn power OFF. Draw water to cool tank below 120°F.

Check sensor. Sensor is held in place with a clip fastened to the well (see photo). Check sensor wire for potential damage or breaks in the wire insulation. Is the sensor fully inserted into the well?

N

If sensor clip is damaged replace clip. Replace sensor if damaged.

Continued on next page.

Y

Check sensor resistance (see Appendix A: Sensor Resistance, page 19).

WARNING

120 volt potential exposure. Use caution making voltage checks to avoid personal injury.

CAUTION

Use caution to not damage connectors when making voltage measurements or jumping terminals.

Checking continuity of sensor across the two black wires (disconnected from control board).



Sensor clip shown properly installed.

The sensor is located next to the top outlet location.

Service Procedure I:

Thermostat Circuit Testing and Replacement

Condition: Water heater not operating. Digital display shows error code 80 high water temperature (over 200°F) (continued from previous page).

Once cause of overheating condition has been diagnosed and corrected, the control board may be reset.

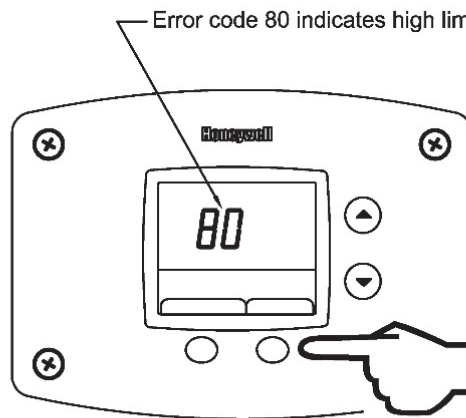
- Reconnect and switch on power to the water heater.
- Press button under "Reset" and hold for 3 seconds.
- Set thermostat to the desired setting.
- Water heater will start.
- Monitor temperatures for one complete heating cycle making sure the maximum tank temperature remains below 200°F.



WARNING

DO NOT operate water heater without verifying that the overheating condition has been corrected.

This water heater is equipped with a manual reset type gas shutoff device designed to shut off the gas to the burners if excessive water temperature occurs. To reset the control, press the lower right button under "RESET" in the display for 3 seconds.



Step 1: Press for 3 seconds to reset control.

Service Procedure I:

Thermostat Circuit Testing and Replacement

APPENDIX-A

Sensor Resistance at Various Temperatures

Be careful when making voltage measurements or jumping terminals not to damage or deform connectors or connector pins.

Draw water from the T&P valve. Compare temperature with temperature ohms chart below.

Example: If the temperature is 84°F, then the resistance through the sensor would be 8449 (see shaded area).

Note: Sensor resistance increases as the temperature falls.

In Degrees F										
°F	0	1	2	3	4	5	6	7	8	9
40	26109	25400	24712	24045	23399	22771	22163	21573	21000	20445
50	19906	19383	18876	18383	17905	17440	16990	16553	16128	15715
60	15314	14925	14548	14180	13823	13477	13140	12812	12494	12185
70	11884	11592	11308	11032	10763	10502	10248	10000	9760	9526
80	9299	9078	8862	8653	8449	8250	8057	7869	7685	7507
90	7333	7165	7000	6839	6683	6531	6383	6238	6098	5961
100	5827	5697	5570	5446	5326	5208	5094	4982	4873	4767
110	4663	4562	4464	4368	4274	4183	4094	4006	3922	3839
120	3758	3679	3602	3527	3453	3382	3312	3244	3177	3112
130	3048	2986	2925	2866	2808	2752	2697	2643	2590	2538
140	2488	2439	2391	2344	2298	2253	2209	2166	2124	2083
150	2043	2004	1966	1928	1891	1856	1820	1786	1753	1720
160	1688	1656	1625	1595	1566	1537	1509	1481	1454	1427
170	1402	1376	1351	1327	1303	1280	1257	1235	1213	1191
180	1170	1150	1129	1110	1090	1071	1053	1035	1017	999
190	982	965	949	933	917	901	886	871	857	842
200	828	814	801	788	775	762	749	737	725	713

In Degrees C										
°C	0	1	2	3	4	5	6	7	8	9
0	32648	31026	29495	28049	26682	25389	24166	23010	21915	20879
10	19898	18968	18088	17253	16461	15710	14998	14322	13680	13071
20	12492	11942	11419	10922	10450	10000	9572	9165	8778	8409
30	8057	7722	7403	7099	6808	6532	6268	6016	5775	5546
40	5327	5117	4917	4726	4543	4368	4201	4042	3889	3742
50	3602	3468	3340	3217	3099	2986	2878	2774	2675	2579
60	2488	2400	2316	2235	2157	2083	2011	1942	1876	1813
70	1752	1693	1637	1582	1530	1480	1432	1385	1340	1297
80	1256	1216	1177	1140	1105	1070	1037	1005	974	944
90	916	888	861	835	810	786	763	741	719	698

Service Procedure I:

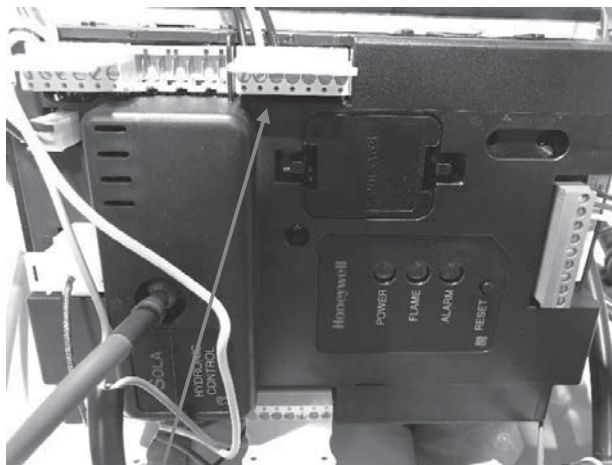
Thermostat Circuit Testing and Replacement

Thermostat Sensor (Thermistor) Replacement Procedure

- Step 1.** Position main power switch to “OFF.”
- Step 2.** Disconnect (unplug) water heater from 120 volt power source.
- Step 3.** Un-latch and remove top surround cover from top of heater.
- Step 4.** Fold back insulation by top outlet location to expose temperature sensor.
- Step 5.** Disconnect temperature sensor from control board (see photos below).
- Step 6.** Unclip sensor from well and pull sensor to remove, **DO NOT** remove well.
- Step 7.** Install new sensor completely into well and reinstall sensor clip.
- Step 8.** Connect temperature sensor to control.
- Step 9.** Fold insulation back into place. Be sure there are **NO** wires in contact with burner.
- Step 10.** Restore 120 volt power supply and water supply to water heater, check and repair any leaks found. Confirm proper operation following the lighting instructions on the lighting instruction label, or the lighting instruction located in the Installation and Operating Manual.
- Step 11.** Replace surround cover on top of heater.

WARNING

120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.



Disconnect sensor harness
from control board

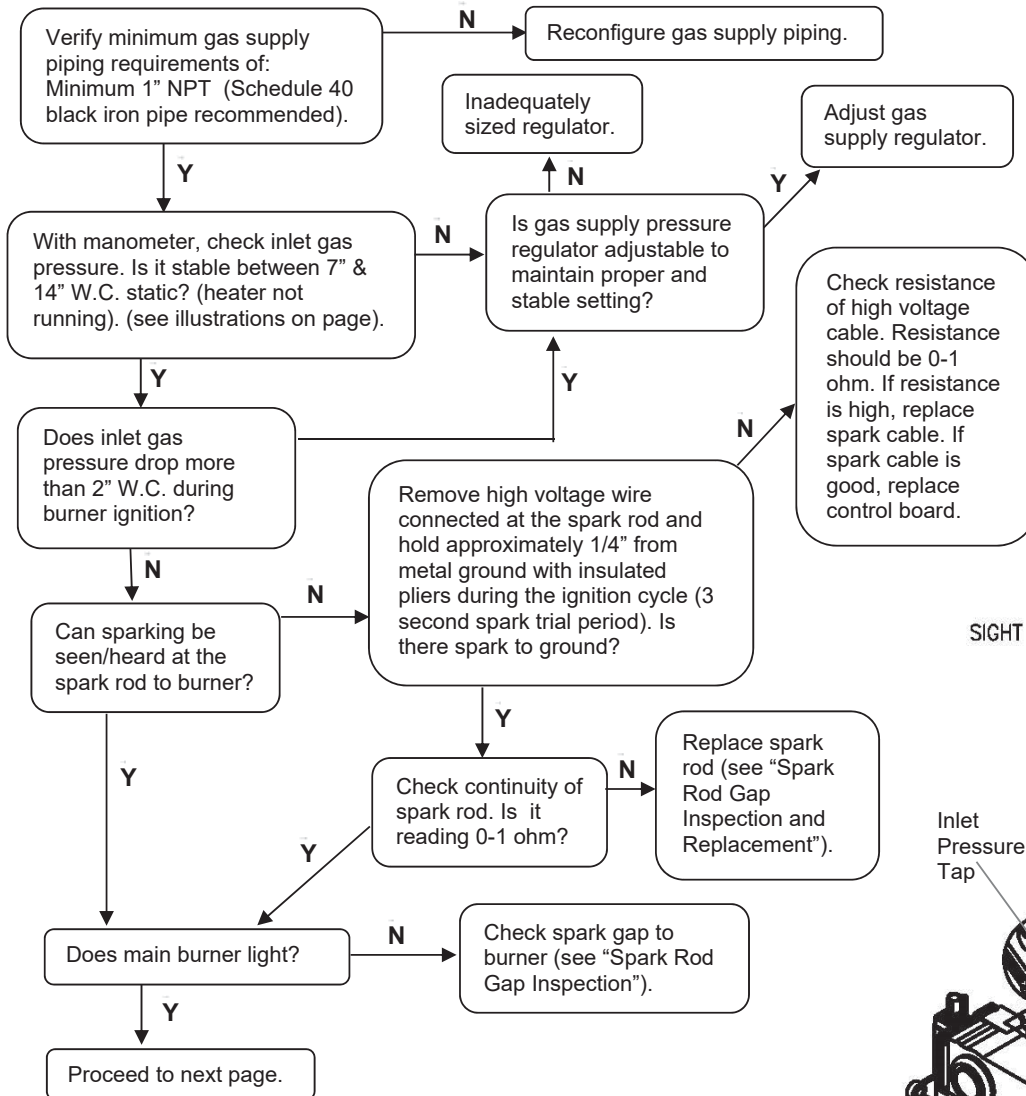


Sensor clip shown
properly installed

Service Procedure II: Combustion System Testing and Replacement

Observe burner operation through the sight glass located on the combustion insert mounting flange. Normal burner operation should ignite smoothly, without evidence of coughing or huffing upon ignition. The burner flame should be a blue flame near the burner surface in a uniform flame pattern. Occasional yellow or white streaks are normal.

Note: On this high input model that uses metal fiber mesh burner a red glow from the burner surface is normal.

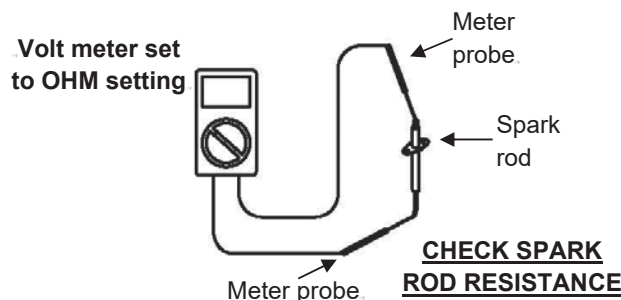
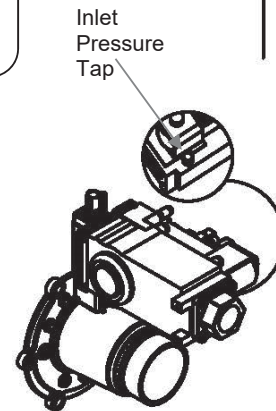
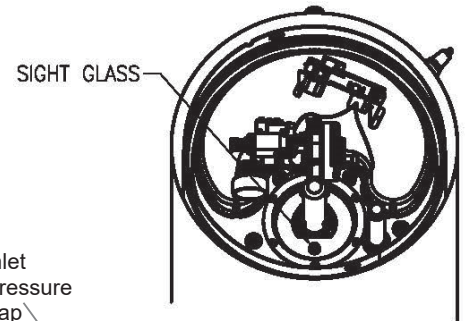


WARNING

Removing screw from inlet gas pressure tap will immediately allow gas to flow from pressure tap.

