BRADFORD WHITE®

WATER HEATERS

Ultra High Efficiency Water Heaters

eF Series® Models



SERVICE MANUAL

Troubleshooting Guide
and Instructions for Service

(To be performed ONLY by
qualified service providers)

Models Covered by This Manual:

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

WARNING
CANCER AND REPRODUCTIVE HARM
WWW.P65WARNINGS.CA.GOV

As required by the state of California Proposition 65.

238-45817-00F REV 08/18

Save this manual for future reference

Ultra High Efficiency Water Heaters

Table of Contents

	Page	eF Service Procedure
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.

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, ¼" 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 of Honeywell Integrated Control System

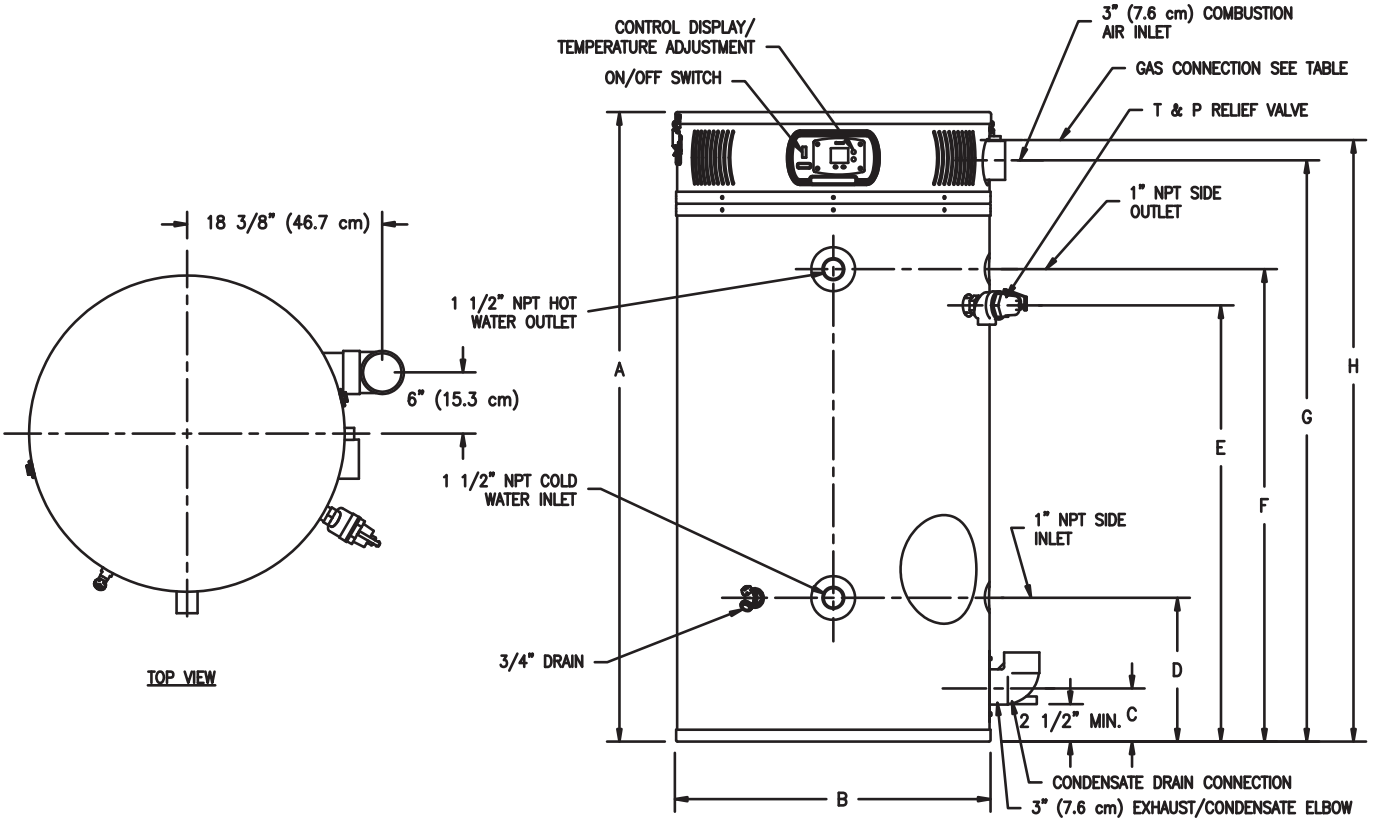
Serial Numbers including and AFTER GB13006174 and ALL EFR models

- 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 miswirng.
- 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.

NOTICE:

THE EF100T399 MODEL SERIES DO NOT USE THE HONEYWELL INTEGRATED CONTROL SYSTEM. THESE MODELS USE THE UT ELECTRONICS CONTROL MODULE WITH HOT SURFACE IGNITION.

Specifications



			Recovery GPH at Degree Rise					DIMENSIONS (INCHES)												
Model No	Input Rate BTU/h	1st Hr Del Gal @ 100°F Rise	40°F	100°F	140°F	Stg Cap U.S. Gal	Therm Eff %	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)	Shpg Wt (lbs)
EFR-1-60T-120	120,000	180	345	138	99	60	95.0	57	28 ¼	5	13	40	42 ¼	52 ½	53 ½	1	1	¾	¾	570
EF60T125	125,000	187	363.6	145.5	103.9	60	96.0	57	28 ¼	5	13	40	42 ¼	52 ½	53 ½	1 ½	1	¾	¾	570
EF60T150	150,000	211	422.7	169.1	120.8	60	93.0	57	28 ¼	5	13	40	42 ¼	52 ½	53 ½	1 ½	1	¾	¾	570
EF60T199	199,999	265	557.6	223	158	60	92.0	57	28 ¼	5	13	40	42 ¼	52 ½	53 ½	1 ½	1	¾	¾	570
EF100T150	150,000	250	450.5	180.2	129	100	99.1	77 5/8	28 ¼	5	13	60	62 ¼	73 1/8	74 ¾	1 ½	1	¾	¾	900
EF100T199	199,999	309	597	238.8	171	100	98.5	77 5/8	28 ¼	5	13	60	62 ¼	73 1/8	74 ¾	1 ½	1	¾	¾	900
EF100T250	250,000	364	734.8	293.9	210	100	97.0	77 5/8	28 ¼	5	13	60	62 ¼	73 1/8	74 ¾	1 ½	1	¾	¾	900
EF100T300	300,000	405	836.4	334.5	239	100	92.0	77 5/8	28 ¼	5	13	60	62 ¼	73 1/8	74 ¾	1 ½	1	¾	¾	900
EF100T399	399,999	521	1,127	451	322	100	93.0	77 5/8	28 ¼	5	13	60	62 ¼	73 1/8	73 ¼	1 ½	1	1	1	950

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	CO2: 10-11%, CO: less then 0.04 percent (400 PPM) air free

Honeywell Integrated Control System

Serial Numbers including and AFTER GB13006174 and ALL EFR models

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 then 0.04 percent (400 PPM) air free

NOTICE:

THE EF100T399 MODEL SERIES DO NOT USE THE HONEYWELL INTEGRATED CONTROL SYSTEM. THESE MODELS USE THE UT ELECTRONICS CONTROL MODULE WITH HOT SURFACE IGNITION.

