



## Ultra High Efficiency Water Heaters

# SERVICE MANUAL

Troubleshooting Guide  
and Instructions for Service

(To be performed ONLY by  
qualified service providers)



**Models Covered  
by This Manual:**



eF Series® Ultra High Efficiency  
Models:

EFR160T120\*(EN,SX)  
EF60T125(E)\*(N,X)(A)(2)  
EF60T150(E)\*(N,X)(A)(2)  
EF60T199(E)\*(N,X)(A)(2)  
EF100T150(E)\*(N,X)(A)(2)  
EF100T199(E)\*(N,X)(A)(2)  
EF100T250(E)\*(N,X)(A)(2)  
EF100T300(E)\*(N,X)(A)(2)  
EF100T399(E)\*(N,X)(A)(2)  
(\* ) Denotes Warranty Years



## Ultra High Efficiency Water Heaters

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### Table of Contents

	<u>Page</u>	<u>eF Service Procedure</u>
Introduction	3	---
How to use this manual	4	---
Tool required for service	4	---
Features	5	---
Specifications	6	---
Sequence of Operation	10	---
Troubleshooting	16	---
Thermostat Circuit, Testing & Replacement	35	I
Combustion System Testing and Replacement	43	II
Burner Tube Inspection & Replacement	49	III
Gas Valve Replacement	51	IV
Blower Testing and Replacement	52	V
Exhaust Pressure Switch Testing and Replacement	54	VI
Hot Surface Igniter Testing and Replacement	60	VII
Flame Sensor Testing and Replacement	62	VIII
Spark Rod Gap Adjustment and Replacement	64	IX
Ignition Module/Control Board Replacement	66	X
Transformer Replacement	68	XI
Intake Pressure Testing and Replacement	69	XII
Vent Safety Switch Testing and Replacement	71	XIII
Anode & Flue Baffle Inspection and Replacement	73	XIV
Installation Check List	78	---
Heater Service Report	79	---
Parts List	80	---
Glossary of Terms	89	---



## Introduction

The Bradford White eF Series® 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 eF Series® Ultra High Efficiency Water Heater.

The Bradford White eF Series® 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 module. The module monitors the status of the electronic thermostat, vent temperature limit switch, vent system pressure switches and a flame sensor to control output voltage to blower motor, hot surface igniter/spark rod and gas valve. The module contains programming which determines the sequence of operation and timings for purge periods, trial for ignition, flame sensing and lockout. The module will also provide diagnostic information 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 eF Series® Ultra High Efficiency Water Heater operational faults. Please read this service manual completely and provide as much information regarding the eF Series® 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 personal for the primary purpose of troubleshooting analysis and repair of the Bradford White eF Series® Ultra High Efficiency Water Heater. Understanding the sequence of operation section of this manual will contribute greatly to troubleshooting this product.

An "Installation Check List" is shown towards the end of this manual. Compare the installation against the installation check list to confirm all requirements are met.

An "eF 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 insure accurate troubleshooting.

Troubleshooting begins with "System Observation" to determine failure mode as indicated by the LED status of the ignition module. 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 (magna-helic) 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 Gage:	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" min.) with alligator clip at both ends.
Various Hand Tools:	Pipe wrench, channel locks, open end wrench set, 12" crescent wrench, Allen wrench set, torx bit set, screw drivers (common & phillips), long reach (12") magnetic tip phillips head screw driver #2 tip, 1/4" 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.



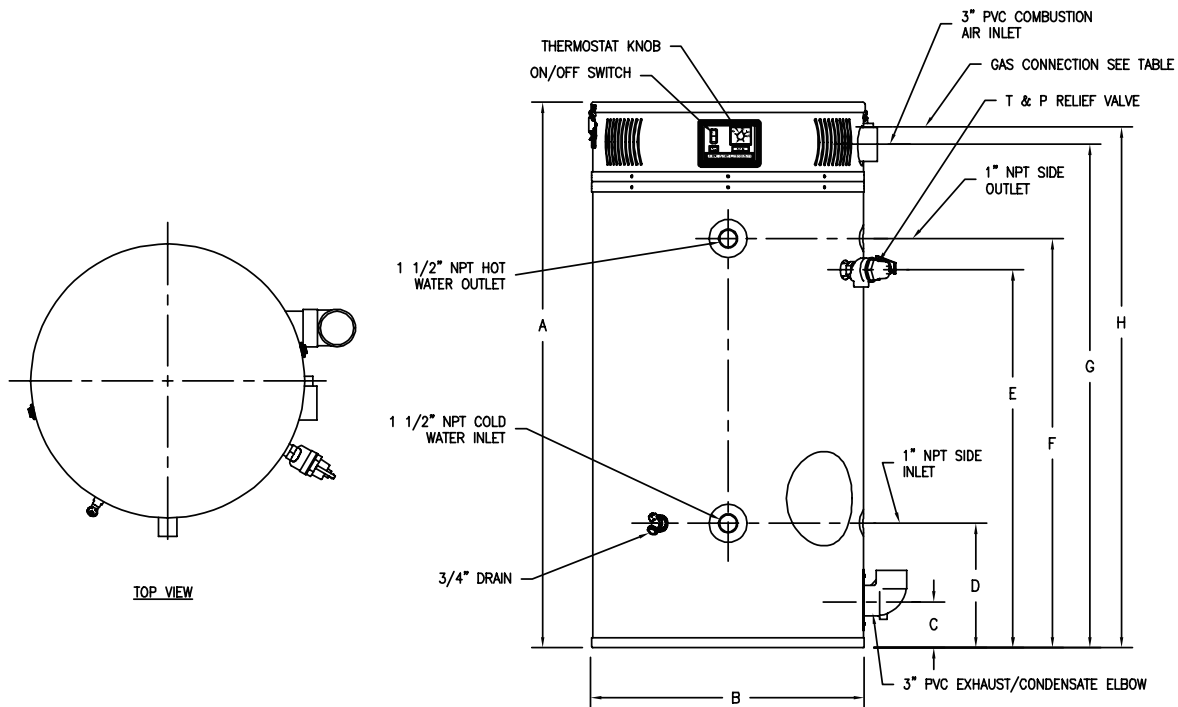
## Features

### Features of Honeywell Integrated Control System

- Attractive digital water heater display on control panel for setting and displaying the temperature setpoint. Pressing temperature UP and DOWN buttons changes the temperature setpoint. Same water heater display used on all models. Temperature format may be displayed in °F or °C.
- Single control board with plug in wiring controls temperature, ignition, and blower operation.
- Reduced number of parts for servicing and wiring.
- 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. Eliminates burned out hot surface igniter replacements.
- Water heater display will show diagnostic codes in the event the water heater needs servicing. Aids in diagnosing and servicing the water heater.
- Water heater display can show previous error code history to further aid in servicing the water heater.



# Specifications



Model No	Input Rate BTU/h	1 <sup>st</sup> Hr Del Gal @ 100°F Rise	Recovery GPH at Degree Rise			Stg Cap U.S. Gal	Therm Eff %	DIMENSIONS (INCHES)												Shpg Wt (lbs)
			40°F	100°F	140°F			A Ht	B Dia	C Flr to Vent Outlet	D Flr to Inlet Wtr Conn	E Flr to T&P Valve Conn	F Flr To Outlet Wtr Conn	G Flr. To Air Intake	H Flr to Gas Conn	Front Wtr Conn Dia	Space Heating Conn Dia	Gas Conn Dia (NPT)	T&P Valve Open (NPT)	
EFR-1-60T-120	120,000	180	345	138	99	60	95.0	57	28 1/4	5	13	40	42 1/4	52 1/2	53 1/2	1	1	3/4	3/4	570
EF60T125	125,000	187	363.6	145.5	103.9	60	96.0	57	28 1/4	5	13	40	42 1/4	52 1/2	53 1/2	1 1/2	1	3/4	3/4	570
EF60T150	150,000	211	422.7	169.1	120.8	60	93.0	57	28 1/4	5	13	40	42 1/4	52 1/2	53 1/2	1 1/2	1	3/4	3/4	570
EF60T199	199,999	265	557.6	223	158	60	92.0	57	28 1/4	5	13	40	42 1/4	52 1/2	53 1/2	1 1/2	1	3/4	3/4	570
EF100T150	150,000	250	450.5	180.2	129	100	99.1	77 5/8	28 1/4	5	13	60	62 1/4	73 1/8	74 3/4	1 1/2	1	3/4	3/4	900
EF100T199	199,999	309	597	238.8	171	100	98.5	77 5/8	28 1/4	5	13	60	62 1/4	73 1/8	74 3/4	1 1/2	1	3/4	3/4	900
EF100T250	250,000	364	734.8	293.9	210	100	97.0	77 5/8	28 1/4	5	13	60	62 1/4	73 1/8	74 3/4	1 1/2	1	3/4	3/4	900
EF100T300	300,000	405	836.4	334.5	239	100	92.0	77 5/8	28 1/4	5	13	60	62 1/4	73 1/8	74 3/4	1 1/2	1	3/4	3/4	900
EF100T399	399,999	521	1,127	451	322	100	93.0	77 5/8	28 1/4	5	13	60	62 1/4	73 1/8	73 1/4	1 1/2	1	1	1	950



## Specifications

### Hot Surface Ignition System

Power supply	Dedicated 120 VAC, 60 Hz, 15A, GFI
Gas Supply	Minimum 1" NPT for EF100T399, all others ¾" NPT (schedule 40 black iron pipe recommended)
Approved Gas Type	Natural or Propane. Unit must match gas type supplied.
Gas Pressure (Nat & L.P.)	14.0" W.C. maximum static, 4.5" W.C. minimum running (recommend 7.0" W.C. min running)
Venting System	Power vent, balanced direct vent or unbalanced direct vent. See vent tables on page 7
Approved Vent Materials	PVC or CPVC
Minimum Clearance for Servicing	18" from top, 24" from front, 4" sides and rear.
Maximum Water Supply Pressure	150 PSI
Thermostat Sensor	11,900 Ohms @ 70°F, ECO opens @ 201°F Max., ECO close @ 100°F Min.
Temperature Dial	Min. set point 5400-6600 ohms, Max set point 0-50 ohms.
Thermostat Board	Max temp 180°F, Min temp 91°F, 24VAC, 60Hz max.
Ignition Module	See "Sequence of Operation, for models starting with CF serial and later"
Transformer	120VAC primary, 24VAC secondary, 40VA.
Hot Surface Igniter	120VAC, 30-120 ohms @ room temperature.
Flame Sensor Output	Minimum 1 micro amp, Typical range 4 to 7 micro amps.
Gas Valve	Negative regulation, 24 VAC, ½" PSI max., 4.5" W.C. Minimum running inlet.
Vent Safety Switch	Normally closed, opens @ 350°F, manual reset.
Intake Pressure Switch "CF" serial number or later	Not required.
Intake Pressure Switch serial numbers prior to "CF"	24VAC, normally closed, opens on vacuum increase @ -1.20 W.C.
Blocked Vent Pressure Switch "CF" serial number or later	24VAC, normally closed, opens when pressure increases to +2.70 W.C.
Exhaust pressure switch serial numbers prior to "CF"	24VAC, normally open, closes on pressure increase as follows Note 1: +2.58" W.C. EF(60,100)T199 +1.50" W.C. EF100T150 (see note 2) +1.22" W.C. EF60T150, EF100T250 +2.08" W.C. EF60T125 +0.55" W.C. EF100T300 (see note 3) Note 2: +5.6" W.C. on serials prior to AH5039107 Note 3: +0.8" W.C. on serials prior to AK5288269
Blower	120VAC, 60Hz, .6-1 amps, 6400 RPM.
Combustion Levels	CO <sub>2</sub> : 10-11%, CO: less than 0.04 percent (400 PPM) air free



## Specifications

# Honeywell Integrated Control System

Power supply	Dedicated 120 VAC, 60 Hz, 15A
Gas Supply	Minimum ¾" NPT (schedule 40 black iron pipe recommended)
Approved Gas Type	Natural or Propane. Unit must match gas type supplied.
Gas Pressure (Nat & L.P.)	14.0" W.C. maximum static, 4.5" W.C. minimum running (recommend 7.0" W.C. min running)
Venting System	Power vent, balanced direct vent or unbalanced direct vent. See vent tables on page 7
Approved Vent Materials	PVC or CPVC
Minimum Clearance for Servicing	18" from top, 24" from front, 4" sides and rear.
Maximum Water Supply Pressure	150 PSI
Thermostat Sensor	11,900 Ohms @ 70°F, ECO opens @ 207°F Max., ECO close @ 120°F Min. Redundant sensor for ECO. Sensor inside well for easy replacement of sensor.
Control Display	Digital display, 24 volts. Temperature Range: 70-180 deg. F. Used to set tank temperature (deg. F or deg. C), show operating status, Display error codes, error code history, limit maximum setpoint temperature.
Control Board	Operates from 24 volt from transformer. Controls tank temperature, ignition functions, combustion blower. See ignition timings in sequence of operation for Integrated Control.
Transformer	120VAC primary, 24VAC secondary, 40VA.
Spark Rod Igniter	0.22" 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, ½" PSI max., 4.5" W.C. Minimum running inlet.
Vent Safety Switch	Normally closed, opens @ 350°F, manual reset.
Blocked Vent Pressure Switch	24VAC, normally closed, opens when pressure increases to +2.70 W.C.
Blower	120VAC, 60Hz, .6-1 amps, 6400 RPM.
Combustion Levels	CO2: 10-11%, CO: less than 0.04 percent (400 PPM) air free





## Specifications

### Vent Tables

<b><u>Balanced Direct Vent Systems</u></b> <b><u>PVC, CPVC</u></b>			
Total length of intake piping and exhaust piping added together must not exceed "Maximum Combined Length" Shown below			
<b><u>Maximum Combined Length (feet)</u></b>			
<b><u>Model Number</u></b>	<b><u>2"</u></b>	<b><u>3"</u></b>	<b><u>4"</u></b>
<b><u>EFR-1-60T120</u></b>	60'	120'	170'
<b><u>EF60T125, EF100T150</u></b>	N/A	120'	170'
<b><u>EF60T150, EF100T199</u></b>	N/A	100'	150'
<b><u>EF60T199, EF100T250</u></b>	N/A	80'	130'
<b><u>EF100T300</u></b>	N/A	60'	110'
<b><u>EF100T399</u></b>	N/A	50'	100'

<b><u>Unbalanced Direct Vent Systems</u></b> Air intake CAN NOT exceed exhaust by more than 30 feet			
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<b><u>Power Vented Systems</u></b> <b><u>PVC, CPVC</u></b>			
Total length of exhaust piping must not exceed "Maximum Vent Length" Shown below			
<b><u>Maximum Vent Length (feet)</u></b>			
<b><u>Model Number</u></b>	<b><u>2"</u></b>	<b><u>3"</u></b>	<b><u>4"</u></b>
<b><u>EFR-1-60T120</u></b>	60'	120'	170'
<b><u>EF60T125, EF100T150</u></b>	N/A	120'	170'
<b><u>EF60T150, EF100T199</u></b>	N/A	100'	150'
<b><u>EF60T199, EF100T250</u></b>	N/A	80'	130'
<b><u>EF100T300</u></b>	N/A	60'	110'
<b><u>EF100T399</u></b>	N/A	50'	100'

#### Notes:

- 1) Multiply the total number of 90° elbows (intake and exhaust) by 5 feet. Do not include the termination fittings or 3" condensate elbow.
- 2) Multiply the total number of 45° elbows (intake and exhaust) by 2 ½ feet.
- 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: EF100T199

A 3" Balanced Direct vent system has 30 feet of straight exhaust pipe and 30 feet of straight intake pipe. It has 3- 90° elbows in the exhaust and 3- 90° elbows in the intake. It has 1- 45° elbow in the exhaust and 1- 45° elbow in the intake.

Therefore:

6- 90° elbows x 5 feet = 30 feet.

2- 45° elbows x 2½ feet = 5 feet.

60 feet of straight pipe + 30 feet + 5 feet = 95 feet.

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



# Sequence of Operation

For models prior to CF serial numbers

## For models prior to CF serial numbers

1 Thermostat calls for heat.

-Prior to energizing blower, ignition module checks safety circuits for normal switch positions:

- a) Vent temp switch normally closed.
- b) Intake pressure switch normally closed.
- c) Exhaust pressure switch normally open.

If the vent temp switch is open, the control waits **indefinitely** for temp switch to close (green light stays on).

If the exhaust pressure switch contacts are closed (not in normal position), the ignition module will wait 45 seconds for pressure switch contact to open before energizing blower. If after 45 seconds and pressure switch contacts do not open, the ignition module locks out with the PURGE light flashing indicating pressure switch fault.

2 Blower energizes.

3 Pressure switch proves blower/vent system operation.

If the N.O. contacts of the exhaust pressure switch do not close within 5 minutes of the blower being on, the control locks out with the PURGE light flashing indicating pressure switch fault.

4 Blower pre-purge period (5 seconds) indicated by the PURGE LED on the module.

5 Igniter warm up (18 seconds), indicated by the IGNITER LED on the module.

6 Trial for ignition (4 seconds, three trials).

- a) Flame establishing period (2.5 seconds) gas valve and igniter on, indicated by the IGNITER and VALVE LED on the module.
- b) Burner on, flame proving period (1.5 seconds, looking for minimum of 1 micro amps), indicated by the FLAME & VALVE LED on the module.

7 Steady state operation.

Ignition module monitors:

- Thermostat circuit.
  - When thermostat opens, gas valve is shut down and post purge begins.
- Safety circuit.
  - If vent temp switch opens, gas valve is shut down, system will post purge and wait for switch to close before attempting re-ignition.
  - If either pressure switch opens, Gas valve is shut down, Blower is shut down for 30 seconds after which blower is re-energized and system attempts re-ignition starting at pressure switch proving mode.
- Flame sensor circuit.
  - If flame is lost, gas valve is shut down, system will post purge and system attempts re-ignition starting at pressure switch proving mode.

8 Thermostat satisfies.

9 Burner off.

10 Blower post purge (15 seconds).



# Sequence of Operation

For models prior to CF serial numbers

## For models prior to CF serial numbers

### Lockout Conditions

If normally closed pressure switch contacts open during burner operation, gas valve closes, burner shuts off. Blower restarts after 30 seconds and runs 5 minutes to wait for pressure switch to close. If not, locks out.

The system will go into lock out mode for the following reasons:

- Pressure switches stuck open or closed.
  - a) Check for exhaust or intake obstructions.
  - b) Check for compliance with vent tables.
  - c) Check for evidence of moisture or condensate present in pressure switch tubing or pressure switch.
- No ignition after 3 attempts.
  - a) Check gas pressures.
  - b) Igniter resistance too high (lower resistance preferred <150 Ohms).
  - c) Check venturi screw adjustment (6 ½ turns from bottom)
  - d) Flame sense micro amp not present (1 to 5 micro amps required).

Lock out reset is accomplished by shutting OFF the line voltage to the system or opening the 24V thermostat circuit for at least 2 seconds.

System will automatically reset lockout after 1 hour of continuous call for heat from the thermostat. Three ignition trials will be attempted each hour until the thermostat is satisfied.

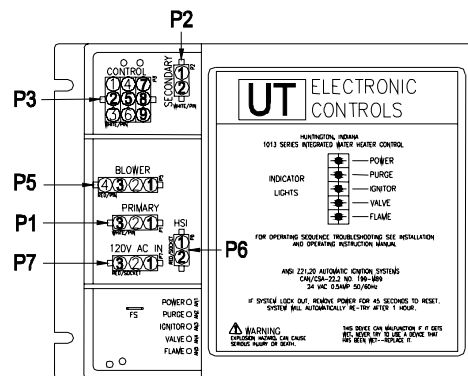
### Ignition Module Specifications

#### Control Functions:

- Ignition & heating functions in response to thermostat.
- Hot surface ignition using a microprocessor to control timing, flame sensing using flame rectification & ignition retries.
- Monitoring of system pressure switches and limit switches.
- Control of gas valve, inducer motor, and hot surface igniter element based on thermostat demand and status of safety inputs.
- Diagnostic indicators to provide information on power to control and control status.
- Non-interchangeable polarized plug-in connectors for all interconnections.

#### Control Inputs:

- Thermostat call for heat.
- Limit Switch Circuit (normally closed)
- Pressure Switch Circuit (normally open)
- Flame sensing.
- Low voltage supply.
- Line voltage supply.

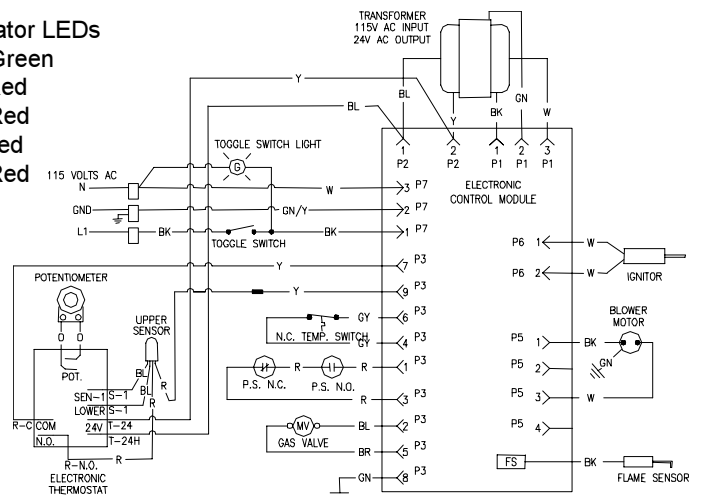


### IGNITION MODULE

#### Control Outputs:

- Inducer motor
  - Hot surface igniter
  - Gas valve
  - Status indicator LEDs
- Power - Green  
Purge - Red  
Igniter - Red  
Valve - Red  
Flame - Red

### WIRING DIAGRAM





# Sequence of Operation

For models starting with  
CF serial numbers and later.

## For models starting with CF serial numbers and later.

- 1 Thermostat calls for heat.  
Prior to energizing blower, ignition module checks to make sure the vent temperature switch is in the normally closed position. If the vent temperature switch is open, the control waits indefinitely for the temperature switch to close.
- 2 Blower energizes, pressure switch contacts are normally closed. If the pressure switch contacts are open, blower operates for up to 5 minutes waiting for contacts to close, then blower stops and flashes red PURGE LED indicating lock-out condition.
- 3 Blower pre-purge period (5 seconds) indicated by PURGE LED on the module
- 4 Igniter warm up (18 seconds), indicated by the IGNITER LED on the module. **Note: The blocked vent pressure switch must be in the normally closed position for the ignition cycle to start.**
- 5 Trial for Ignition (4 seconds, 3 trials).
  - a) Flame establishing period (2.5 seconds), gas valve and igniter on, indicated by the IGNITER and VALVE LED on the module.
  - b) Burner on, flame proving period (1.5 seconds, looking for minimum of 1 micro amps), indicated by the FLAME & VALVE LED on the module.
- 6 Steady state operation.  
Ignition module monitors:
  - Thermostat circuit.
    - When thermostat opens, gas valve is shut down and post purge begins.
  - Safety circuit.
    - If vent temperature switch opens, gas valve is shut down, system will post purge and wait for switch to close before attempting re-ignition.
    - If the blocked vent pressure switch opens, indicating a blocked exhaust vent condition, the gas valve is shut down, blower shuts down for 30 seconds and is re-energized and system attempts re-ignition if the pressure switch is closed. Blower operates for 5 minutes to wait for pressure switch to close, then shuts off with purge light flashing (lock-out). Will restart in 1 hour to attempt to close the switch and restart ignition sequence.
  - Flame sensor circuit.
    - If flame is lost, gas valve is shut down, system will post purge and system attempts re-ignition.
- 7 Thermostat satisfied.
- 8 Burner off.
- 9 Blower post purge (15 seconds).



# Sequence of Operation

For models starting with  
CF serial numbers and later.

For models starting with CF serial numbers and later.

## Lockout Conditions

Lockout conditions:

The system will go into lock out mode for the following reasons:

Blocked vent pressure switch contacts open:

Check for obstruction in exhaust pipe and vent terminal.

Check for blocked condensate trap or drain line. In cold climates, make sure drain is not frozen.

No ignition after 3 attempts:

- Check inlet and outlet gas pressures (pressure taps located on top of gas valve).
- Igniter resistance too high (lower resistance preferred < 150 ohms).
- Misadjusted venturi screw (should be 6.5 turns out from bottom).
- Flame sense microamp not present (1.0 microamps minimum, should be 5 microamps or more). If burner lit, check flame rod for deposits.
- Check burner tube condition. Refer to section EF-III for Burner Tube Inspection and Replacement.

## Ignition Module Specifications

### Control Functions:

- Ignition & heating functions in response to thermostat.
- Hot surface ignition using a microprocessor to control timing, flame sensing using flame rectification & ignition retries.
- Monitoring of system pressure switches and limit switches.
- Control of gas valve, inducer motor, and hot surface igniter element based on thermostat demand and status of safety inputs.
- Diagnostic indicators to provide information on power to control and control status.
- Non-interchangeable polarized plug-in connectors for all interconnections.

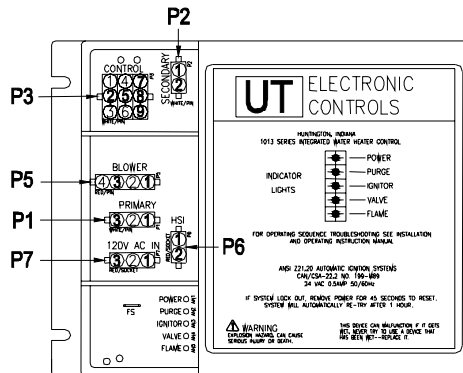
### Control Inputs:

- Thermostat call for heat.
- Blocked vent pressure switch (normally closed)
- Flame sensing.
- Low voltage supply.
- Line voltage supply.

### Control Outputs:

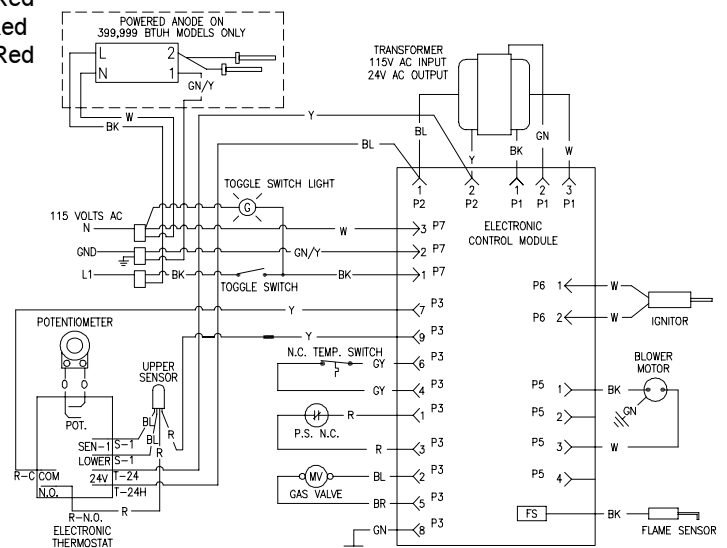
- Inducer motor
- Hot surface igniter
- Gas valve
- Status indicator LEDs

Power - Green  
Purge - Red  
Igniter - Red  
Valve - Red  
Flame - Red



**IGNITION MODULE**

## WIRING DIAGRAM





# Sequence of Operation

For models with Honeywell Integrated Control System w/ Direct Spark Ignition

## Honeywell Integrated Control System w/ Direct Spark Ignition

- 1 Thermostat calls for heat.
- 2 Combustion blower starts.
- 3 Blower pre-purge period of 30 seconds.
- 4 Trial for Ignition. (5 seconds, 3 trials).
  - Flame establishing period (3 seconds), gas valve opens, sparks from spark rod to burner surface to ignite the gas.
  - Burner on, flame proving period (2 seconds). Requires a minimum of 0.8 microamp through flame sense rod to prove flame.
  - If either blocked vent safety switch contacts (normally closed) or blocked vent pressure switch contacts (normally closed) are open, then the ignition sequence will not start and an error code 29 (Pressure switch failed to close or open) will be shown on the display.
- 5 Steady State Operation: Burner continues to operate until:
  - Thermostat circuit opens, gas valve closes, blower continues to operate for 30 second post-purge period.
  - If the normally closed blocked vent pressure switch opens, the gas valve closes, the blower continues to operate indefinitely and error code 29 will be displayed after a couple minutes with "Service Needed", "Pressure Switch".
  - If the normally closed 1<sup>st</sup> Pass Collector vent safety switch opens, the gas valve closes, the blower post-purges, then shuts off with error code 26 displayed in a lockout condition.
- 6 Thermostat satisfied
- 7 Gas valve closes, burner extinguished.
- 8 Blower post purge for 30 seconds.