WARNING

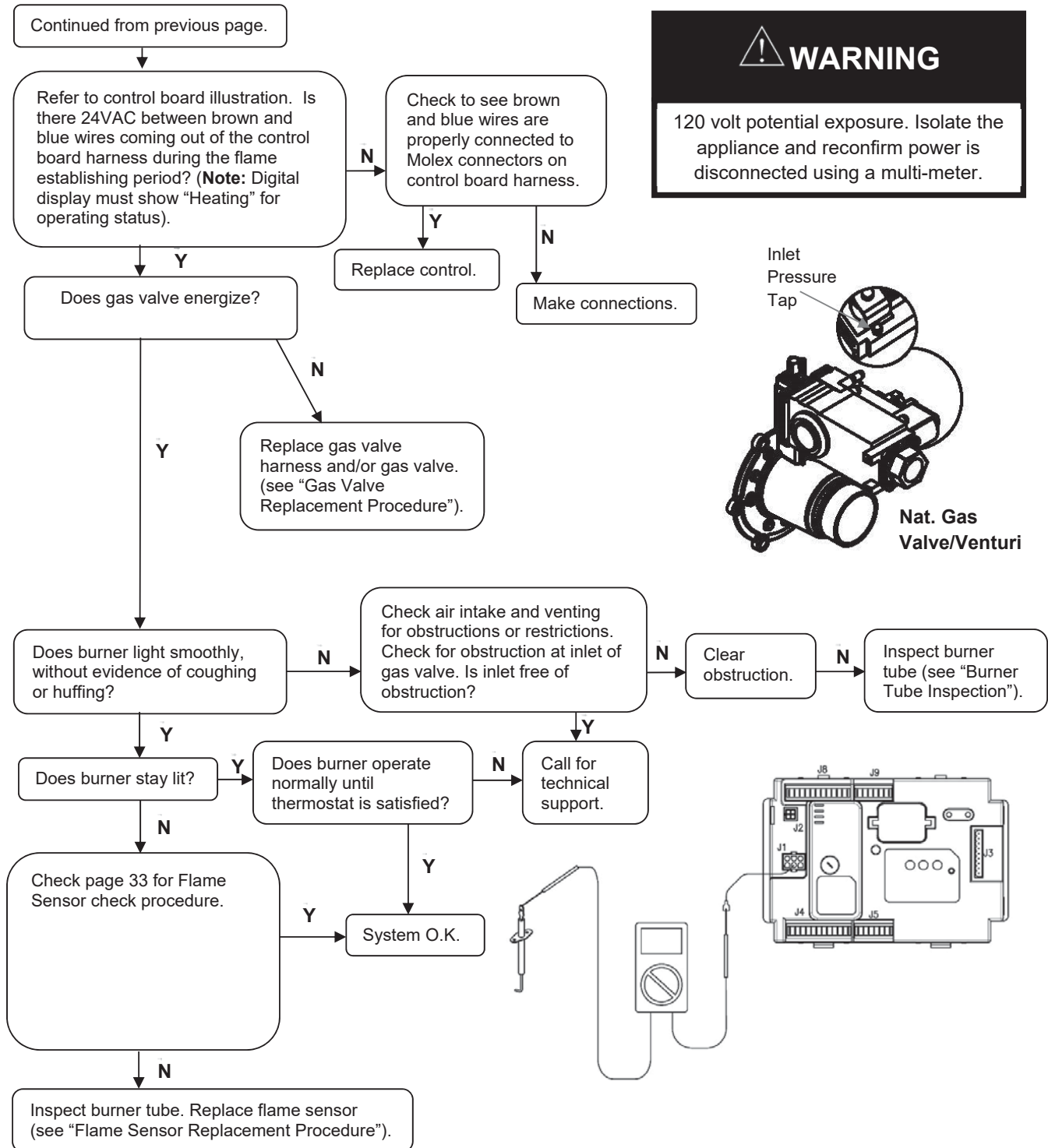
120 volt potential exposure. Use caution making voltage checks to avoid personal injury.



Service Procedure II: Combustion System Testing and Replacement

Observe burner operation through the sight glass located on the combustion insert mounting flange. Normal burner operation should ignite smoothly, without evidence of coughing or huffing upon ignition. The burner flame should be a blue flame near the burner surface in a uniform flame pattern. Occasional yellow or white streaks are normal.

Note: On this high input model that uses metal fiber mesh burner a red glow from the burner surface is normal.



Service Procedure II: Combustion System Testing and Replacement

WARNING

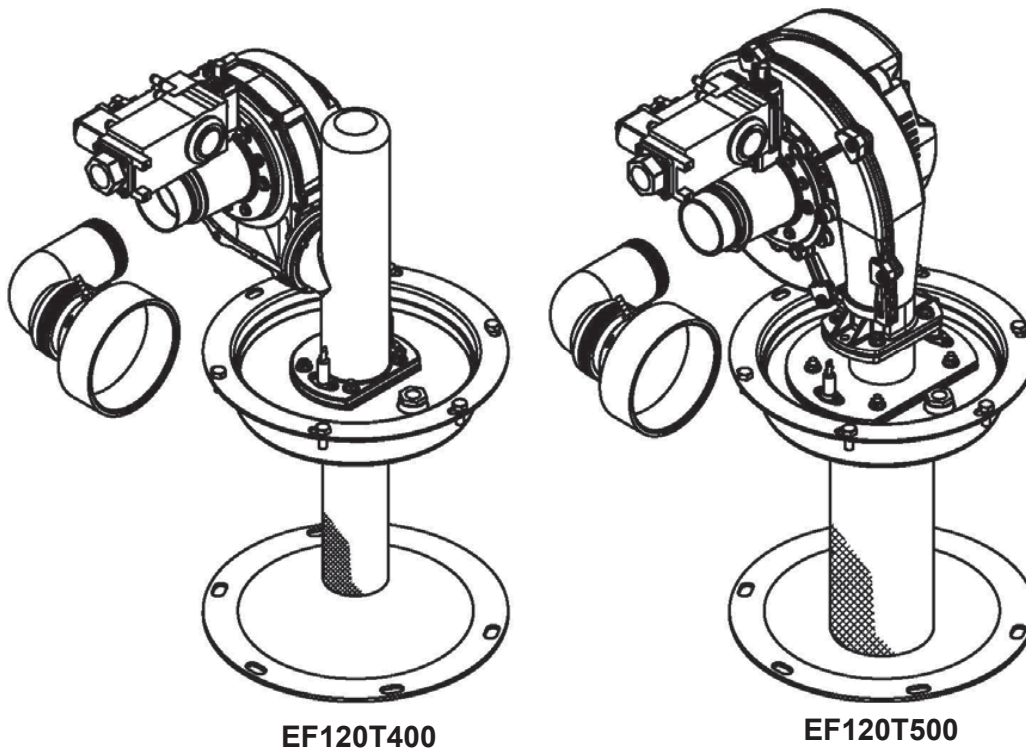
Heater components may be **HOT** when performing the following steps in this procedure. Take necessary precaution to prevent personal injury.

Combustion System Removal Procedure

- Step 1.** Position main power switch to "OFF".
- Step 2.** Disconnect (unplug) water heater from 120 volt power source.
- Step 3.** Turn off gas supply to water heater.
- Step 4.** Un-latch and remove surround cover from top of heater.
- Step 5.** From the gas valve, disconnect the gas connection, intake venting, silicone tubing, and wire harness.
- Step 6.** Disconnect flame sensor and blower wire harnesses. Disconnect high voltage cable from spark rod connection.
- Step 7.** Remove the 5 bolts (1/2" socket) holding the burner mounting insert in place.
- Step 8.** Carefully remove combustion assembly with gasket from water heater.
- Step 9.** See next page for combustion system installation procedure.

WARNING

120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.



Service Procedure II: Combustion System Testing and Replacement

Combustion System Replacement Procedure

Step 1. Fully inspect burner mounting insert gasket for the following:

- Tears
- Missing material
- Cracks
- Dirt or debris
- Other imperfections that would inhibit proper seal

If gasket is NOT affected by any of the above, gasket replacement is not required.

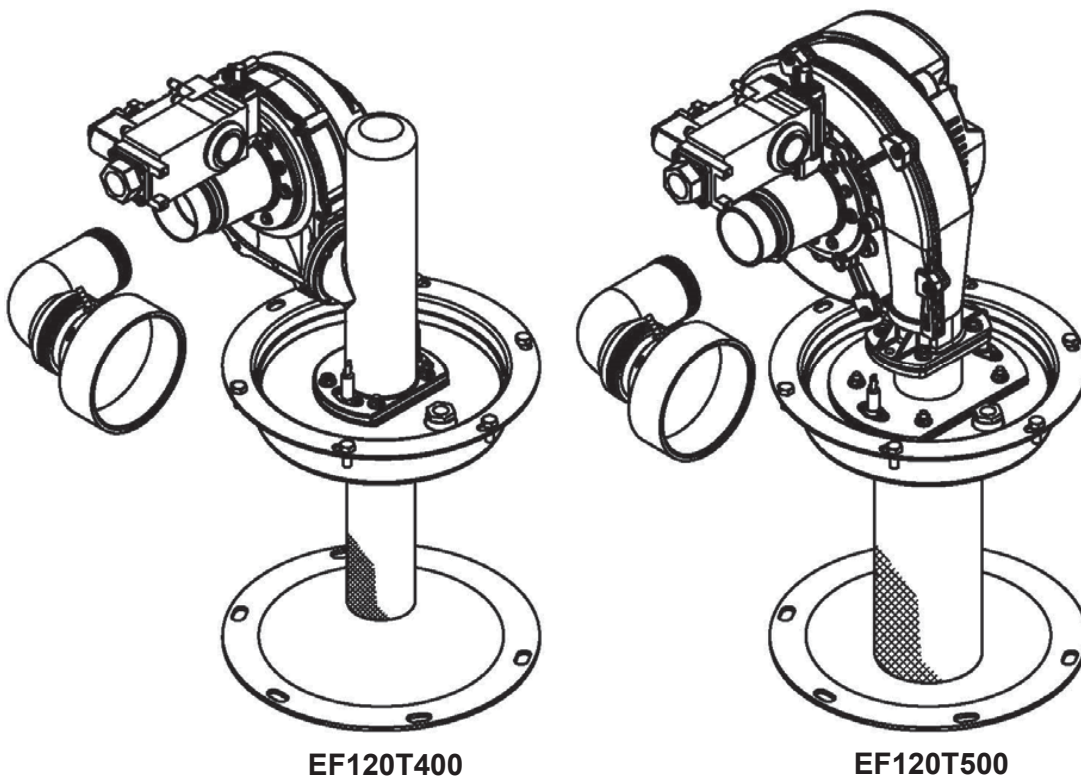
Step 2. Install combustion assembly using new gasket or fully inspected gasket from Step 1. Secure combustion assembly at the burner mounting insert using screws from Step 6 on previous page. Tighten bolts evenly.

Step 3. Reconnect high voltage cable to spark rod, flame sensor, blower, and gas valve.

Step 4. Reconnect intake venting, gas supply, and silicone tubing to gas valve. Turn on gas supply to heater and check for gas leaks. Repair any gas leaks found.

Step 5. Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label, or the lighting instruction located in the Installation and Operating Manual.

Step 6. Replace surround cover on top of water heater.