Vent Tables

Balanced Direct Vent Systems PVC, CPVC			
Total length of intake piping and exhaust piping added together must not exceed "Maximum Combined Length" Shown below			
Maximum Combined Length (feet)			
Model Number	**2"**	**3"**	**4"**
EFR-1-60T120	60'	120'	170'
EF60T125, EF100T150	30'	120'	170'
EF60T150, EF100T199	30'	100'	150'
EF60T199	30'	80'	130'
EF100T250	N/A	80'	130'
EF100T300	N/A	60'	110'
EF100T399	N/A	50'	100'

Power Vented Systems PVC, CPVC			
Total length of exhaust piping must not exceed "Maximum Vent Length" Shown below			
Maximum Vent Length (feet)			
Model Number	**2"**	**3"**	**4"**
EFR-1-60T120	60'	120'	170'
EF60T125, EF100T150	30'	120'	170'
EF60T150, EF100T199	30'	100'	150'
EF60T199	30'	80'	130'
EF100T250	N/A	80'	130'
EF100T300	N/A	60'	110'
EF100T399	N/A	50'	100'

Unbalanced Direct Vent Systems
Air intake CAN NOT exceed exhaust by more than 30 feet

WARNING! The EF100T250 and EF100T300 models are not approved for 2 inch diameter vent pipe. Venting with 2 inch pipe on these models may result in damage to the water heater or cause an unsafe condition. DO NOT use 2 inch Vent or Air Intake Pipe on EF100T250/300 models.

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:

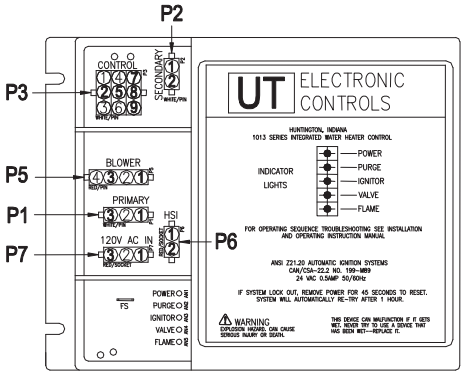
- Ignition & heating functions in response to thermostat.
- Hot surface ignition using a microprocessor to control timing, flame sensing using flame rectification & ignition retries.
- Monitoring of system pressure switches and limit switches.
- Control of gas valve, inducer motor, and hot surface igniter 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.

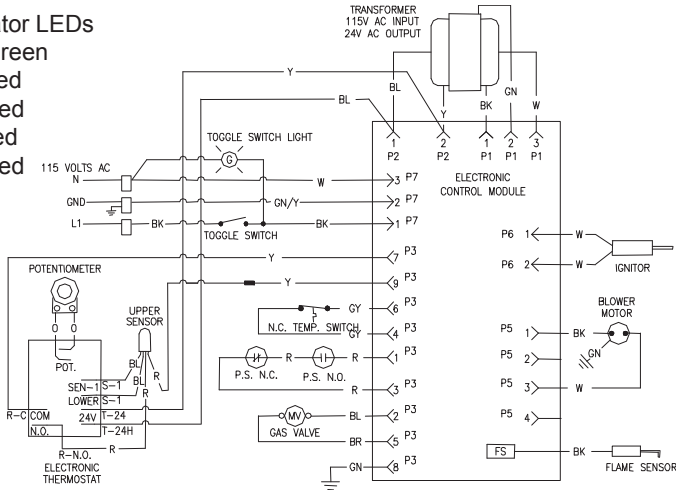
Control Outputs:

- 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 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:

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

Ignition Module Specifications

Control Functions:

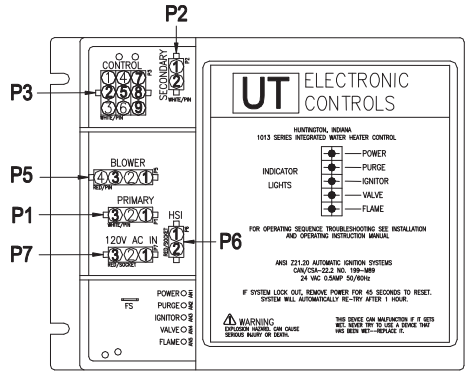
- Ignition & heating functions in response to thermostat.
- Hot surface ignition using a microprocessor to control timing, flame sensing using flame rectification & ignition retries.
- Monitoring of system pressure switches and limit switches.
- Control of gas valve, inducer motor, and hot surface igniter 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.

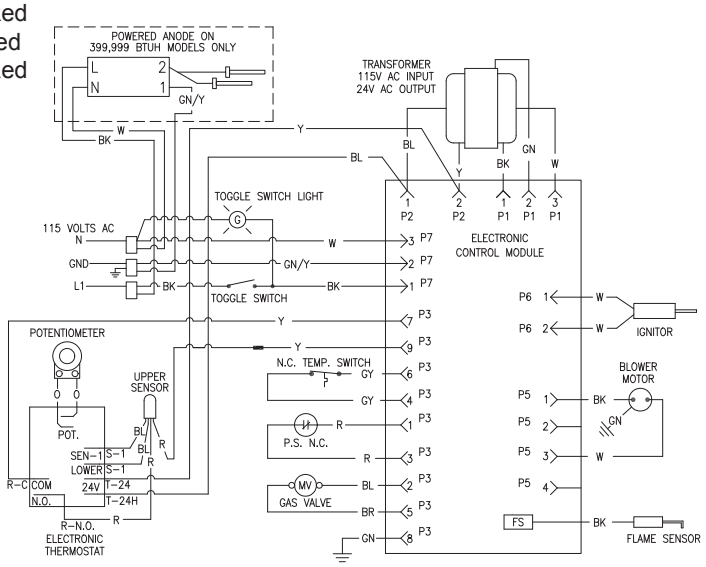
Control Outputs:

- 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

Serial Numbers including and AFTER GB13006174 and ALL EFR models (Excluding EF100T399 model series)

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 1st 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

Serial Numbers including and AFTER GB13006174 and ALL EFR models

Lockout Conditions

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

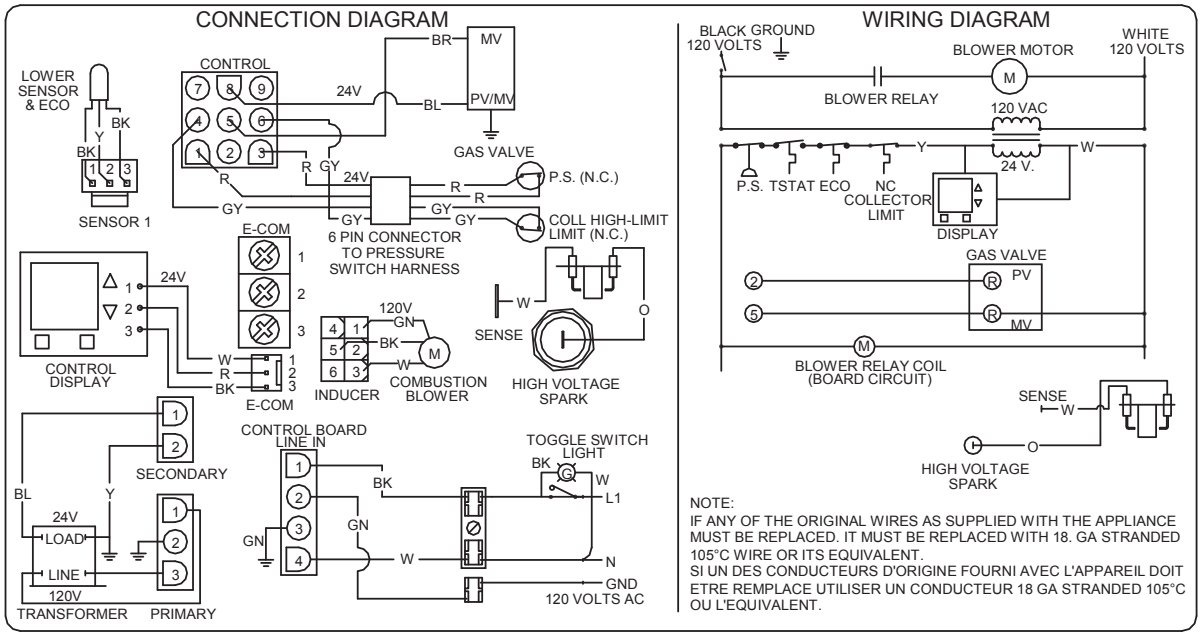
1. ERROR CODE 62 or 63
   Control board will go into “Soft Lockout” if the main burner cannot be lit or fails to prove flame after 3 ignition trials. The water heater display indicates a lockout condition by showing an error code number (62 or 63) with “Service Needed” in the control display window. 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



NOTE:
IF ANY OF THE ORIGINAL WIRES AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED. IT MUST BE REPLACED WITH 18. GA STRANDED 105°C WIRE OR ITS EQUIVALENT.
SI UN DES CONDUCTEURS D'ORIGINE FOURNI AVEC L'APPAREIL DOIT ETRE REMPLACE UTILISER UN CONDUCTEUR 18 GA STRANDED 105°C OU L'EQUIVALENT.

Troubleshooting

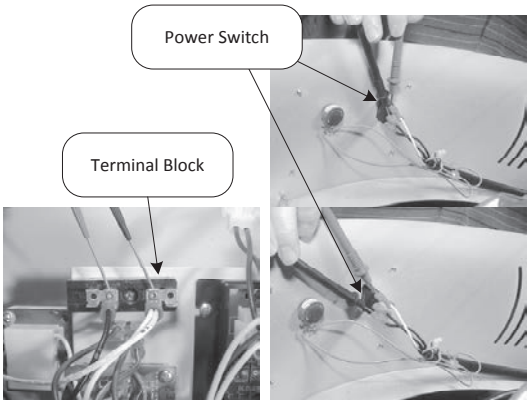
System Observation
For models with Hot Surface Ignition

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

Is front panel power switch light on, indicating power?
- N → Position front panel power switch to "ON" position.
- Y →

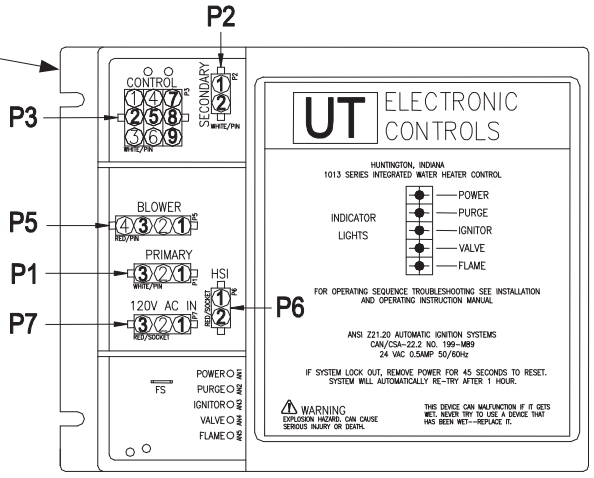
Is there 120VAC across switch? (see photo at right)
- Y → Light burned out, replace switch.
- N →

Is there 120VAC across terminal block? (see photo at right)
- Y → Repair/replace wire harness to switch.
- N → Determine power source problem and correct.