# Sequence of Operation

For models with Honeywell Integrated Control System w/ Direct Spark Ignition

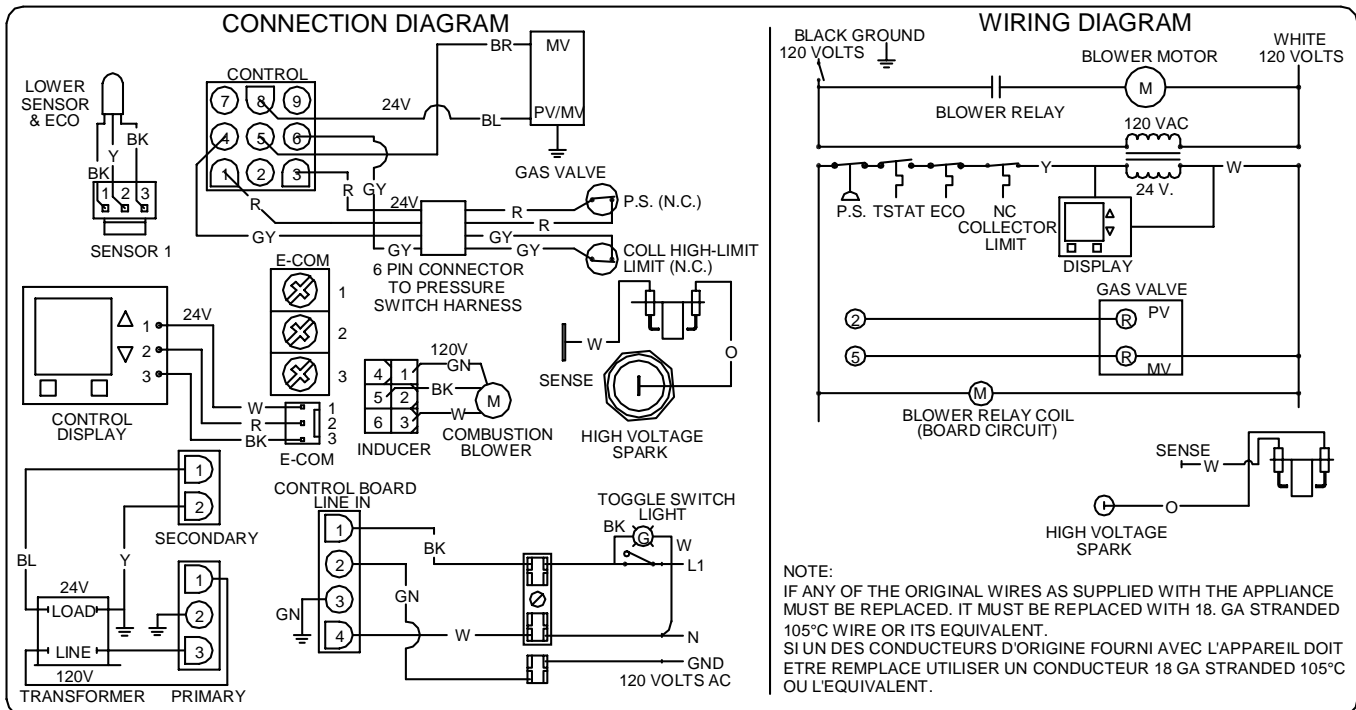
## Honeywell Integrated Control System w/ Direct Spark Ignition

### Lockout Conditions

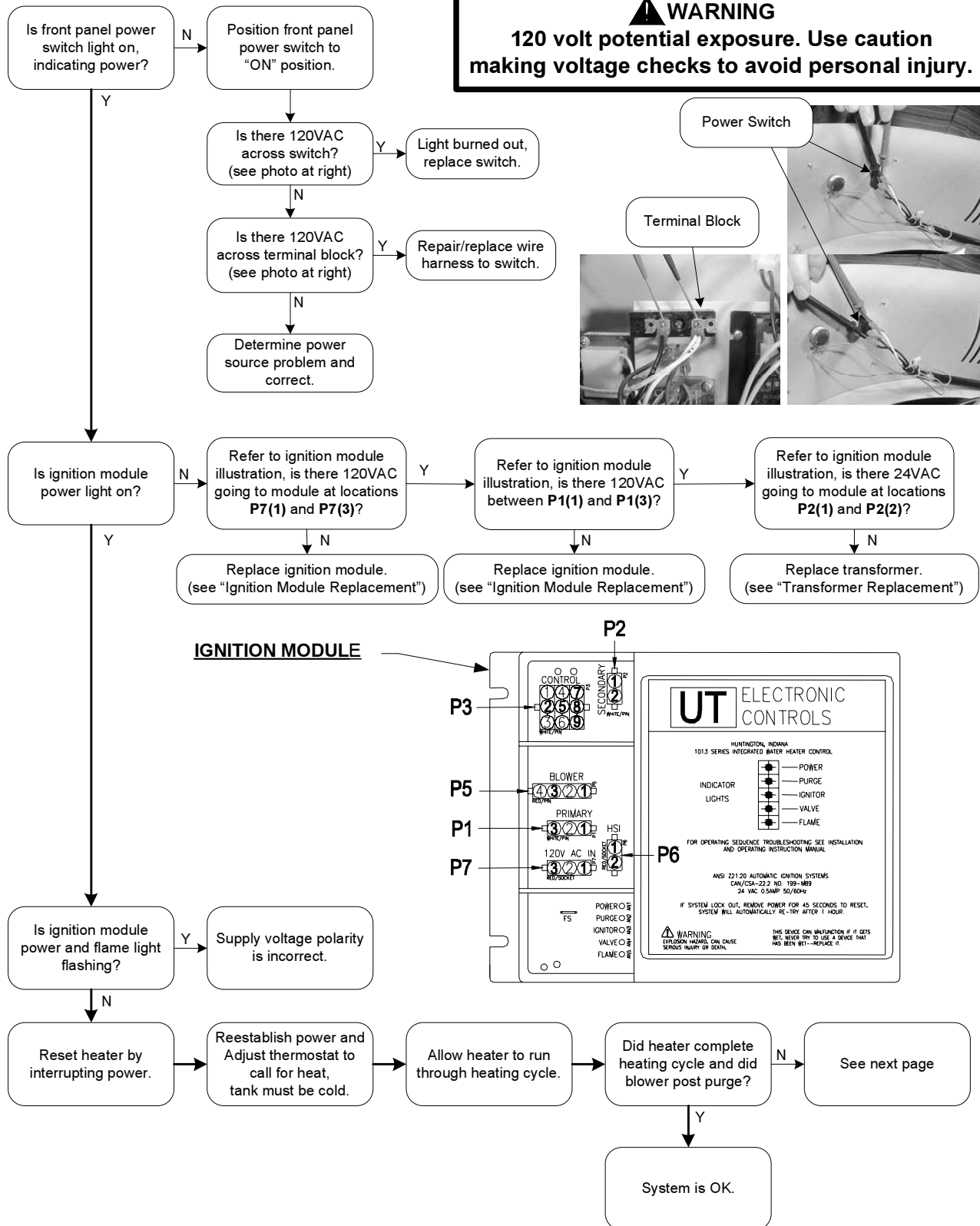
The system will go into lock out mode for the following reasons:

1. **ERROR CODE 62 or 63**  
Control board will go into "Soft Lockout" if the main burner cannot be lit or fails to prove flame after 3 ignition trials. The water heater display indicates a lockout condition by showing an error code number (62 or 63) with "Service Needed" in the control display window. Refer to error codes in the diagnostic section of this Service Manual. In a "Soft Lockout" condition, the control will wait for 60 minutes and then make 3 more attempts to light the main burners. Soft lockout reset is accomplished by depressing the lower right button under "Reset" for 3 seconds.
2. **ERROR CODE 65**  
If the top of the tank should exceed 200°F, then the high limit control will shut off the burner and the water heater will go into a "Hard Lockout". Error code 65 will be shown in the water heater display. The control can only be reset in the "Service Mode", which is detailed in the "Troubleshooting" section of this Service Manual.
3. **ERROR CODE 29**  
If the exhaust terminal becomes blocked or the condensate elbow fails to drain condensate, the normally closed exhaust pressure switch will open, the gas valve closes, and error code 29 will appear on the control display. When the condition is corrected, the error code will disappear and the water heater will resume normal operation. No resetting of the control display is needed for the pressure switch error code.
4. **ERROR CODE 26**  
If the vent safety switch located near the exhaust pressure switch should open, the gas valve will close, the blower will post-purge and error code 26 will appear on the display. The lockout condition will reset once the problem is corrected and the switch reset. Refer to "Vent Safety Switch Testing and Replacement" in this Service Manual.

## CONNECTION/WIRING DIAGRAM



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





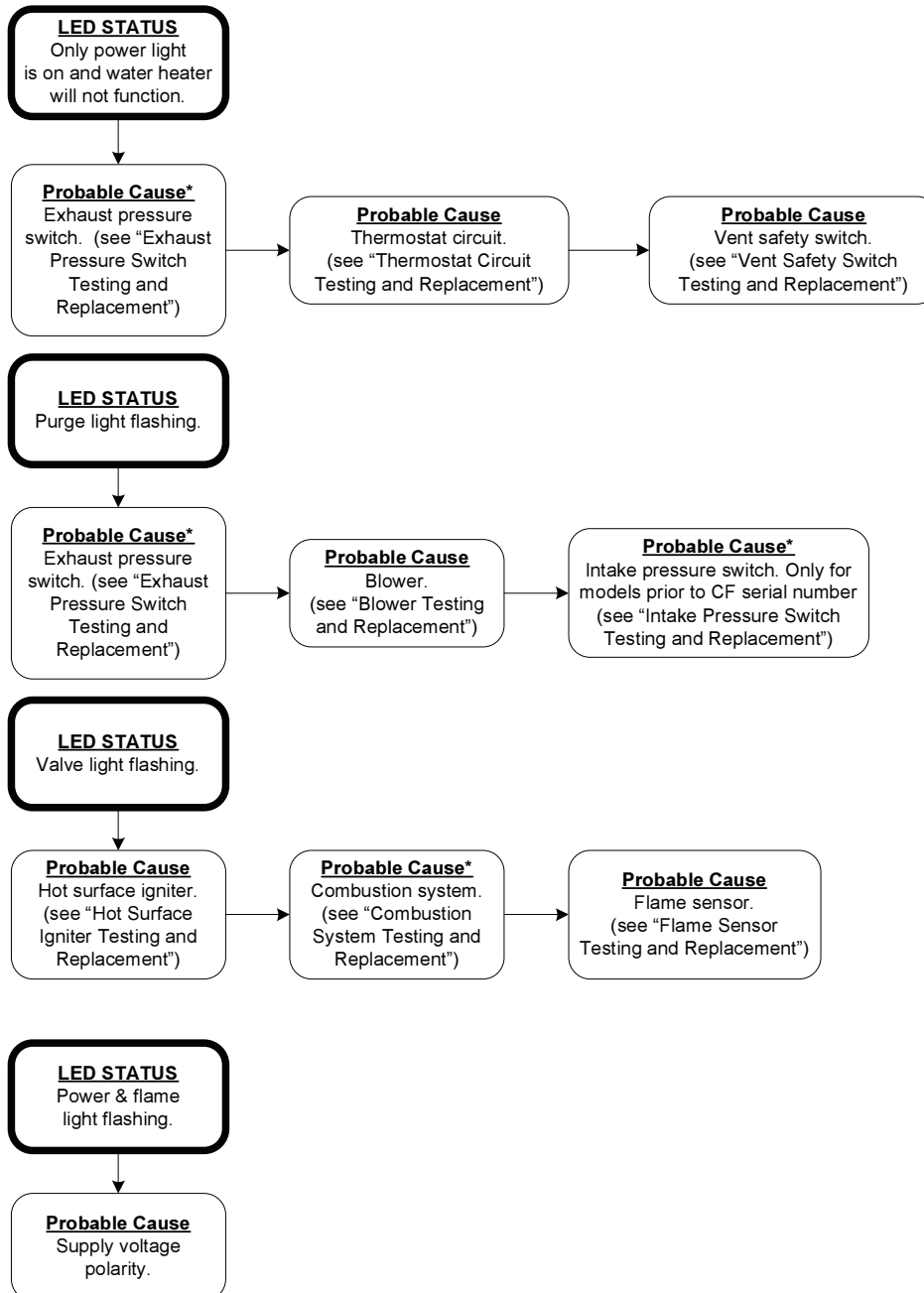


# Troubleshooting

LED status & probable cause  
For models with Hot Surface Ignition

Determine failure mode by observing flashing LED status on ignition module.  
LED status and probable cause shown below.

\* Denotes conditions that may require the water heater to be isolated from the vent system to determine root cause.



**Water Heater Fault: Water heater does not operate**  
**Display Error Code: Water heater display does not operate - blank display**

Check main power supply to water heater - fuse, circuit breaker, plug receptacle, line cord or wiring to water heater.

Check to make sure switch on front of control panel is in the ON position

Verify Primary voltage at the control board.

Verify Secondary voltage at the control board.

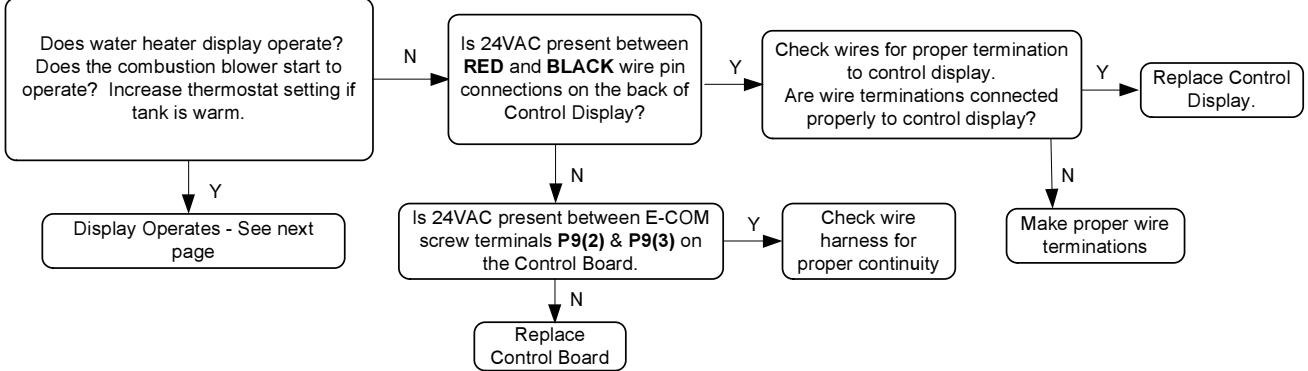
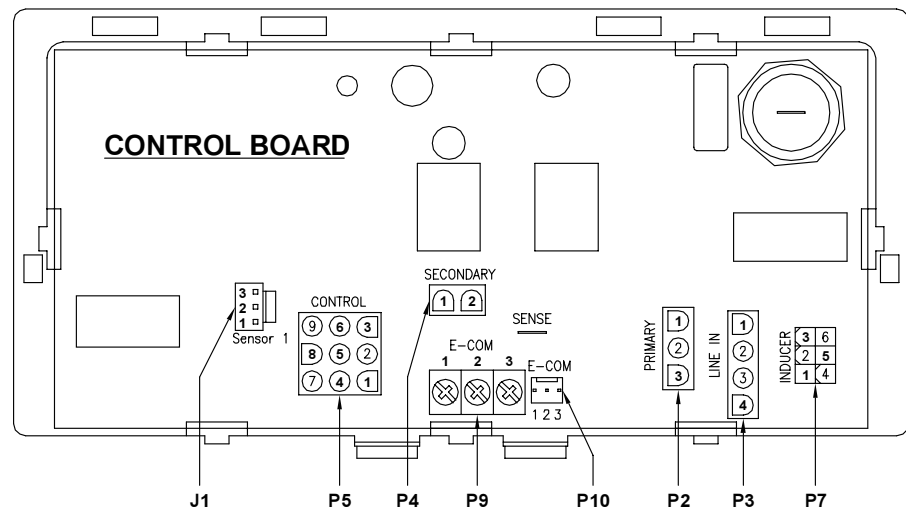
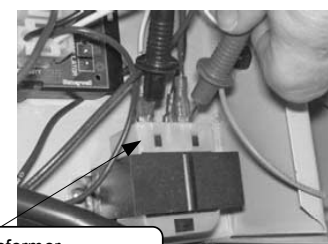
Refer to Control Board illustration. Voltage at primary pins **P2(1)** & **P2(3)** will be 110-120. If not, check Line In pins **P3(1)** & **P3(4)**. Check line cord with volt meter. Replace line cord if defective.

Refer to Control Board illustration. Voltage at secondary pins **P4(1)** & **P4(2)** will be 24VAC. If not, check transformer. Replace transformer or wire harness.

Transformer  
Top terminals are 24VAC;  
Bottom terminals are 120VAC

**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

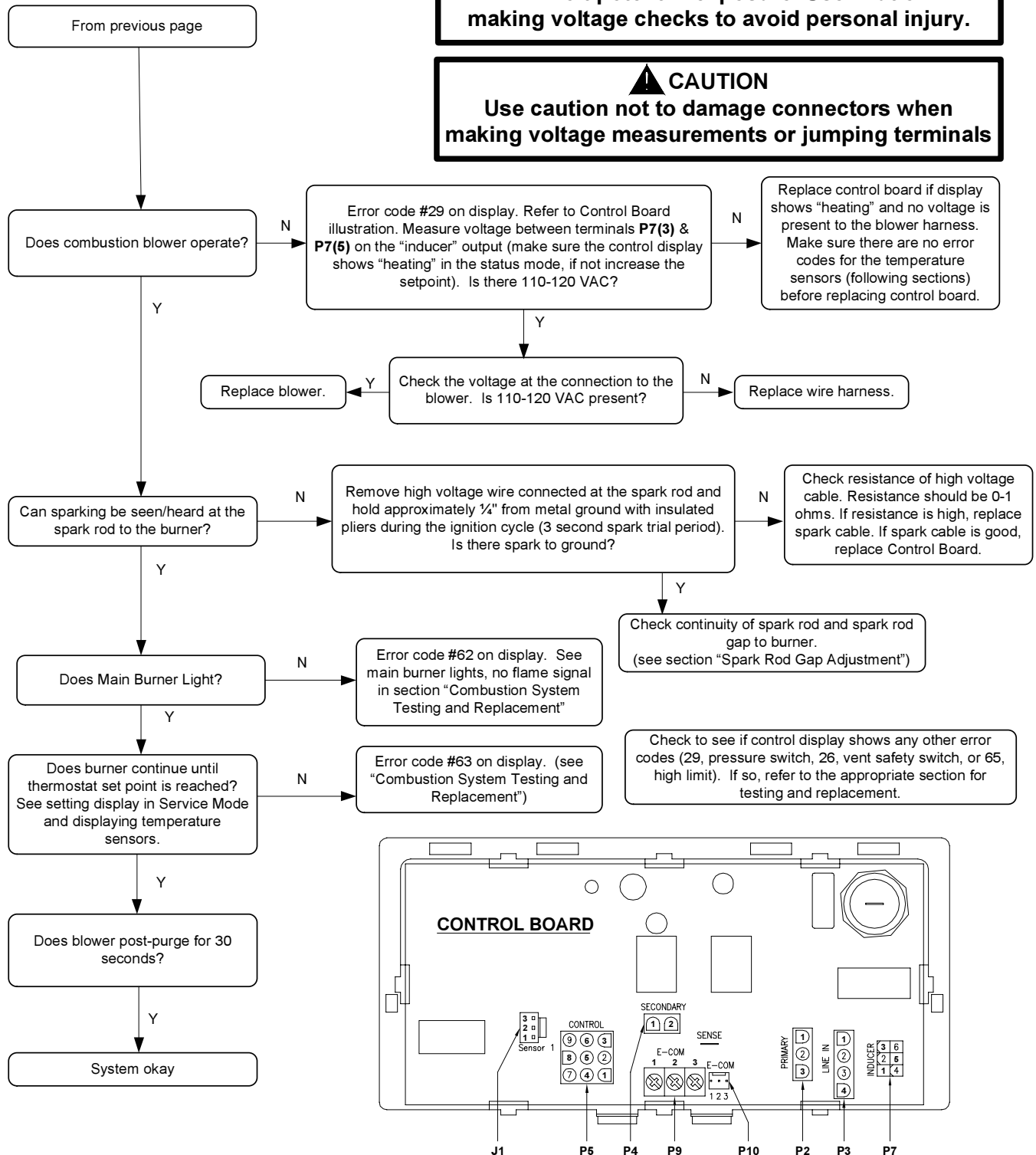


## WARNING

**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**



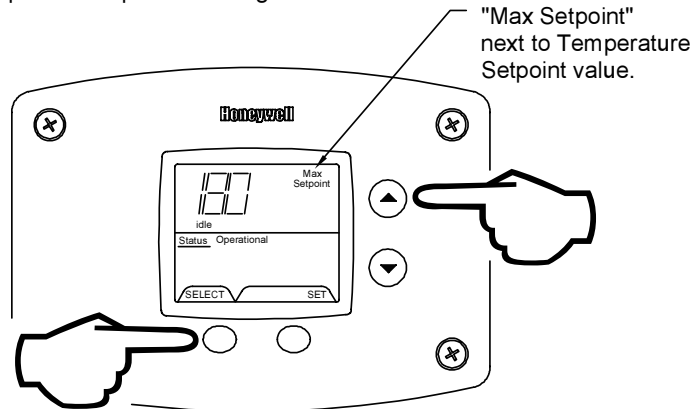


## Troubleshooting

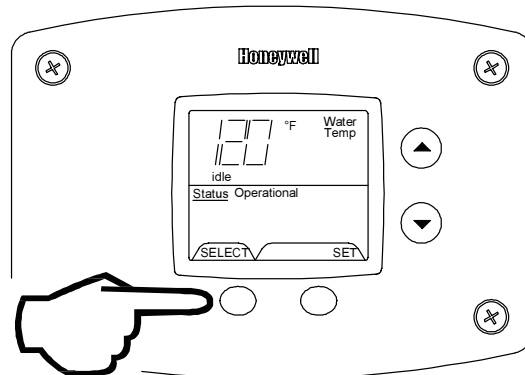
Accessing Service Mode on Control Display  
For models with Honeywell Integrated Control

The display has a "service mode" for changing the maximum setpoint and accessing information in aiding servicing of the water heater. This procedure is for service and installation personnel only. To enter the Service Mode, follow the steps illustrated below:

Step 1: Press "Select" and "Temperature Up" buttons together and hold for 3 seconds until "Max Setpoint" is shown in the display.

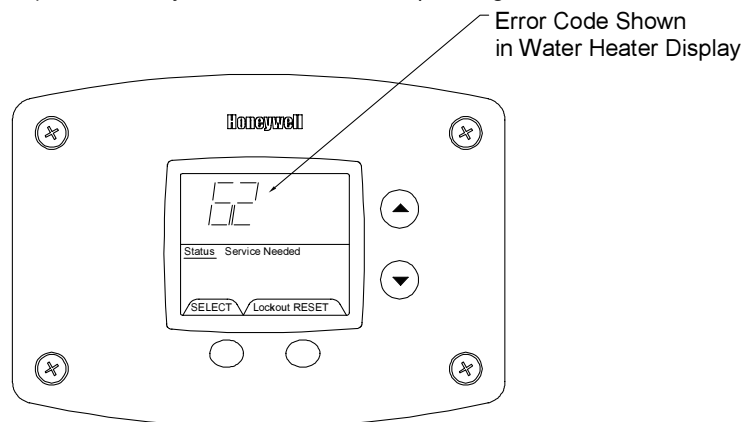


Step 2: Pressing "Select" button will change display to next mode



**The following is the sequence of modes available in "Service Mode" by pressing the "Select" button:**

Error Code Number (Display/Reset). This is only shown if there is an operating error in the "User Mode".

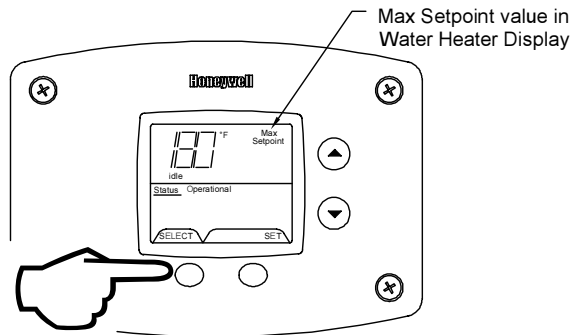




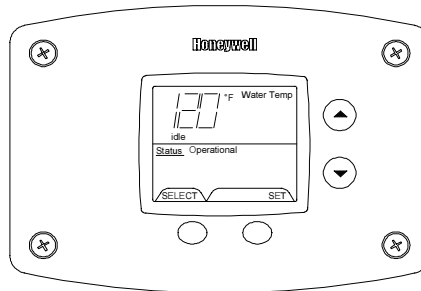
## Troubleshooting

Accessing Service Mode on Control Display  
For models with Honeywell Integrated Control

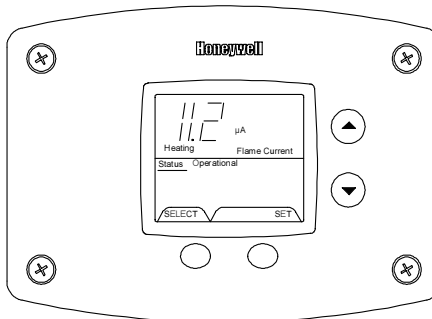
1. Max Setpoint (Display/Change)



2. Tank Sensor Temperature Displayed Water Temperature Average.



3. Flame Current of Burner Flame Sensor (Displays only in the Heating Cycle)

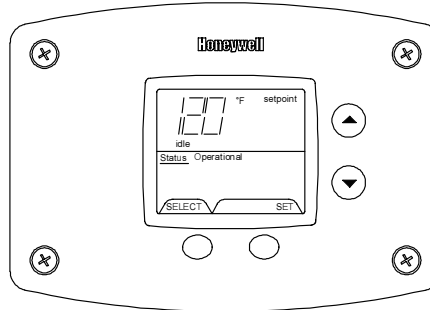




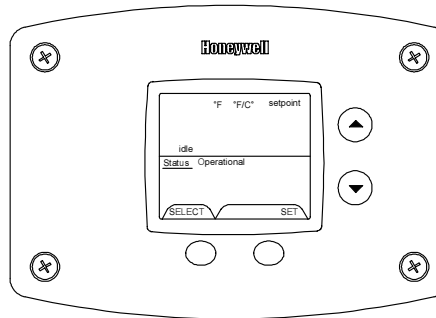
## Troubleshooting

Accessing Service Mode on Control Display  
For models with Honeywell Integrated Control

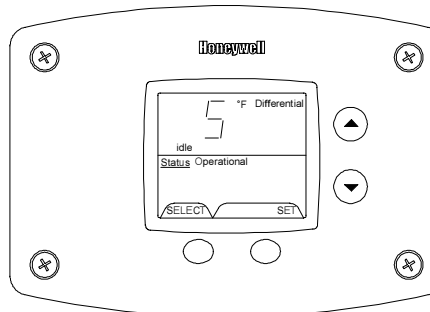
### 4. Setpoint (Display/Change)



### 5. °F/°C (Display/Change)



### 6. Differential (Display only - shows the differential of the thermostat)

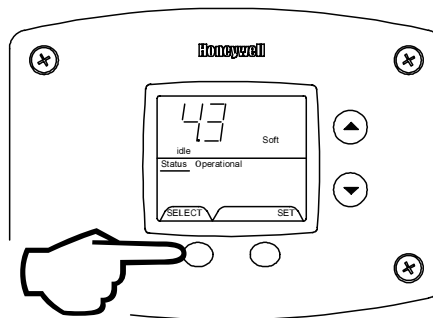




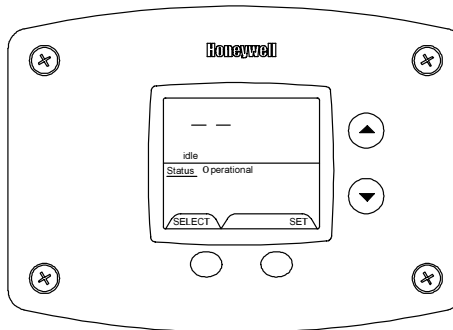
## Troubleshooting

Accessing Service Mode on Control Display  
For models with Honeywell Integrated Control

### 7. Software Version (Display only)



8. Error Code History (Displays if there are present error codes or up to 10 previous error codes). Water Heater Display will show a "--" if there are no error codes.

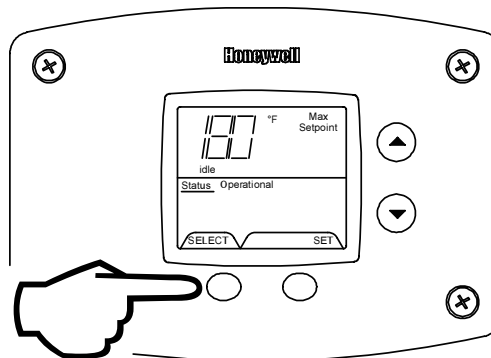


### To change the Maximum Setpoint Limit (Max Setpoint) for the temperature setpoint:

Step 1: In service mode press the "Select" button until "Max Setpoint" is displayed.

#### **WARNING**

Setting the water temperature to the maximum set point can result in scalding hot water delivered to the faucets. It is highly recommended that the maximum setpoint be adjusted to the lowest temperature possible for the needs of the installation. Make sure the water heater control display is not in a public area that can result in the temperature settings being improperly adjusted.

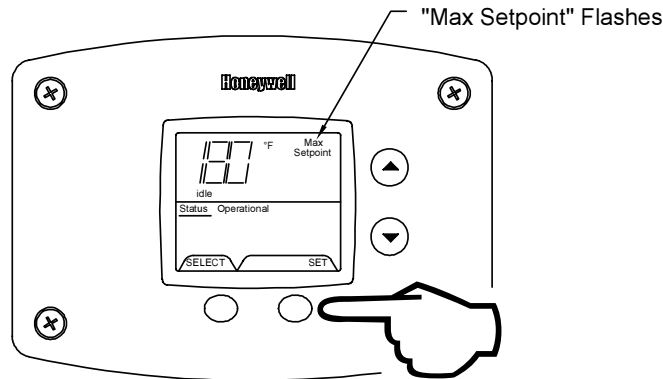




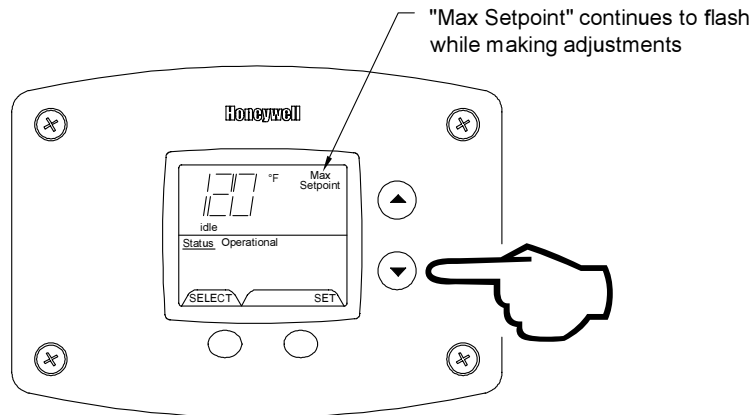
## Troubleshooting

Accessing Service Mode on Control Display  
For models with Honeywell Integrated Control

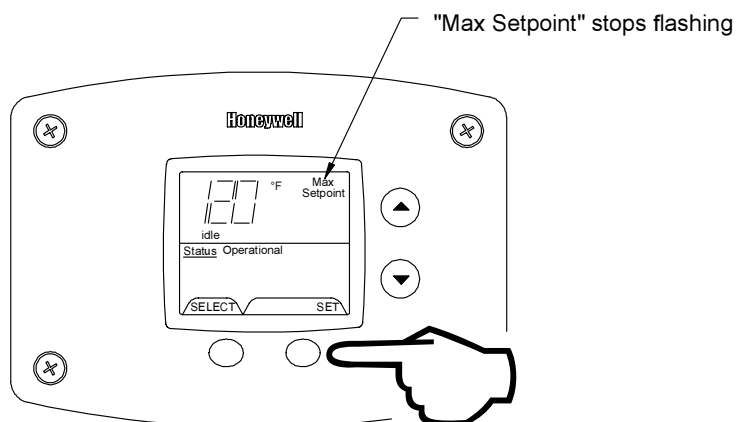
Step 2: Press "Set" button to enter setting mode. "Max Setpoint" will flash to indicate setting mode.



Step 3: Press the "UP" or "DOWN" buttons to change the maximum setpoint value. This will limit the maximum setpoint the user can select. Note: The maximum setpoint is approximately 180°F.



Step 4: Press "Set" button to confirm new "Max Setpoint" value and stop setting mode.



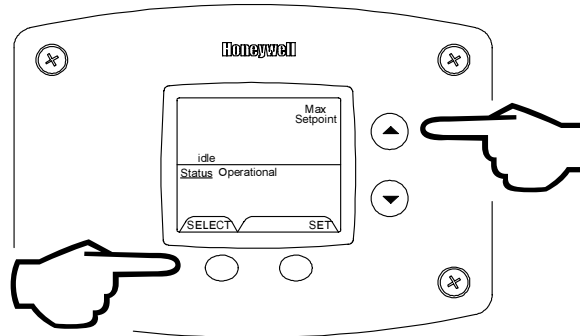




## Troubleshooting

Accessing Service Mode on Control Display  
For models with Honeywell Integrated Control

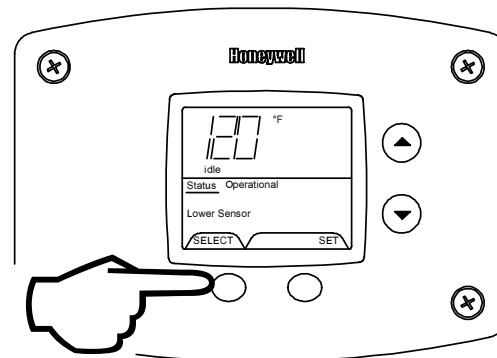
Step 5: 30 Seconds after the last button press, the Water Heater Display will go back to "User Mode". It will read "Max Setpoint" without showing a temperature value if the temperature setpoint is at the maximum setting. The Water Heater Display can be set back to the "User Mode" immediately by pressing both the "Temperature Up" and "Select" buttons together for 3 seconds.



Exiting Service Mode

### Display of Water Temperature:

Step 1: In Service Mode, Press the "Select" button until "Water Temp" is displayed in the upper right section of the water heater display. This is the reading for the sensor.



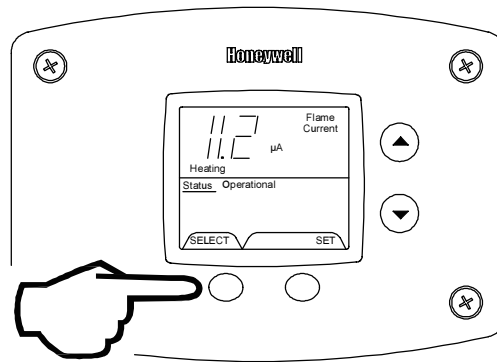


## Troubleshooting

Accessing Service Mode on Control Display  
For models with Honeywell Integrated Control

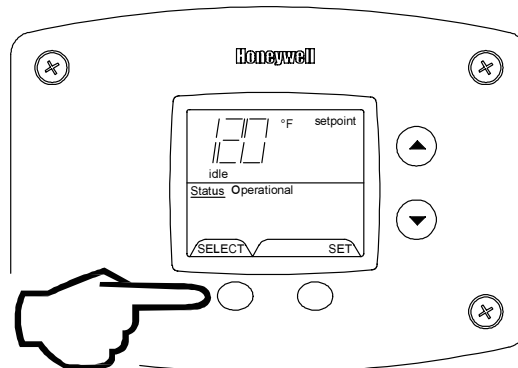
### To Display Flame Sense Current of the Pilot Flame Sensor:

The pilot flame sense current is available only when the burners are in operation. Step 1: Make sure the status displays "Heating" or draw enough hot water to start the burners. Step 2: Enter the "Service Mode" described previously. Step 3: Press the "Select" button until a number value is displayed with "Flame Current" to the right of the number. The value displayed is in microamps ( $\mu\text{A}$ ).



### To Display and Change Temperature Setpoint:

Step 1: In "Service Mode" press the "Select" button until "Setpoint" is shown in the water heater display

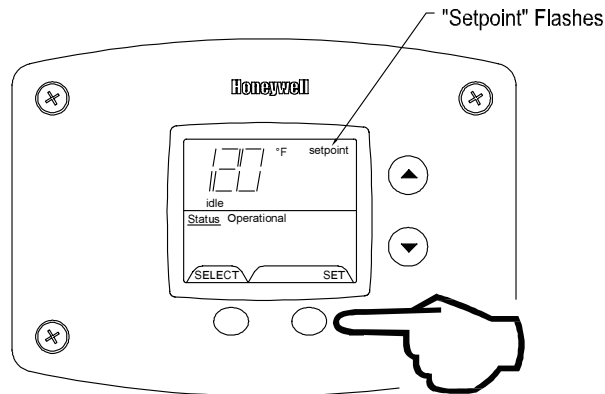




## Troubleshooting

Accessing Service Mode on Control Display  
For models with Honeywell Integrated Control

Step 2: Press the "Set" button to enter the setting mode. "Setpoint" will flash in the water heater display.