Service Procedure III:

Burner Tube Inspection and Replacement

WARNING

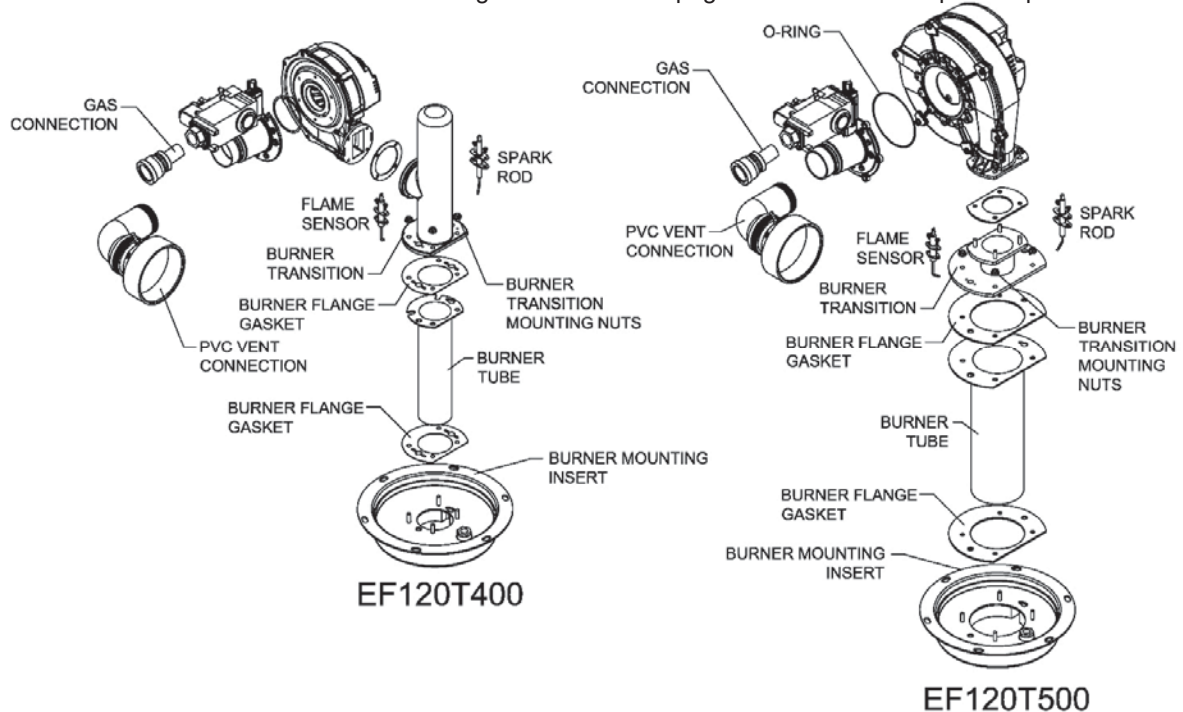
Heater components may be **HOT** when performing the following steps in this procedure. Take necessary precaution to prevent personal injury.

Burner Tube Removal Procedure

- Step 1.** Position main power switch to "OFF".
- Step 2.** Disconnect (unplug) water heater from 120 volt power source.
- Step 3.** Turn off gas supply to water heater.
- Step 4.** Un-latch & remove surround cover from top of heater.
- Step 5.** From the gas valve, disconnect the gas connection, intake venting, wire harness, and silicone tubing.
- Step 6.** Disconnect wire harness from blower assembly.
- Step 7.** Remove the two screws each holding the spark rod and flame sensor in place (long reach magnetic Phillips screw driver). Carefully remove spark rod and flame sensor from combustion assembly.
- Step 8.** Remove the 4 nuts (7/16" wrench) holding the burner transition in place. Lift the blower/gas valve transition assembly from burner mounting insert, remove gasket and set aside.
- Step 9.** Remove burner tube from burner mounting insert. See next page for burner tube inspection procedure.

WARNING

120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.



Service Procedure III:

Burner Tube Inspection and Replacement



Heater components may be **HOT** when performing the following steps in this procedure. Take necessary precaution to prevent personal injury.

Burner Tube Inspection

- Step 1.** Inspect burner tube as follows (metal fiber mesh burner).
- Outer fiber mesh should be uniform with no tears or deterioration.
 - Gently squeeze burner tube, Burner tube should feel firm without any soft areas around the sides or at the bottom.
 - Visually inspect inside burner tube, burner tube should be intact with no areas of deterioration. Ports should be free of any debris.
- Step 2.** If burner tube is affected by any of the above, replacement is required. Refer to burner tube replacement procedure below.

Burner Tube Replacement Procedure

Note: Provide the model and serial number for the correct replacement burner.

- Step 1.** Fully inspect burner flange gaskets, igniter and flame sensor gaskets for the following:
- Tears
 - Missing material
 - Cracks
 - Dirt or debris
 - Other imperfections that would inhibit proper seal
- If gaskets are **NOT** affected by any of the above, gasket replacement is not required.
- Step 2.** Install burner tube with gaskets into burner mounting insert. Be sure gasket surfaces are free of debris.
- Step 3.** Reconnect the blower/gas valve/transition assembly to burner mounting insert. Secure using nuts from Step 8 on previous page.
- Step 4.** Carefully reinstall flame sensor with gasket and spark rod with gasket and secure with screws from Step 7 on previous page. Reconnect wire harnesses to sensor and igniter.
- Step 5.** Reconnect wire harnesses to blower motor and to gas valve.
- Step 6.** Reconnect intake venting, gas supply, and silicone tubing to gas valve. Turn on gas to heater and check for gas leaks; repair any gas leaks found.
- Step 7.** Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label, or the lighting instruction located in the Installation and Operating Manual.
- Step 8.** Replace surround cover on top of water heater.

Service Procedure IV:

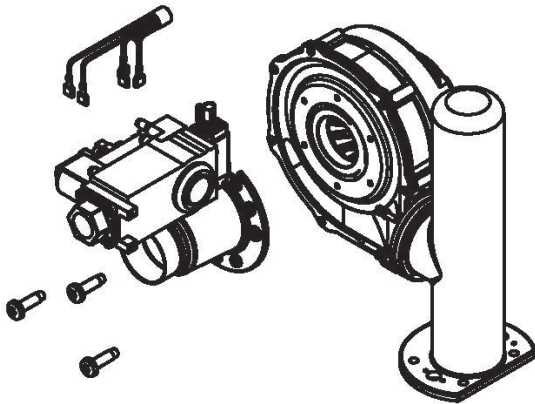
Gas Valve Replacement

Gas Valve Replacement Procedure

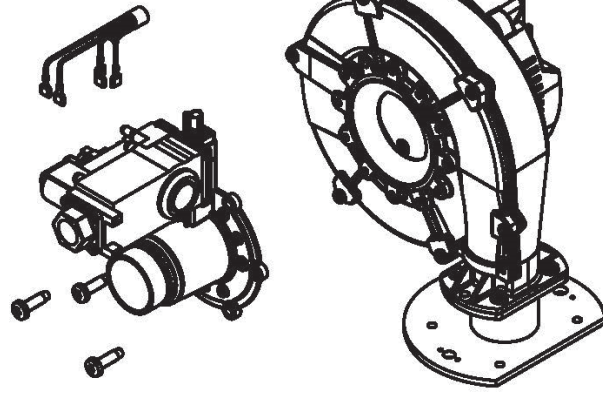
- Step 1.** Position main power switch to "OFF".
- Step 2.** Disconnect (unplug) water heater from 120 volt power source.
- Step 3.** Turn off gas supply to water heater.
- Step 4.** Un-latch & remove surround cover from top of heater.
- Step 5.** From the gas valve, disconnect the gas connection, PVC venting, wire harness, and silicone tubing.
- Step 6.** Remove the 3 gas valve mounting screws (T40 Torx bit) located as shown below on the venturi mounting flange and remove gas valve from water heater.
- Step 7.** Remove any residual gasket material from blower and venturi mounting flange.
- Step 8.** Install new gas valve with new gasket provided. Secure gas valve in place using screws from Step 6.
- Step 9.** Reconnect intake venting, gas supply, silicone tubing, and wire harness to gas valve. Turn on gas supply to heater and check for gas leaks, repair any gas leaks found.
- Step 10.** Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instruction located in the Installation and Operating Manual.
- Step 11.** Replace surround cover on top of water heater.

WARNING

120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

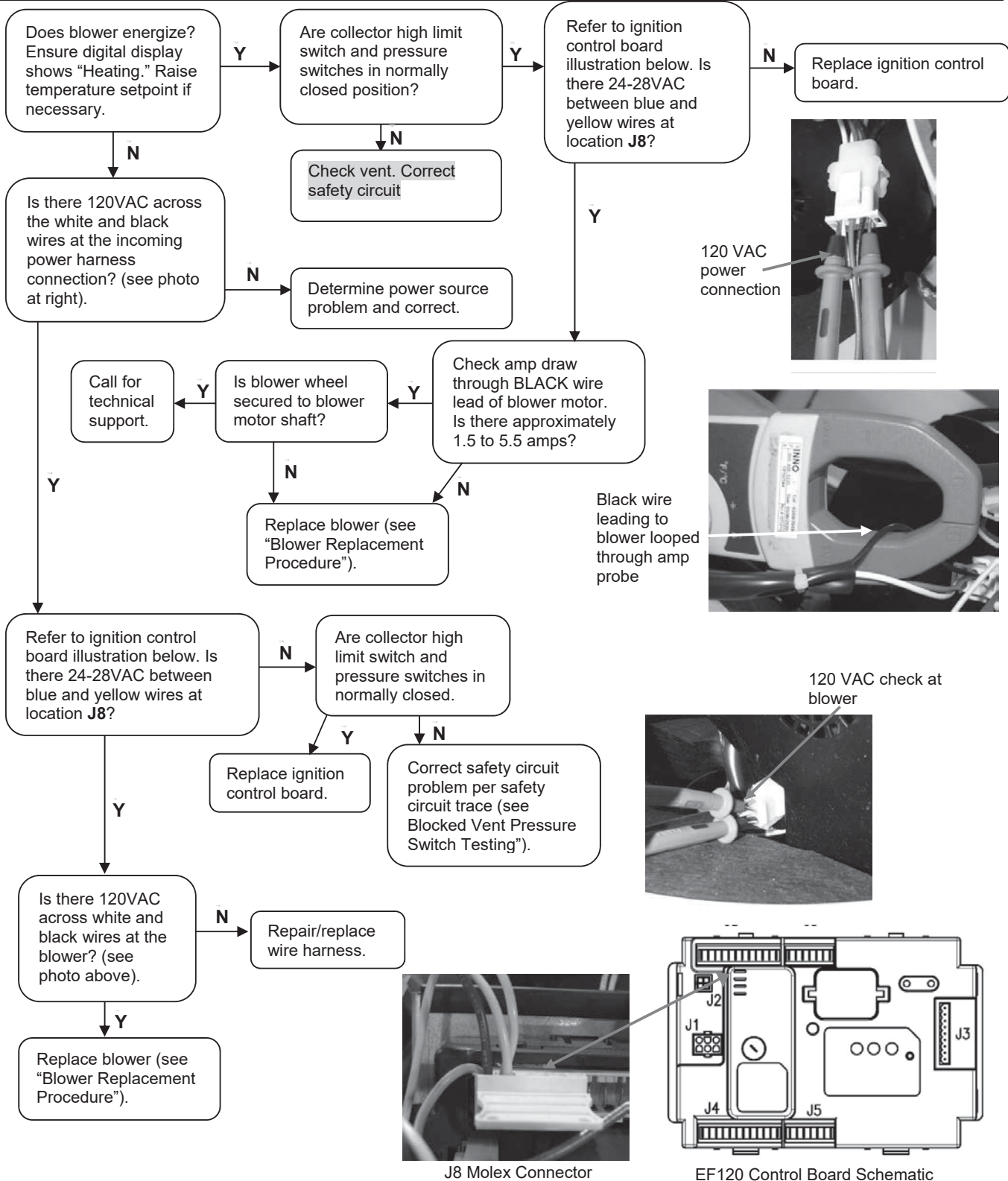


EF120T400 Gas Valve/Venturi



EF120T500 Gas Valve/Venturi

Service Procedure V: Blower Testing and Replacement



Service Procedure V:

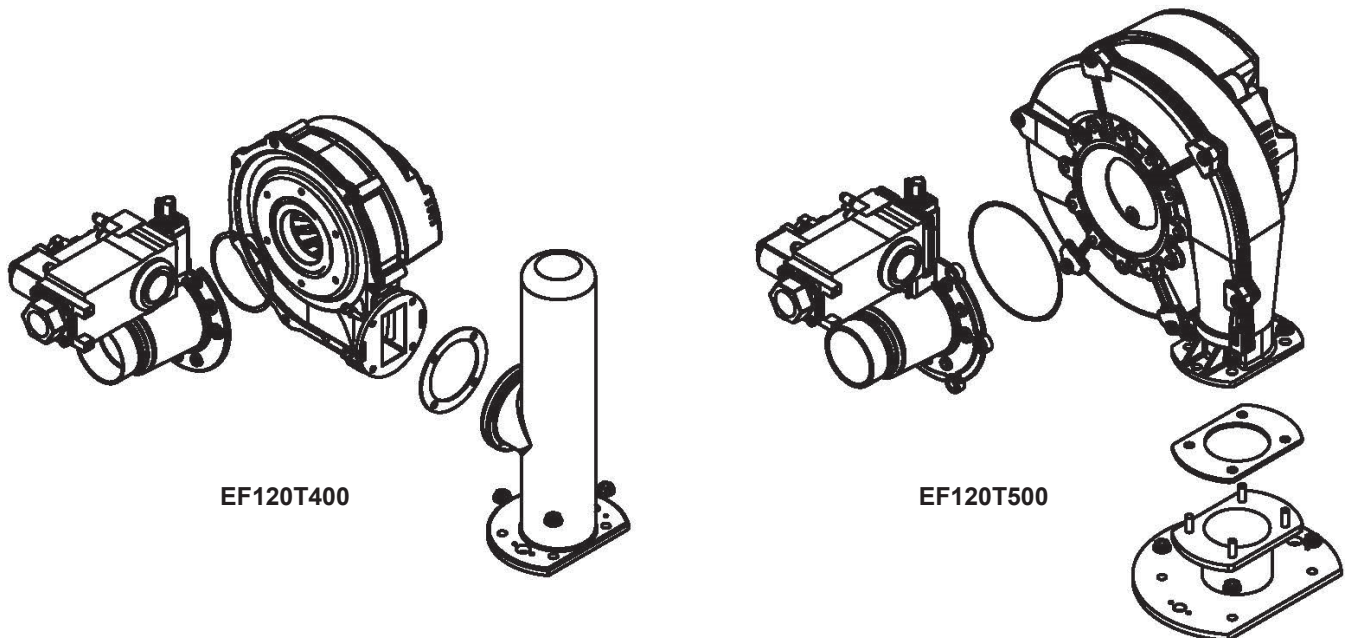
Blower Testing and Replacement

Blower Replacement Procedure

WARNING

120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

- Step 1.** Position main power switch to "OFF".
- Step 2.** Disconnect (unplug) water heater from 120 volt power source.
- Step 3.** Turn off gas supply to water heater.
- Step 4.** Un-latch & remove surround cover from top of heater.
- Step 5.** Disconnect the 2 wire harnesses from blower.
- Step 6.** Disconnect intake vent and gas supply from gas valve assembly.
- Step 7.** Remove the 3 gas valve mounting screws (T40 Torx bit) located on the venturi mounting flange.
- Step 8.** Remove the 4 blower flange mounting screws (5/32" allen wrench) and remove blower from transition flange.
- Step 9.** Remove any residual gasket material from venturi mounting flange and transition flange.
- Step 10.** Install new blower with new gasket provided. Secure blower in place using screws from Step 8.
- Step 11.** Reconnect gas valve assembly to blower with new gasket provided. Secure gas valve in place using screws from Step 7.
- Step 12.** Reconnect intake vent and gas line to gas valve assembly and check for gas leaks. Repair any leaks found.
- Step 13.** Reconnect the 2 wire harnesses to blower assembly, restore 120 volt power supply, and gas supply to water heater. Confirm proper operation following the lighting instructions on the lighting instruction label, or the lighting instructions located in the Installation and Operating Manual.
- Step 14.** Replace surround cover on top of water heater.

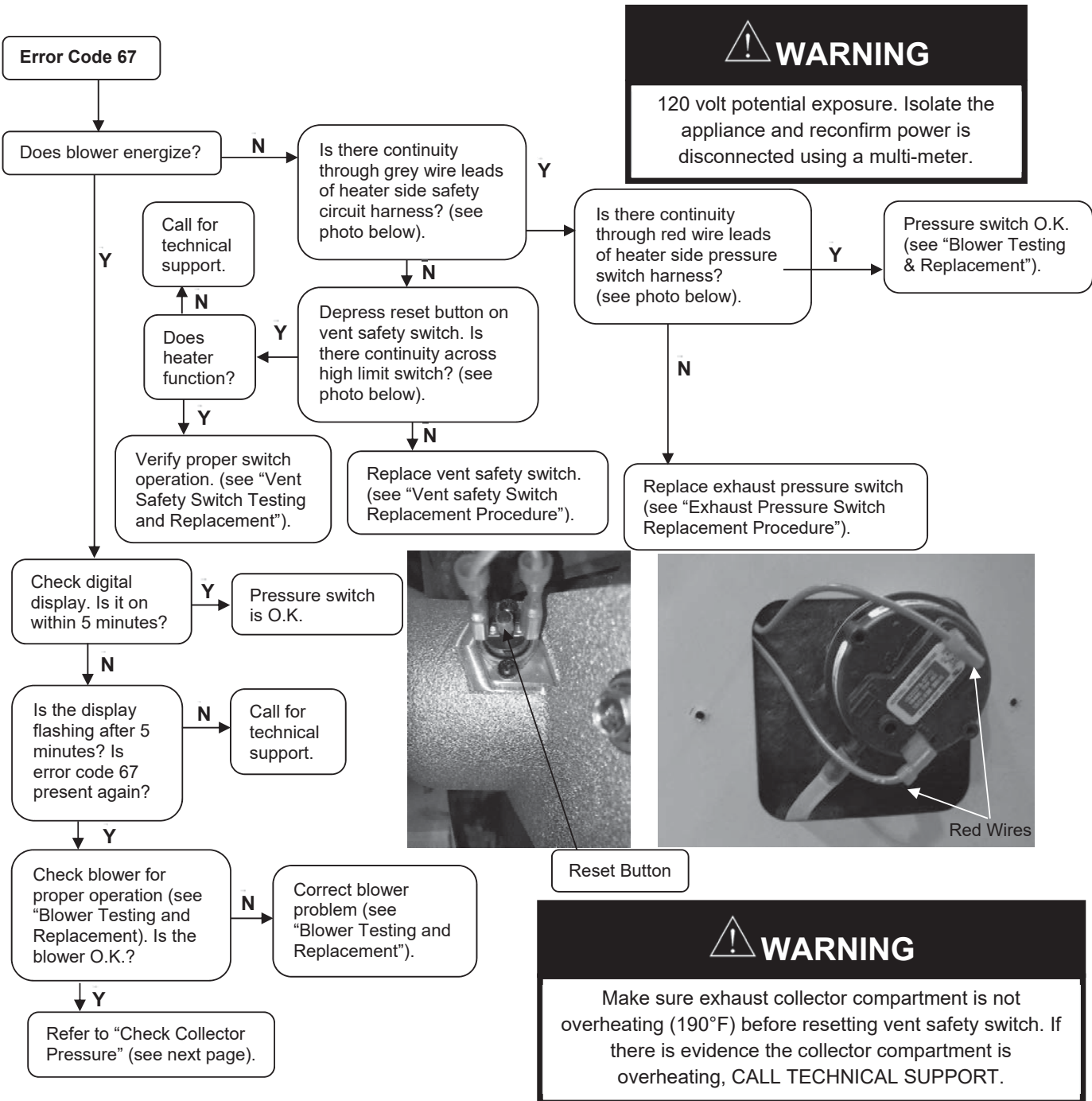


Service Procedure VI:

Blocked Vent Pressure Switch Testing and Replacement

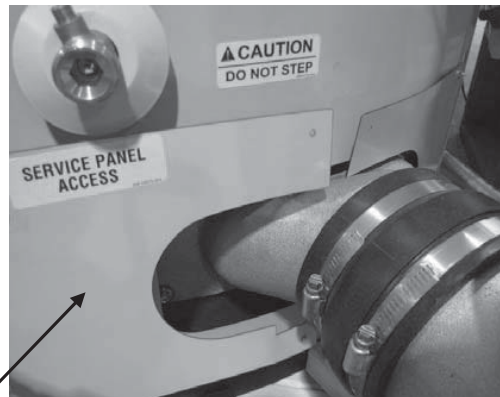
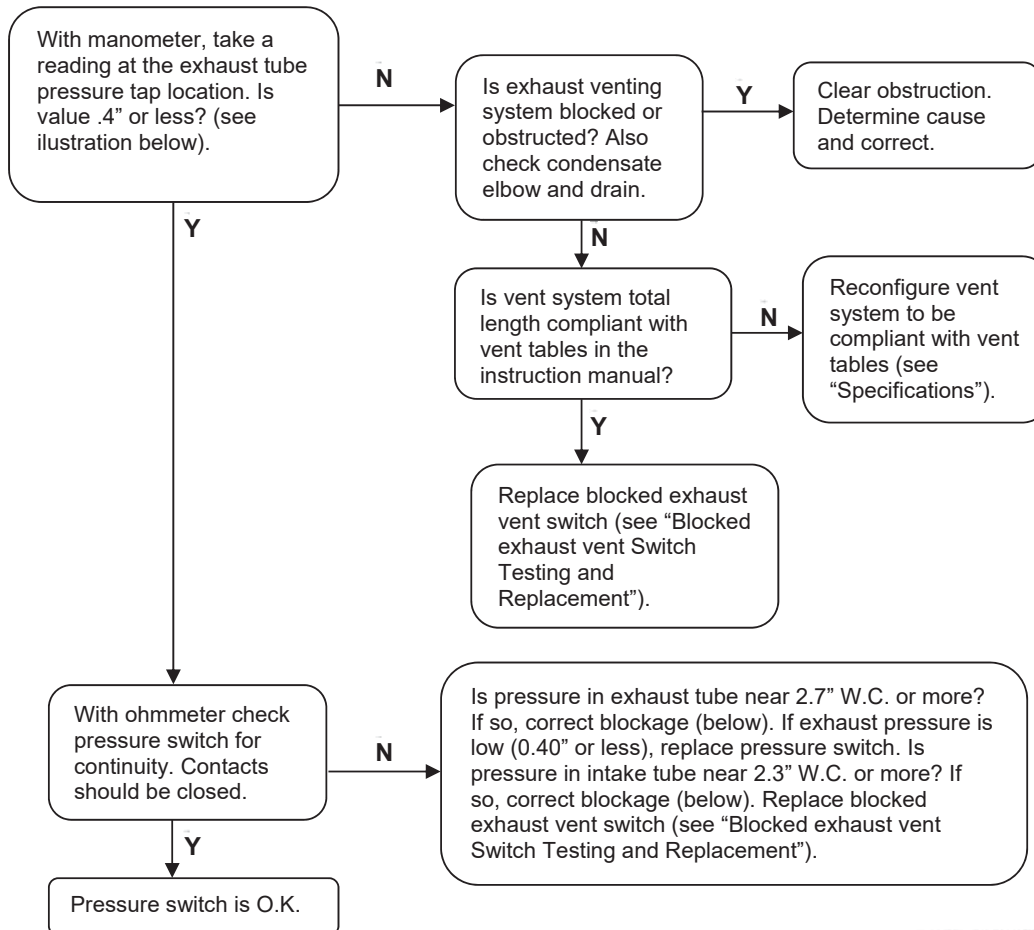
Sequence of Operation:

The blocked vent pressure switch monitors the pressure in the exhaust tube. The switch contacts are normally closed and will not open unless there is a blockage in the exhaust venting or terminal (snow, ice, debris). If the blocked vent pressure switch contacts open after the thermostat initiates the blower, the blower will remain on for up to 5 minutes waiting for the contacts to close. If the contacts remain open, the blower will stop and error code 67 will display.