Is ignition module power light on?
- N → Refer to ignition module illustration, is there 120VAC going to module at locations **P7(1)** and **P7(3)**?
  - Y → Refer to ignition module illustration, is there 120VAC between **P1(1)** and **P1(3)**?
    - Y → Refer to ignition module illustration, is there 24VAC going to module at locations **P2(1)** and **P2(2)**?
      - N → Replace transformer. (see "Transformer Replacement")
    - N → Replace ignition module. (see "Ignition Module Replacement")
  - N → Replace ignition module. (see "Ignition Module Replacement")
- Y →

IGNITION MODULE



Is ignition module power and flame light flashing?
- Y → Supply voltage polarity is incorrect.
- N →

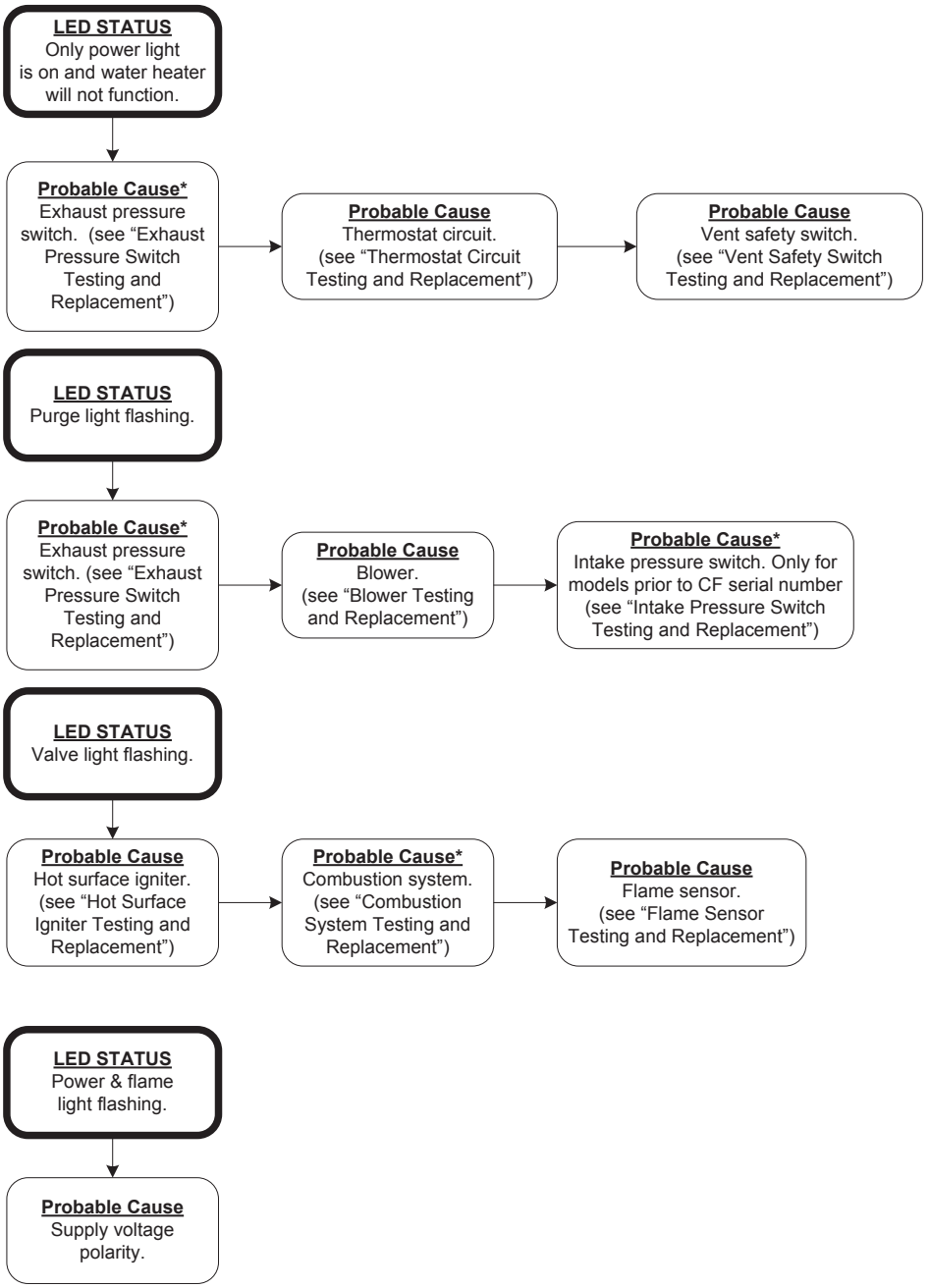
Reset heater by interrupting power. → Reestablish power and Adjust thermostat to call for heat, tank must be cold. → Allow heater to run through heating cycle. → Did heater complete heating cycle and did blower post purge?
- N → See next page
- Y → System is OK.

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.



Troubleshooting

System Observation
For models with Direct Spark Ignition

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.

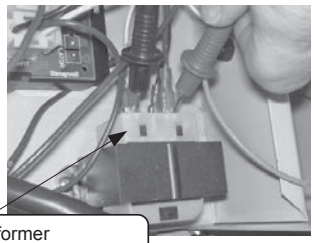
Refer to Control Board illustration. Voltage at primary pins **P2(1)** & **P2(3)** will be 110-120. If not, check Line In pins **P3(1)** & **P3(4)**. Check line cord with volt meter. Replace line cord if defective.

Verify Secondary voltage at the control board.

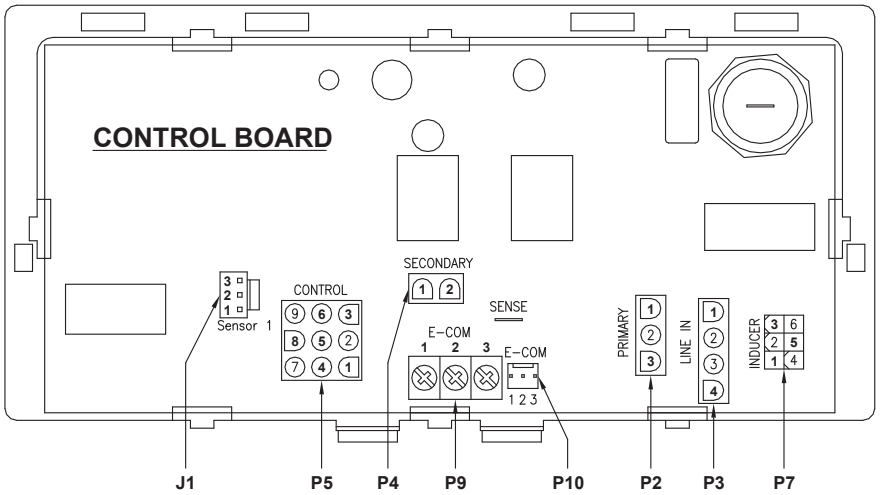
Refer to Control Board illustration. Voltage at secondary pins **P4(1)** & **P4(2)** will be 24VAC. If not, check transformer. Replace transformer or wire harness.

⚠ 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



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



Does water heater display operate? Does the combustion blower start to operate? Increase thermostat setting if tank is warm.

N → Is 24VAC present between **RED** and **BLACK** wire pin connections on the back of Control Display?

Y → Check wires for proper termination to control display. Are wire terminations connected properly to control display?

Y → Replace Control Display.