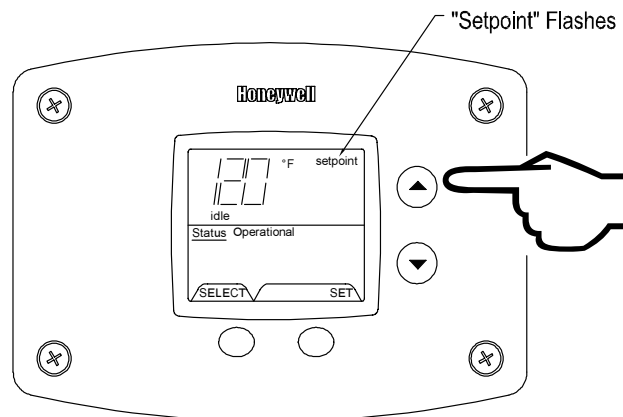
Step 3: To raise the temperature setpoint, press the "Temperature Up" button until the desired temperature is shown on the water heater display.

### NOTICE

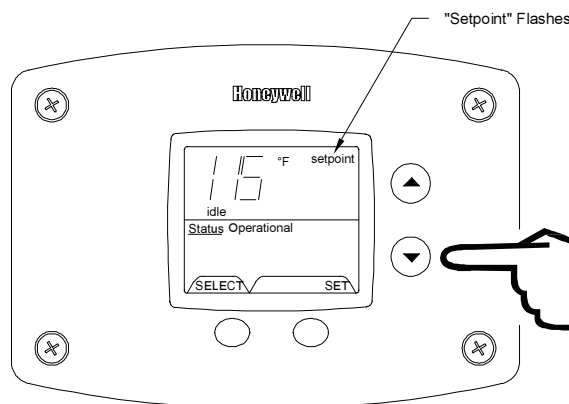
The maximum temperature that can be set in the Water Heater Display is limited to the "Max Setpoint" described previously. To change the "Max Setpoint", refer to the procedure "To Change the Maximum Setpoint Limit..." described previously under "Accessing the Service Mode on the Water Heater Display".

### WARNING

Setting the water temperature to the maximum set point can result in scalding hot water delivered to the faucets. It is highly recommended that the maximum setpoint be adjusted to the lowest temperature possible for the needs of the installation. Make sure the water heater control display is not in a public area that can result in the temperature settings being improperly adjusted.



Step 4: To lower the temperature setpoint, press the "Temperature Down" button until the desired temperature is shown on the water heater display.

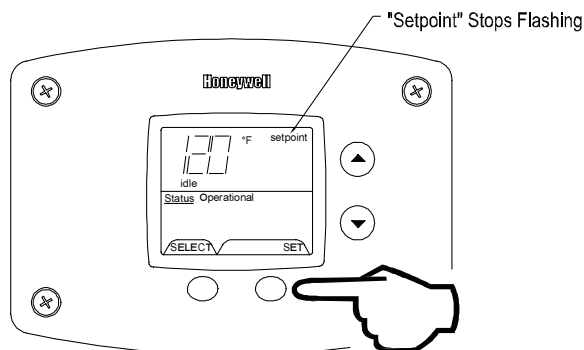




## Troubleshooting

Accessing Service Mode on Control Display  
For models with Honeywell Integrated Control

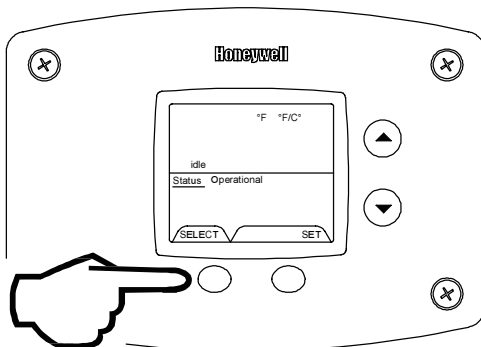
Step 5: When the desired setpoint is reached on the water heater display, press the “Set” button to confirm the new setpoint. “Setpoint” stops flashing in the water heater display.



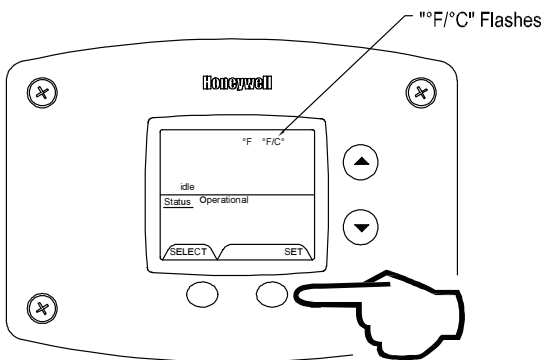
**To Display and Change Temperature Format (°F/°C):**

**To Change Temperature Format in Display from °F to °C or °C to °F:**

Step 1: While in “Service Mode”, press “Select” button until “°F/°C” is shown in the upper right portion of the water heater display.



Step 2: Press “Set” button to change temperature format. “°F/°C” symbol will flash in the water heater display.

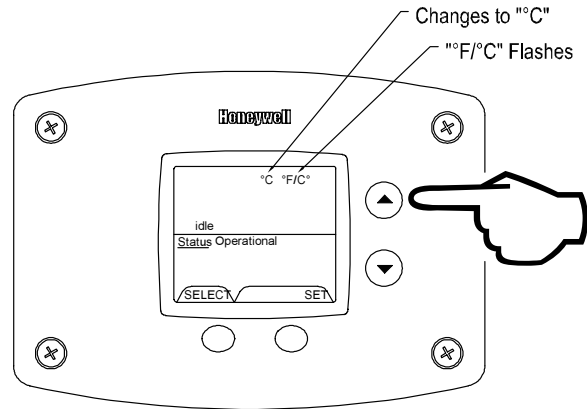




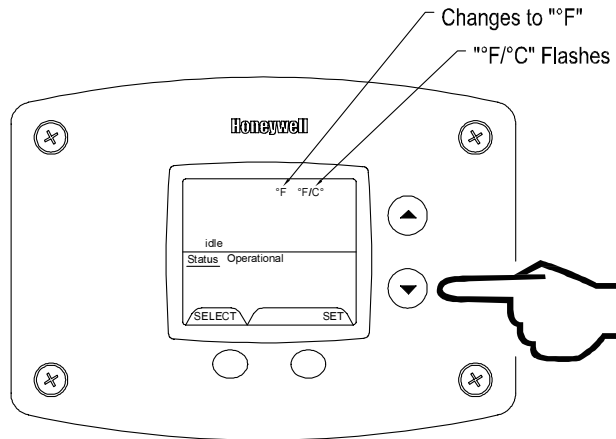
## Troubleshooting

Accessing Service Mode on Control Display  
For models with Honeywell Integrated Control

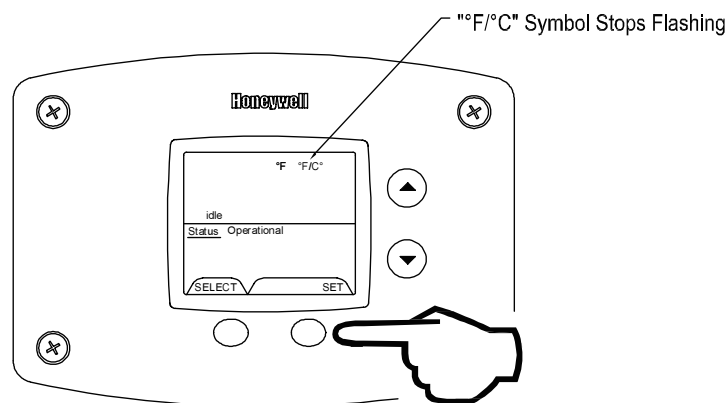
Step 3a: Press "Temperature Up" button to change temperature format to °C



Step 3b: Press "Temperature Down" button to change temperature format to °F



Step 4: Press "Set" button to confirm °F or °C format. °F/°C will stop flashing

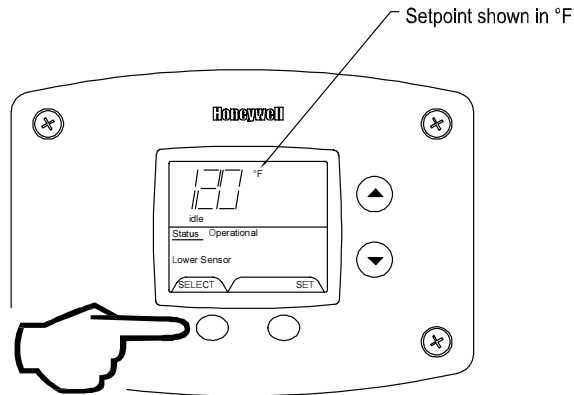




## Troubleshooting

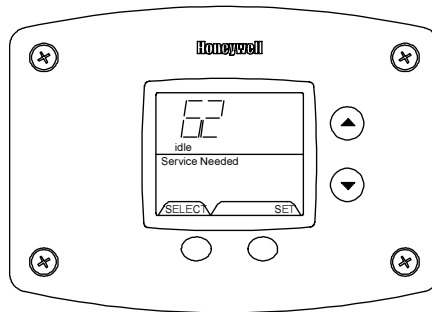
Accessing Service Mode on Control Display  
For models with Honeywell Integrated Control

Step 5: Pressing "Select" button will return display to setpoint in format selected (°F or °C) immediately



### Error Codes and Error History Display:

If there is an operating problem with the water heater, an error code number will appear on the water heater display with "Service Needed" to the right of the "Status" indicator. The error code label is located under the Water Heater Display and the following section in this Service Manual explains the error codes with corrective actions to repair the water heater.



### Error Code History:

In "Service Mode" pressing the "Select" button after the "Software Version" (item 8 in the previously described sequence of service modes) will show an error code history, if there have been any previous operating problems with the water heater. If the display shows --, there is not a current error code. The Water Heater Display will provide up to 10 previous error codes. The oldest error code will be stored in code index #1 and the most recent in code index #10.



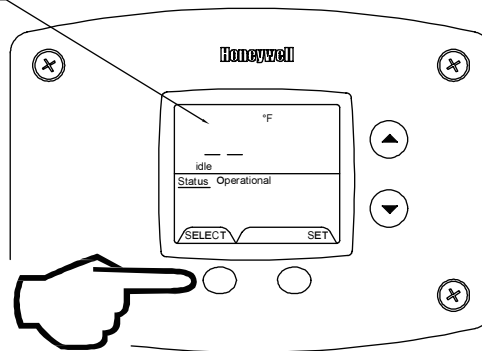
## Troubleshooting

Accessing Service Mode on Control Display  
For models with Honeywell Integrated Control

To view previous error codes:

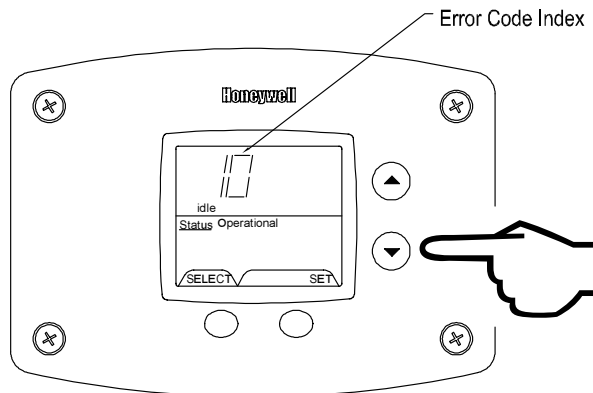
Step 1: In "Service Mode" press the "Select" button until the next display after the "Software Version". If there are no current error codes, the display will show --.

No Current Error Code



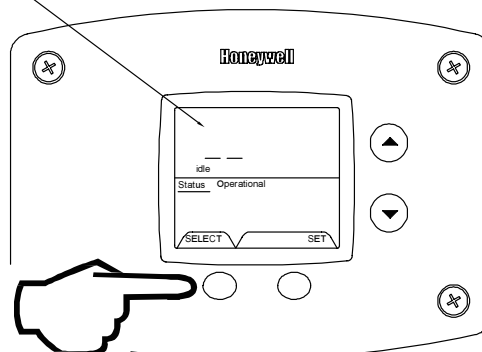
Step 2: Press the "Temperature Down" button to select the error code index, starting with the most recent error code "10".

Error Code Index



Step 3: Press the "Select" button to view the error code for "code 10". If there is a number displayed, note what the number is. The label next to the water heater display will identify the code number. If no number is displayed with only a "--" in the water heater display, then there has not been an error code for error code index 10.

No Error Code Shown  
for Code Index 10

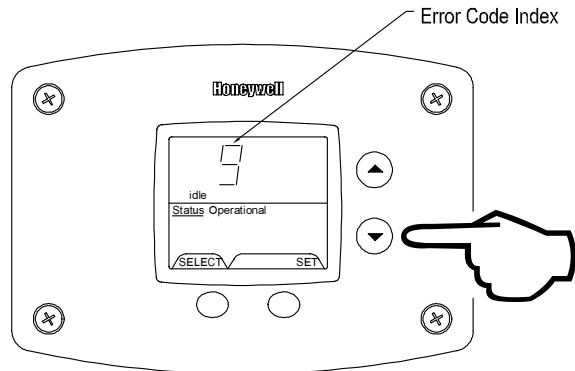




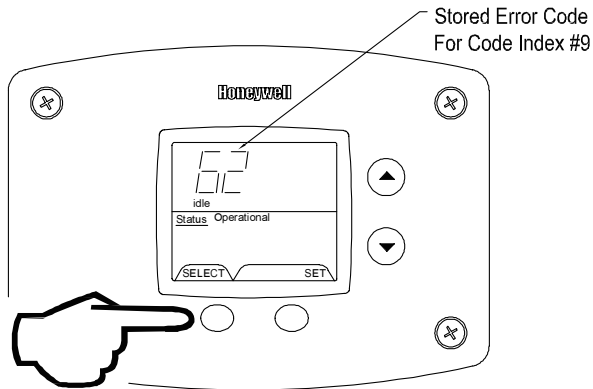
## Troubleshooting

Accessing Service Mode on Control Display  
For models with Honeywell Integrated Control

Step 4: Press the "Temperature Down" button to change to the previous code index, code #9.

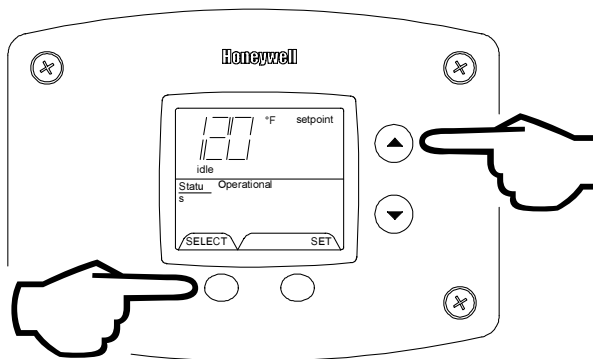


Step 5: Press the "Select" button for code index #9 to view if there are any code numbers.



Step 6: Continue pressing the "Temperature Down" button to change to the next error code index and press "Select" to view the error code number, if any, for that index number. Continue on to index #1, the oldest error code index. The water heater display will store up to 10 error codes with the oldest code starting in code index #1 with the most recent code in code index #10.

Step 7: 10 seconds after the last button press, the Water Heater Display will revert back to the current error code display. To exit Service Mode, either wait 30 seconds or press Temperature Up button and Select Button for 3 seconds.



Exiting Service Mode





## ERROR CODE DEFINITIONS

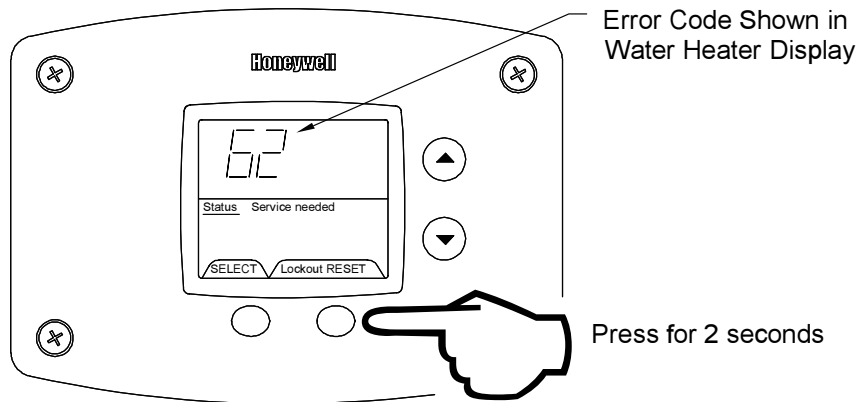
If the water heater has an operating problem, there will be a number in the water heater display with “Service Needed” shown below the error code number. Note the error code and the definition in the chart below. This label appears on the control box under the water heater display. The following sections will provide instructions for servicing each error code.

HONEYWELL INTEGRATED CONTROL ERROR CODE DISPLAY FOR EF MODEL SERIES	
ERROR CODE	DEFINITION
4	LOW FLAME SENSE CURRENT
6	FLAME SENSED OUT OF NORMAL SEQUENCE (BEFORE OPENING GAS VALVE OR AFTER CLOSING GAS VALVE)
23	FLAME DETECTED BEFORE IGNITION
24	FLAME DETECTED AFTER A HEATING CYCLE COMPLETES
29	PRESSURE SWITCH FAILED TO CLOSE OR OPEN (STUCK OPEN)
32	LOWER SENSOR READINGS FAULTY
57	FLAME ROD SHORTED TO GROUND
58	AC LINE FREQUENCY ERROR - SIGNAL TOO NOISY OR FREQUENCY INCORRECT
59	LINE VOLTAGE TOO LOW OR HIGH
61	DC OUTPUT VOLTAGE UNSTABLE
62	MAXIMUM NUMBER OF RETRIES DETECTED
63	MAXIMUM NUMBER OF IGNITION RECYCLES DETECTED
64	ELECTRONICS FAILURE
65	HIGH WATER TEMPERATURE (OVER 200°F)
IF ANY OF THE ABOVE CODES APPEAR ON THE CONTROL DISPLAY, CONTACT YOUR PLUMBER OR QUALIFIED SERVICE AGENT FOR SERVICE OF THE WATER HEATER.	

## ⚠ WARNING

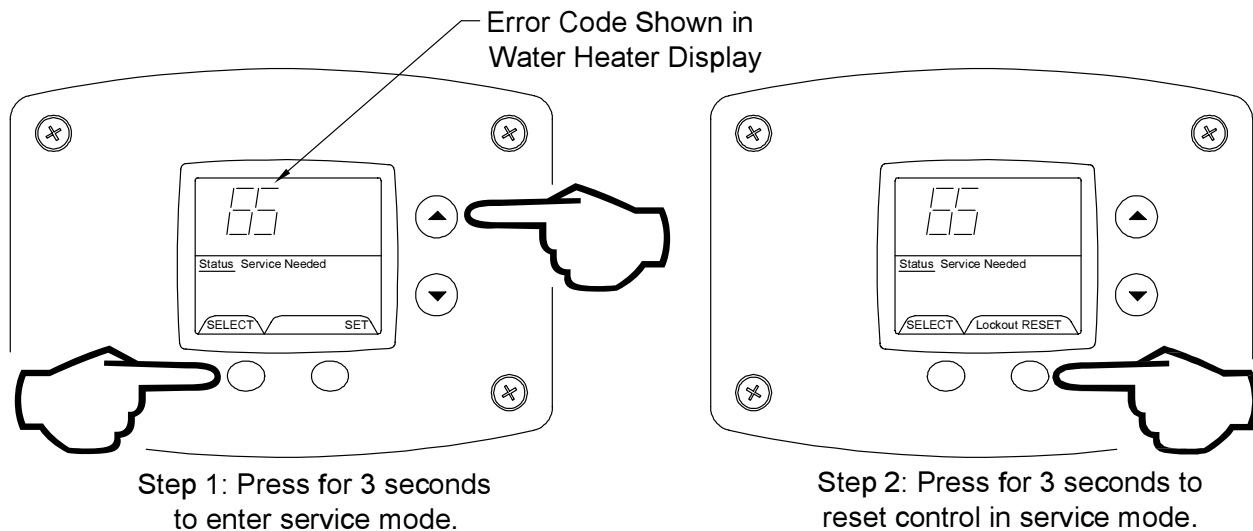
The following procedure is for service and installation personnel only. Resetting lockout conditions without correcting the malfunction can result in a hazardous condition.

If an error code is displayed (except for #4, low flame sense current), the water heater will be in a "lockout condition" with the water heater display showing the error code number and "Service Needed" in the status section of the display window. Error codes 62 (maximum number of retries detected) and 63 (maximum number if ignition recycles detected) are "Soft Lockouts" in which the control can be reset in the "User Mode" by pressing the lower right button under "Lockout Reset" shown in the lower right portion of the display. The control will also go through 3 attempts to relight the burners every hour in the soft lockout condition.



All other error codes will put the water heater into a "Hard Lockout" condition, in which the water heater will not operate and cannot be reset in the "User Mode". To reset a hard lockout, first enter the "Service Mode" described earlier by pressing both the "Temperature Up" and "Select Buttons" at the same time for 3 seconds. Then press the lower right button under "Lockout Reset" in the water heater display and hold for 3 seconds.

## Resetting Error Codes in Hard Lockout Condition





# SERVICE PROCEDURE EF-I

## Thermostat Circuit Testing and Replacement

**For models with Honeywell Integrated Control System**

**IMPORTANT NOTE:** This procedure assumes a cool tank

### ⚠ 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

**Condition: Water Heater Not Operating**  
Display shows error code "32" ( 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 0.5 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 display in "Service Mode").

**Condition: Water Heater Not Operating**  
Display shows error code "65"  
High Water Temperature (over 200 °F)

**WARNING**  
Do not reset the 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?

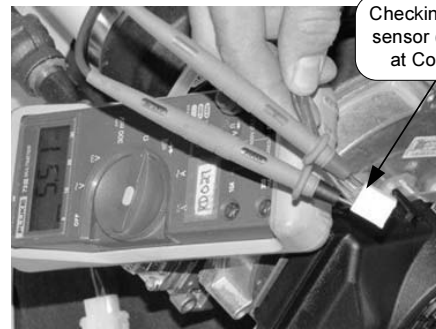
N

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

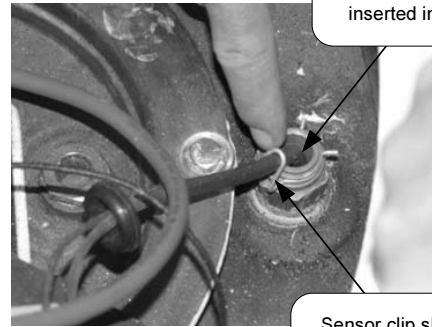
Continued on next page

Y

Check Sensor Resistance (See Sensor Resistance Testing, following section)



Checking continuity of sensor (disconnected at Control Board)



Sensor shown fully inserted into well

Sensor clip shown installed properly



## SERVICE PROCEDURE EF-I

### Thermostat Circuit Testing and Replacement

#### For models with Honeywell Integrated Control System

Condition: Water Heater Not Operating  
Display shows error code "65"  
High Water Temperature (over 200 °F)  
(Continued from previous page)

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

- Reconnect and switch on power to the water heater.
- Enter service mode on the water heater display (see illustration)
- Press button under "Lockout 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 well below 200 °F

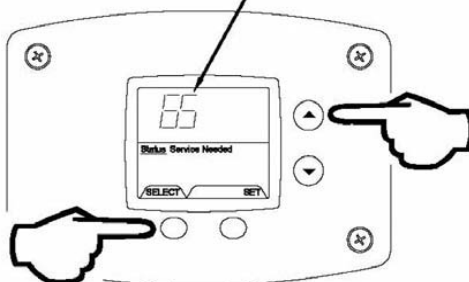


#### WARNING

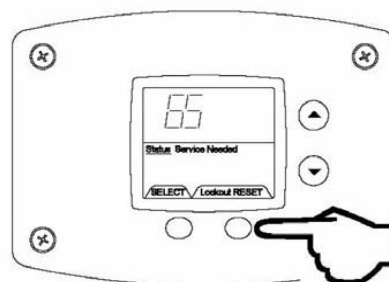
Do not operate water heater without verifying that the overheating condition has been corrected.

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, first press the "temperature up" and "select" buttons on the water heater display for 3 seconds to enter service mode. Then press the lower right button under "RESET" in the display for 3 seconds.

Error code 65 indicates high limit lockout condition



Step 1: Press for 3 seconds to enter service mode.



Step 2: Press for 3 seconds to reset control.



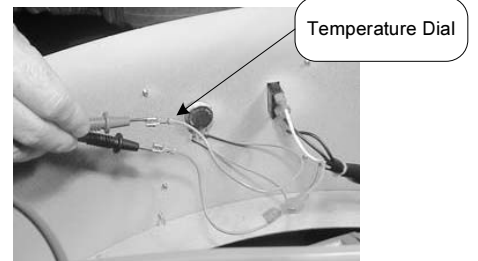
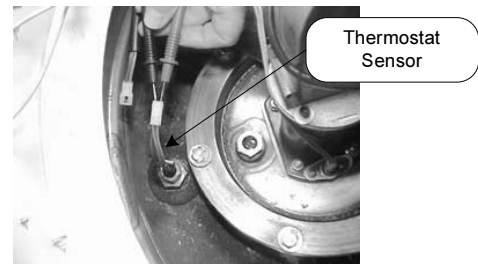
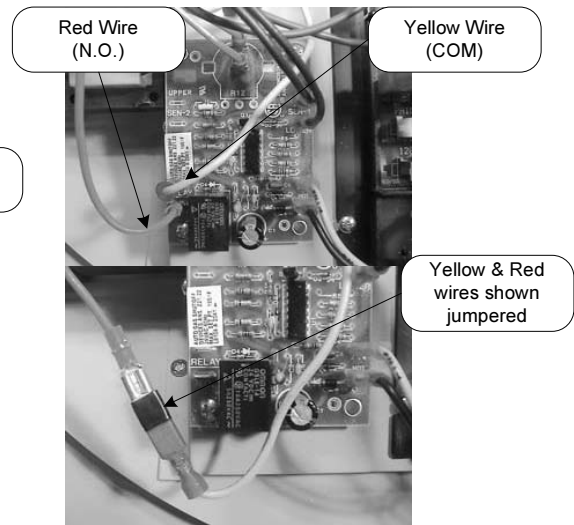
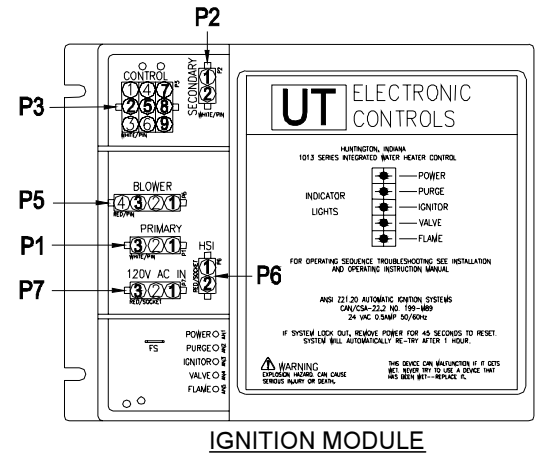
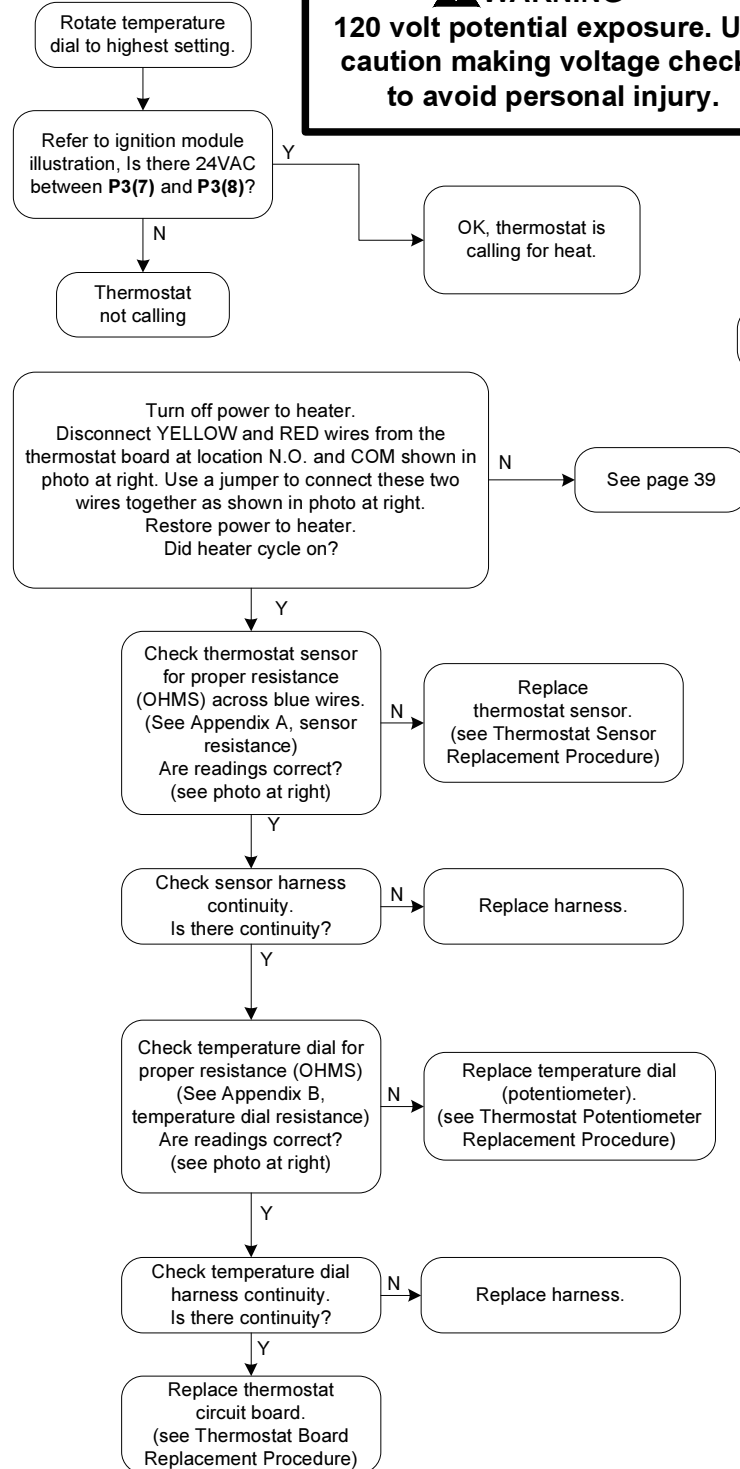
# SERVICE PROCEDURE EF-I

## Thermostat Circuit Testing and Replacement

**For models with Hot Surface Ignition**

**IMPORTANT NOTE:** This procedure assumes a cool tank

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





# SERVICE PROCEDURE EF-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 temperature of sensor 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

### APPENDIX - B

#### Temperature Dial Resistance

Proper Readings Should Be Greater Than 4800 Ohms at  
Minimum Setting  
And Less Than 50 Ohms at Maximum.