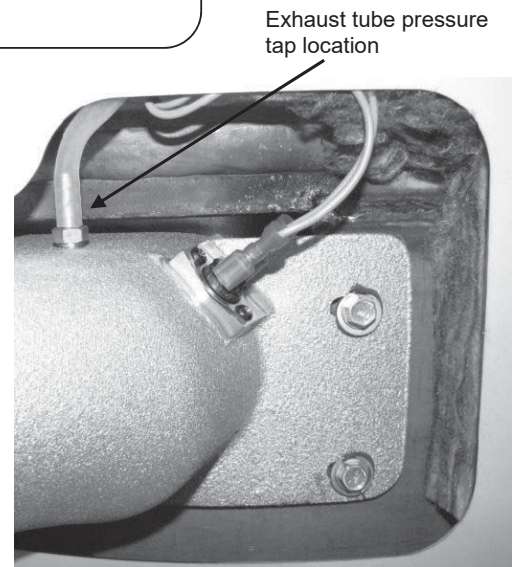


Service Procedure VI: Blocked Vent Pressure Switch Testing and Replacement

Check Exhaust Tube Pressure



Exhaust tube pressure tap located behind service panel access doors at bottom of heater

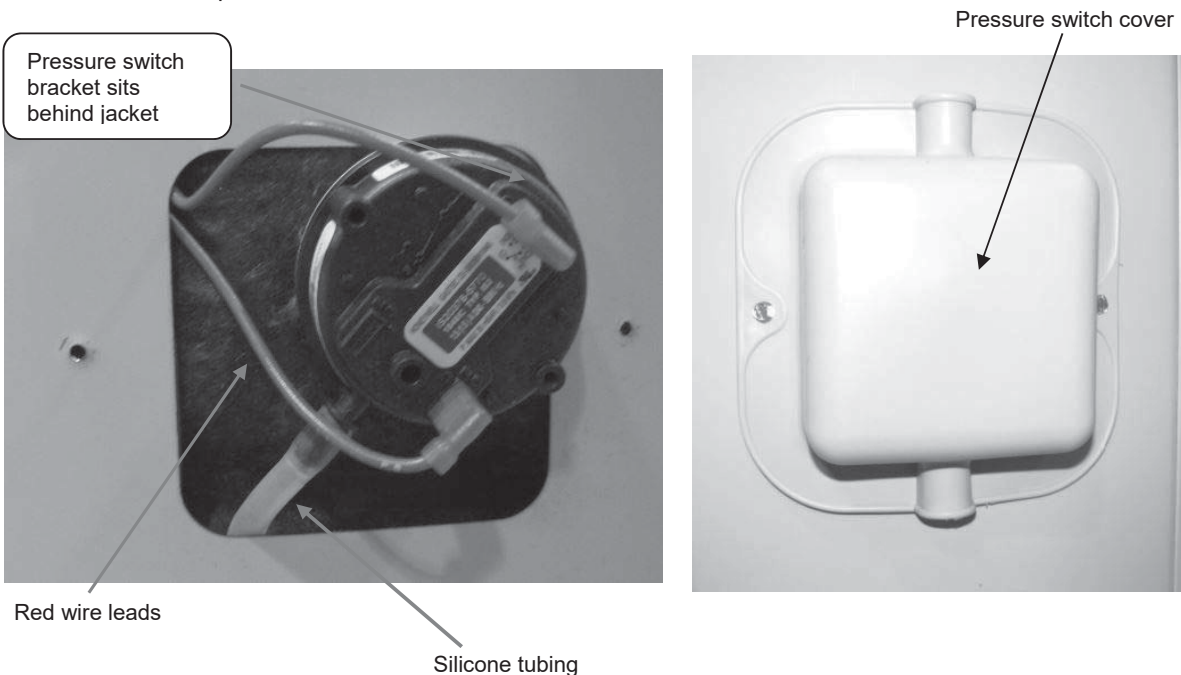


Service Procedure VI:

Blocked Vent Pressure Switch Testing and Replacement

Exhaust Pressure Switch Replacement Procedure

- Step 1.** Position main power switch to "OFF" position.
- Step 2.** Loosen adhesive backed rubber escutcheon from service panel access cover and slide escutcheon back along exhaust pipe to allow for removal of cover.
- Step 3.** Remove screws from service panel access cover (1/4" nut driver) and remove cover from heater (see photos below).
- Step 4.** Disconnect silicone tubing and wire leads from pressure switch (see photos below).
- Step 5.** Remove pressure switch mounting screws (5/16" nut driver) and remove pressure switch (common screwdriver).
- Step 6.** Assemble new pressure switch to heater using screws from Step 5.
- Step 7.** Reconnect red wire leads. **Note:** Wire leads are interchangeable with either terminal.
- Step 8.** Reconnect silicone tubing to pressure switch as follows:
a) Exhaust pipe tubing connects to single tap located on switch
- Step 9.** Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label, or the lighting instructions located in the Installation and Operating Manual.
- Step 10.** Reinstall service panel access cover and rubber escutcheon.



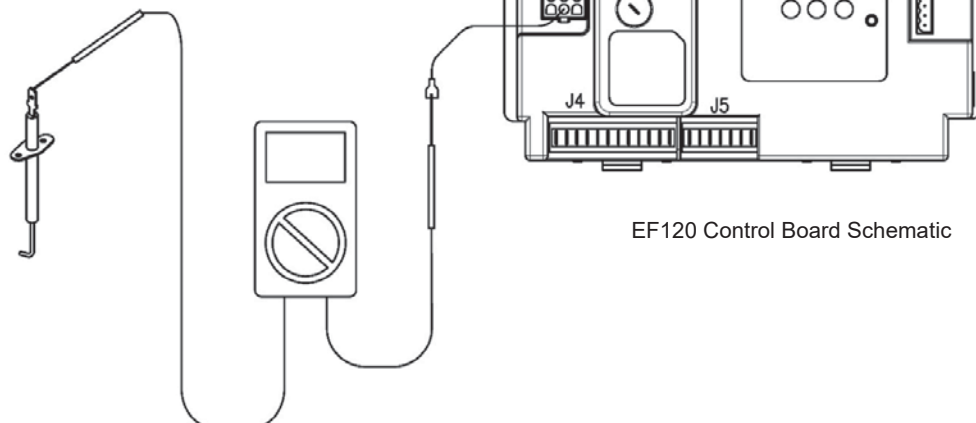
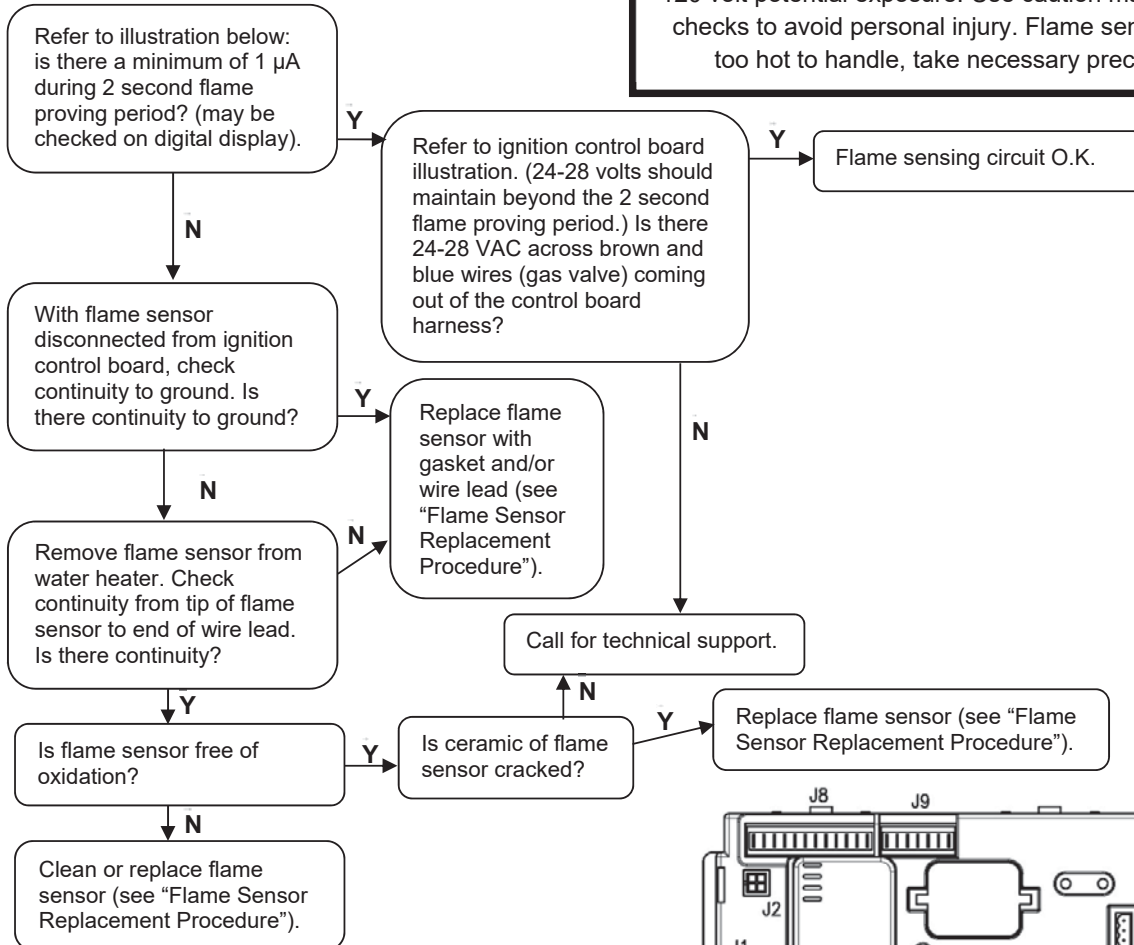
Service Procedure VII: Flame Sensor Testing and Replacement

Flame Sensor Testing Procedure



WARNING

120 volt potential exposure. Use caution making voltage checks to avoid personal injury. Flame sensor may be too hot to handle, take necessary precautions.



EF120 Control Board Schematic

Service Procedure VII:

Flame Sensor Testing and Replacement

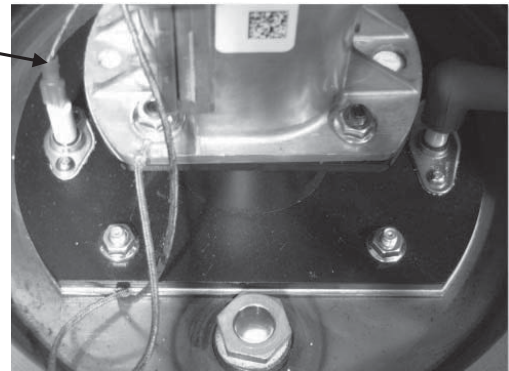
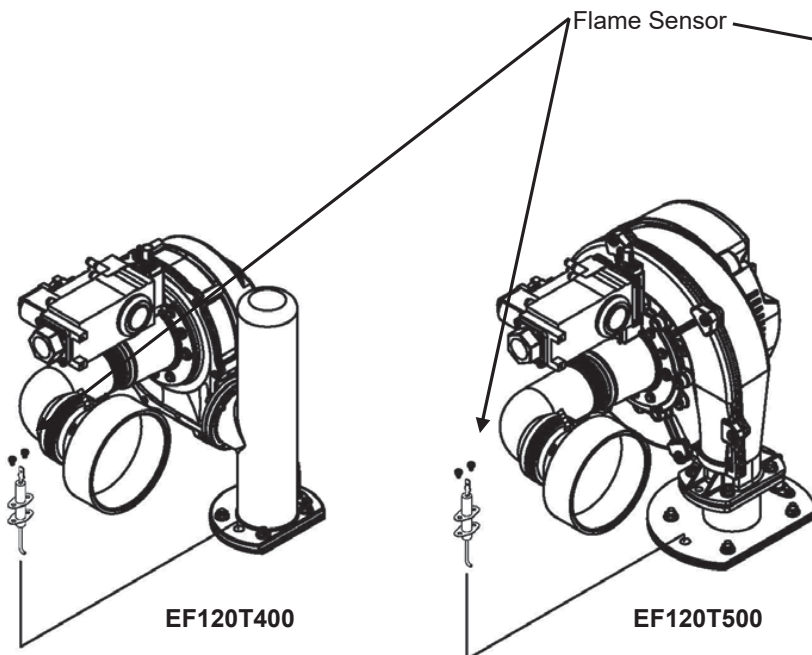
Flame Sensor Replacement Procedure

- Step 1.** Position main power switch to "OFF".
- Step 2.** Disconnect (unplug) water heater from 120 volt power source.
- Step 3.** Un-latch & remove surround cover from top of heater.
- Step 4.** Fold back insulation in front of combustion assembly to expose flame sensor (see photo below).
- Step 5.** Disconnect wire lead from control board.
- Step 6.** Remove the 2 sensor mounting screws (magnetic tip, long reach Phillips screwdriver), remove flame sensor, and gasket from transition base flange.
- Step 7.** Remove any residual gasket material from transition base flange.
- Step 8.** Install new flame sensor with new gasket provided using screws from Step 6. Arrange flame sensor with hook towards burner.
- Step 9.** Reconnect flame sensor wire.
- Step 10.** Fold insulation back into place. Be sure **NO** wires are in contact with burner flange.
- Step 11.** Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label, or the lighting instructions located in the Installation and Operating Manual.
- Step 12.** Replace surround cover on top of water heater.