N → Make proper wire terminations

Y → Display Operates - See next page

N → Is 24VAC present between E-COM screw terminals **P9(2)** & **P9(3)** on the Control Board.

Y → Check wire harness for proper continuity

N → Replace Control Board

Troubleshooting

System Observation
For models with Direct Spark Ignition

⚠ 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

From previous page

Does combustion blower operate?
- N → Error code #29 on display. Refer to Control Board illustration. Measure voltage between terminals **P7(3)** & **P7(5)** on the "inducer" output (make sure the control display shows "heating" in the status mode, if not increase the setpoint). Is there 110-120 VAC?
  - N → Replace control board if display shows "heating" and no voltage is present to the blower harness. Make sure there are no error codes for the temperature sensors (following sections) before replacing control board.
  - Y → Check the voltage at the connection to the blower. Is 110-120 VAC present?
    - Y → Replace blower.
    - N → Replace wire harness.
- Y

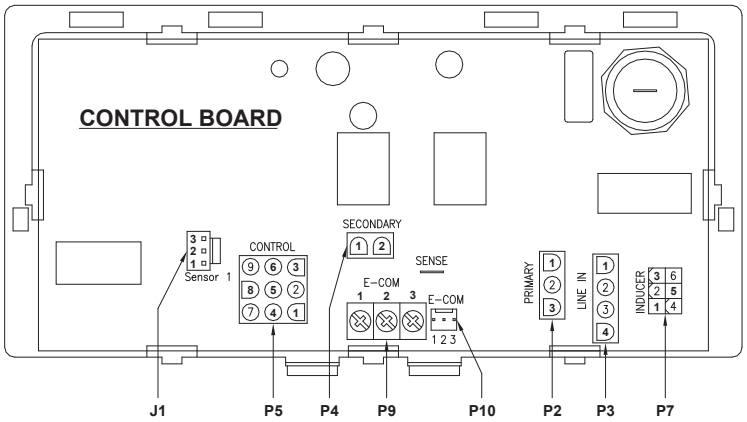
Can sparking be seen/heard at the spark rod to the burner?
- N → Remove high voltage wire connected at the spark rod and hold approximately ¼" from metal ground with insulated pliers during the ignition cycle (3 second spark trial period). Is there spark to ground?
  - N → Check resistance of high voltage cable. Resistance should be 0-1 ohms. If resistance is high, replace spark cable. If spark cable is good, replace Control Board.
  - Y → Check continuity of spark rod and spark rod gap to burner. (see section "Spark Rod Gap Adjustment")
- Y

Does Main Burner Light?
- N → Error code #62 on display. See main burner lights, no flame signal in section "Combustion System Testing and Replacement"
- Y

Does burner continue until thermostat set point is reached? See setting display in Service Mode and displaying temperature sensors.
- N → Error code #63 on display. (see "Combustion System Testing and Replacement")
- Y → Check to see if control display shows any other error codes (29, pressure switch, 26, vent safety switch, or 65, high limit). If so, refer to the appropriate section for testing and replacement.

Does blower post-purge for 30 seconds?
- Y

System okay

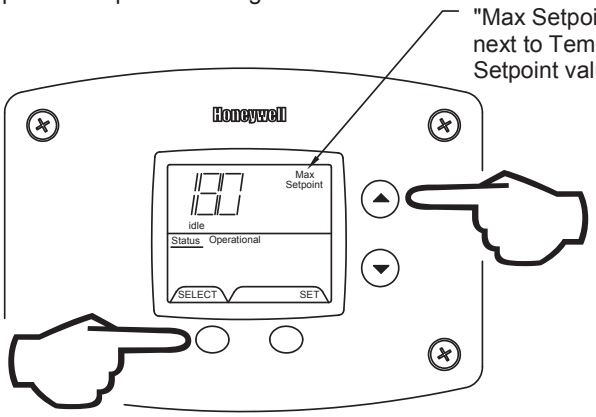


Troubleshooting

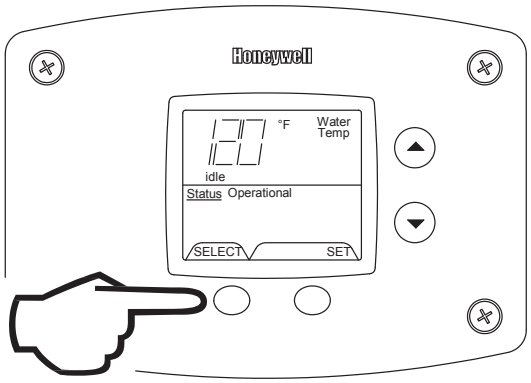
Accessing Service Mode on Control Display
For models with Honeywell Integrated Control

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.

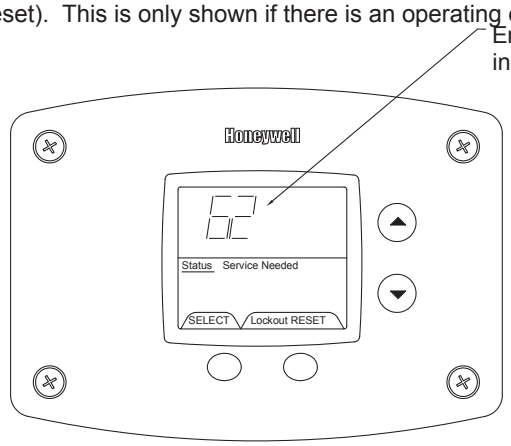


Step 2: Pressing “Select” button will change display to next mode



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

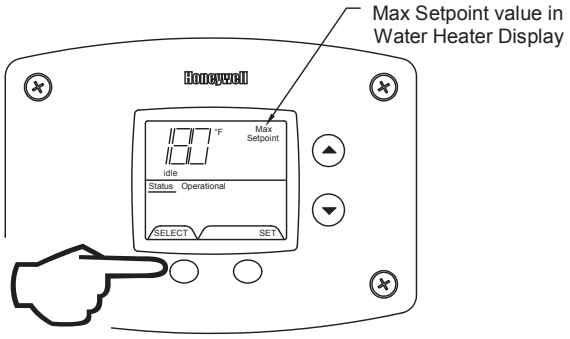
Error Code Number (Display/Reset). This is only shown if there is an operating error in the “User Mode”.