*Be Careful When Making Voltage Measurements or Jumping Terminals  
Not to Damage or Deform Connectors or Connector Pins.*

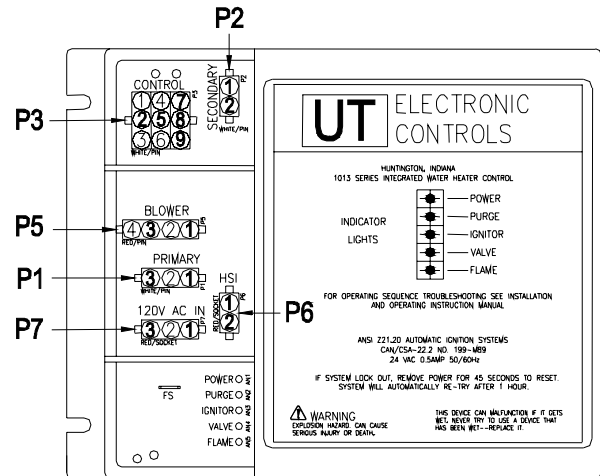
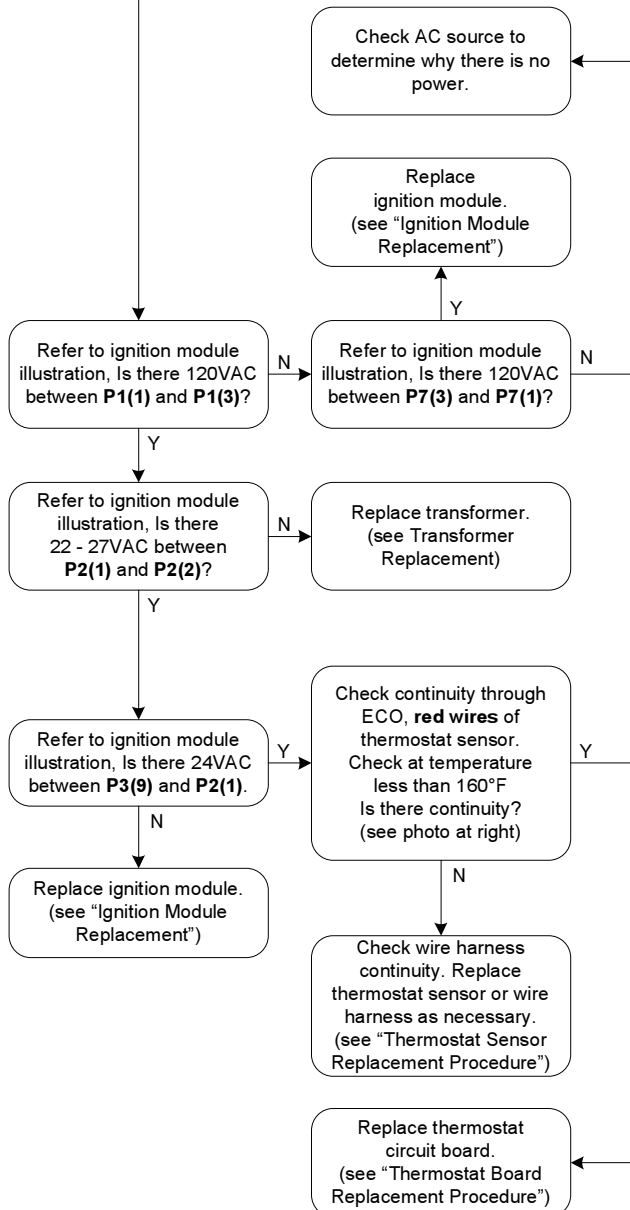
# SERVICE PROCEDURE EF-I

## Thermostat Circuit Testing and Replacement

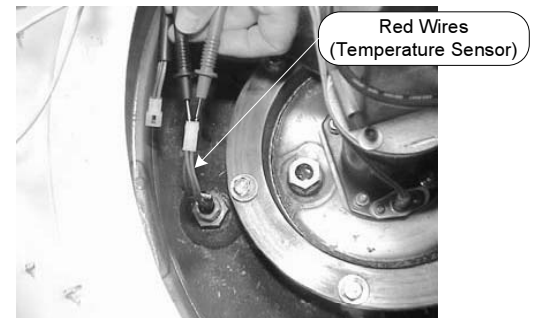
**For models with Hot Surface Ignition**

Thermostat circuit.  
(continued from page 37)

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



**IGNITION MODULE**







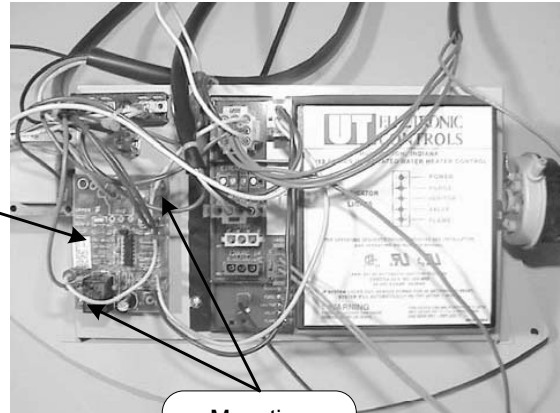
# SERVICE PROCEDURE EF-I

## Thermostat Circuit Testing and Replacement

### Thermostat Board Replacement Procedure (Hot Surface Ignition)

- 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. Locate thermostat board on control panel.  
(see photo at right)
- Step 5. Carefully disconnect all wires from thermostat board.  
  
Note: it may be necessary to identify wires for proper re-connection.
- Step 6. Remove the two screws (Phillips head screw driver) that secure thermostat board to control panel.
- Step 7. Install new thermostat board to control panel using screws from step 6.
- Step 8. Carefully reconnect wiring per the wire diagram below. Reconfirm wire connections are correct prior to putting heater back in service
- 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 instruction manual.
- Step 10. Replace surround cover on top of heater.

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

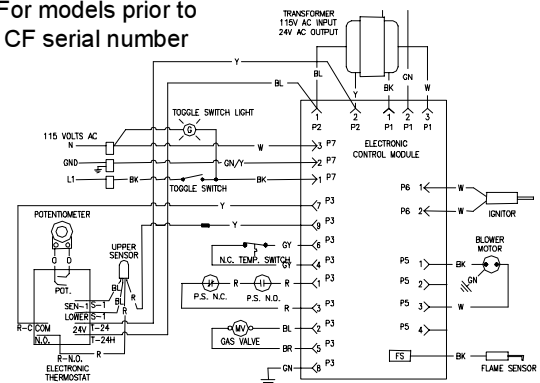


Thermostat Board

Mounting screw locations

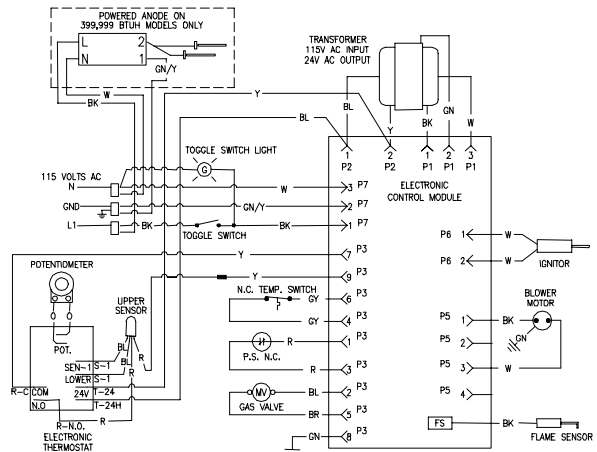
### WIRING DIAGRAM

For models prior to CF serial number



### WIRING DIAGRAM

For models starting with CF serial numbers and later.





### Thermostat Potentiometer Replacement Procedure

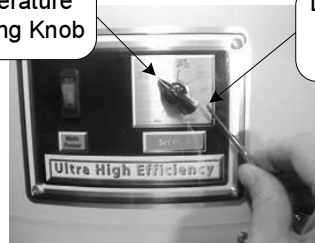
- Step 1. Position main power switch to "OFF"
- Step 2. Disconnect (unplug) water heater from 120 volt power source.
- Step 3. Un-latch and remove top surround cover from top of heater.

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

- Step 4. Loosen set screw of adjusting knob (small blade screw driver) and remove adjusting knob from potentiometer. (see photos at right)

Temperature  
Adjusting Knob

Loosen set screw  
with small blade  
screw driver



- Step 5. Remove retaining nut (1/2" wrench) and washer from potentiometer. (see photos at right)

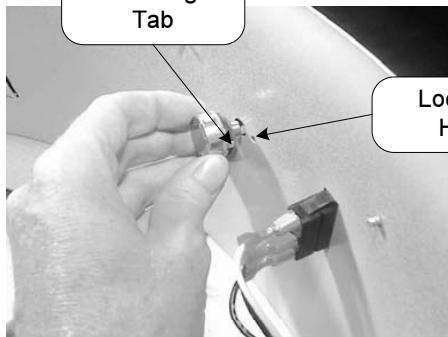
Remove  
retaining nut



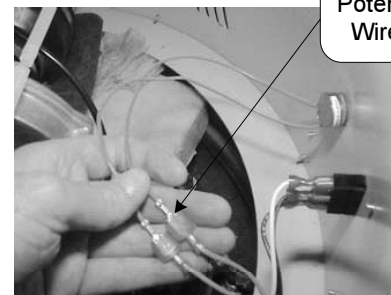
- Step 6. From inside of surround area, remove potentiometer with gasket from side of surround. Notice how indexing tab on potentiometer assembles into locating hole of surround. (see photos below)

Indexing  
Tab

Locating  
Hole



Potentiometer  
Wire Leads



- Step 7. Disconnect potentiometer wire leads. (see photo at right)
- Step 8. Install new potentiometer with gasket into side of surround. Be sure to assemble with indexing tab inserted into locating hole on side of surround (see photos above).
- Step 9. Reconnect wires to potentiometer. Note: Wire leads are interchangeable with either wire.
- 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 instruction manual.
- Step 11. Replace surround cover on top of heater.

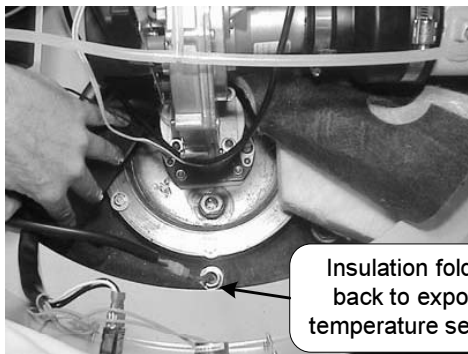


## SERVICE PROCEDURE EF-I

### Thermostat Circuit Testing and Replacement

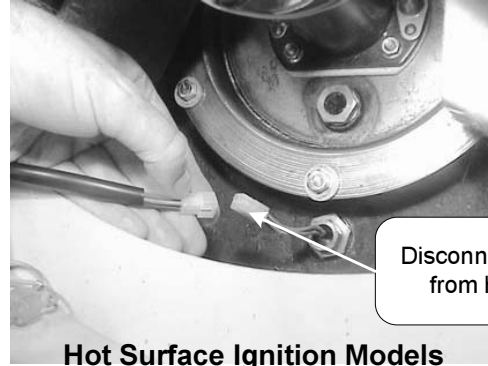
#### Thermostat Sensor (Thermister) Replacement Procedure

- Step 1. Position main power switch to "OFF"
- Step 2. Disconnect (unplug) water heater from 120 volt power source.
- Step 3. **Hot Surface Ignition Models:** Drain water heater down to a point below the top of the tank.
- Step 4. Un-latch and remove top surround cover from top of heater.
- Step 5. Fold back insulation just in front of burner to expose temperature sensor (see photo below).
- Step 6. Disconnect temperature sensor from harness (see photos at right).



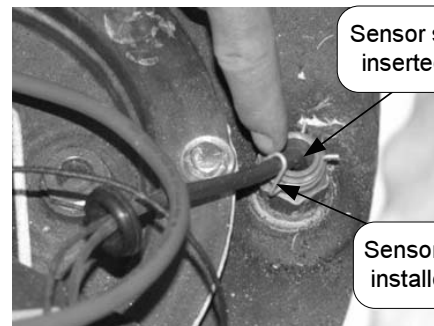
Insulation folded back to expose temperature sensor

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



Disconnect sensor from harness

Hot Surface Ignition Models



Sensor shown fully inserted into well

Sensor clip shown installed properly

Direct Spark Ignition Models

- Step 7. **Hot Surface Ignition Models:** Remove temperature sensor (1-1/16" hex, deep well socket) from heater.  
**Direct Spark Ignition Models:** Unclip sensor from well and pull sensor to remove, do not remove well.

Note: Using a deep well socket will allow room inside socket for sensor connector and wires.

- Step 8. **Hot Surface Ignition Models:** Apply Teflon tape or applicable thread lubricant to threads of new sensor. Install new thermostat sensor and Connect to wire harness from step 6.  
**Direct Spark Ignition Models:** Install new sensor completely into well and reinstall sensor clip.
- 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 instruction manual.
- Step 11. Replace surround cover on top of heater.



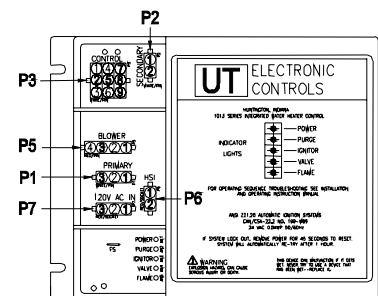
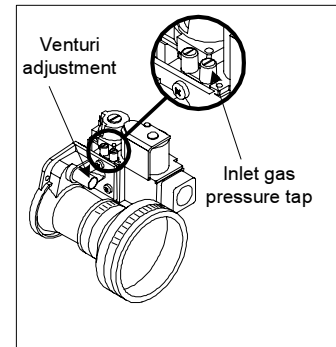
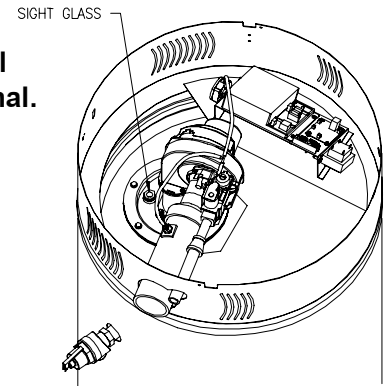
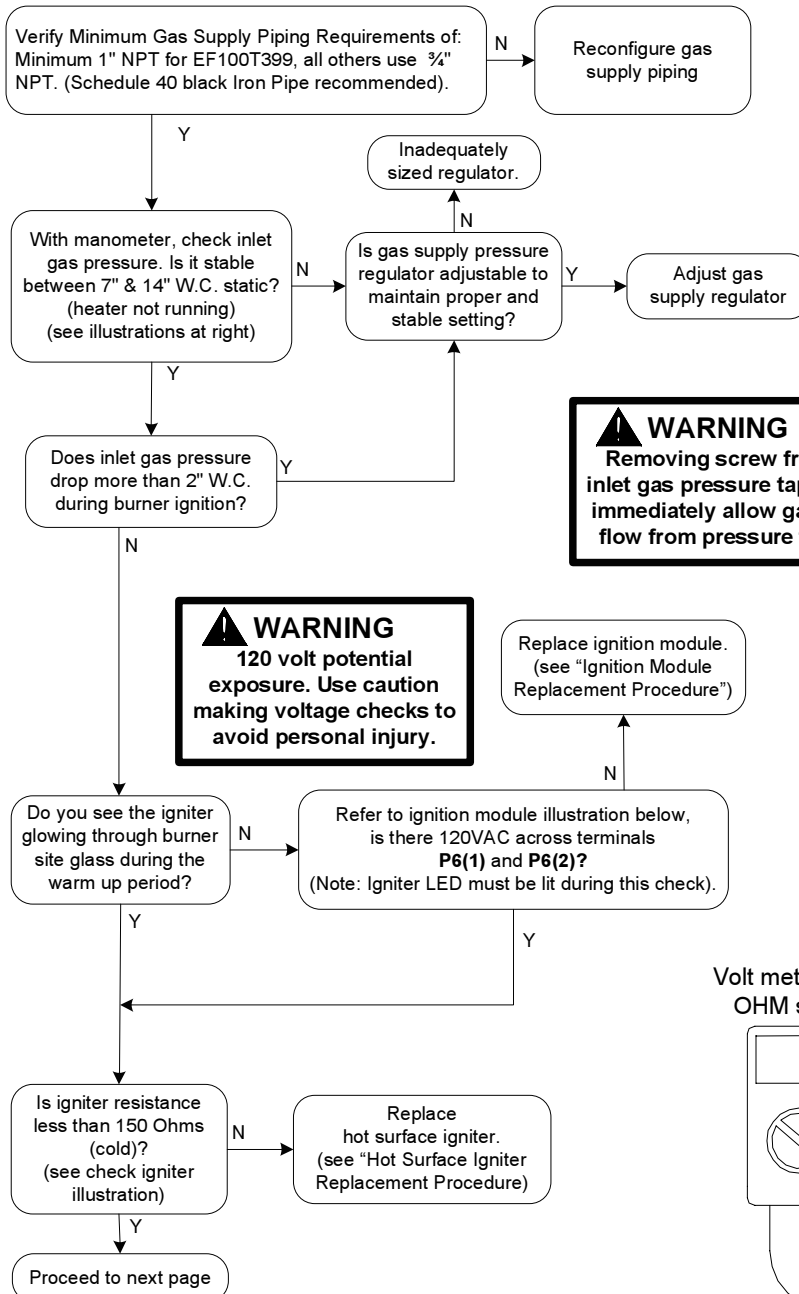
# SERVICE PROCEDURE EF-II

## 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.

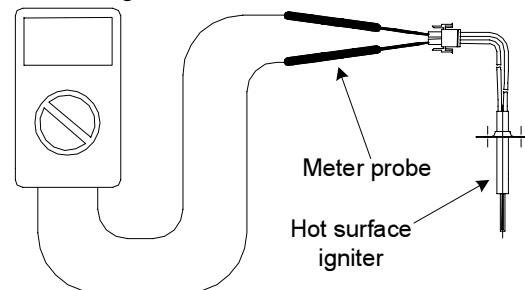
### For models with Hot Surface Ignition System

**Note:** On higher input models using metal fiber mesh burner (serial number "CK" and later) a red glow from the burner surface is normal.



**IGNITION MODULE**

Volt meter set to OHM setting



**CHECK IGNITER RESISTANCE**



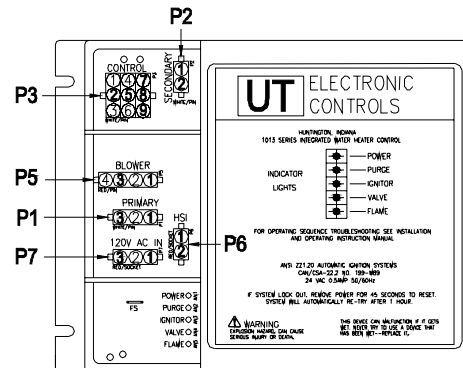
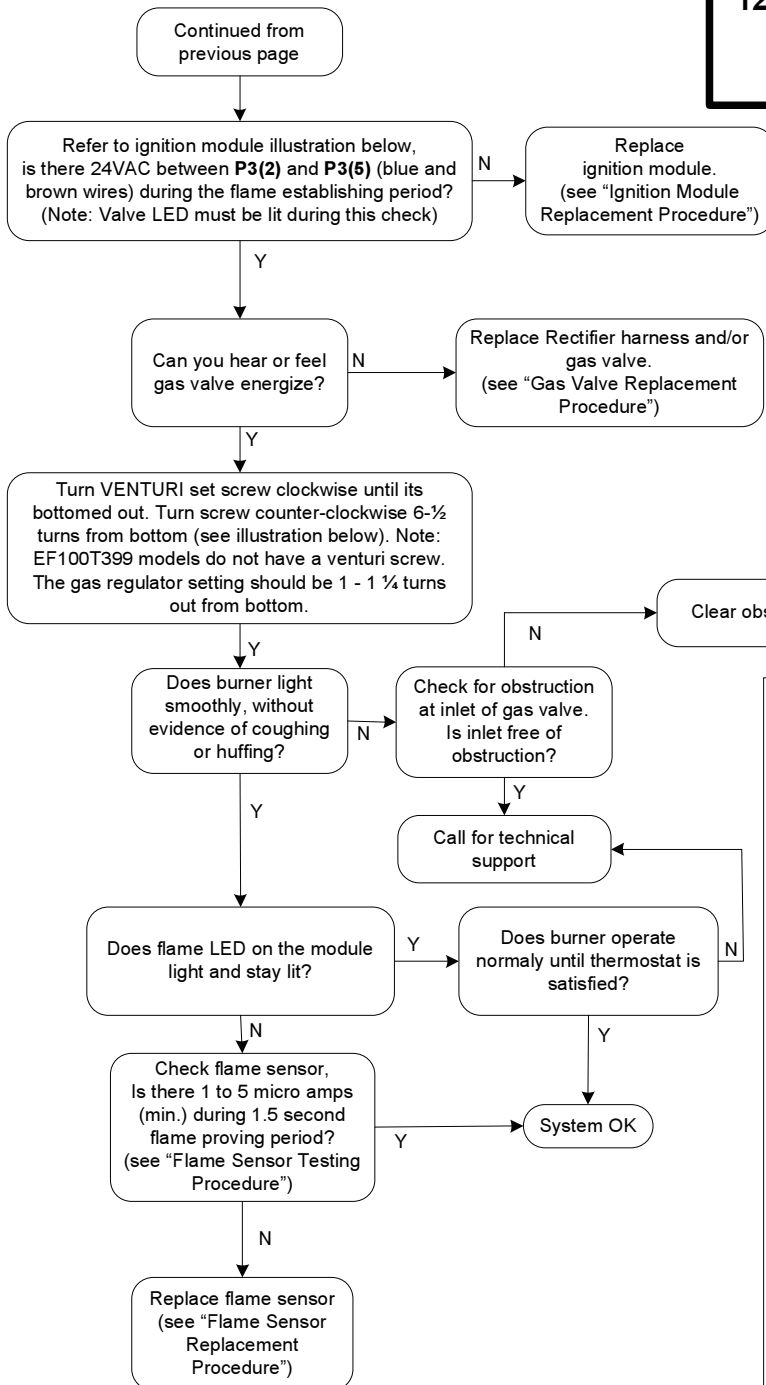
# SERVICE PROCEDURE EF-II

## Combustion System Testing and Replacement

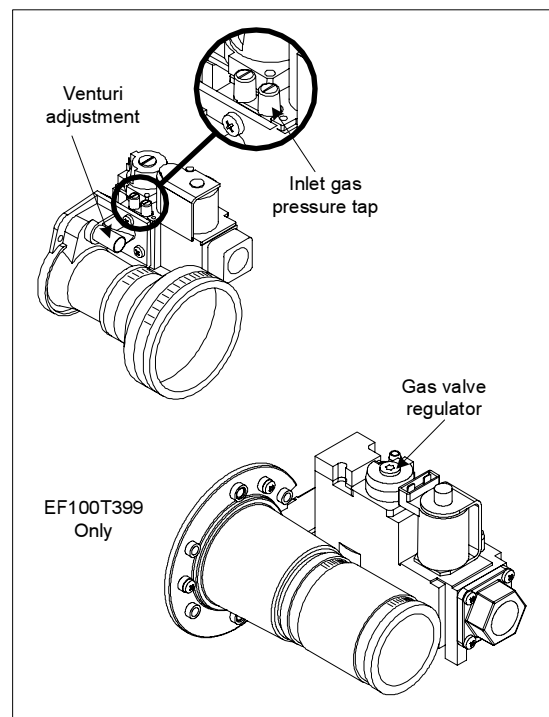
Observe burner operation through the sight glass located on the combustion insert mounting flange. Normal burner operation should ignite smoothly, without evidence of coughing or huffing upon ignition. The burner flame should be a blue flame near the burner surface in a uniform flame pattern. Occasional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

### For models with Hot Surface Ignition System

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



IGNITION MODULE





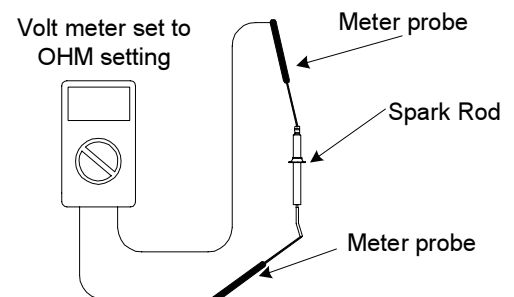
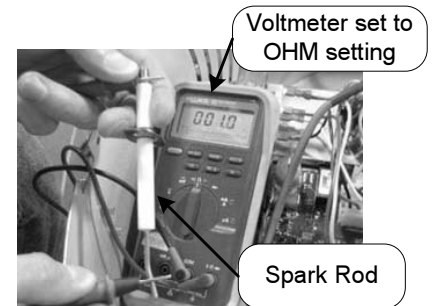
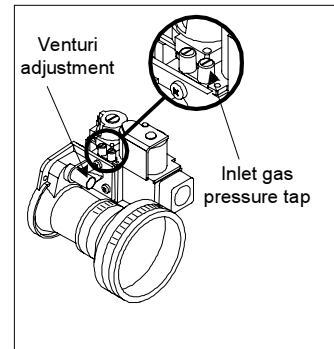
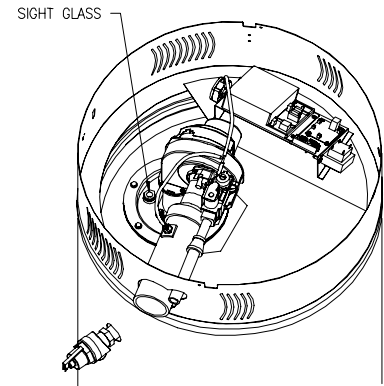
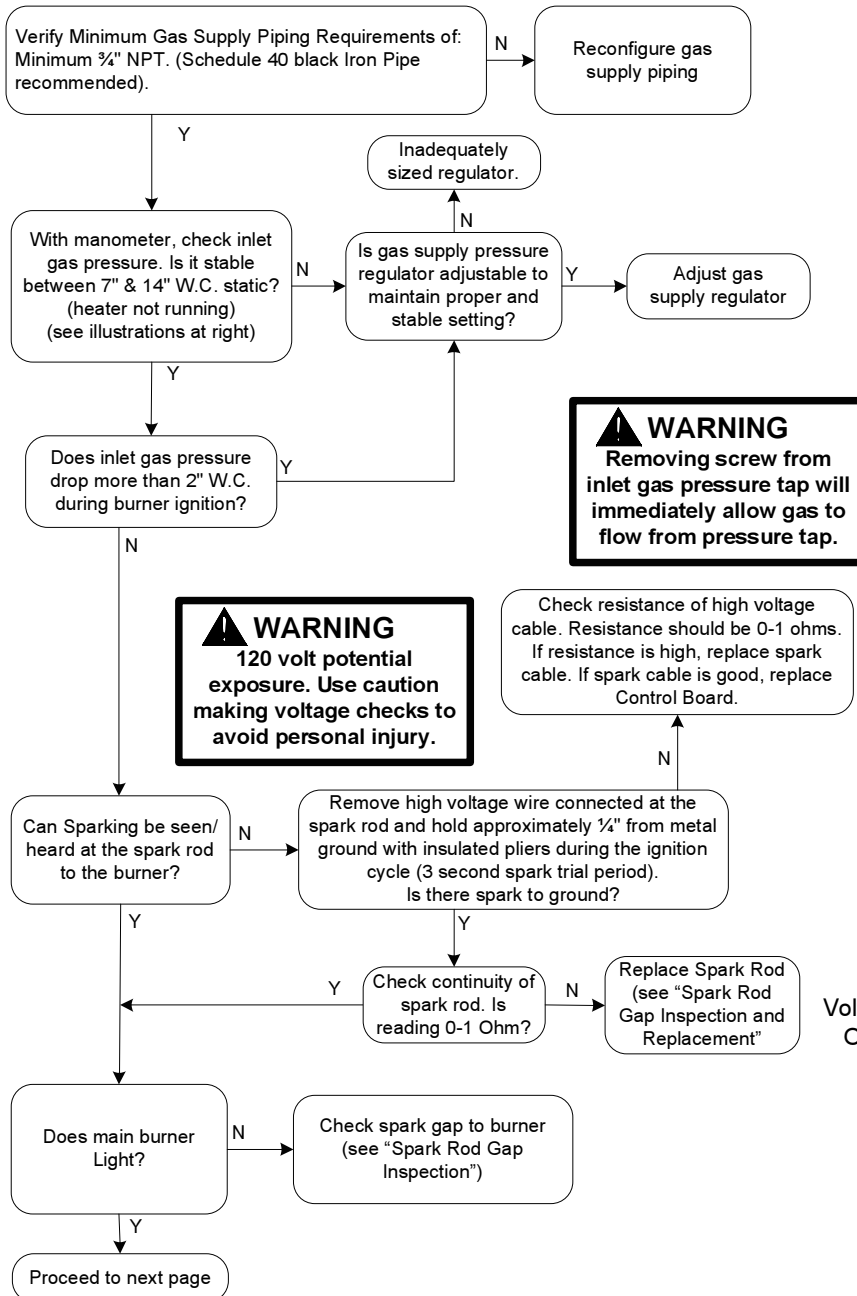
## SERVICE PROCEDURE EF-II

### 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.

#### For models with Direct Spark Ignition

**Note:** On higher input models using metal fiber mesh burner a red glow from the burner surface is normal.



**CHECK SPARK ROD  
RESISTANCE**



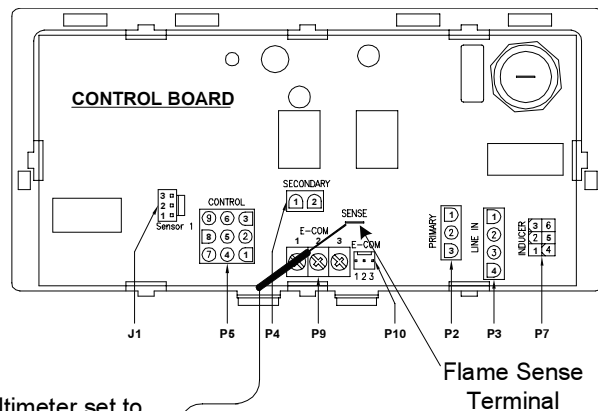
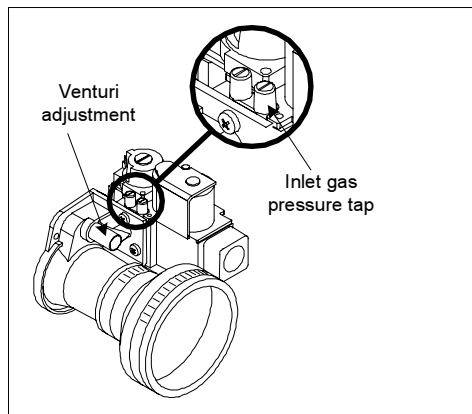
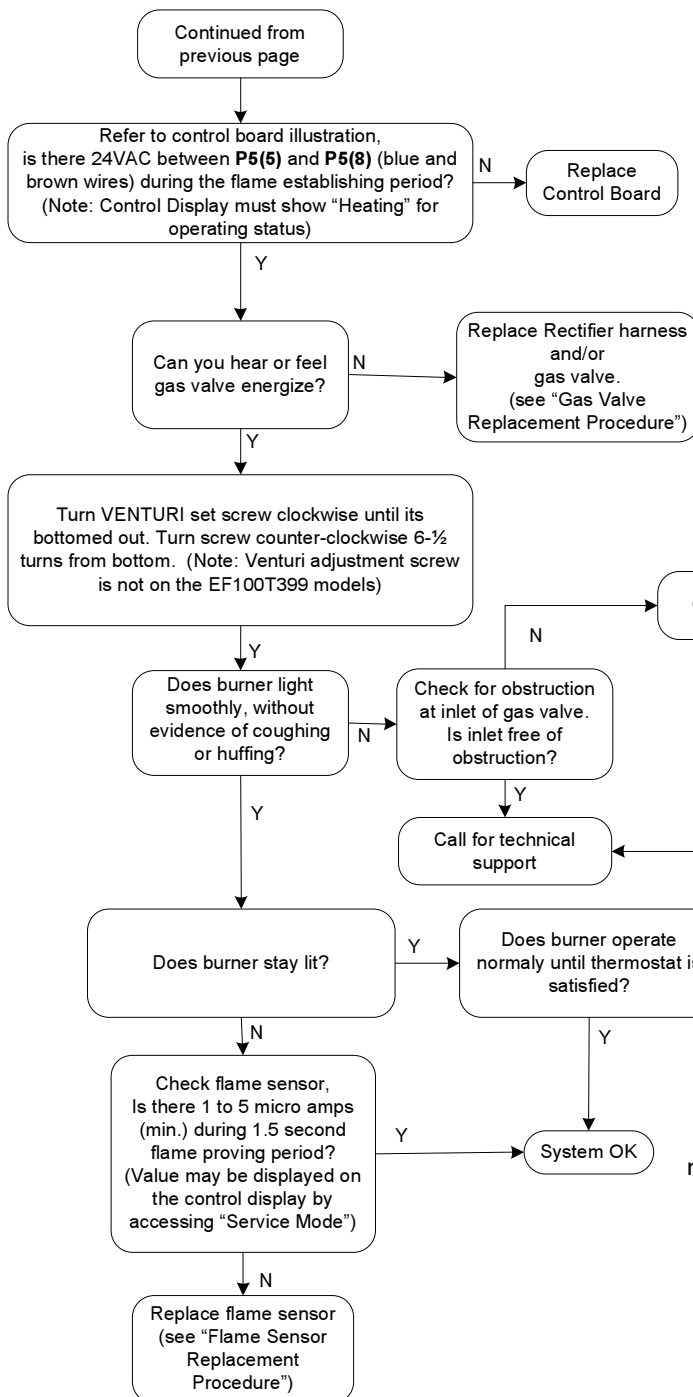
# SERVICE PROCEDURE EF-II

## 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.

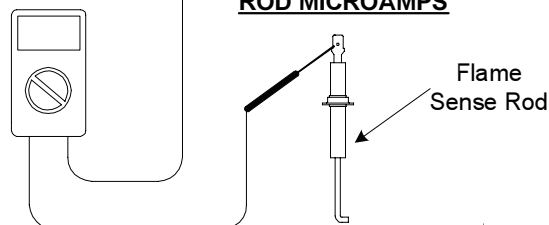
### For models with Direct Spark System

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



Multimeter set to microamp (µA) setting

**CHECK FLAME SENSE ROD MICROAMPS**







## SERVICE PROCEDURE EF-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.

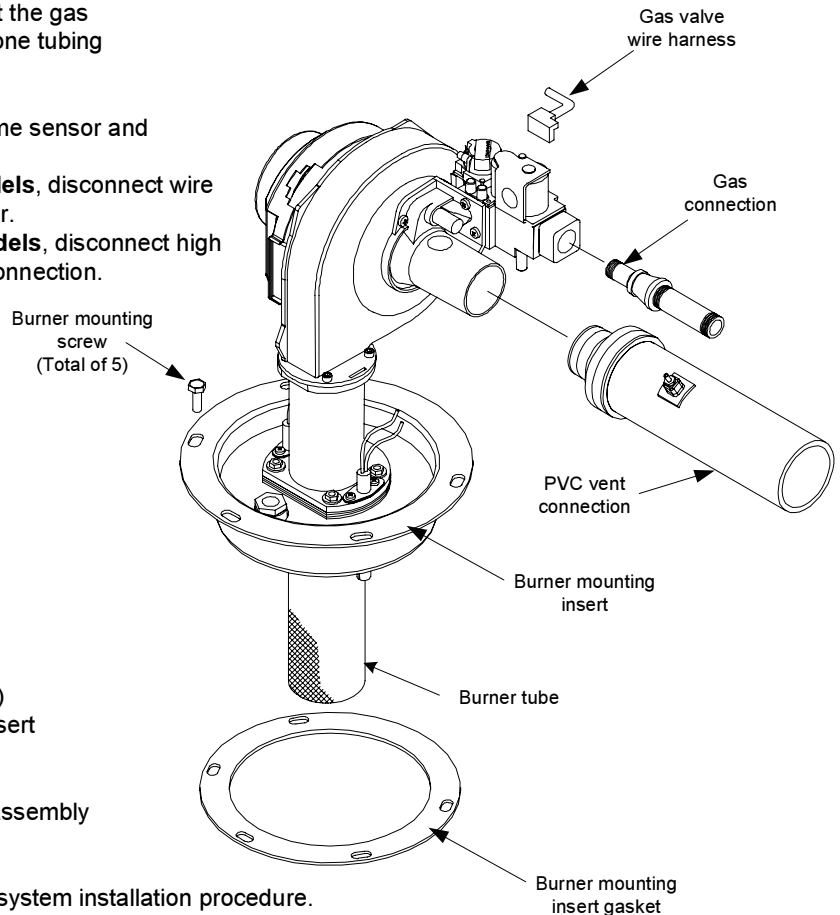
### Combustion System Removal Procedure

- 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, PVC venting, Silicone tubing and wire harness.
- Step 6. Disconnect wire harnesses flame sensor and blower.