WARNING

120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.



(EF120T500 model pictured)

Service Procedure VIII:

Spark Rod Gap Adjustment and Replacement

Spark Rod Gap Inspection and Adjustment

- Step 1.** Remove combustion system as described in "Combustion System Removal Procedure."
- Step 2.** Measure spark gap between the spark rod and burner tube. Acceptable spark gap is from 3/16" to 1/4" (see photo below).
- Step 3.** If spark gap is not between 3/16" to 1/4", the spark rod may be carefully bent by supporting the end near the ceramic insulator with pliers and bending the end near the burner tube with needle nose pliers (see photo below).
- Step 4.** Clean spark rod with steel wool or emery cloth.
- Step 5.** Re-measure and verify spark gap are between 3/16" to 1/4" after bending.
- Step 6.** Verify the integrity of all gaskets and replace where required.
- Step 7.** Reinstall the combustion system per "Combustion System Replacement Procedure" and check several ignitions to ensure the burner lights smoothly.

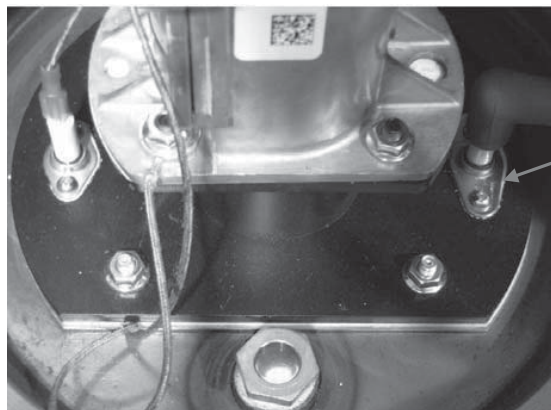
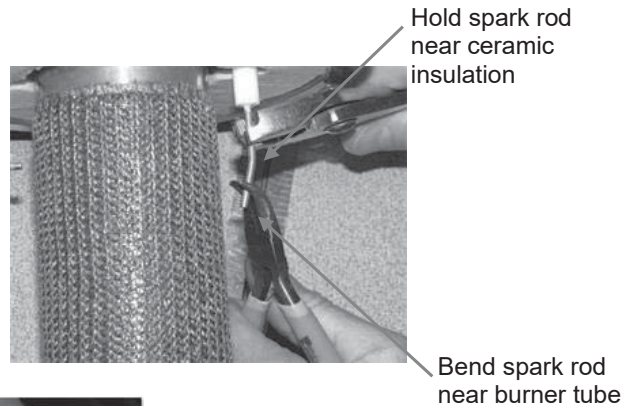
WARNING

Spark gap must be set from 3/16" to 1/4". Failure to set and verify proper spark gap may result in a delayed ignition resulting in damage to the water heater.

CAUTION

Use caution while performing these steps to prevent stressing or cracking the ceramic insulator.

Burner Tube Spark Rod



Spark Rod

Service Procedure VIII:

Spark Rod Gap Adjustment and Replacement

Spark Rod Replacement Procedure

- Step 1.** Position main power switch to "OFF".
- Step 2.** Disconnect (unplug) water heater from 120 volt power source.
- Step 3.** Un-latch & remove surround cover from top of heater.
- Step 4.** Fold back insulation in front of combustion assembly to expose spark rod (see photo below).
- Step 5.** Disconnect wire lead from spark rod.
- Step 6.** Remove the 2 mounting screws (magnetic tip, long reach Phillips screw driver). Remove spark rod and gasket from transition base flange.
- Step 7.** Remove any residual gasket material from transition base flange.
- Step 8.** Install new spark rod with new gasket provided using screws from Step 6. Arrange spark rod with hook towards burner (off-center mounting hole towards the front of the water heater).
- Step 9.** Remove combustion system following "Combustion System Removal Procedure" and verify spark gap following "Spark Rod Gap Inspection and Adjustment." Reassemble combustion system following "Combustion System Replacement Procedure."
- Step 10.** Fold insulation back into place. Be sure **NO** wires are in contact with burner flange.
- Step 11.** Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label, or the lighting instructions located in the Installation and Operating Manual.
- Step 12.** Replace surround cover on top of water heater.

WARNING

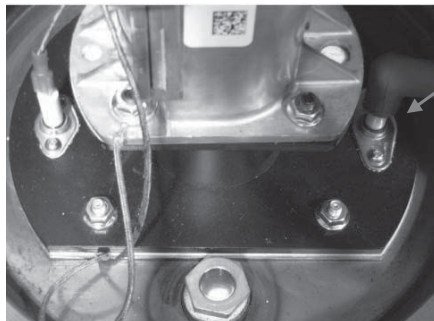
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

WARNING

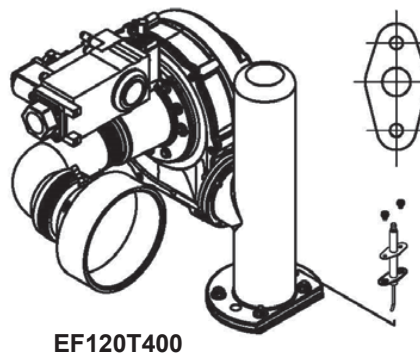
If the spark rod is replaced for any reason, the combustion system **MUST** be removed and the spark gap to the burner measured and adjusted properly.

WARNING

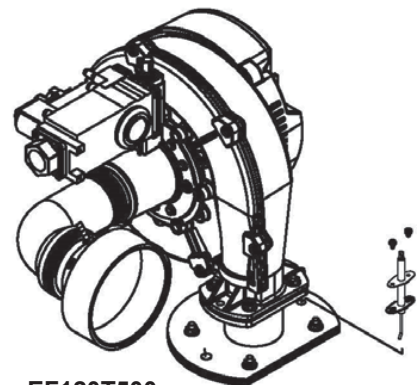
Spark gap must be set from 3/16" to 1/4". Failure to set and verify proper spark gap may result in a delayed ignition resulting in damage to the water heater.



(EF120T500 model pictured)



EF120T400



EF120T500

Service Procedure IX:

Ignition Control Board Replacement

Control Board Replacement

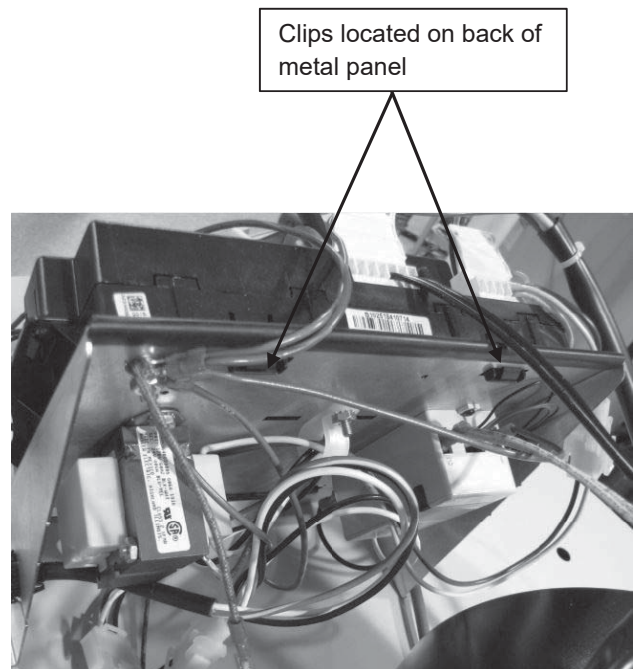
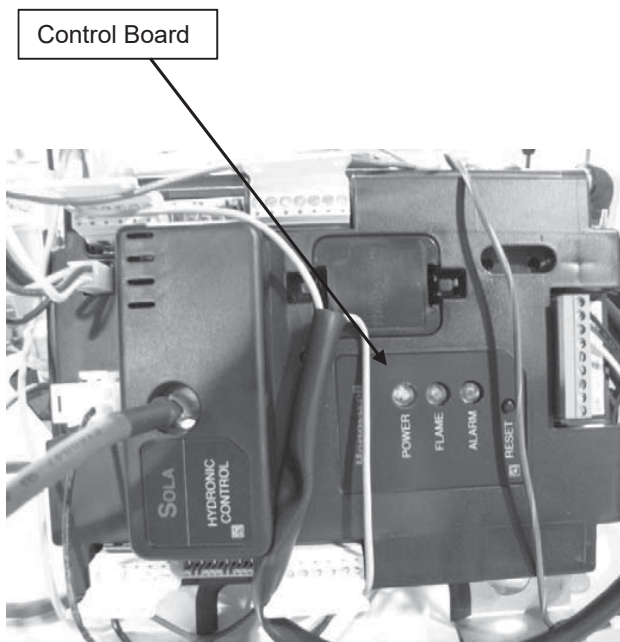
- Step 1.** Position main power switch to “OFF”.
- Step 2.** Disconnect (unplug) water heater from 120 volt power source.
- Step 3.** Un-latch and remove top surround cover from top of water heater.
- Step 4.** Locate control board.
- Step 5.** Carefully disconnect all wire connections from control board.

Note: It may be necessary to identify wires for proper re-connection.

- Step 6.** Depress the plastic tabs on the top back side of the control board first.
- Step 7.** Tilt the control board and slide control board hook tabs from slots in the metal panel (see photo below).
- Step 8.** Replace control board and all wire connections.
- Step 9.** Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label, or the lighting instruction located in the Installation and Operating Manual.
- Step 10.** Replace surround cover on top of water heater.

WARNING

120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.



Service Procedure X:

Transformer Replacement

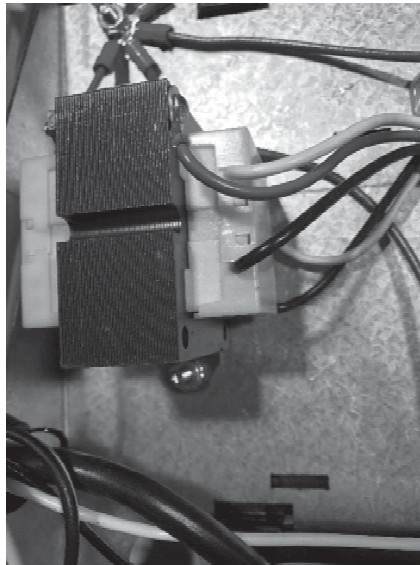
Transformer Replacement Procedure

- Step 1.** Position main power switch to “OFF”.
- Step 2.** Disconnect (Unplug) water heater from 120 Volt power source.
- Step 3.** Un-latch & remove surround cover from top of water heater.
- Step 4.** Disconnect primary leads (black and white) and secondary leads (blue and yellow) from the transformer (connections are different sizes to prevent interchanging).
- Step 5.** Remove the 2 nuts (7/16” nut driver) holding the transformer in place and remove transformer from control board (see photo below).
- Step 6.** Install new transformer and secure in place with screws from Step 6.
- Step 7.** Reconnect primary and secondary wires to transformer (leads are different sizes to prevent interchanging).
- Step 8.** Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label, or the lighting instruction located in the Installation and Operating Manual.
- Step 9.** Replace surround cover on top of water heater.