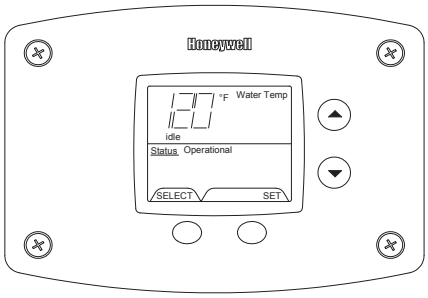
Troubleshooting

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

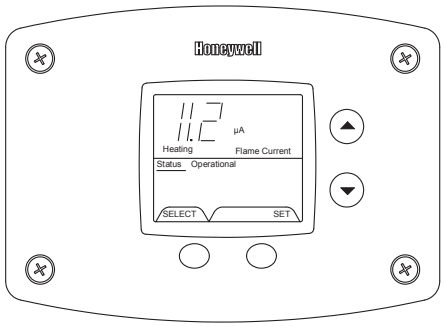
1. Max Setpoint (Display/Change)



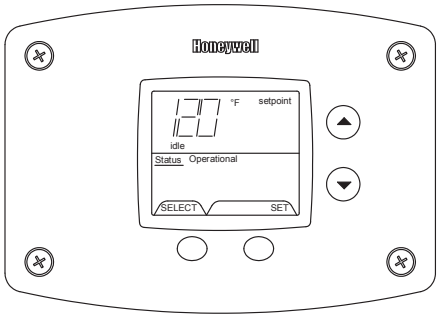
2. Tank Sensor Temperature Displayed Water Temperature Average.



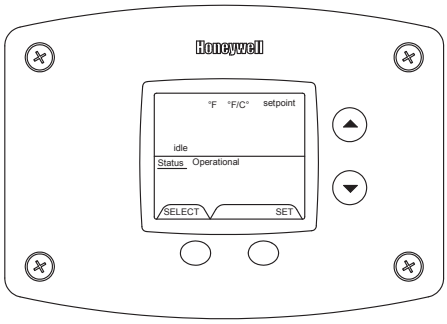
3. Flame Current of Burner Flame Sensor (Displays only in the Heating Cycle)



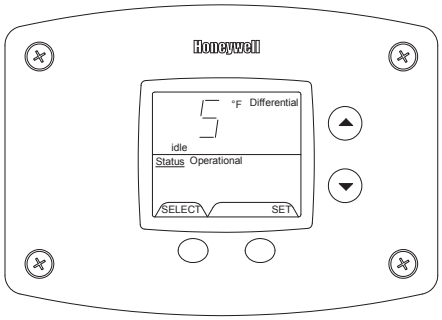
4. Setpoint (Display/Change)



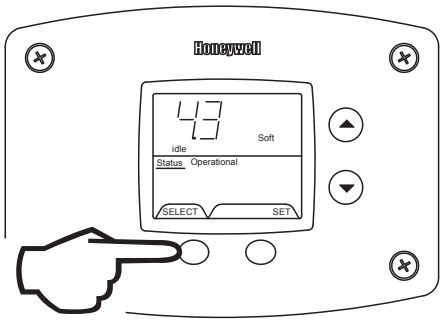
5. °F/°C (Display/Change)



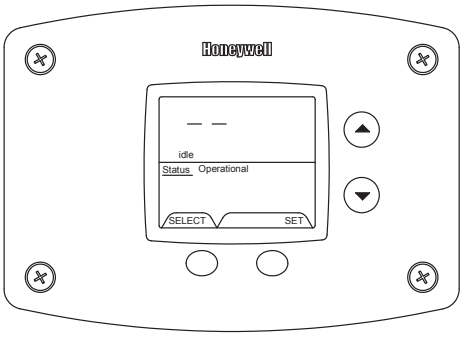
6. Differential (Display only - shows the differential of the thermostat)



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.

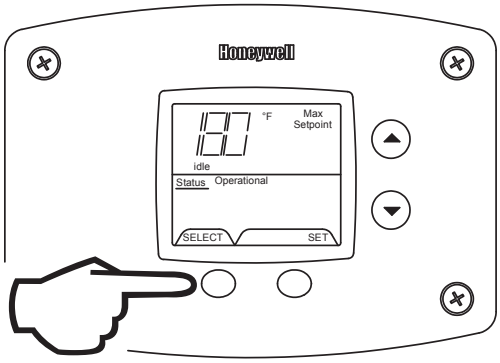


To change the Maximum Setpoint Limit (Max Setpoint) for the temperature setpoint:

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

WARNING

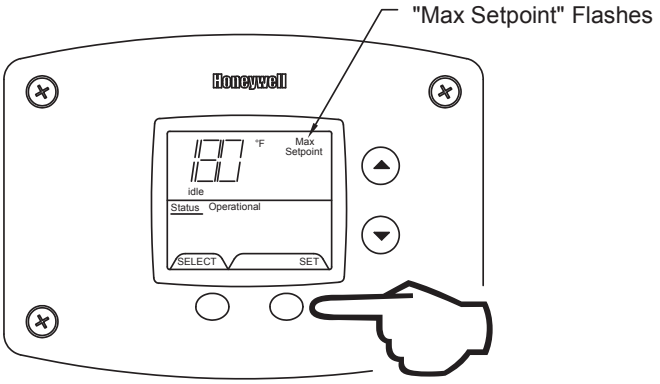
Setting the water temperature to the maximum set point can result in scalding hot water delivered to the faucets. It is highly recommended that the maximum setpoint be adjusted to the lowest temperature possible for the needs of the installation. Make sure the water heater control display is not in a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



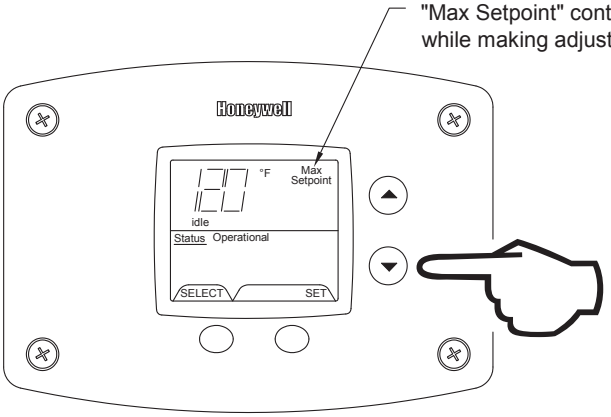
Troubleshooting

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

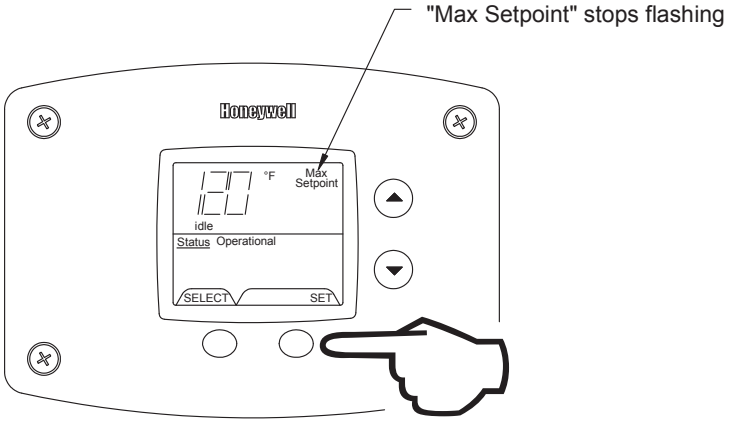
Step 2: Press “Set” button to enter setting mode. “Max Setpoint” will flash to indicate setting mode.