**For Hot Surface Ignition models**, disconnect wire harness from hot surface igniter.  
**For Direct Spark Ignition models**, disconnect high voltage cable from spark rod connection.

#### ⚠ WARNING

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



- Step 7. Remove the 5 bolts (½" 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.



## SERVICE PROCEDURE EF-II

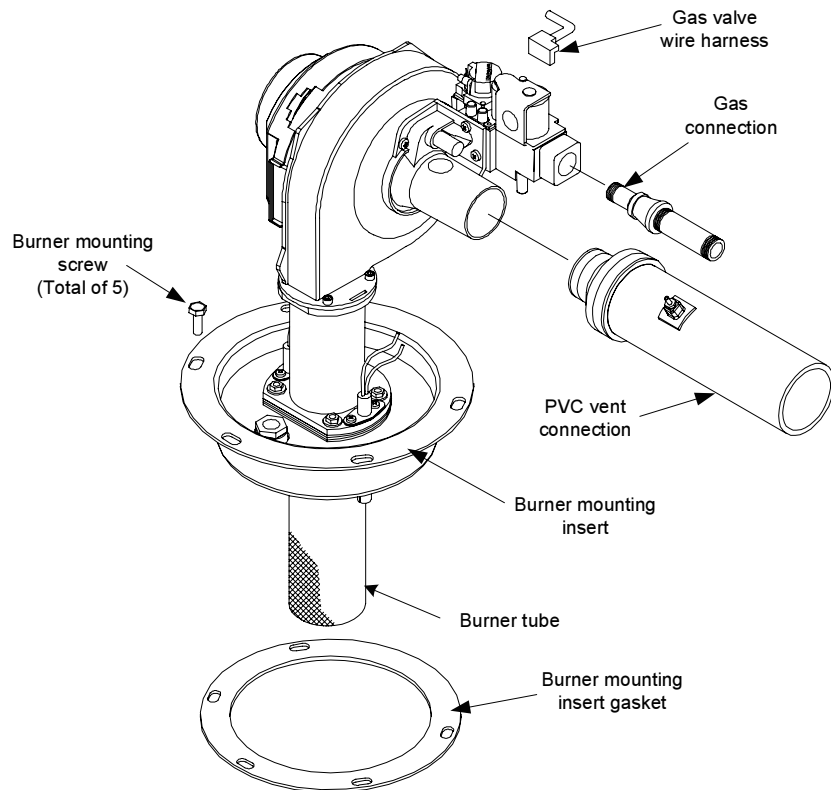
### Combustion System Testing and Replacement

#### Combustion System Replacement Procedure

- Step 1. Fully inspect burner mounting insert gasket for the following:
- a) Tears
  - b) Missing material
  - c) Cracks
  - d) Dirt or debris
  - e) 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 screws evenly.
- Step 3. Reconnect wire harnesses to hot surface igniter or high voltage cable to spark rod, flame sensor, blower and gas valve.
- Step 4. Reconnect PVC 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 instruction manual.
- Step 6. Replace surround cover on top of water heater.







## SERVICE PROCEDURE EF-III

### Burner Tube Inspection and Replacement

#### ⚠ WARNING

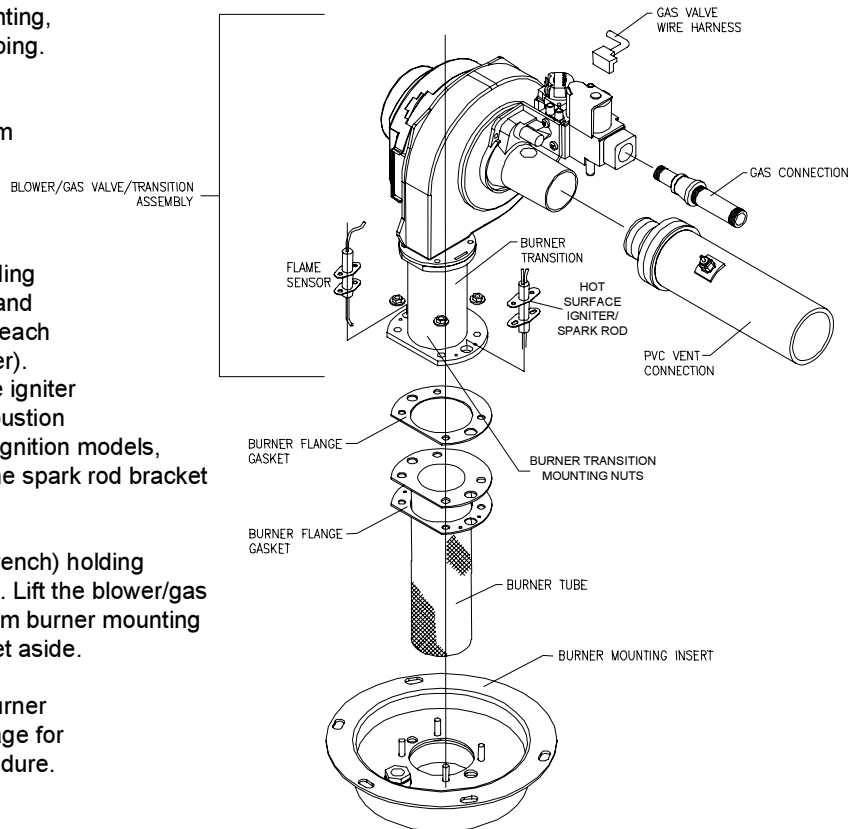
Heater components may be **HOT** when performing the following steps in this procedure.  
Take necessary precaution to prevent personal injury.

### 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, PVC venting, wire harness and silicone tubing.
- Step 6. Disconnect wire harness from blower assembly.
- Step 7. Remove the two screws holding each the hot surface igniter and flame sensor in place (long reach magnetic Phillips screw driver). Carefully remove hot surface igniter and flame sensor from combustion assembly. For Direct Spark Ignition models, remove the two screws on the spark rod bracket and remove the spark rod.
- 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 EF-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 Inspection

- Step 1. Inspect burner tube as follows (BSI ceramic fiber mesh burner, water heaters prior to serial number "CK") :
- a) Visually inspect ceramic fiber mesh, mesh should be uniform in appearance without large gaps, tears or fraying. Mesh should have uniform pattern allowing for unrestricted gas flow.
  - b) Gently squeeze burner tube, Burner tube should feel firm without any soft areas around the sides or at the bottom.
  - c) Visually inspect inside burner tube, Burner tube should be intact with no areas of deterioration. Ports should be free of any debris.
- Inspect burner tube as follows (Acotech metal fiber mesh burner, water heaters with "CK" serial number or later).
- a) Outer fiber mesh should be uniform with no tears or deterioration.
- 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:** New metal fiber mesh burner (Acotech) is the replacement burner for the BSI ceramic fiber sock burner. The length of burner will not be the same as the previous BSI burner. Provide the model and serial number for the correct replacement burner.

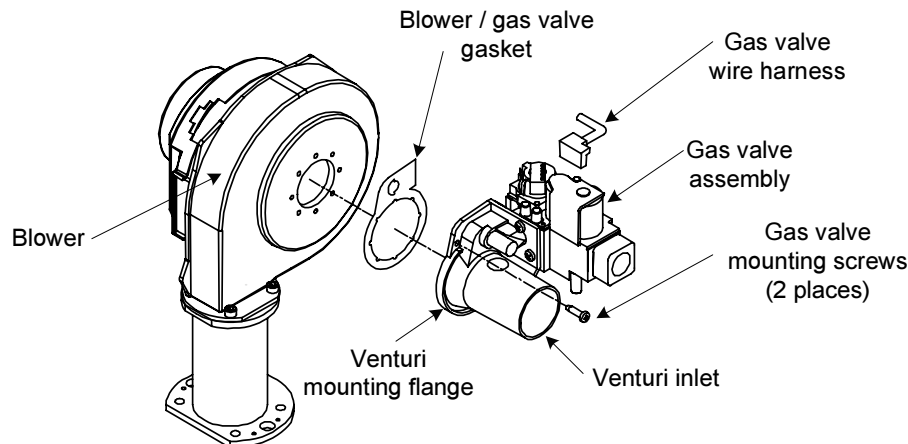
- Step 1. Fully inspect burner flange gaskets, igniter and flame sensor gaskets for the following:
- a) Tears
  - b) Missing material
  - c) Cracks
  - d) Dirt or debris
  - e) Other imperfections that would inhibit proper seal
- If gaskets are NOT affected by any of the above, gasket replacement is 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 hot surface igniter 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 PVC 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 instruction manual.
- Step 8. Replace surround cover on top of water heater.

### 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 2 gas valve mounting screws (Torx bit) located at the 11:00 O'clock & 5:00 O'clock position 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.

#### **⚠ WARNING**

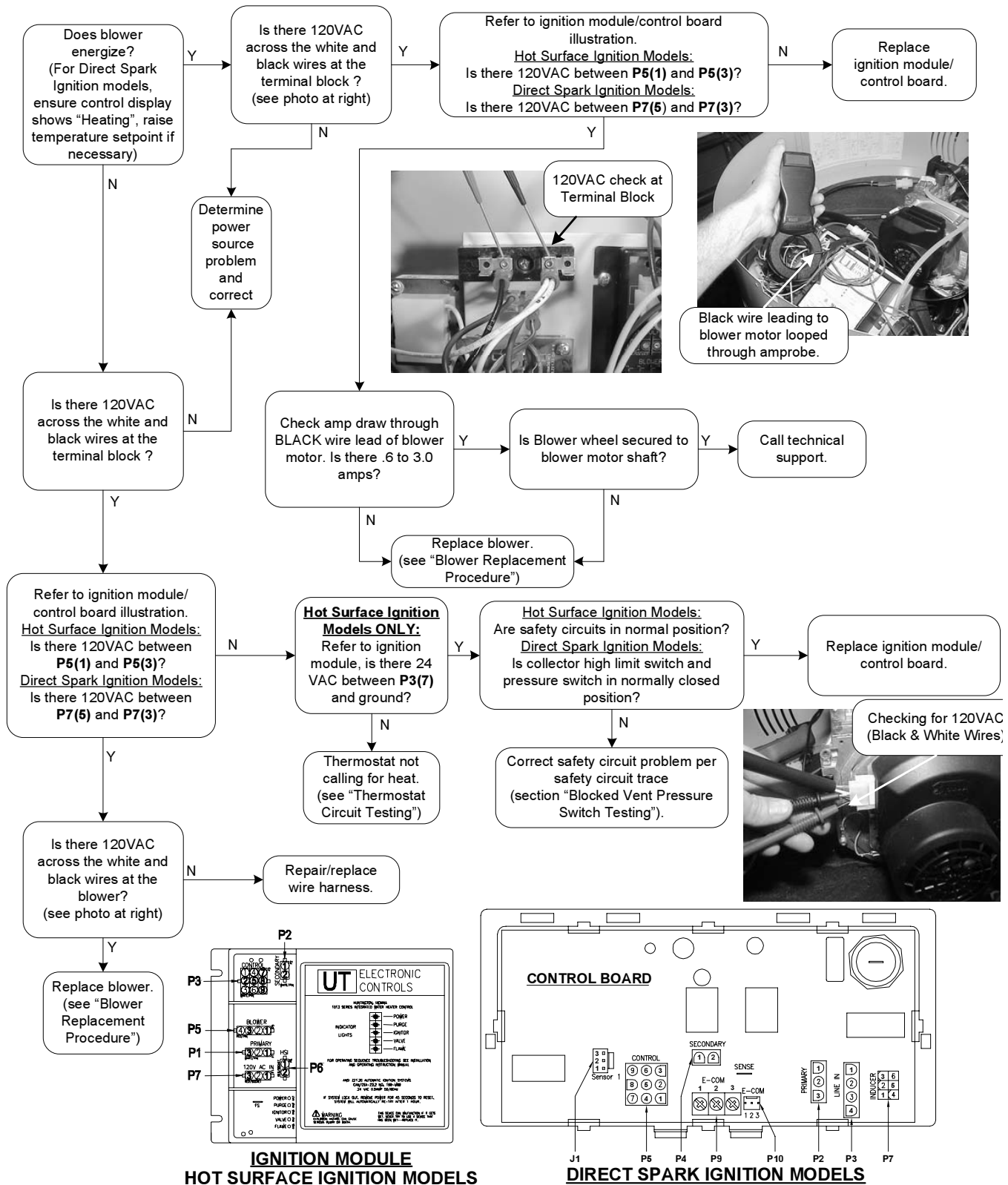
**120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.**



- Step 8. Install new gas valve with new gasket provided. Secure gas valve in place using screws from step 6.
- Step 9. Reconnect PVC venting, gas supply, silicone tubing & 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 instruction manual.
- Step 11. Replace surround cover on top of water heater.

# Service Procedure EF-V

## Blower Testing and Replacement

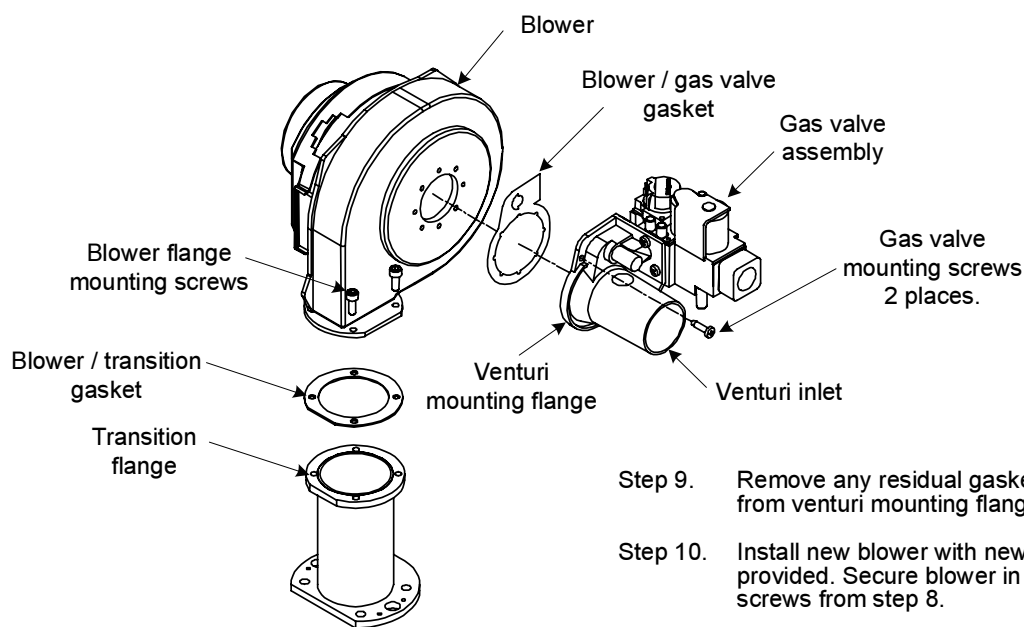


### Blower Replacement Procedure

#### ⚠ 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 wire harness from blower.
- Step 6. Disconnect intake vent and gas supply from gas valve assembly.
- Step 7. Remove the 2 gas valve mounting screws (Torx bit) located at the 11:00 O'clock & 5:00 O'clock position 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 wire harness to blower assembly, restore 120 volt power supply & Gas 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 instruction manual.
- Step 14. Replace surround cover on top of water heater.



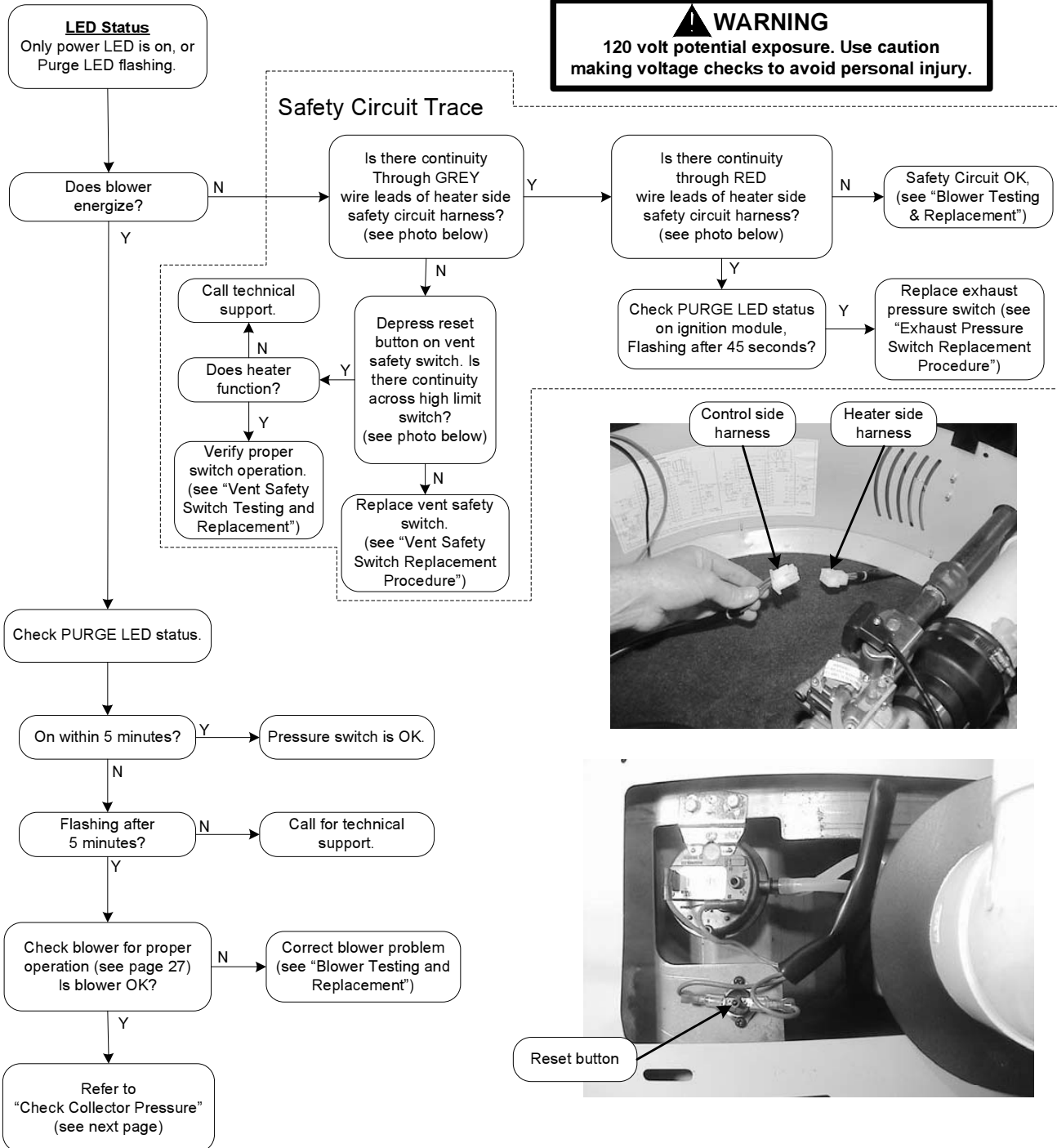
## Service Procedure EF-VI

### Exhaust Pressure Switch Testing and Replacement

For serial numbers prior to "CF"

#### Sequence of operation:

With the thermostat calling for heat, prior to energizing blower, the ignition module checks the exhaust pressure switch for normal switch position of normally open. If the exhaust pressure switch contacts are closed (not in normal position), the ignition module waits 45 seconds for the pressure switch contacts to open. If the pressure switch contacts do not open after 45 seconds, the ignition module locks out with the PURGE LED flashing indicating a pressure switch fault.



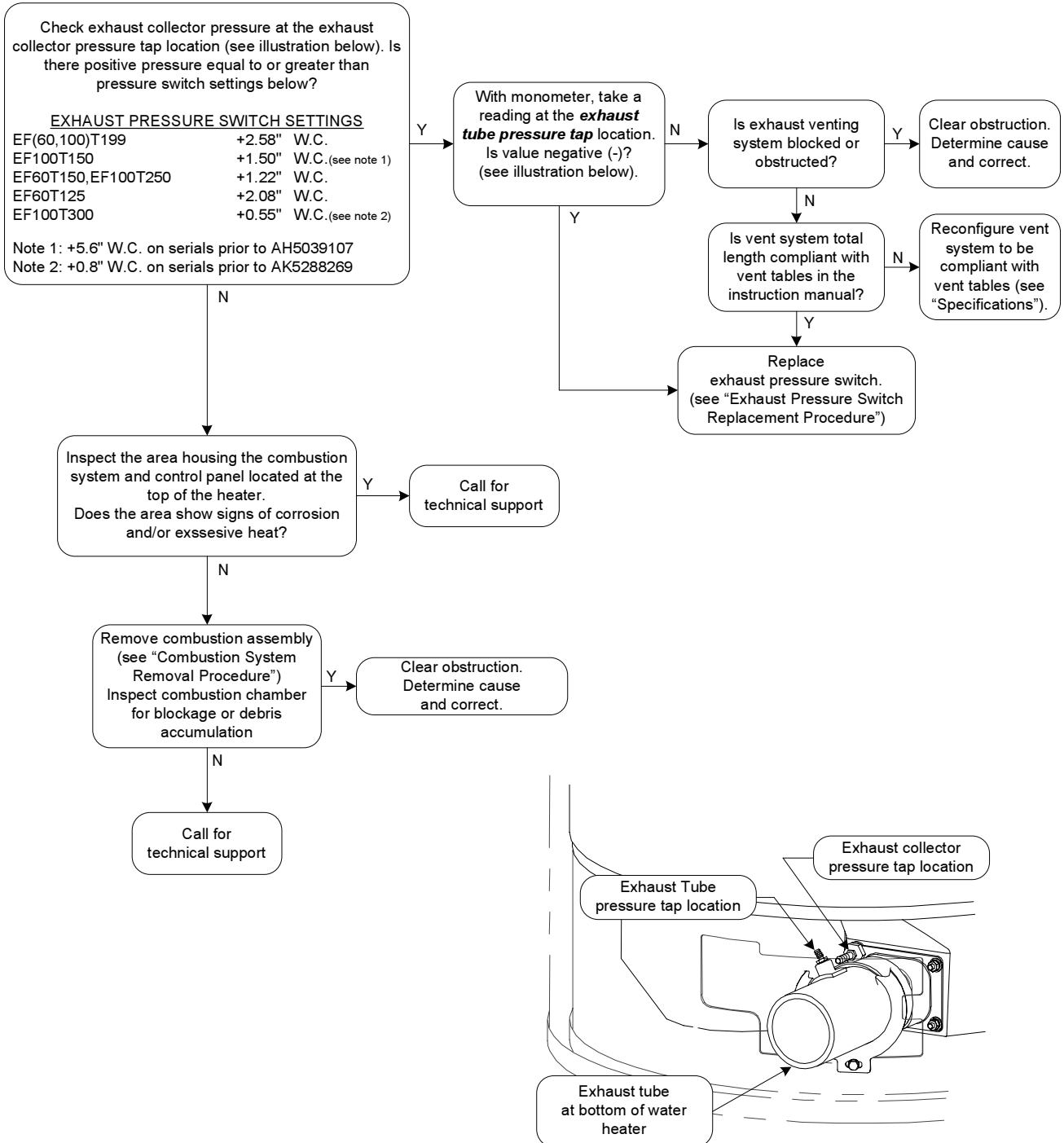


# Service Procedure EF-VI

## Exhaust Pressure Switch Testing and Replacement

For serial numbers prior to "CF"

### Check Collector Pressure







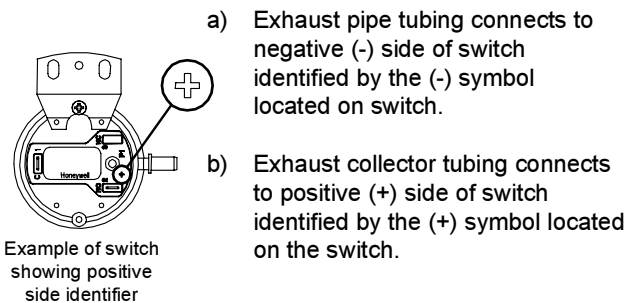
## Service Procedure EF-VI

### Exhaust Pressure Switch Testing and Replacement

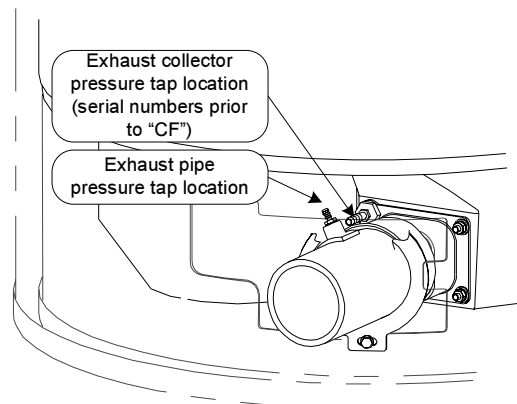
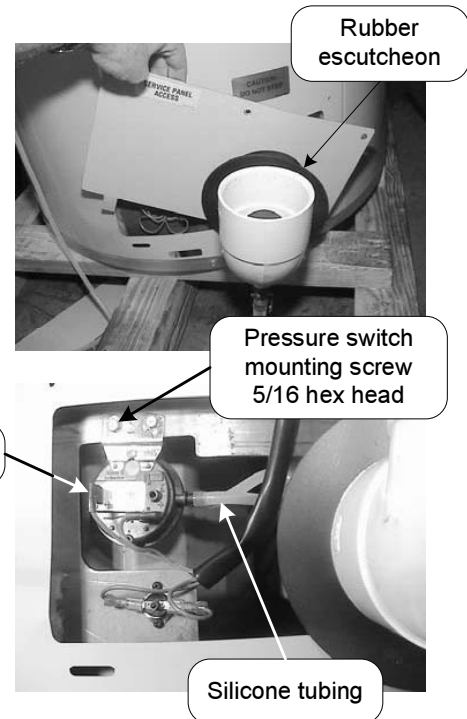
For serial numbers prior to "CF"

## 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 at right)
- Step 4. Disconnect silicone tubing and wire leads from pressure switch. (see photos at right)
- Step 5. Remove pressure switch mounting screws (5/16" wrench) and remove pressure switch.
- Step 6. Assemble new pressure switch to heater using screws from step 5.
- Step 7. Reconnect wire leads. Note: wire leads are interchangeable with either terminal.
- Step 8. Reconnect silicone tubing to pressure switch as follows:



- 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 instruction manual.
- Step 10. Reinstall service panel access cover and rubber escutcheon.





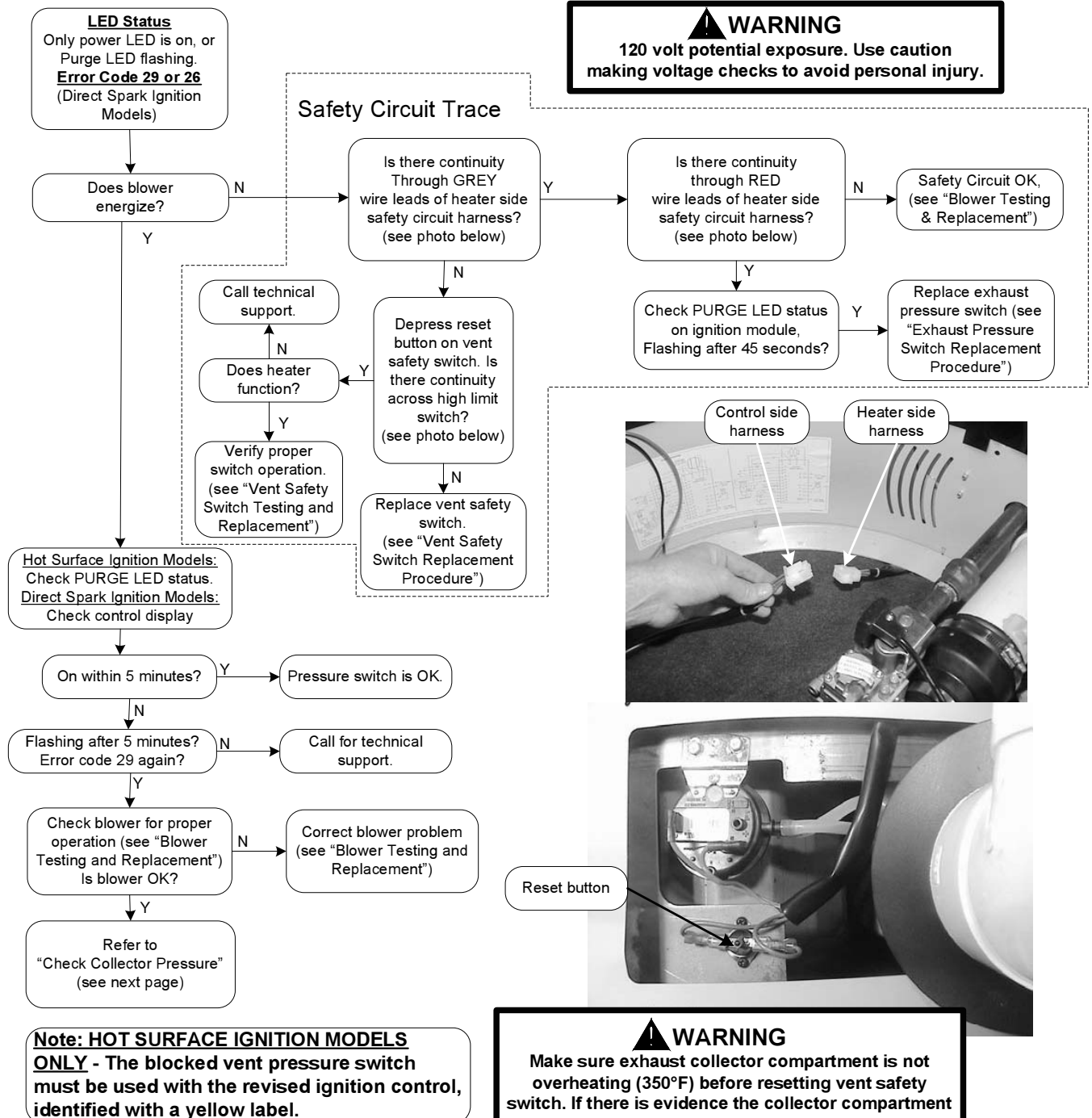


# Service Procedure EF-VI

## Blocked Vent Pressure Switch Testing and Replacement for serial number "CF" and later

### 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 to 5 minutes waiting for the contacts to close. If the contacts remain open, the blower will stop and the PURGE LED will flash for hot surface ignition models, or error code 29 will display for direct spark ignition models.