WARNING

120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

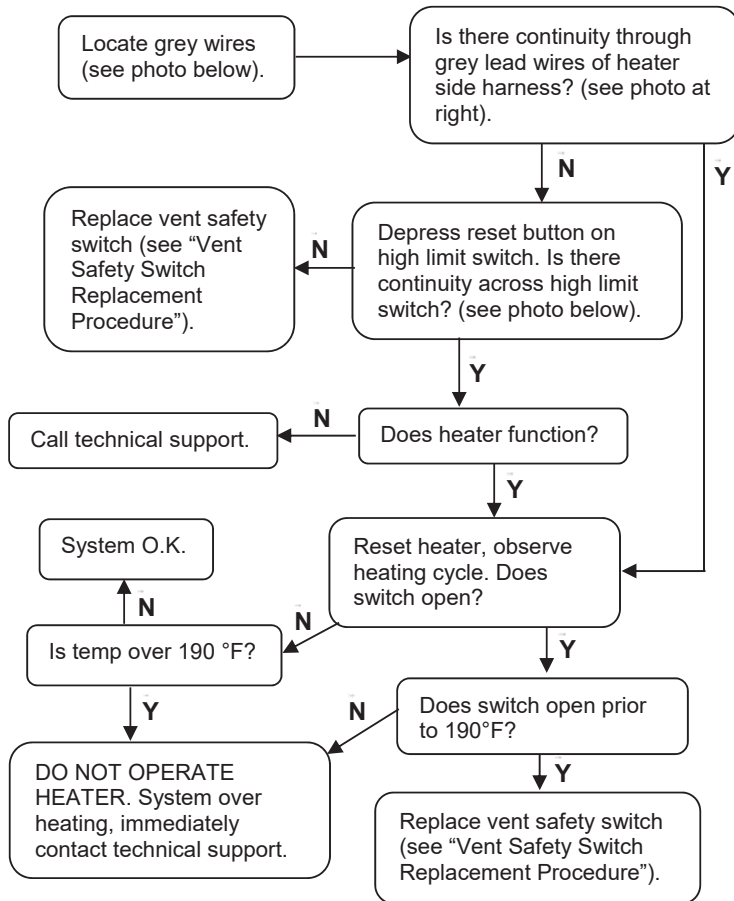


Service Procedure XI:

Vent Safety Switch Testing and Replacement

Sequence of Operation:

Error code 67 will display, indicating an open circuit for the vent safety switch. Determine if temperature has reached 190°F before resetting switch and restoring operation. If evidence of extreme temperature is present, call technical support.



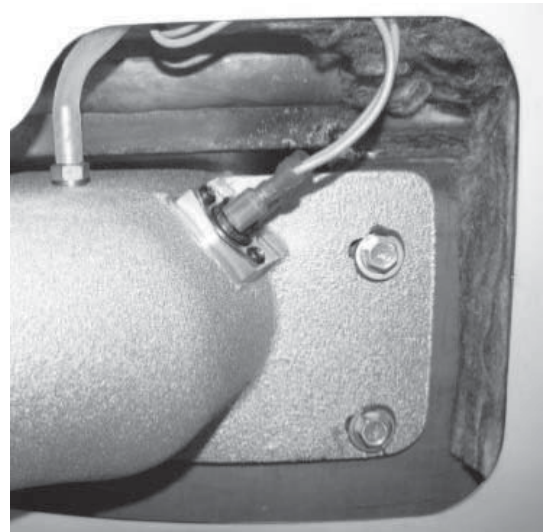
WARNING

120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

WARNING

Make sure exhaust collector compartment or exhaust flue gases are not overheating (190°F) before resetting vent safety switch. If there is evidence of overheating, CALL TECHNICAL SUPPORT.

Vent safety switch is labeled as "Exhaust Limit Switch" in wiring diagram.



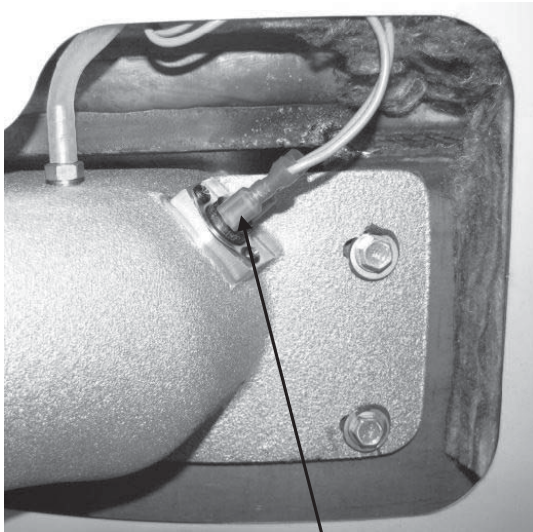
Vent Safety Switch Location

Service Procedure XI:

Vent Safety Switch Testing and Replacement

Vent Safety Switch Replacement Procedure

- Step 1.** Position main power switch to "OFF".
- Step 2.** Loosen adhesive backed rubber escutcheon from service panel access cover and slide escutcheon back along exhaust pipe to allow for removal of cover (see photos below).
- Step 3.** Remove screws from service panel access cover (1/4" nut driver) and remove cover from heater (see photos below).
- Step 4.** Disconnect grey wire leads from vent safety switch (see photo below).
- Step 5.** Remove the 2 switch mounting screws (Phillips screwdriver) and remove switch from heater.
- Step 6.** Install new switch using screws from Step 5.
- Step 7.** Reconnect wire leads. **Note:** Wire leads are interchangeable with either switch terminal.
- Step 8.** Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label, or the lighting instruction located in the Installation and Operating Manual.
- Step 9.** Reinstall service panel access cover and rubber escutcheon.



Vent Safety Switch



Service Panel Access Covers

Service Procedure XII:

Power Anode Inspection and Replacement

Powered Anode Replacement



WARNING

Heater components may be **HOT** when performing the following steps in this procedure. Take necessary precaution to prevent personal injury.

The powered anode control board is located on the right vertical side of the control board inside the surround panel. The control board has a LED indicator light to show the status of operation. When the tank is filled with water and the power supply is on to the water heater, the light should have a steady green glow to indicate that protection current is flowing and operating normally. If the indicator light is not glowing, the power supply to the water heater or powered anode system is disconnected.

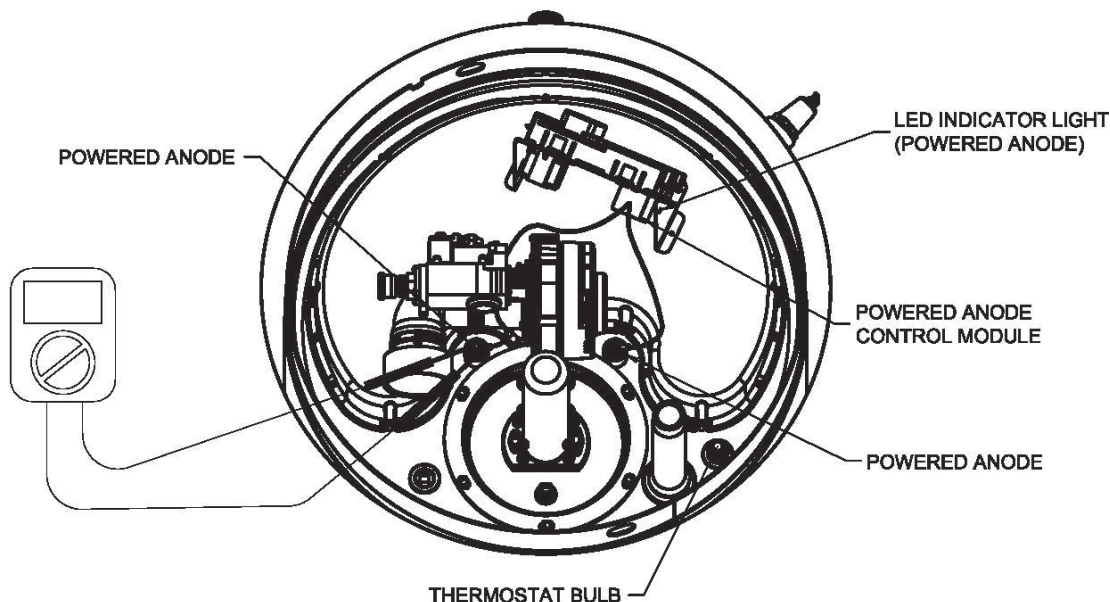
Step 1. Check the power supply or wire connections to the powered anode control (120 VDC).

Step 2. Indicator light diagnostic codes:

- a) If the LED is flashing red, then there is a malfunction with the powered anode system. Make sure there are **NO** bare spots in the wire insulation to the powered anode rods.

Step 3. Check all electrical connections. The powered anode rods are insulated from the water heater tank in the bushing.

- a) With an ohmmeter, check continuity between the powered anode terminal and the bushing. There should be **NO** continuity. If there is continuity, replace the powered anode assembly.



Water Heater Installation Checklist

Product Handling- Carefully uncrate the heater. Move in place with a hand truck (**DO NOT** use the venting pipes for handles).

Electrical Requirements- Make sure there is 120 volts line voltage. Line voltage must be properly polarized. Adequate ground supplied to the heater.

Venting Requirements- All venting must stay within the required lengths and diameter (see table below). Proper support of the venting pipe is required (every 5 ft vertical and 3 ft horizontal). Termination must be located to prevent re-circulation of flue gases. Use factory supplied intake and exhaust terminations.

Gas Requirements- Gas piping sized adequately, 1" (Nat.). Install a properly sized regulator (if unknown, assure an adequate volume of gas is available). 7" W.C. is required when the unit is running. Gas pressure must stay below 14" W.C. static pressure. Pressure drops between static pressure and operating flow should be less than 3" W.C.

Condensate Requirements- Condensate line needs to slope to a drain at a minimum of 1/4 in per ft. Make sure the condensate line does not have the potential to freeze. If using more than one heater and using a common condensate line, make sure the condensate line is properly sized.

Service/Mechanical Room- Provide adequate space for servicing heater. Leave room to get to the bottom safety switch as well as enough overhead room to remove the anode rods for servicing (18 in minimum).

Vent Tables

Balanced Direct Vent Systems		
<u>PVC, CPVC</u>		
Total length of intake piping and exhaust piping added together must NOT exceed "Maximum Combined Length" shown below		
<u>Maximum Combined Length (feet)</u>		
Model Number	4"	6"
EF120T400	120'	240'
EF120T500	120'	240'

Unbalanced Direct Vent Systems

Air intake **CANNOT** exceed exhaust
by more than 30 ft

Power Vented Systems		
<u>PVC, CPVC</u>		
Total length of exhaust piping must NOT exceed "Maximum Vent Length" shown below		
<u>Maximum Combined Length (feet)</u>		
Model Number	4"	6"
EF120T400	120'	240'
EF120T500	120'	240'

WARNING

The EF100T399 model is **NOT** approved for 2 or 3 in diameter vent pipe. Venting with 2 or 3 in pipe may result in damage to the water heater or cause an unsafe condition. **DO NOT use 2 in vent or air intake pipe.**

Note: Each 90° elbow is equivalent to 5 ft of straight pipe.

Note: Each 45° elbow is equivalent to 2.5 ft of straight pipe.

Water Heater Service Report

Date: _____

Service Provider: _____

Model Number: _____

Phone Number: _____

Serial Number: _____

Venting (PVC, CPVC):

Vent size 4", 6" _____

Intake 90° Elbows (qty) _____

Exhaust 90° Elbows (qty) _____

Intake 45° Elbows (qty) _____

Exhaust 45° Elbows (qty) _____

Length of Straight Pipe
(Intake) _____

Length of Straight Pipe
(Exhaust) _____

Gas Line:

Size & Material _____

Distance from Meter to Water
Heater _____

Gas Pressure:

Static _____

Running Inlet _____

Manifold _____

Electrical:

Line Voltage _____

Igniter Resistance _____

Low Voltage _____

Flame Sense (µA) _____

Polarity _____

Spark Gap _____

LED Flashing Y or N _____ Which One(s) _____

Error Codes on Digital Display _____

Condensate Line:

Size & Material _____

Length _____

Is trap provided Y or N _____

Exhaust Collector Pressure:

Inches W.C. _____

Combustion:

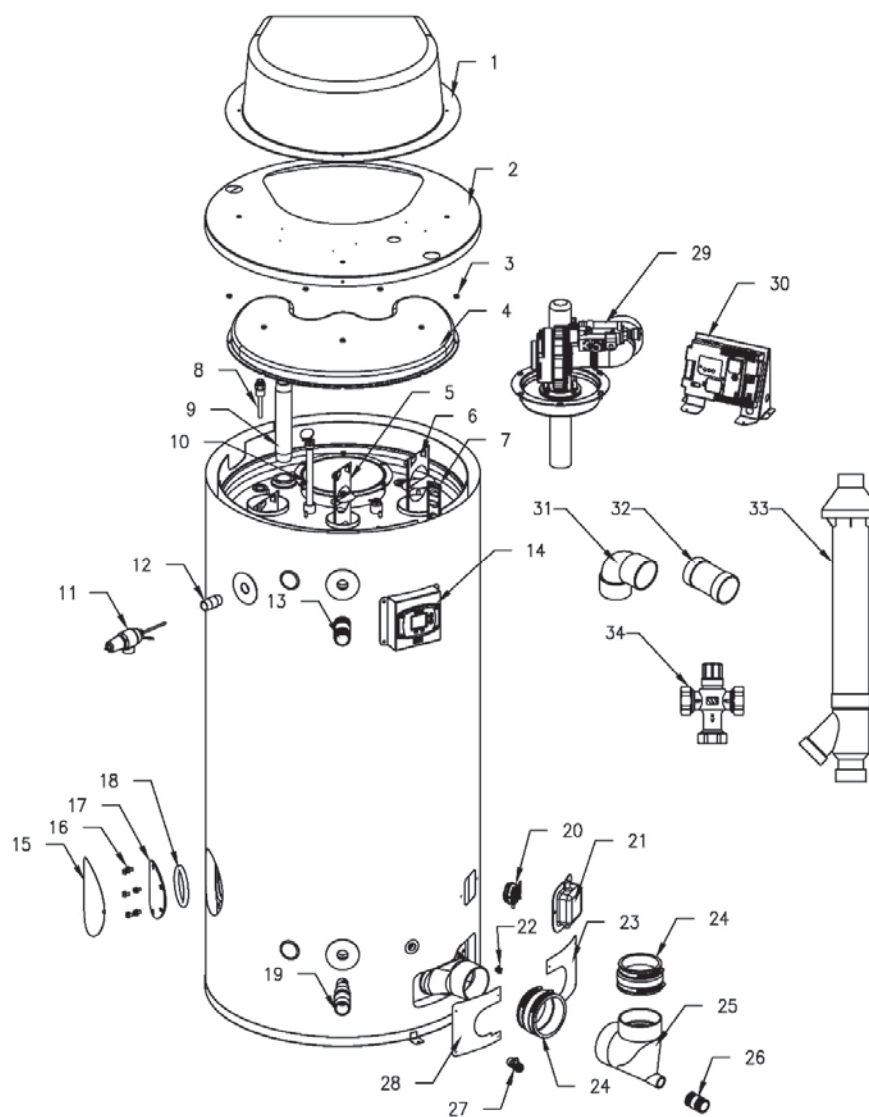
CO₂ _____

CO _____

Installation Site Name & Address:

Installation Site Contact Name & Phone Number

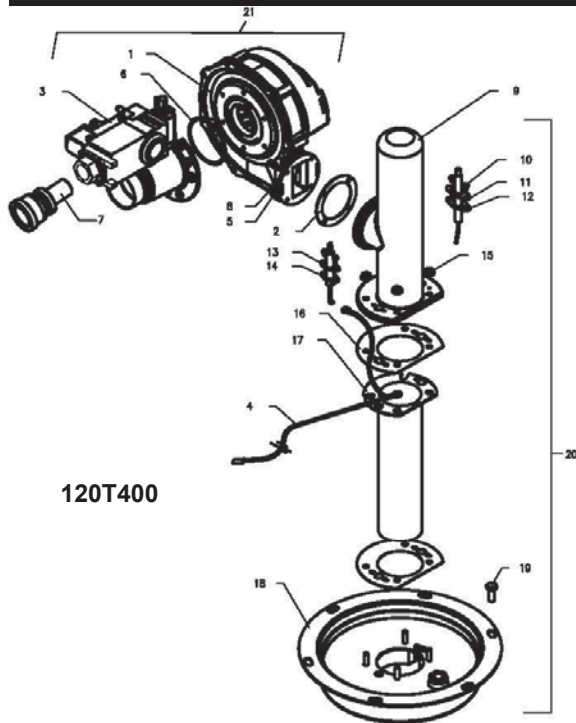
Parts Diagram



Customer must specify complete model number and serial number when ordering service parts.

Water Heater Full Assembly (120T Model)	
1	Surround assembly
2	Jacket Head
3	Hex Nut
4	2 nd Pass Collector
5	Baffle 4" Flue (1)
6	Baffle 5" Flue (2)
7	Baffle 2" Flue (19)
8	Thermal Well
9	Alternate Hot Water Outlet
10	Power Anode
11	T & P Relief Valve
12	Nipple
13	Hot Water Outlet
14	Control Board Display Assembly
15	Cleanout Cover
16	Screw 5/16-18 X 3/4"
17	Cleanout Access Cover
18	Cleanout Gasket
19	Cold Water Inlet (Hydrojet) Assembly
20	Exhaust Pressure Switch
21	Pressure Switch Cover
22	Exhaust Limit Switch
23	Service Door Right
24	Exhaust Coupler
25	Condensate Elbow
26	Condensate Coupler
27	Drain Valve
28	Service Door Left
29	Combustion Assembly (Specify Model)
30	Control Panel Assembly
31	Intake Vent Terminal
32	Exhaust Vent Terminal
33	Concentric Vent System (Optional)
34	Thermostatic Mixing Valve (Optional)

Parts Diagram

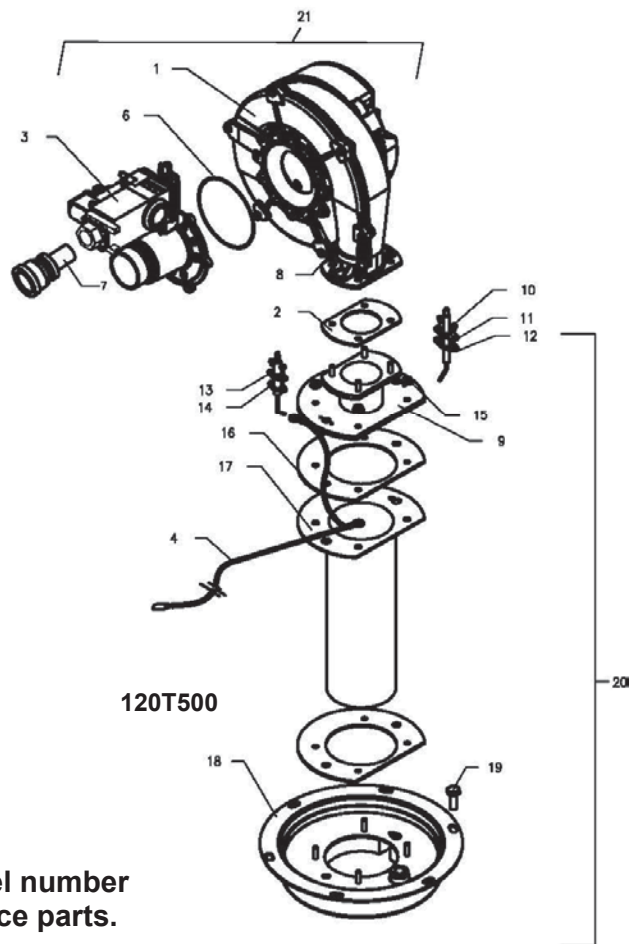


120T400

2 Combustion Ass'y

1	Blower
2	Blower/Transition Tube Gasket
3	Gas Valve/Venturi
4	Ground Wire
5	Lock Washer (120T400 ONLY)
6	O-Ring
7	Gas Pipe Ass'y
8	Screw (120T400) Hex Nut (120T500)
9	Transition Tube
10	Screw
11	Spark Rod

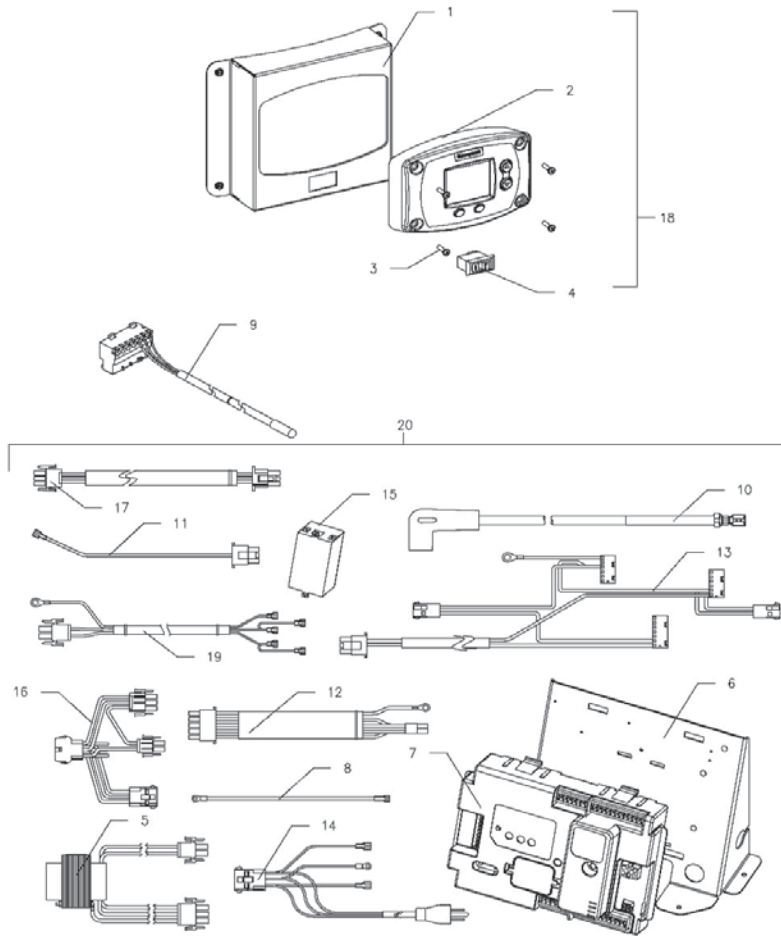
12	Spark Rod Gasket
13	Flame Sensor
14	Flame Sensor Gasket
15	Hex Nut
16	Burner Gasket
17	Burner
18	Burner Mounting Insert
19	Hex Bolt
20	Burner Ass'y
21	Blower/Gas Valve Ass'y



120T500

Customer must specify complete model number and serial number when ordering service parts.

Parts Diagram



CC Ignition Control Assembly			
1	Display Mount	11	Flame Sense Harness
2	Control Display	12	Blower Modulating Harness
3	Screw	13	Control Harness
4	Power Switch	14	Power Cord Harness
5	Transformer	15	Power Anode Control
6	Control Panel	16	Power Switch Harness
7	Control	17	Blower Harness
8	Ground Wire	18	Display Assembly
9	T-Stat Sensor Harness	19	Gas Valve Harness
10	High Voltage Spark Harness	20	Control Assembly

Customer must specify complete model number and serial number when ordering service parts.

Manufactured under one or more of the following U.S. Patents: 5,277,171; 5,341,770; 5,372,185; 5,485,879; 5,574,822; 5,596,952; 5,660,165; 5,682,666; 5,761,379; 5,943,984; 5,954,492; 5,988,117; 6,056,542; 6,142,216; 6,442,178; 6,684,821; 6,935,280; 7,063,132; 7,063,133; 7,007,748; 7,270,087; 7,334,419; 7,337,517; 7,409,925; 7,458,341; 7,559,293; 7,621,238; 7,634,976; 7,650,859; 7,665,210; 7,665,211; 7,699,026; 7,866,168; 7,900,589; 7,971,560; 7,992,526 8,082,888; 8,146,772; Other U.S. and Foreign patent applications pending. Current Canadian Patents: 2,092,105; 2,107,012; 2,108,186; 2,112,515; 2,143,031; 2,239,007; 2,262,174; 2,314,845; 2,409,271; 2,476,685; 2,504,824; 2,548,958

Glossary of Terms

AC	Alternating Current	NOx	Oxides of Nitrogen
BTU/H	British Thermal Units	NPT	National Pipe Thread
CO	Carbon Monoxide	PSI	Pounds per Square Inch
CO2	Carbon Dioxide	RPM	Revolutions per Minute
DC	Direct Current	VA	Volt Amps
DSI	Direct Spark Ignition	VAC	Volts Alternating Current
ECO	Energy Cut Off	W.C.	Inches of Water Column
GFI	Ground Fault Interrupt	°C	Degrees Centigrade
GPM	Gallons per Minute	°F	Degrees Fahrenheit
Hz	Hertz	μA	Micro Amp
LED	Light Emitting Diode		

Notes

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



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