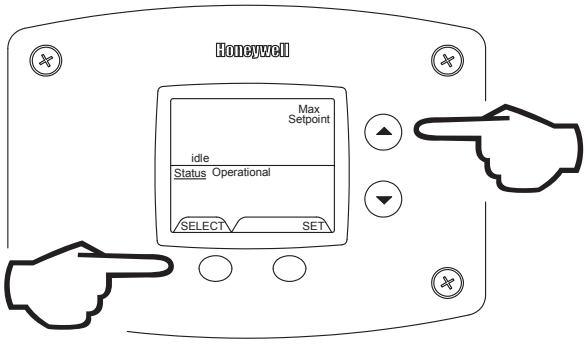
Step 3: Press the “UP” or “DOWN” buttons to change the maximum setpoint value. This will limit the maximum setpoint the user can select. Note: The maximum setpoint is approximately 180°F.



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



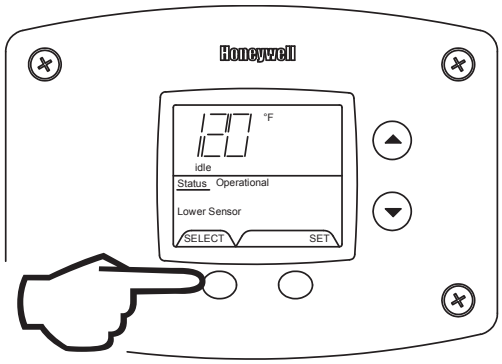
Step 5: 30 Seconds after the last button press, the Water Heater Display will go back to “User Mode”. It will read “Max Setpoint” without showing a temperature value if the temperature setpoint is at the maximum setting. The Water Heater Display can be set back to the “User Mode” immediately by pressing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



Exiting Service Mode

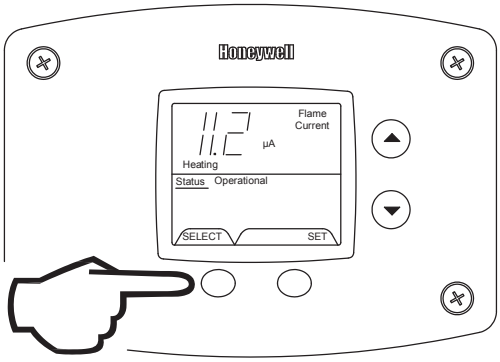
Display of Water Temperature:

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.



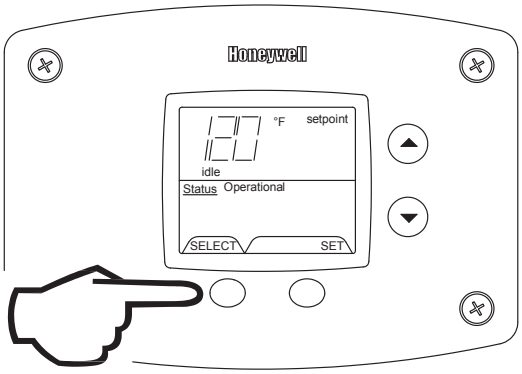
To Display Flame Sense Current of the Pilot Flame Sensor:

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 (µA).

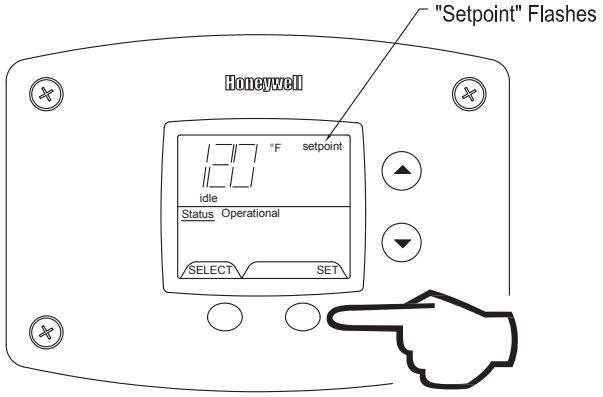


To Display and Change Temperature Setpoint:

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



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



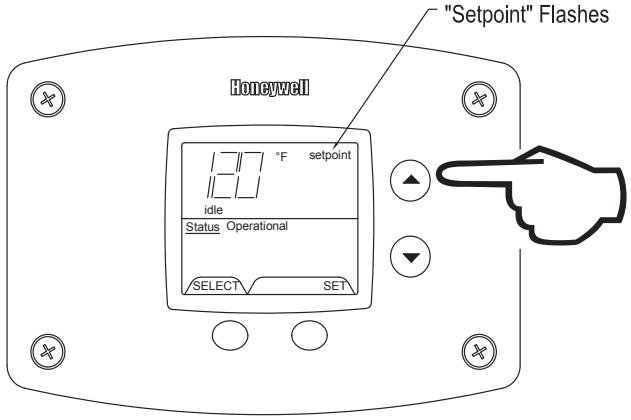
Step 3: To raise the temperature setpoint, press the “Temperature Up” button until the desired temperature is shown on the water heater display.

NOTICE

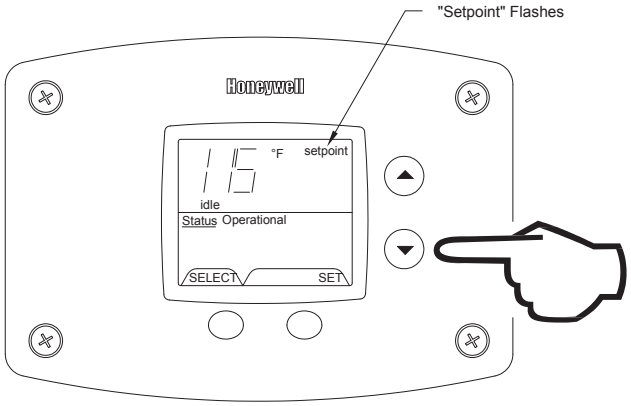
The maximum temperature that can be set in the Water Heater Display is limited to the “Max Setpoint” described previously. To change the “Max Setpoint”, refer to the procedure “To Change the Maximum Setpoint Limit…" described previously under “Accessing the Service Mode on the Water Heater Display”.