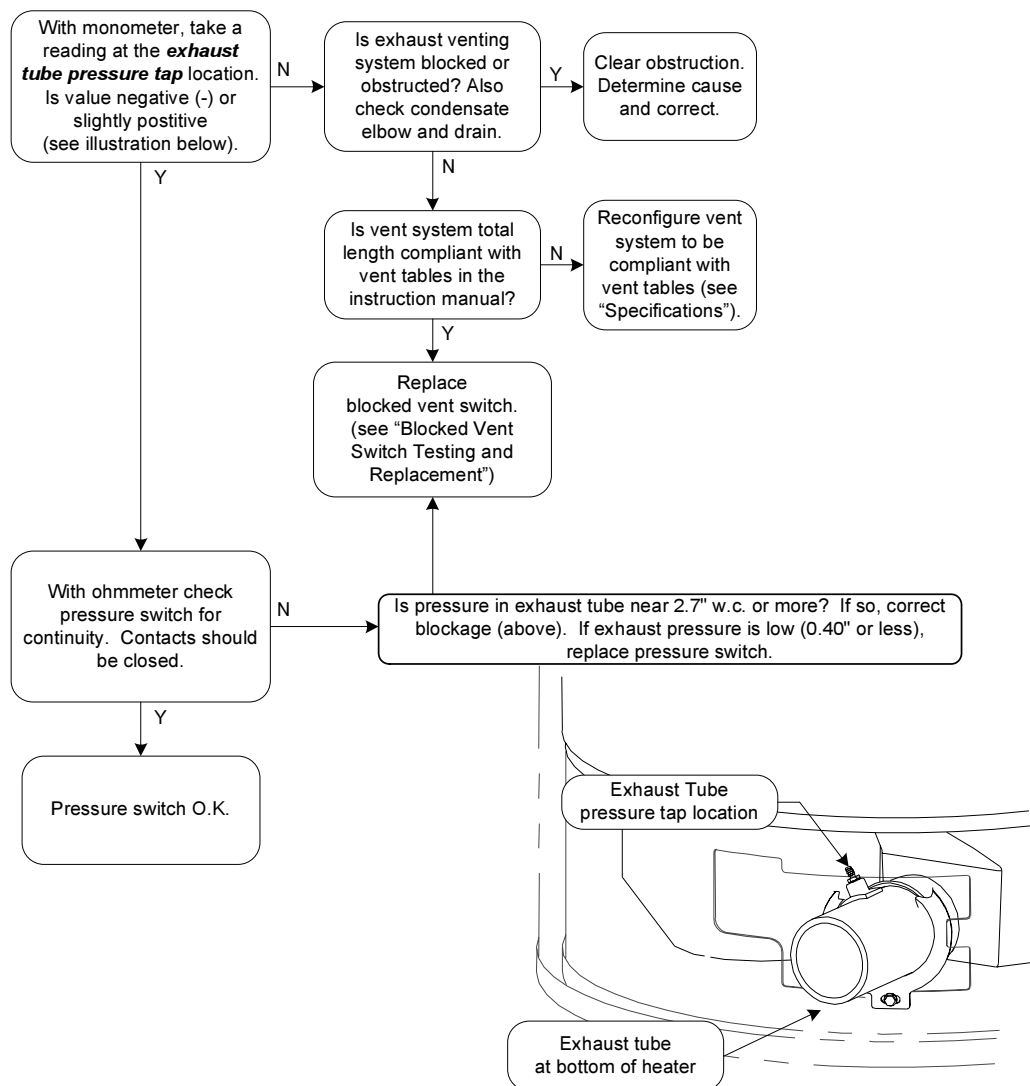




## Service Procedure EF-VI

### Blocked Vent Pressure Switch Testing and Replacement for serial number "CF" and later

#### Check Exhaust Tube Pressure





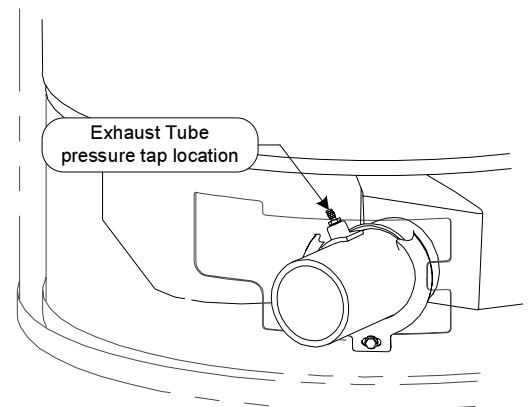
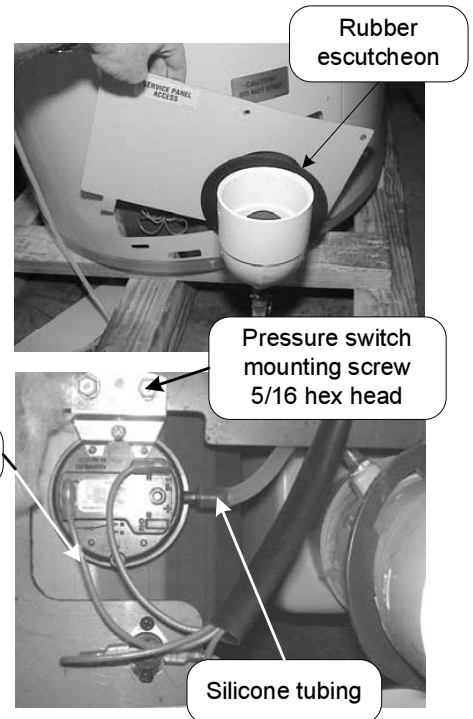
## Service Procedure EF-VI

### Blocked vent Switch Testing and Replacement

For serial number "CF" or later

## 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 at right)
- Step 4. Disconnect silicone tubing and wire leads from pressure switch. (see photos at right)
- Step 5. Remove pressure switch mounting screws (5/16" wrench) and remove pressure switch.
- Step 6. Assemble new pressure switch to heater using screws from step 5.
- Step 7. Reconnect wire leads. Note: wire leads are interchangeable with either terminal.
- Step 8. Reconnect silicone tubing to pressure switch as follows:
- 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 instruction manual.
- Step 10. Reinstall service panel access cover and rubber escutcheon.



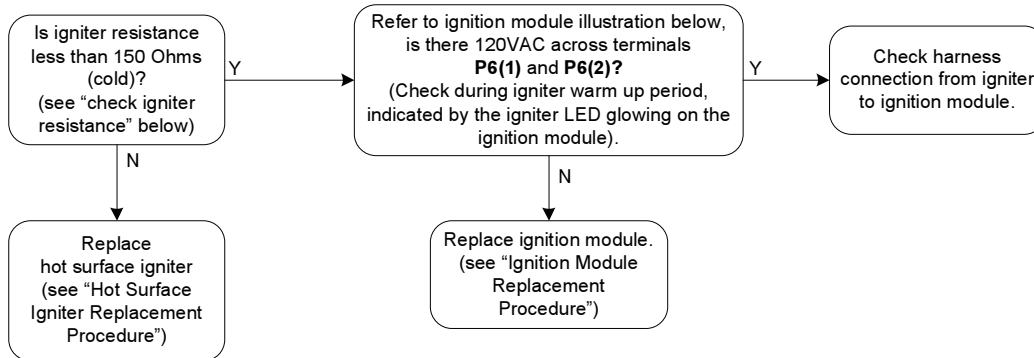


# Service Procedure EF-VII

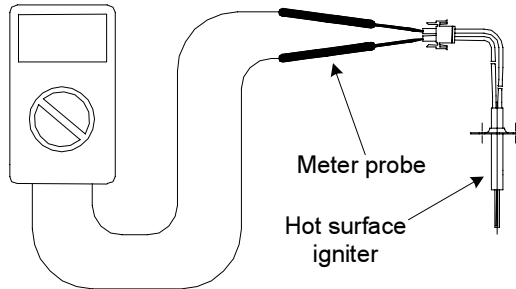
## Hot Surface Igniter Testing and Replacement

### Hot surface Igniter Testing Procedure

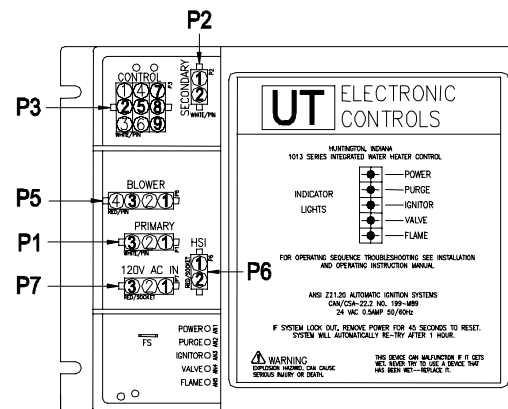
**⚠ WARNING**  
120 volt potential exposure. Use caution making voltage checks to avoid personal injury. Igniter may be too hot to handle, take necessary precautions



Volt meter set to OHM setting



### CHECK IGNITER RESISTANCE



### IGNITION MODULE



## Service Procedure EF-VII

### Hot Surface Igniter Testing and Replacement

#### Hot surface Igniter 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 hot surface igniter. (see photo at right)
- Step 5. Disconnect igniter wire leads from ignition module.
- Step 6. Remove the 2 igniter mounting screws (magnetic tip, long reach Phillips screw driver) and remove igniter and gasket from transition base flange.
- Step 7. Remove any residual gasket material from transition base flange.



#### WARNING

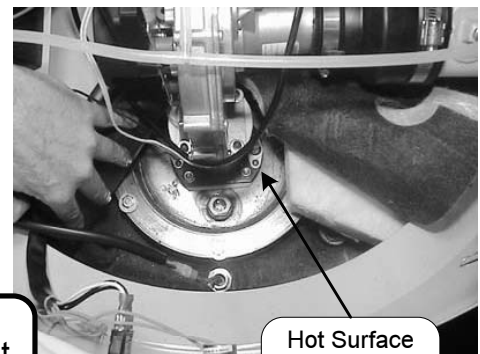
**120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.**

#### Note:

New replacement igniter will not have a shield over element. Handle carefully to prevent breakage.

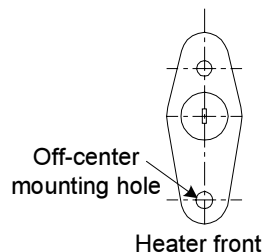
#### Note:

Do not handle igniter element or allow foreign material to come in contact with element.



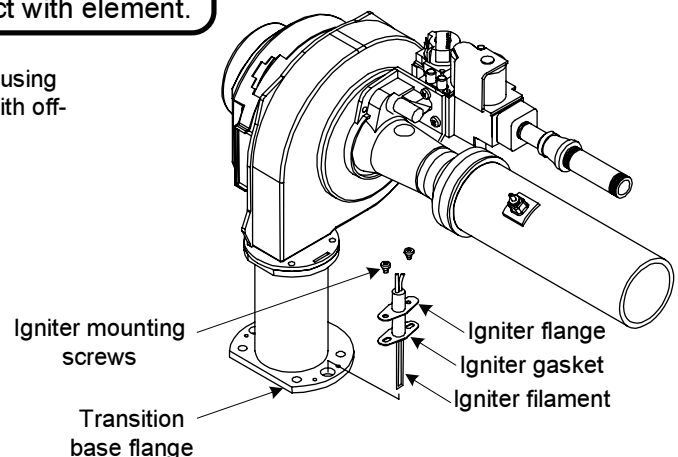
Hot Surface Igniter

- Step 8. Install new igniter with new gasket provided using screws from step 5. Arrange igniter flange with off-center hole towards front of heater.



Off-center mounting hole

Heater front



Igniter mounting screws

Transition base flange

Igniter flange

Igniter gasket

Igniter filament

- Step 9. Reconnect igniter wire harness.
- 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 instruction manual.
- Step 12. Replace surround cover on top of water heater.

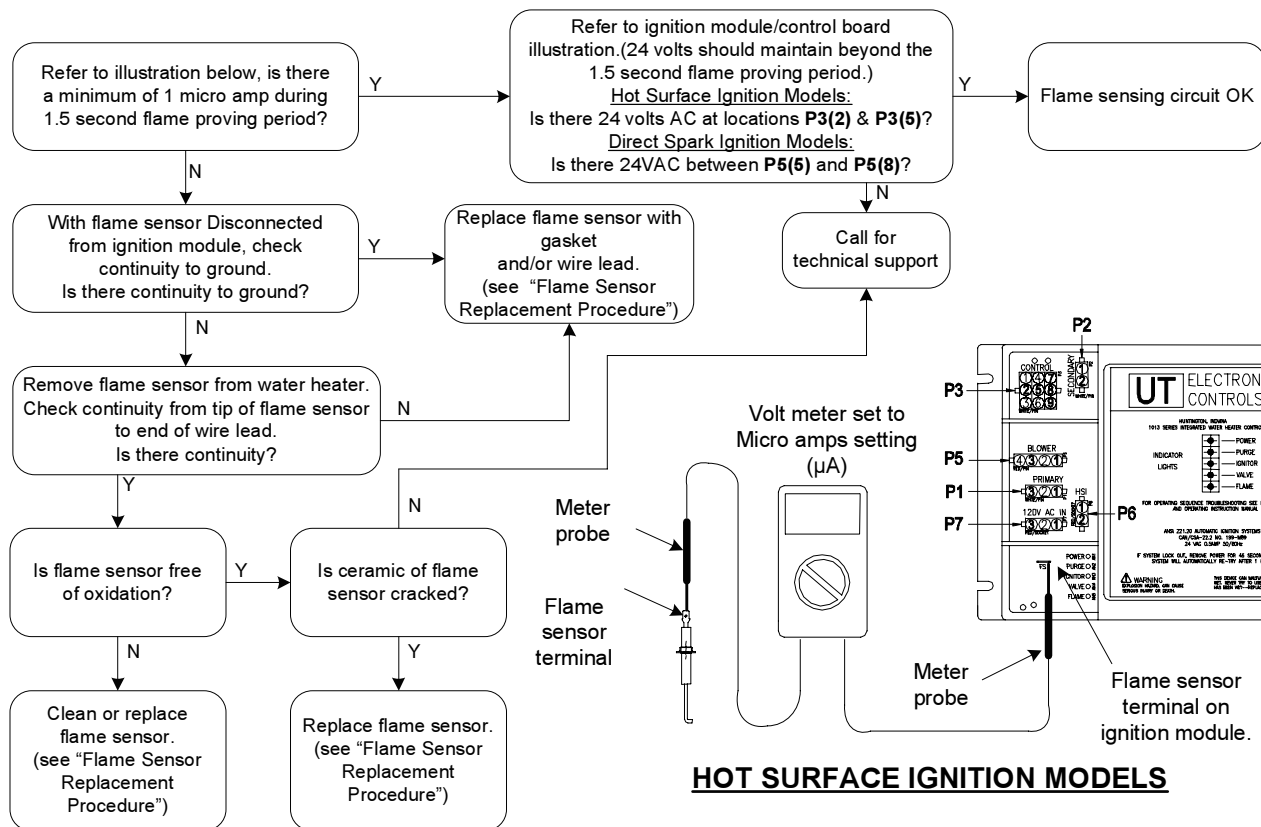


# Service Procedure EF-VIII

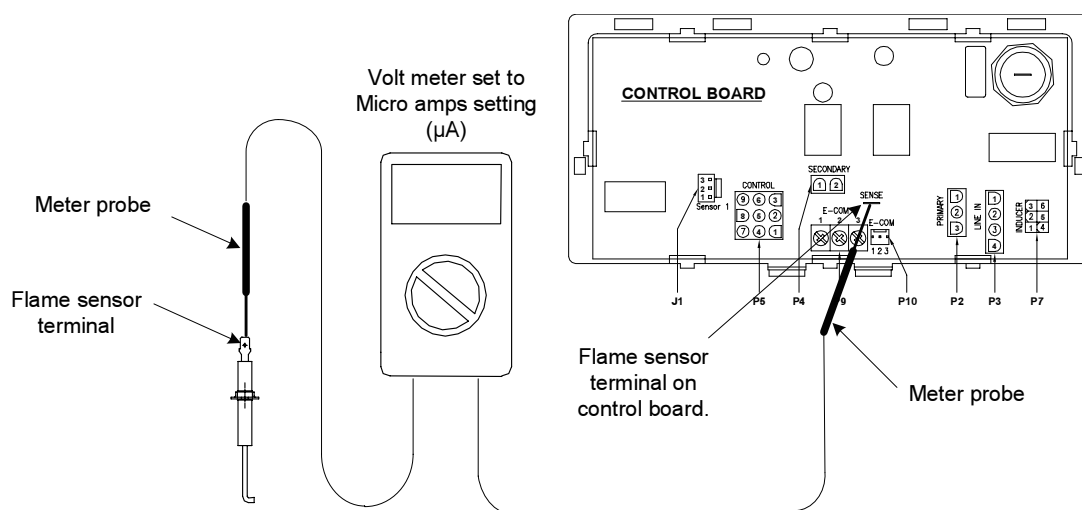
## Flame Sensor Testing and Replacement

### 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



### HOT SURFACE IGNITION MODELS



### DIRECT SPARK IGNITION MODELS



## Service Procedure EF-VIII

### 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 at right)

Step 5. Disconnect wire lead from flame sensor.

Step 6. Remove the 2 sensor mounting screws (magnetic tip, long reach Phillips screw driver) and remove flame sensor & 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.

Flame sensor mounting screws

Flame sensor

Flame sensor gasket

Arrange hook of sensor towards burner

Transition base flange

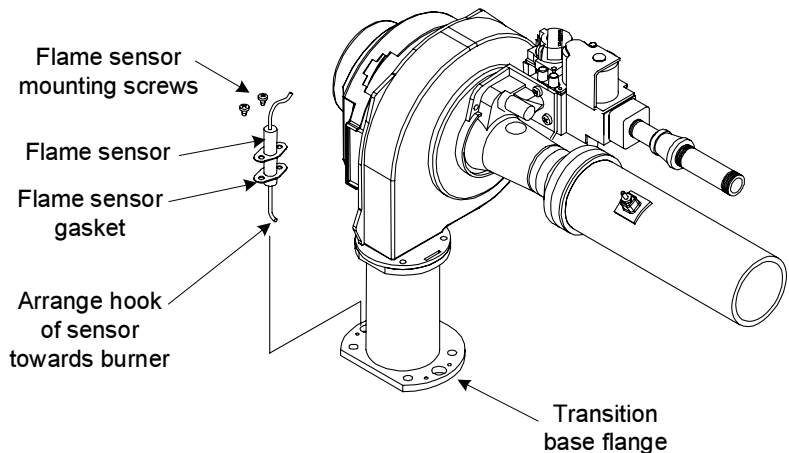
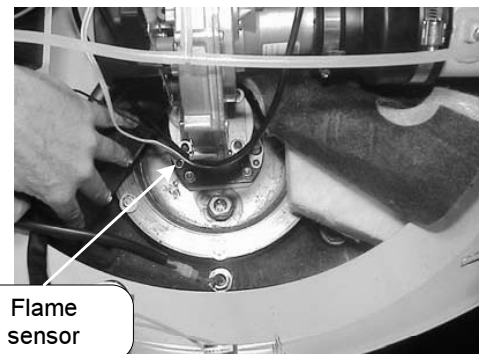
Step 9. Reconnect flame sensor wire.

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 instruction 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.**







## SERVICE PROCEDURE EF-IX

### Spark Rod Gap Adjustment and Replacement

#### Spark Rod Gap Inspection and Adjustment

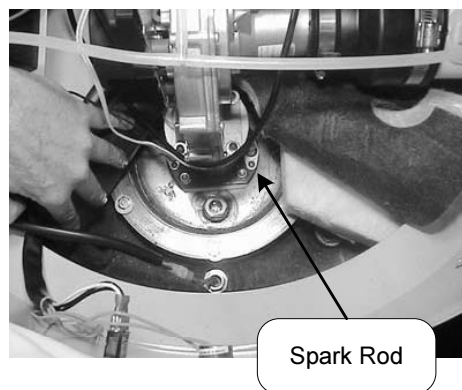
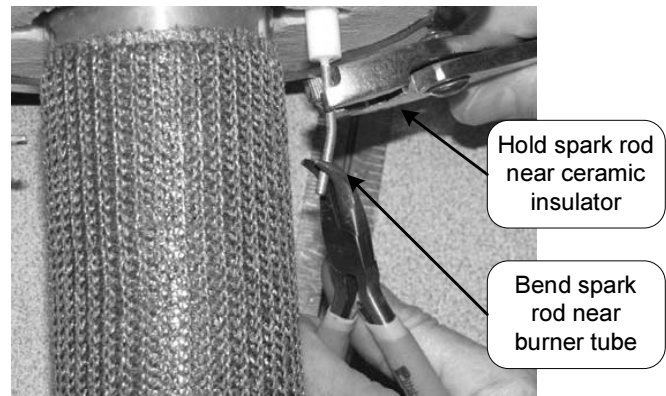
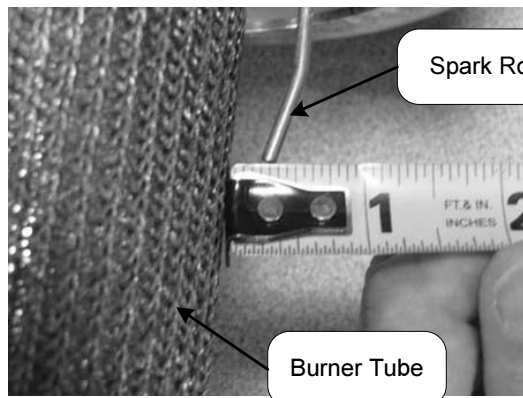
- Step 1. Remove combustion system as described in "Combustion System Removal Procedure".
- Step 2. Measure spark gap between the spark rod and burner tube. Acceptable spark gap is between 3/16" - 1/4" (see photo below).
- Step 3. If spark gap is not between 3/16" - 1/4", the spark rod may be carefully 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. Re-measure and verify spark gap is between 3/16" - 1/4" after bending.
- Step 5. 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 to 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.







## SERVICE PROCEDURE EF-IX

### 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 at right)
- Step 5. Disconnect wire lead from spark rod.
- Step 6. Remove the 2 mounting screws (magnetic tip, long reach Phillips screw driver) and remove spark rod & 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".

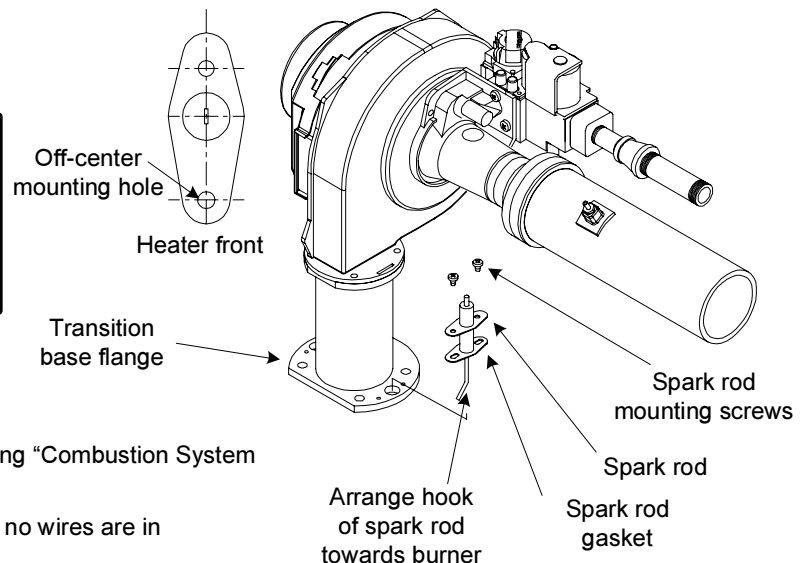
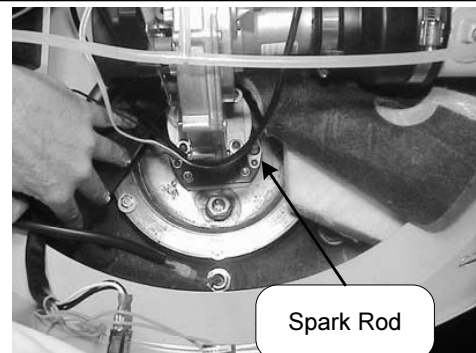
**⚠ WARNING**  
**Spark gap must be set to 3/16" to 1/4". Failure to set and verify proper spark gap may result in a delayed ignition resulting in damage to the water heater.**

#### ⚠ WARNING

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

#### ⚠ WARNING

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



- Step 9. 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 instruction manual.
- Step 12. Replace surround cover on top of water heater.



## Service Procedure EF-X

### Ignition Module/Control Board Replacement

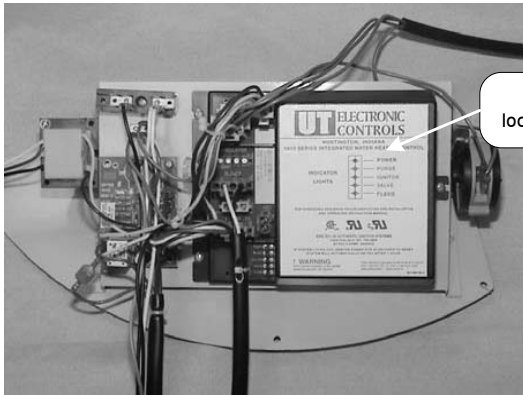
#### Ignition Module Replacement Procedure

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. Locate Ignition module on control panel inside surround area. (see photo below)



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

**Note: Replacement hot surface ignition module works on all EF models prior to and later than "CF" serial numbers. Direct spark ignition models use a different control board (detailed in following section).**

Step 5. Carefully disconnect all wire harness connection to ignition module. Connection are non-interchangeable to insure proper reinstallation.

Step 6. Remove the 3 screws (Phillips screw driver) holding the ignition module in place and remove ignition module from control panel.

Step 7. Install new ignition module and secure in place with screws from step 6.

Step 8. Carefully reconnect all wire harness connection to ignition module. Connection are non-interchangeable to insure proper reinstallation.

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 instruction manual.

Step 10. Replace surround cover on top of water heater.



## Service Procedure EF-X

### Ignition Module/Control Board Replacement

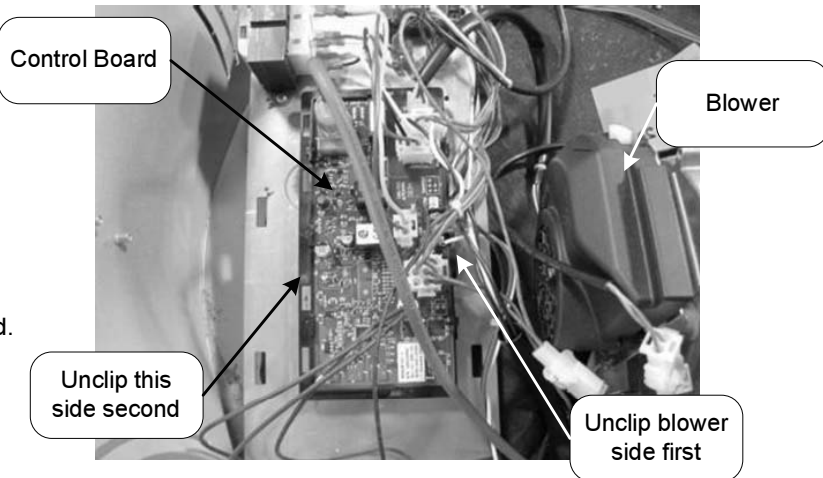
#### **Control Board Replacement** (Honeywell Integrated Control w/ Direct Spark Ignition)

- 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.

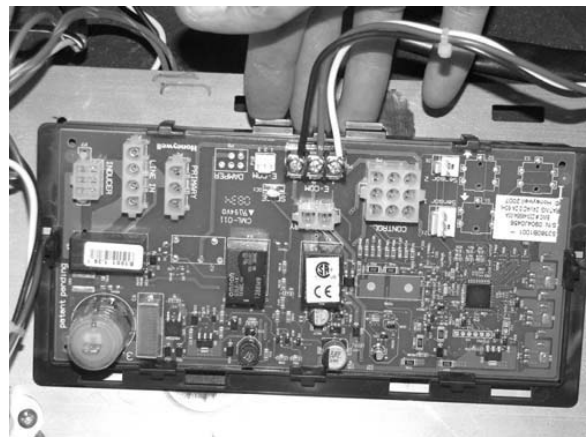
**⚠ WARNING**  
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

- 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 blower side of the control board first.
- Step 7. Tilt the control panel and slide control hook tabs from slots in the control panel (see photo at right).
- 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 instruction manual.
- Step 10. Replace surround cover on top of water heater.



## 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.

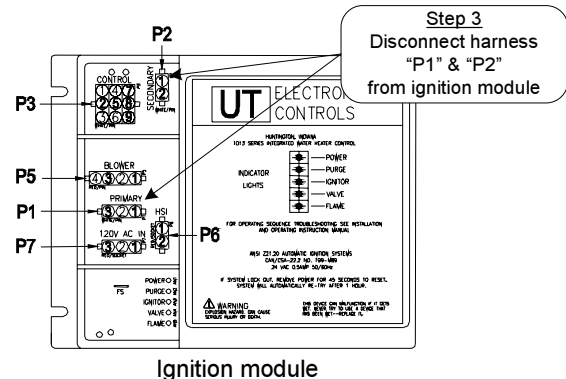
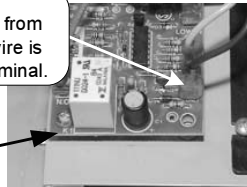
**WARNING**  
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

- Step 4. **For Hot Surface Ignition models**, refer to ignition module illustration below, Disconnect wire harness P1 labeled "PRIMARY" and P2 labeled "SECONDARY" from ignition module.

- Step 5. **For Hot Surface Ignition models**, Disconnect secondary leads (blue & yellow wire) from thermostat board. Note the blue wire is connected to 24 volt "HOT" terminal. (see photo below)  
**For Direct Spark Ignition models**, Disconnect primary leads (black & white) and secondary leads (blue & yellow) from the transformer. (leads are different sizes to prevent interchanging)

Step 5  
Disconnect blue & yellow wire from thermostat board. Note blue wire is connected to 24 volt "HOT" terminal.

Thermostat board

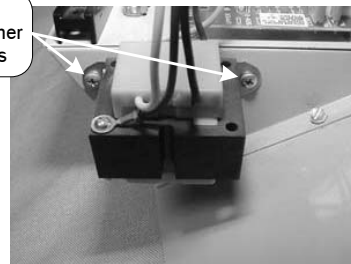


- Step 6. Remove the 2 screws ( short Phillips screw driver) holding the transformer in place and remove transformer from control panel. (see photo below)

- Step 7. Install new transformer and secure in place with screws from step 6.

- Step 8. **For Hot Surface Ignition models**, Reconnect wire harness P1 & P2, connections are non-interchangeable to insure proper reconnection.  
**For Direct Spark Ignition models**, Reconnect primary and secondary wires to transformer. (leads are different sizes to prevent interchanging)

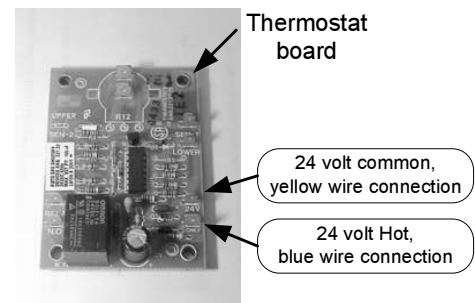
Step 6  
Remove transformer mounting screws



- Step 9. **For Hot Surface Ignition models**, Reconnect blue & yellow wire leading from the P2 connection on ignition module to thermostat board. Note the blue wire must connect to the 24 volt "HOT" terminal. (see photo at right)

- 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 instruction manual.

- Step 11. Replace surround cover on top of water heater.





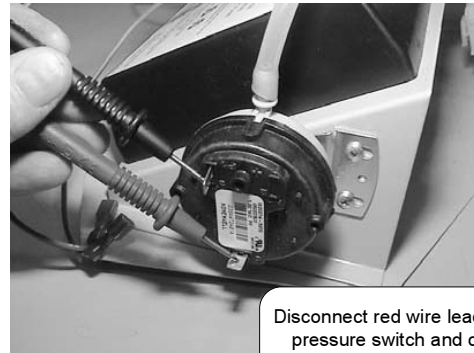
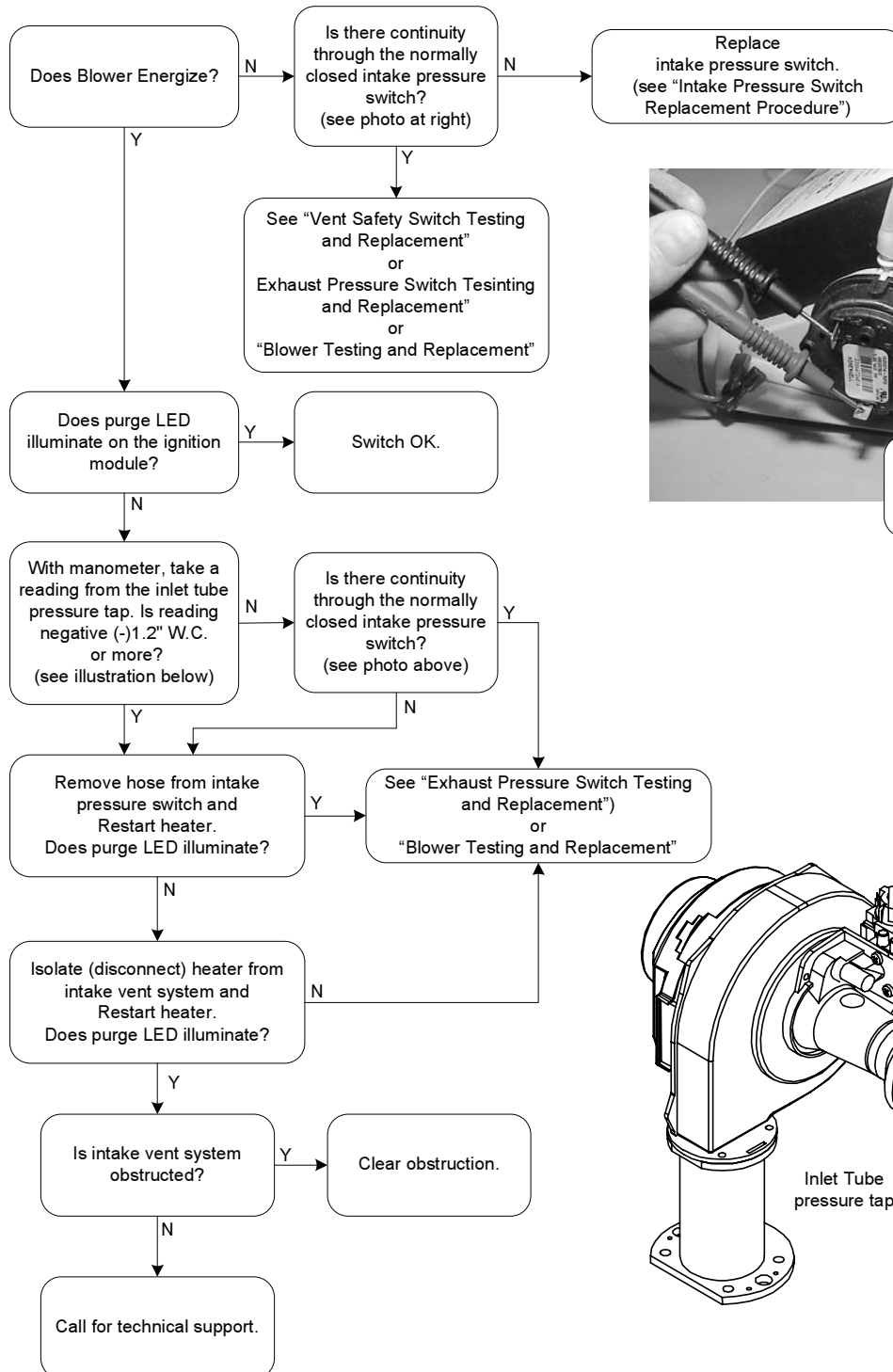
## Service Procedure EF-XII

### Intake Pressure Switch Testing and Replacement

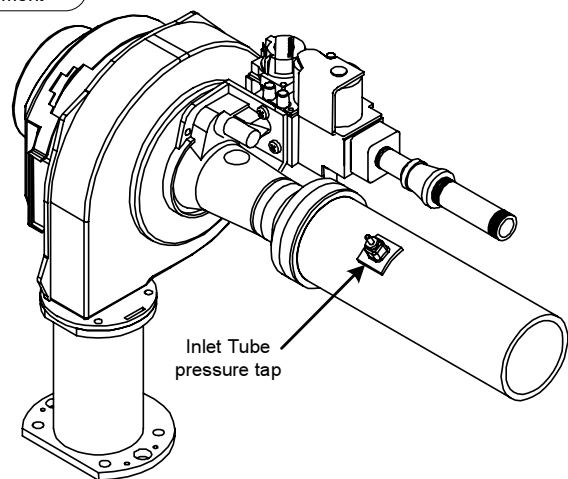
Used on EF water heaters prior to "CF" serial number.

**Notice:**  
The intake pressure switch is not used on serial number "CF" and later.

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



Disconnect red wire leads from pressure switch and check continuity through switch.





## Service Procedure EF-XII

### Intake Pressure Switch Testing and Replacement

Used on EF water heaters prior to "CF" serial number.

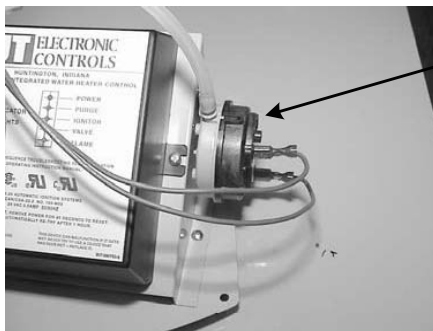
## Intake Pressure Switch Replacement Procedure



### WARNING

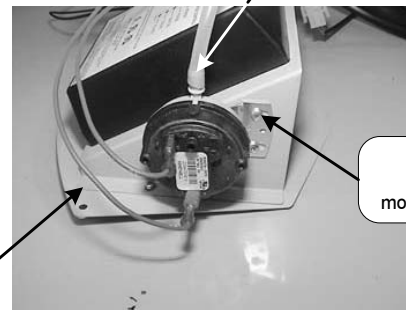
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

- Step 1. Position main power switch to "OFF".
- Step 2. Disconnect (Unplug) water heater from 120 Volt power source.
- Step 3. Un-latch & remove surround cover from top of water heater.
- Step 4. Locate intake pressure switch on control panel inside surround area (see photos below).



- Step 5. Disconnect red wire leads from pressure switch (see photo at right).

Step 5  
Disconnect red wires



Step 6  
Disconnect tubing from pressure switch

Step 7  
Remove 2 mounting screws

- Step 6. Disconnect silicone tubing from pressure switch (see photos above).
- Step 7. Remove the two screws (Phillips screw driver) holding the intake pressure switch in place and remove pressure switch from control panel (see photos above).
- Step 8. Install new pressure switch and secure in place with screws from step 7.
- Step 9. Reconnect silicone tubing (from step 6) to pressure switch.
- Step 10. Reconnect red wires (from step 5) to pressure switch. Note: wires are interchangeable with either switch terminal.
- Step 11. Restore 120 volt power supply to heater & verify proper heater operation following the instructions on the lighting instruction label or the lighting instructions located in the installation & operation manual.
- Step 12. Replace surround cover on top of heater.





## Service Procedure EF-XIII

### Vent Safety Switch Testing and Replacement

#### Sequence of operation:

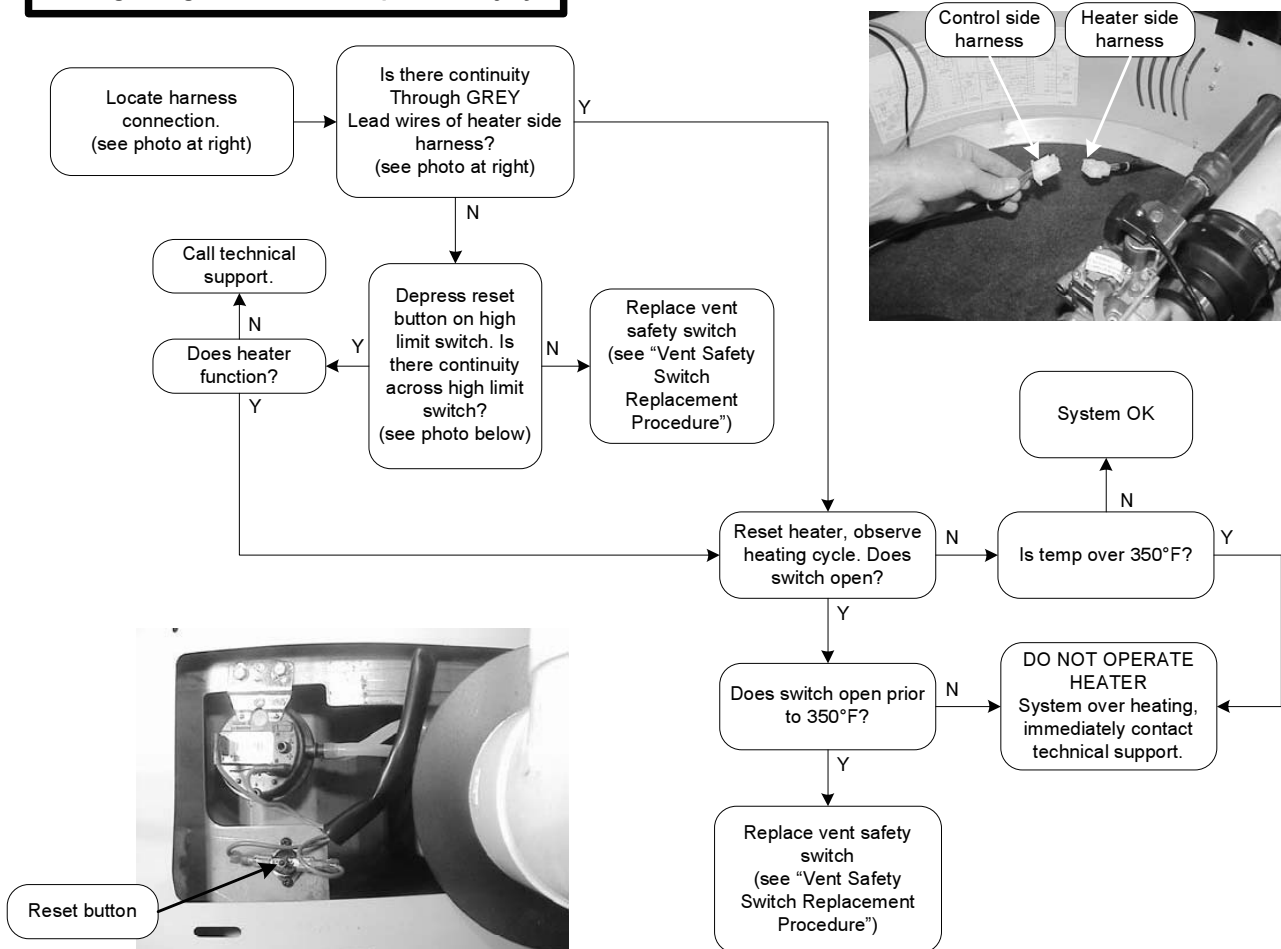
For Hot Surface Ignition models, with the thermostat calling for heat, prior to energizing blower, the ignition module checks the vent safety switch for normal switch position of normally closed. If the vent safety switch contacts are open, (not in normal position), the ignition module waits indefinitely for contact to close. The vent safety switch must be manually reset to close the switch contacts.

For Direct Spark Ignition models, error code 26 will display indicating an open circuit for the vent safety switch. Determine if temperature has reached 350°F before resetting switch and restoring operation. If evidence of extreme temperature is present, call technical support.



#### WARNING

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



#### WARNING

Make sure exhaust collector compartment is not overheating (350°F) before resetting vent safety switch. If there is evidence the collector compartment is overheating, CALL TECHNICAL SUPPORT.



## Service Procedure EF-XIII

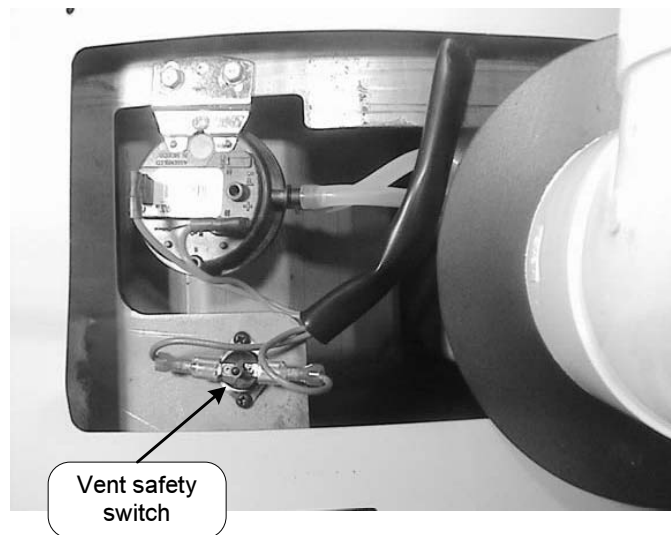
### Vent Safety Switch Testing and Replacement

#### 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 at right).
- Step 3. Remove screws from service panel access cover (1/4" nut driver) and remove cover from heater (see photos at right)



- Step 4. Disconnect wire leads from vent safety switch (see photo at right).
- Step 5. Remove the 2 switch mounting screws (Phillips screw driver) and nuts (5/16 wrench) 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 instruction manual.
- Step 9. Reinstall service panel access cover and rubber escutcheon.





## Service Procedure EF-XIV

### Anode/Flue Baffle Inspection and Replacement

#### Disassembly Procedure for Access to Anodes & Flue Baffles



#### WARNING

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



#### WARNING

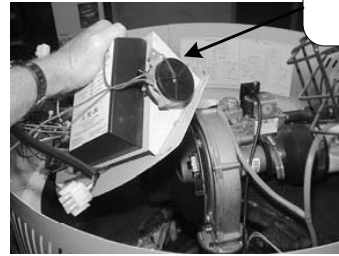
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

- Step 1. Position main power switch to "OFF".
- Step 2. Disconnect (Unplug) water heater from 120 Volt power source.
- Step 3. Un-latch & remove surround cover from top of heater.
- Step 4. Disconnect wire harnesses to allow for removal of control panel.  
Note: Where ever possible, rather than disconnecting at the control panel, follow wire harness away from control panel and disconnect at control component location.
- Step 5. Remove the three control panel mounting screws (1/4" nut driver) and remove control panel from the water heater (see photos below).

Control Panel Mounting Screw



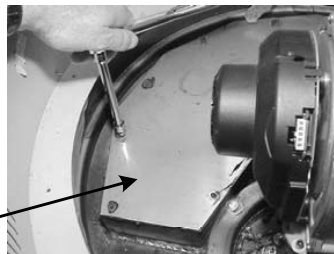
Remove Control Panel



- Step 6. Completely remove insulation (two pieces) from top of heater to expose collector cover

- Step 7. Remove all collector cover screws (5/16" socket) and remove collector cover (see photos at right).

Collector cover

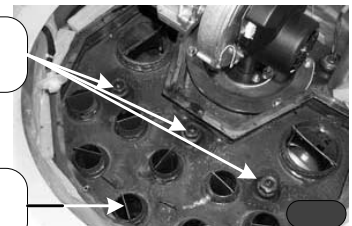


- Step 8. Photo 44 shows heater with collector cover removed allowing access to anode rods and flue baffles.

- a) for anode service, see "Anode Inspection and Replacement"  
b) for flue baffle service, see "Flue Baffle Inspection and Replacement"  
c) for powered anode service, see "Powered Anode Replacement"

Anode locations

Flue baffles



**Note:** EF100T399 models have only 1 anode rod under the 2<sup>nd</sup> pass collector cover.



## Service Procedure EF-XIV

### Anode/Flue Baffle Inspection and Replacement

#### Anode inspection and replacement

##### **WARNING**

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

- Step 1. Turn off water supply and drain water heater.
- Step 2. Disassemble water heater per "Disassembly Procedure for Access to Andoes & Flue Baffles".
- Step 3. Locate and remove anode rods from heater (1-1/16 hex socket).
- Step 4. Visually inspect anode rod. Anode rod should show signs of depletion, this is normal. If the depletion is  $\frac{1}{2}$  of the original diameter (approximately  $\frac{3}{4}$ " diameter), replacement is recommended. If any of the steel core of the anode is exposed, replacement is recommended.
- Step 5. Upon completion of inspection or subsequent replacement, apply Teflon tape or other thread compound to threads of anode and reinstall into heater. Restore water supply and check for and repair any leaks found.
- Step 6. Reinstall collector cover per "Collector Cover Installation Procedure".
- Step 7. Reinstall collector insulation and control panel, reconnect control panel wire harnesses.
- Step 8. Restore 120 volts to water heater and verify proper heater operation following the instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.
- Step 9. Replace surround cover on top of water heater.



## Service Procedure EF-XIV

### Anode/Flue Baffle Inspection and Replacement

#### Flue baffle inspection and replacement



#### WARNING

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

- Step 1. Disassemble heater per "Disassembly Procedure for Access to Anodes & Flue Baffles".
- Step 2. Remove flue baffles from heater (pliers) (8 two inch baffles & 2 four inch baffles).
- Step 3. Visually inspect flue baffles. Flue baffles should show signs of oxidation, this is normal. If the oxidation has deteriorated any portion of the flue baffle, replacement is recommended. If any restrictors are missing, replacement is recommended.
- Step 4. Upon completion of inspection or subsequent replacement, reinstall flue baffles into heater.
- Step 5. Reinstall collector cover per "Collector Cover Installation Procedure".
- Step 6. Reinstall collector insulation and control panel, reconnect control panel wire harnesses.
- Step 7. Restore 120 volts to water heater and verify proper heater operation following the instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.
- Step 8. Replace surround cover on top of water heater.



## Service Procedure EF-XIV

### Powered Anode Replacement for EF100T399 only

## Powered Anode Replacement EF100T399 models only

### ⚠ 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 module is located on the right vertical side of the control panel inside the surround panel. The control 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.

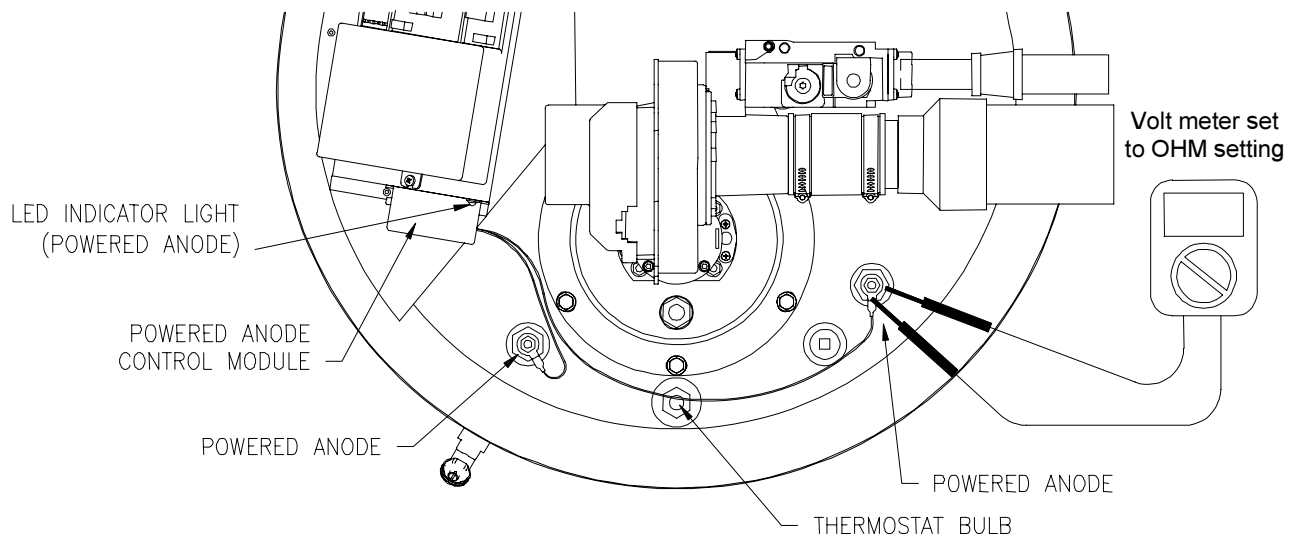
Step 1. Check the power supply or wire connections to the powered anode control.

Step 2. Indicator light diagnostic codes:

- a) If the control 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 not be continuity. If there is continuity, replace the powered anode assembly.



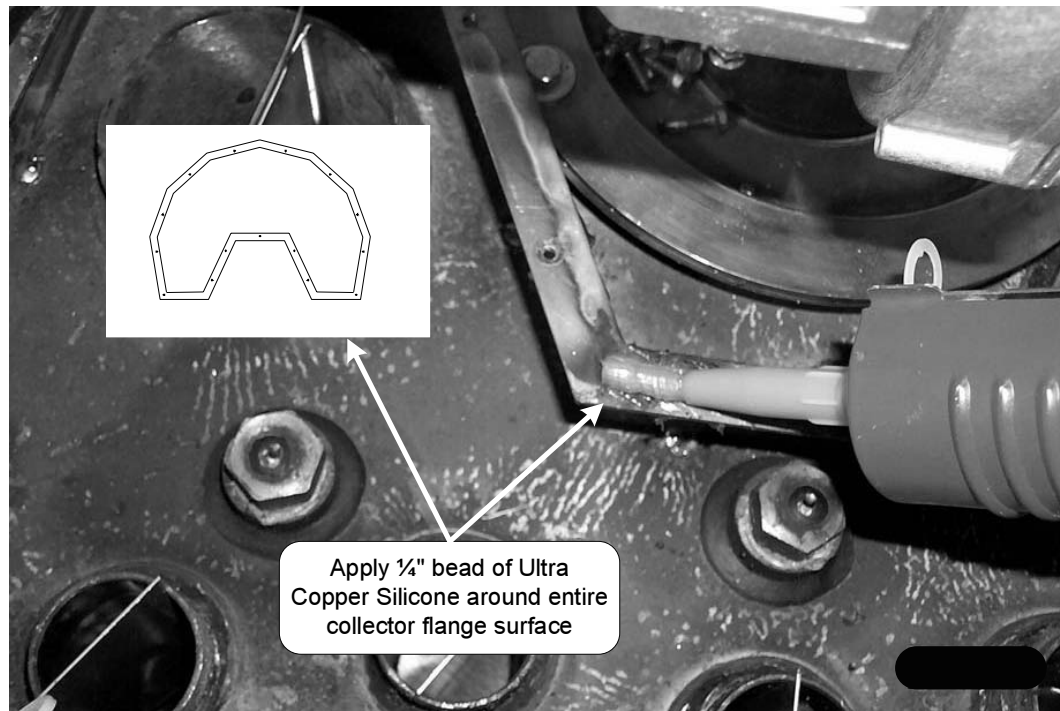


## Service Procedure EF-XIV

### Anode/Flue Baffle Inspection and Replacement

#### Collector Cover Installation Procedure

- Step 1. Remove old silicone from top surface of collector flange and collector cover.
- Step 2. Apply ¼" bead of Ultra Copper Silicone around entire collector flange surface. Allow caulk to "cure" for 10 minutes.
- Step 3. Carefully reinstall collector cover, tighten screws evenly.
- Step 4. Allow a minimum of 6 hours before putting heater back in service.





# Water Heater Installation Check List

**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 a MUST (every 5ft vertical and 3ft horizontal). Termination must be located to prevent re-circulation of flue gases. Medium to long sweep 90° elbows or straight exhaust terminal coupling recommended.

**Gas Requirements** - Gas piping sized adequately, 3/4" or larger to heater or 1" or larger for EF100T399 models. 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" per foot. 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 top and bottom pressure switches as well as enough overhead room to remove the anode rods for servicing (18" min.).

## Vent tables

<b><u>Balanced Direct Vent Systems</u></b> <b><u>PVC, CPVC</u></b>			
Total length of intake piping and exhaust piping added together must not exceed "Maximum Combined Length" Shown below			
<b><u>Maximum Combined Length (feet)</u></b>			
<b><u>Model Number</u></b>	<b><u>2"</u></b>	<b><u>3"</u></b>	<b><u>4"</u></b>
<b><u>EFR-1-60T120</u></b>	60'	120'	170'
<b><u>EF60T125, EF100T150</u></b>	N/A	120'	170'
<b><u>EF60T150, EF100T199</u></b>	N/A	100'	150'
<b><u>EF60T199, EF100T250</u></b>	N/A	80'	130'
<b><u>EF100T300</u></b>	N/A	60'	110'
<b><u>EF100T399</u></b>	N/A	50'	100'

<b><u>Unbalanced Direct Vent Systems</u></b> Air intake <u>CAN NOT</u> exceed exhaust by more than 30 feet
---

<b><u>Power Vented Systems</u></b> <b><u>PVC, CPVC</u></b>			
Total length of exhaust piping must not exceed "Maximum Vent Length" Shown below			
<b><u>Maximum Vent Length (feet)</u></b>			
<b><u>Model Number</u></b>	<b><u>2"</u></b>	<b><u>3"</u></b>	<b><u>4"</u></b>
<b><u>EFR-1-60T120</u></b>	60'	120'	170'
<b><u>EF60T125, EF100T150</u></b>	N/A	120'	170'
<b><u>EF60T150, EF100T199</u></b>	N/A	100'	150'
<b><u>EF60T199, EF100T250</u></b>	N/A	80'	130'
<b><u>EF100T300</u></b>	N/A	60'	110'
<b><u>EF100T399</u></b>	N/A	50'	100'

Note: each 3" & 4" 90° Elbow is equivalent to 5 feet of straight pipe.

Note: each 3" & 4" 45° Elbow is equivalent to 2.5 feet of straight pipe.



## eF Series<sup>®</sup> Heater Service Report

**Date** \_\_\_\_\_

**Service Provider** \_\_\_\_\_

**Model Number** \_\_\_\_\_

**Phone Number** \_\_\_\_\_

**Serial Number** \_\_\_\_\_

**Venting (PVC, CPVC):**

Vent size 3" or 4" \_\_\_\_\_

Intake 90's (qty) \_\_\_\_\_

Intake 45's (qty) \_\_\_\_\_

Length of straight pipe  
(intake) \_\_\_\_\_

Exhaust 90's (qty) \_\_\_\_\_

Exhaust 45's (qty) \_\_\_\_\_

Length of straight pipe  
(exhaust) \_\_\_\_\_

**Gas Line:**

Size & material \_\_\_\_\_

Distance from meter  
to water heater \_\_\_\_\_

**Gas Pressure:**

Static \_\_\_\_\_

Running Inlet \_\_\_\_\_

Manifold \_\_\_\_\_

**Venturi:**

Setting from Bottom in Turns \_\_\_\_\_

**Electrical:**

Line Voltage \_\_\_\_\_

Low Voltage \_\_\_\_\_

Polarity \_\_\_\_\_

Igniter Resistance: \_\_\_\_\_

Flame Sense Micro -Amps: \_\_\_\_\_

Spark Gap: \_\_\_\_\_

LED Flashing Y or N Which One(s) \_\_\_\_\_

Error Codes on Control Display (Direct Spark Ignition System Only): \_\_\_\_\_

**Condensate Line:**

Size & Material \_\_\_\_\_

Length \_\_\_\_\_

Is trap provided Y or N

**Exhaust Collector  
Pressure:**

Positive Inches W.C. \_\_\_\_\_

**Combustion:** CO<sub>2</sub> \_\_\_\_\_

CO \_\_\_\_\_

**Installation Site Name & Address:**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

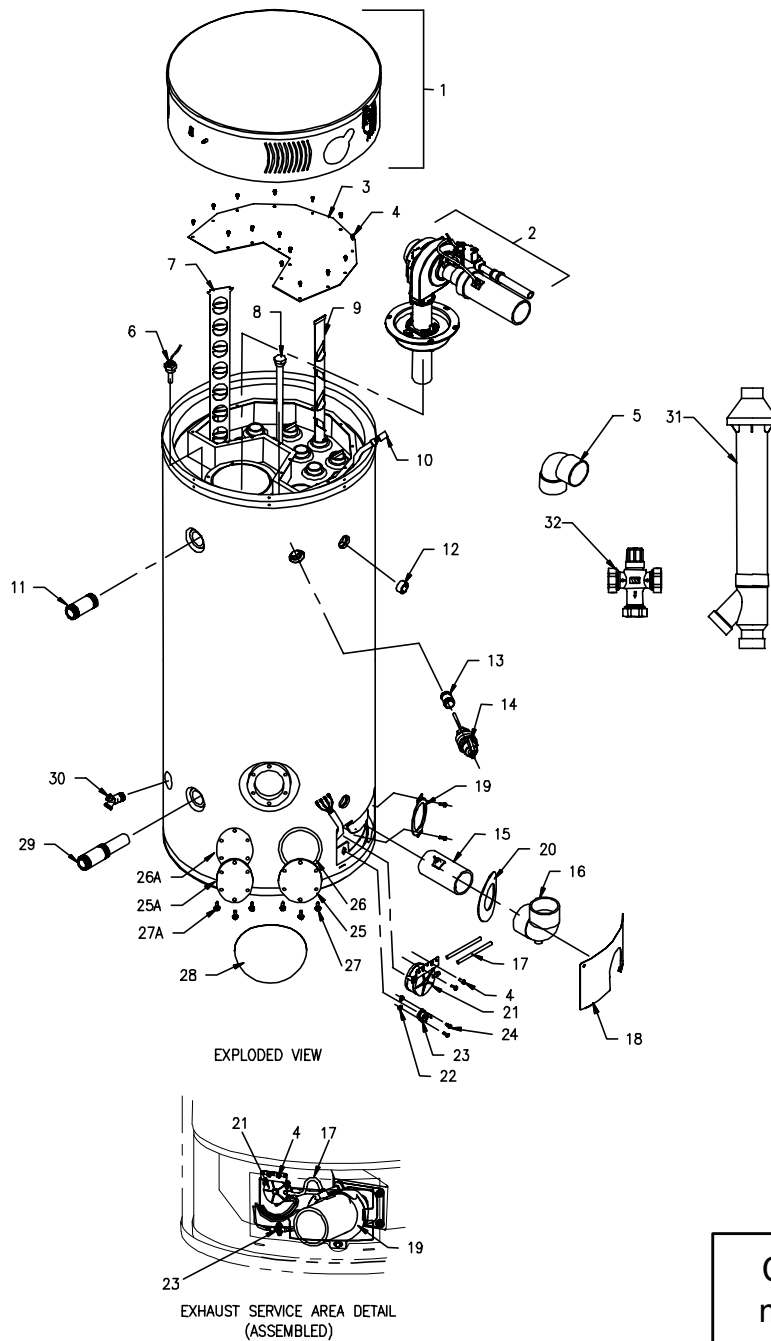
**Installation Site Contact Name &  
Phone Number**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



## Parts List

### Models prior to “CF” serial number



1	Combustion Surround Assy.
2	Burner Assy
3	2 <sup>nd</sup> Pass Top Collector Cover
4	Screw 10-16 x 3/4
5	Vent Termination Elbow
6	Thermostat Sensor Probe
7	Baffle 4" Flue
8	Anode
9	Baffle 2" Flue
10	Wire Harness Service Panel
11	Plastisert Nipple 1-1/2" NPT
12	Plug
13	Nipple
14	T&P Relief Valve
15	Exhaust Pipe (PVC) w/Hose Barb
16	Condensate Trap Elbow
17	Silicone Hose
18	Outer Door Service Panel
19	Vent Pipe Support Bracket
20	NSF Escutcheon
21	Exhaust Pressure Switch
22	Nut
23	Vent Safety Switch
24	Screw 6-32x 3/8
25	Cleanout Access Cover
26	Cleanout Gasket
27	Screw 5/16-18 x 3/4 HH Grade 5
28	Cleanout Cover
29	Cold Water Inlet
30	No Handle Brass Drain Valve
31	Coaxial Vent System
32	ASSE Approved Mixing Valve

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



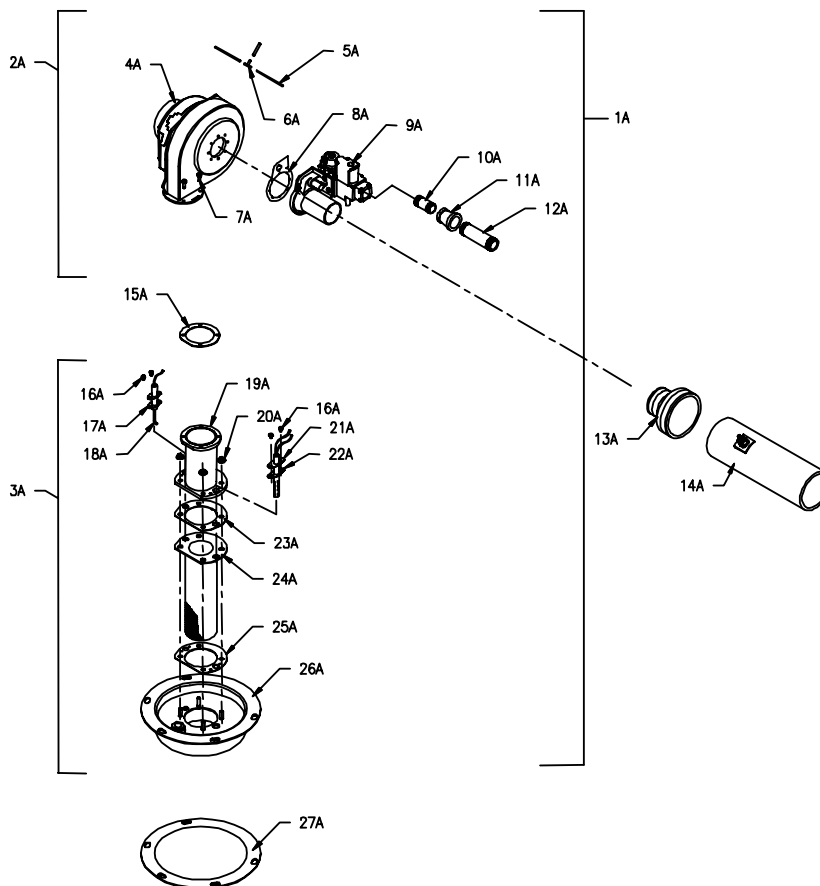
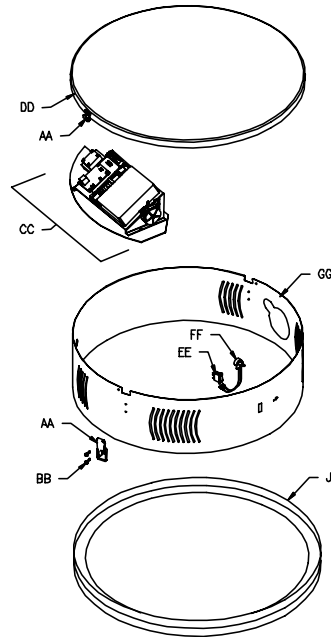


## Parts List

### Models prior to "CF" serial number

AA	Latch Assy
BB	Screw 8-32 x 1/2 RHCR
CC	Ignition Control Assy
DD	Jacket Head
EE	Main Power Switch
FF	Potentiometer
GG	Combustion Surround
JJ	Surround Base

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

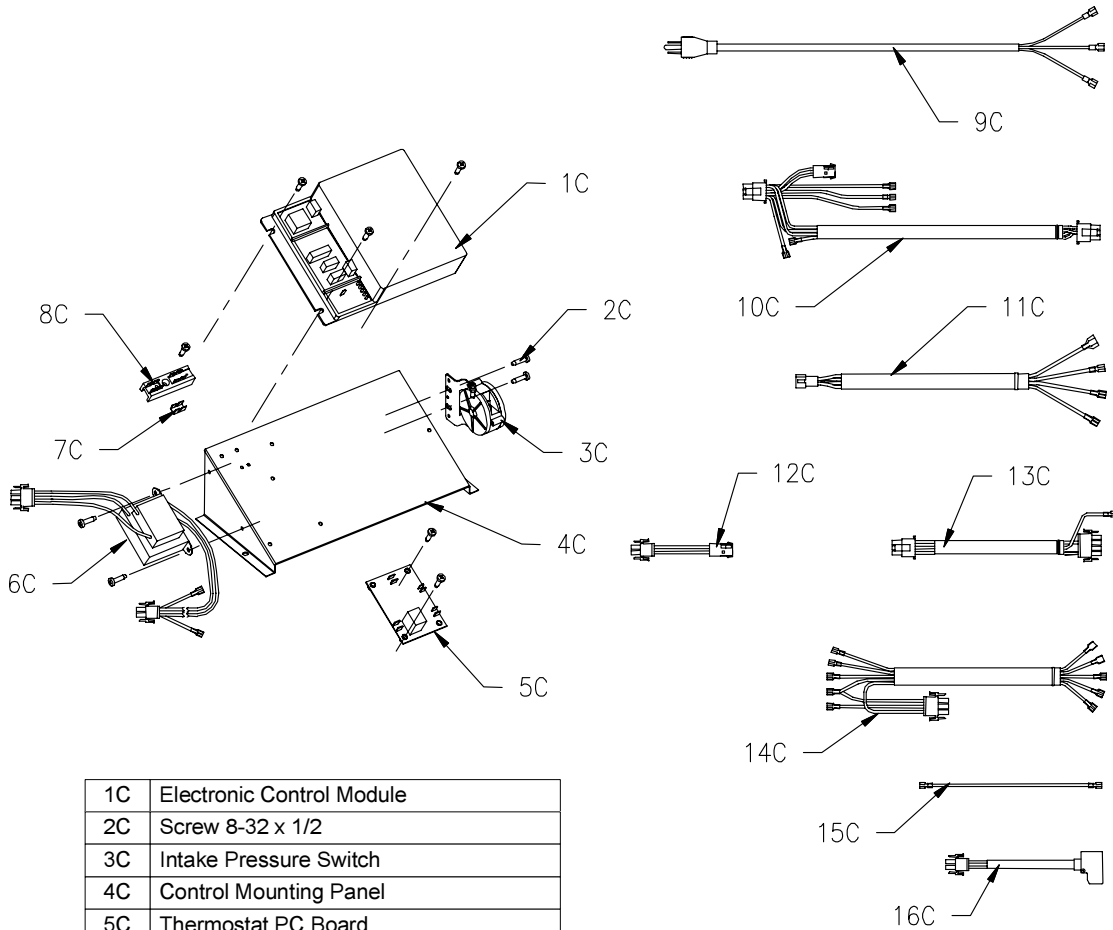


1A	Combustion Surround Assy.
2A	Blower Gas Valve Assy
3A	Burner Assy
4A	Blower EBM
5A	Silicone Hose
6A	Hose Tee Fitting
7A	Screw 10-32 x3/4
8A	Gasket & Screw
9A	Gas Valve
10A	Nipple 1/2" NPT X3"
11A	Reducer 3/4 x 1/2 NPT
12A	Nipple 3/4 NPT x 6"
13A	2" dia. Flex Reducer
14A	Inlet (PVC)
15A	Gasket Blower Transition
16A	Screw 8-32 x 1/4 RHCR
17A	Gasket Flame Sensor
18A	Flame Sensor
19A	Transition Tube
20A	Nut Hex Washer
21A	Gasket Hot Surface Igniter
22A	Hot Surface Igniter
23A	Burner Mounting Gasket
24A	Burner Tube
25A	Burner Mounting Gasket
26A	Burner Mounting Insert
27A	Burner Mounting Insert Gasket



## Parts List

### Models prior to “CF” serial number



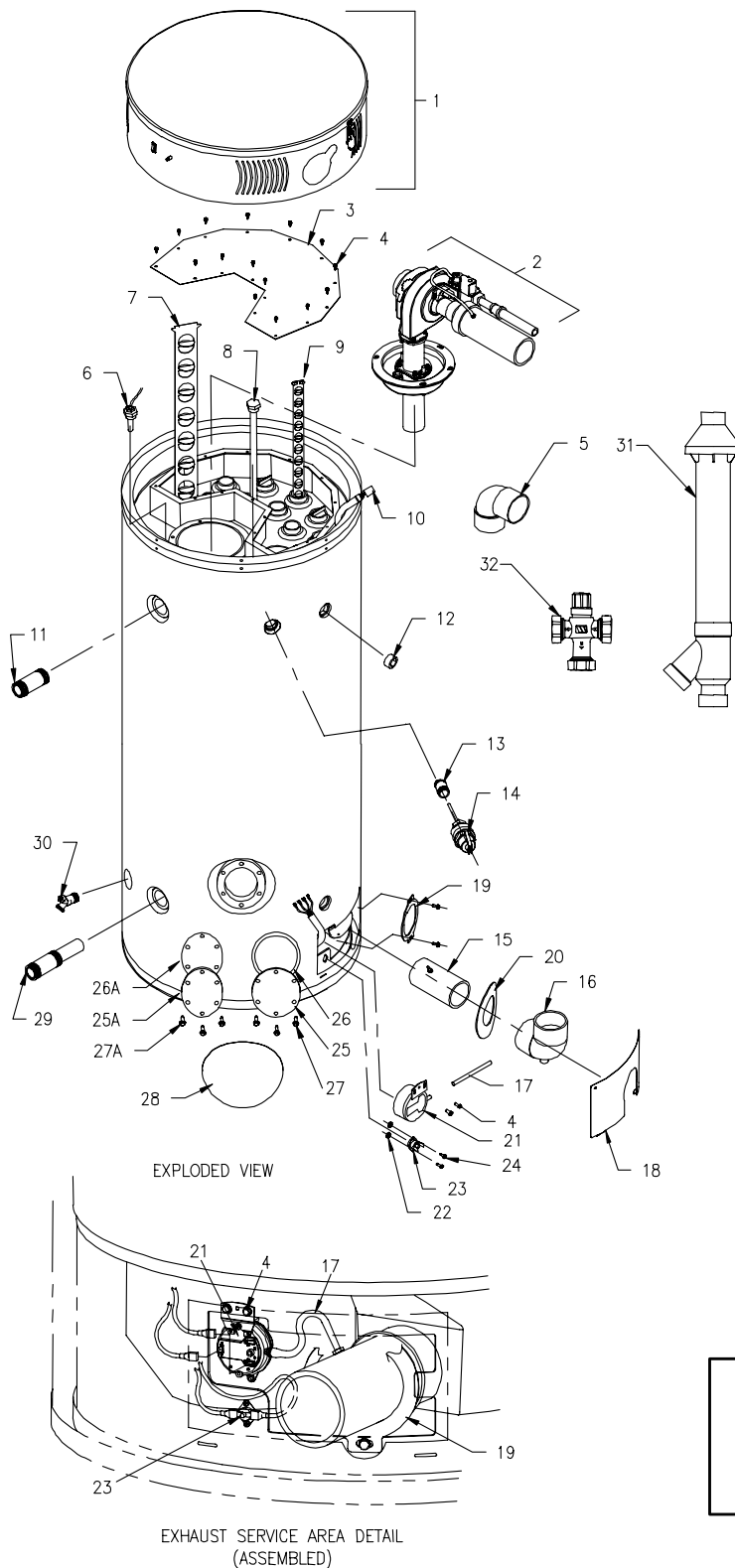
1C	Electronic Control Module
2C	Screw 8-32 x 1/2
3C	Intake Pressure Switch
4C	Control Mounting Panel
5C	Thermostat PC Board
6C	Transformer 120VAC x 24VAC x 40VA
7C	Terminal
8C	Terminal Strip
9C	Power Cord
10C	Control Wire Harness
11C	Thermostat Wire Harness
12C	Igniter Extension Wire
13C	Blower Wire Harness
14C	Power Switch Wire Harness
15C	Flame Sensor Wire Harness
16C	Rectifier Harness

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



## Parts List

For models with "CF" serial or later.



1	Combustion Surround Assy.
2	Burner Assy (specify model)
3	2 <sup>nd</sup> Pass Top Collector Cover
4	Screw 10-16 x 3/4
5	Vent Termination Elbow
6	Thermostat Sensor Probe
7	Baffle 4" Flue (specify model)
8a	Anode Rod Assy
8b	Powered Anode (for EF100T399)
9	Baffle 2" Flue
10	Wire Harness Service Panel
11	Plastisert Nipple 1-1/2" NPT
12	Plug
13	Nipple
14	T&P Relief Valve
15	Exhaust Pipe (PVC) w/Hose Barb (except EF100T399)
16	Condensate Trap Elbow (specify model)
17	Silicone Hose
18	Outer Door Service Panel (specify model)
19	Vent Pipe Support Bracket (except EF100T399)
20	NSF Escutcheon
21	Exhaust Pressure Switch
22	Nuts
23	Collector Temperature Limit Switch
24	Screw 6-32x 3/8
25	Cleanout Access Cover
26	Cleanout Gasket
27	Screw 5/16-18 x 3/4 HH Grade 5
28	Cleanout Cover
29	Cold Water Inlet (Hydrojet) Assy.
30	No Handle Brass Drain Valve
31	Concentric Vent System (optional)
32	ASSE Approved Mixing Valve (optional)

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

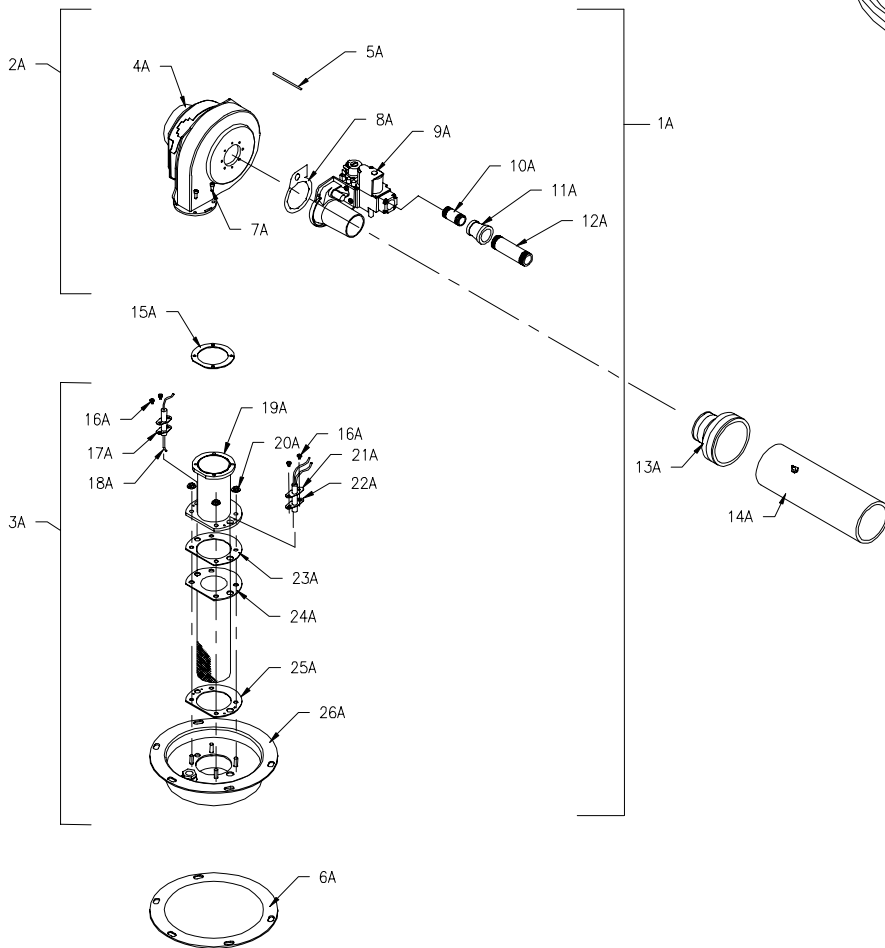
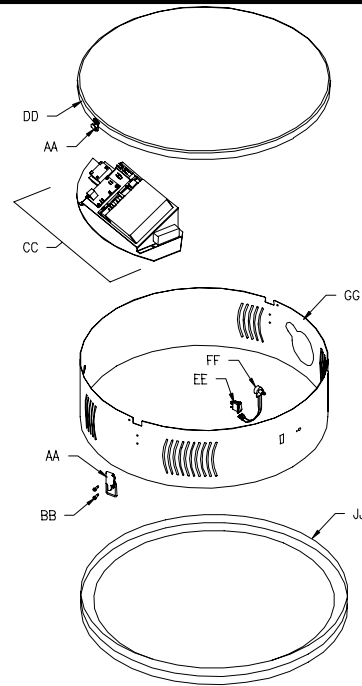


## Parts List

For models with "CF" serial or later.

AA	Latch Assy
BB	Screw 8-32 x 1/2 RHCR
CC	Ignition Control Assy
DD	Jacket Head
EE	Main Power Switch
FF	Potentiometer
GG	Combustion Surround
JJ	Surround Base

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

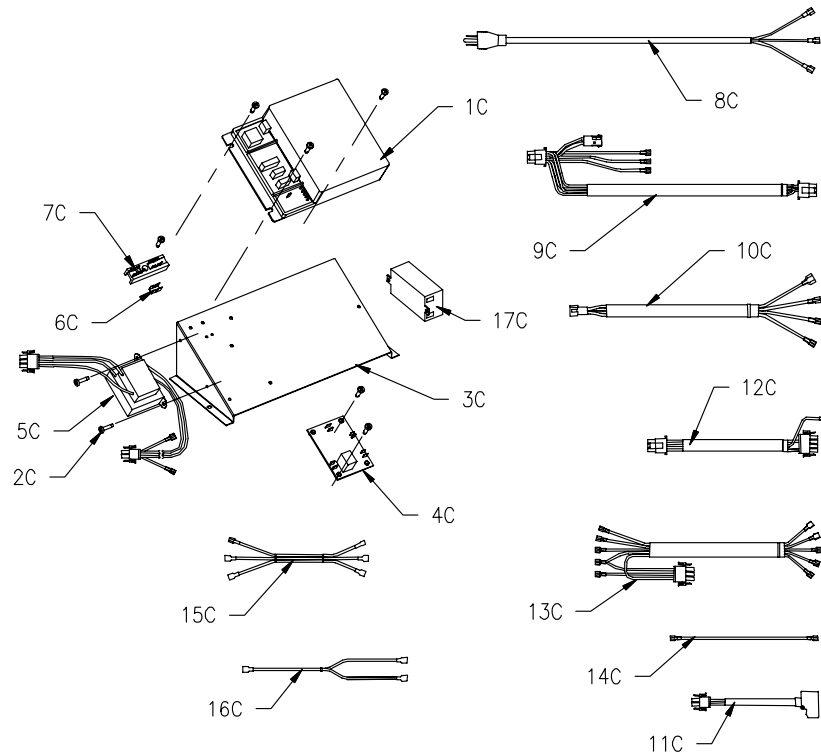


1A	Combustion Surround Assy. (specify model)
2A	Blower Gas Valve Assy (specify model)
3A	Burner Assy (specify model)
4A	Blower EBM (specify model)
5A	Silicone Hose
6A	Burner Mounting Insert Gasket
7A	Screw 10-32 x3/4
8A	Gasket & Screw
9A	Gas Valve (specify model)
10A	Nipple (specify model)
11A	Reducer (specify model)
12A	Nipple (specify model)
13A	2" dia. Flex Reducer (or PVC reducer for 399)
14A	Inlet (PVC)
15A	Gasket Blower Transition (specify model)
16A	Screw 8-32 x 1/4 RHCR
17A	Gasket Flame Sensor
18A	Flame Sensor
19A	Transition Tube
20A	Nut Hex Washer
21A	Gasket Hot Surface Igniter
22A	Hot Surface Igniter
23A	Burner Mounting Gasket
24A	Burner Tube
25A	Burner Mounting Gasket
26A	Burner Mounting Insert



## Parts List

For models with “CF” serial or later.



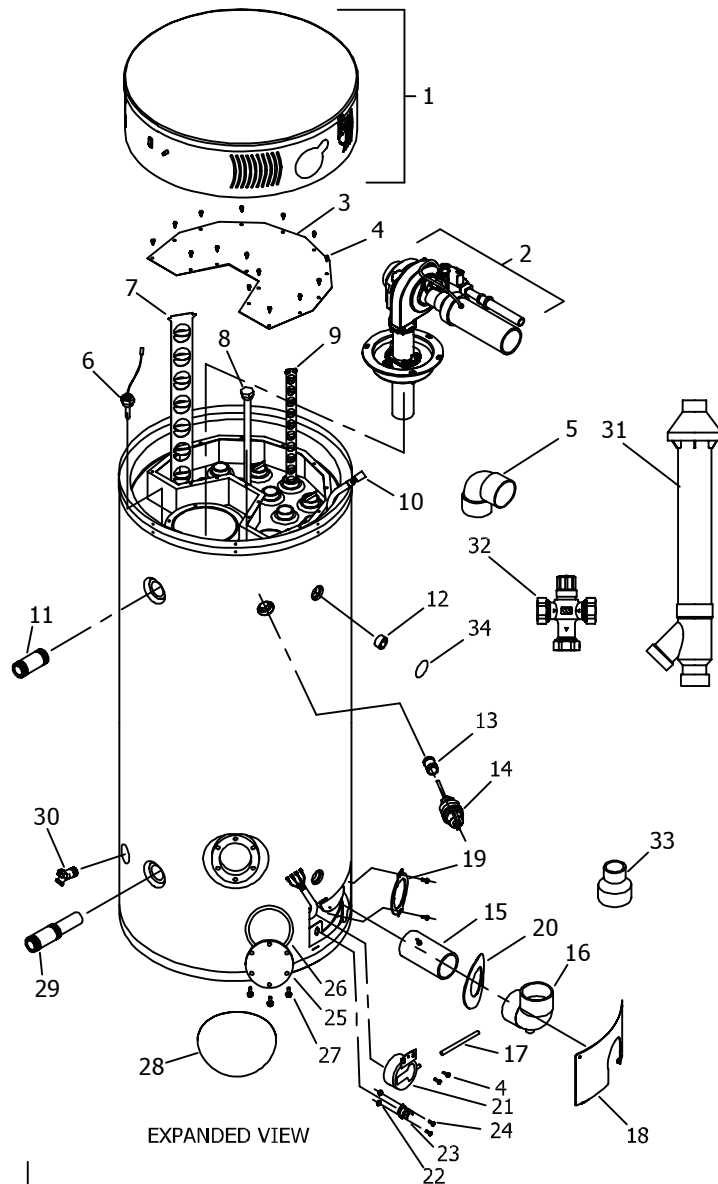
1C	Electronic Control Module
2C	Screw 8-32 x 1/2
3C	Control Mounting Panel
4C	Thermostat PC Board
5C	Transformer 120VAC x 24VAC x 40VA
6C	Terminal
7C	Terminal Strip
8C	Power Cord
9C	Control Wire Harness
10C	Thermostat Wire Harness
11C	Rectifier Harness (specify model)
12C	Blower Wire Harness (specify model)
13C	Power Switch Wire Harness
14C	Flame Sensor Wire Harness
15C	Powered Anode Control Harness (399 only)
16C	Powered Anode Harness (399 only)
17C	Powered Anode Control (399 only)

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

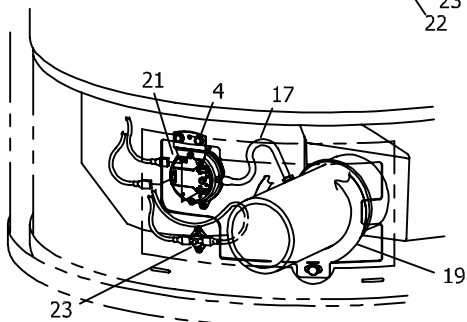


## Parts List

### For models with Direct Spark Ignition



EXPANDED VIEW



EXHAUST SERVICE AREA DETAIL  
(ASSEMBLED)

1	Combustion Surround Assembly
2	Burner Assembly (specify model)
3	2 <sup>nd</sup> Pass Top Collector Cover
4	Screw 10-16 x 3/4
5	Vent Termination Elbow
6	Thermostat Sensor Probe
7	Baffle 4" Flue (specify model)
8	Anode Rod Assembly
9	Baffle 2" flue
10	Wire Harness Service Panel
11	Plastisert Nipple 1-1/2" NPT
12	Plug
13	Nipple
14	T&P Relief Valve
15	Exhaust Pipe (PVC) w/Hose Barb
16	Condensate Trap Elbow (specify model)
17	Silicone Hose
18	Outer Door Service Panel (specify model)
19	Vent Pipe Support Bracket
20	NSF Escutcheon
21	Exhaust Pressure Switch
22	Nuts
23	Collector Temperature Limit Switch
24	Screw 6-32x 3/8
25	Cleanout Access Cover
26	Cleanout Gasket
27	Screw 5/16-18 x 3/4 HH Grade 5
28	Cleanout Cover
29	Cold Water Inlet (Hydrojet) Assembly
30	No Handle Brass Drain Valve
31	Concentric Vent System (optional)
32	ASSE Approved Mixing Valve (optional)
33	Reducer
34	Hole Closure

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

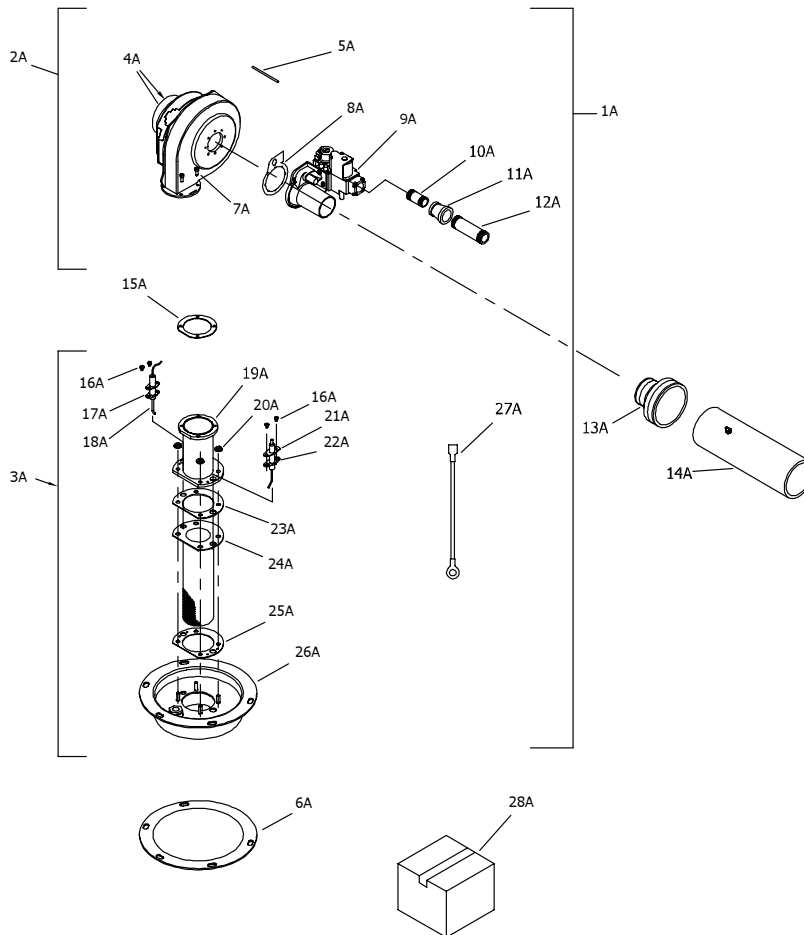
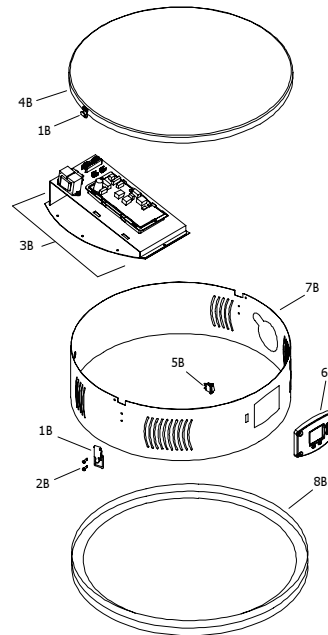


## Parts List

### For models with Direct Spark Ignition

1B	Latch Assy
2B	Screw 8-32 x 1/2 RHCR
3B	Ignition Control Assy
4B	Jacket Head
5B	Main power switch
6B	Honeywell Control Display
7B	Combustion Surround
8B	Surround Base

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

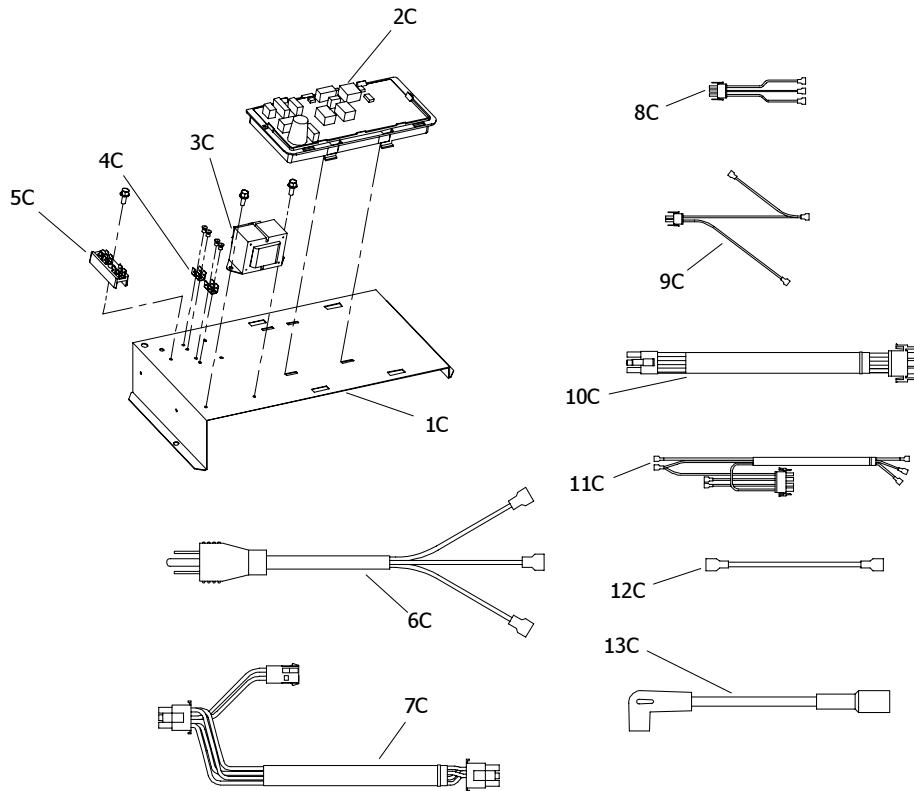


1A	Combustion Surround Assembly (specify model)
2A	Blower Gas Valve Assy. (specify model)
3A	Burner Assy. (specify model)
4A	Blower EBM (specify model)
5A	Silicone Hose
6A	Burner Mounting Insert Gasket
7A	Screw 10-32 x3/4
8A	Gasket
9A	Gas Valve (specify model)
10A	Nipple (specify model)
11A	Reducer (specify model)
12A	Nipple (specify model)
13A	2" dia. Flex Reducer
14A	Inlet (PVC)
15A	Gasket Blower Transition (specify model)
16A	Screw 8-32 x 1/4 RHCR
17A	Gasket Flame Sensor
18A	Flame Sensor
19A	Transition Tube
20A	Nut Hex Washer
21A	Spark Rod
22A	Spark Rod Gasket
23A	Burner Mounting Gasket
24A	Burner Tube
25A	Burner Mounting Gasket
26A	Burner Mounting Insert
27A	Ground Wire
28A	Gas Regulator Kit (Optional)



## Parts List

### For models with Direct Spark Ignition



1C	Control Panel
2C	Control Board
3C	Transformer 120VAC x 24VAC x 40VA
4C	Terminal
5C	Terminal Strip
6C	Power Cord
7C	Controller Wire Harness
8C	Transformer Primary Wire Harness
9C	Transformer Secondary Wire Harness
10C	Blower Wire Harness
11C	Power Switch Wire Harness
12C	Sensor Wire Harness
13C	High Voltage Spark Cable

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



## Glossary of Terms

AC	Alternating Current
BTU/H	British Thermal Units
CO	Carbon Monoxide
CO <sub>2</sub>	Carbon Dioxide
DC	Direct Current
DSI	Direct Spark Ignition
ECO	Energy Cut Off
GFI	Ground fault interrupt
GPM	Gallons per Minute
HSI	Hot Surface Igniter
Hz	Hertz
LED	Light Emitting Diode
NO <sub>x</sub>	Oxides of Nitrogen
NPT	National Pipe Thread
PSI	Pounds per Square Inch
RPM	Revolutions per Minute
VA	Volt Amps
VAC	Volts Alternating Current
W.C.	Inches of Water Column
°C	Degrees Centigrade
°F	Degrees Fahrenheit
μA	Micro Amp

## NOTES

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## This image shows a full page of blank white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page, providing a template for handwriting practice. There are no margins, text, or other markings on the paper.



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contact your professional installer or  
local Bradford White sales representative.

**Sales/800-523-2931**  
***Fax/215-641-1670***  
***Parts Fax/215-641-2180***

**Technical Support/800-334-3393**  
***Fax/269-795-1089***

**Warranty/800-531-2111**  
***Fax/269-795-1089***

**International:**  
**Telephone/215-641-9400**  
***Telefax/215-641-9750***



**Sales/866-690-0961**  
**905-238-0100**

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