WARNING

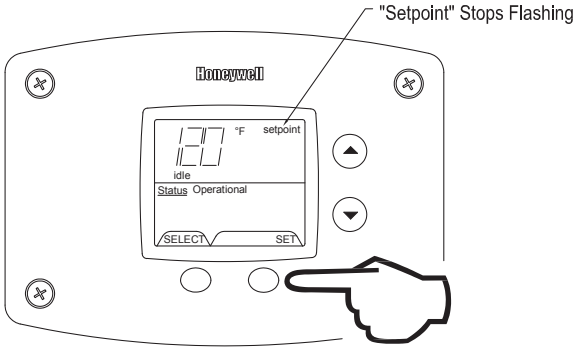
Setting the water temperature to the maximum set point can result in scalding hot water delivered to the faucets. It is highly recommended that the maximum setpoint be adjusted to the lowest temperature possible for the needs of the installation. Make sure the water heater control display is not in a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



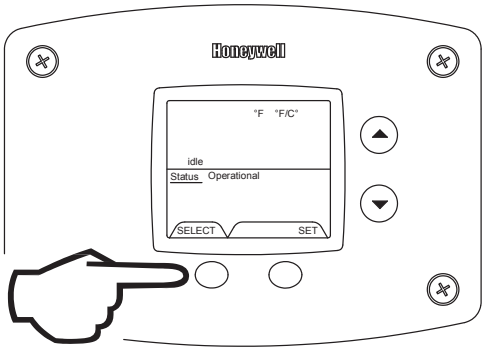
Step 5: When the desired setpoint is reached on the water heater display, press the “Set” button to confirm the new setpoint. “Setpoint” stops flashing in the water heater display.



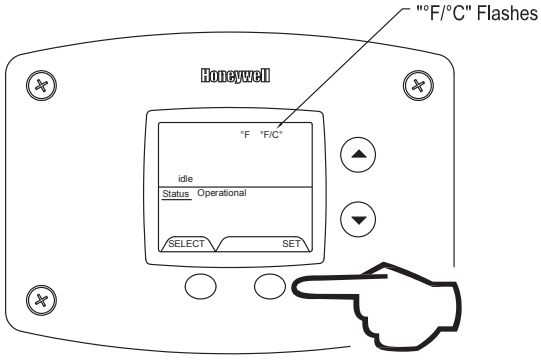
To Display and Change Temperature Format (°F/°C):

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.



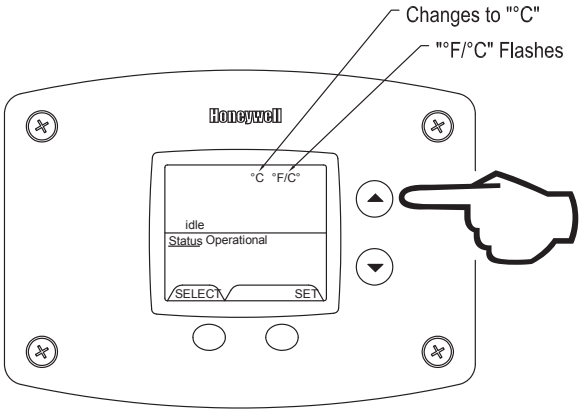
Step 2: Press “Set” button to change temperature format. “°F/°C” symbol will flash in the water heater display.



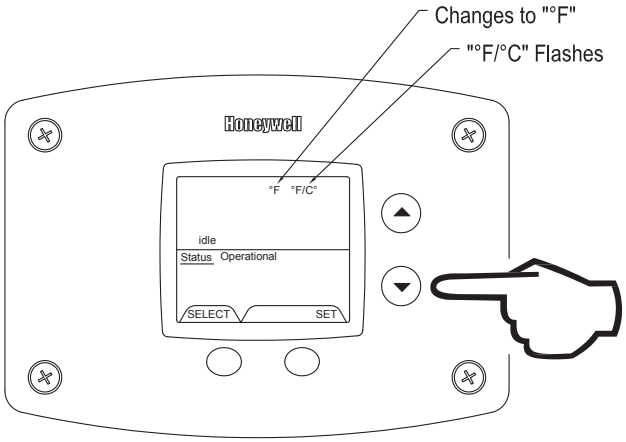
Troubleshooting

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

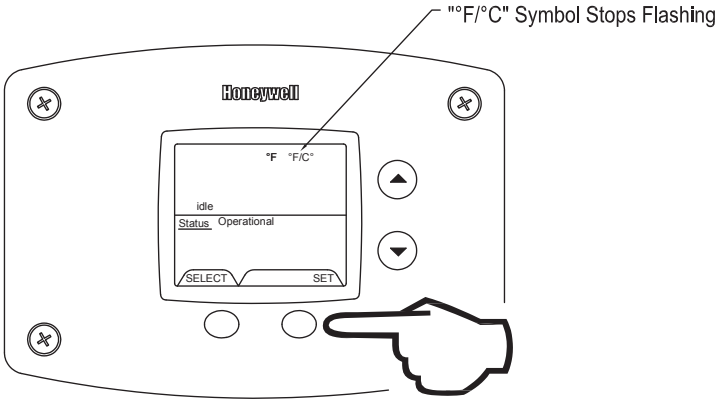
Step 3a: Press “Temperature Up” button to change temperature format to °C



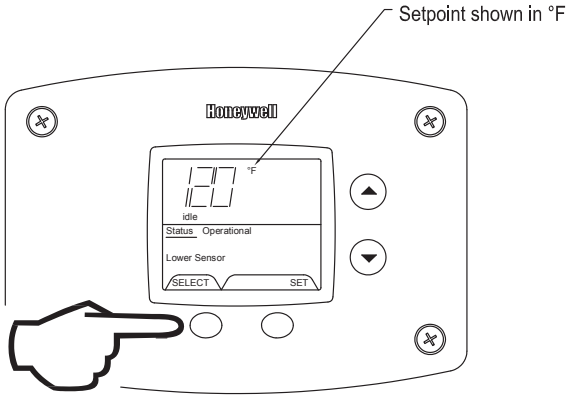
Step 3b: Press “Temperature Down” button to change temperature format to °F



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

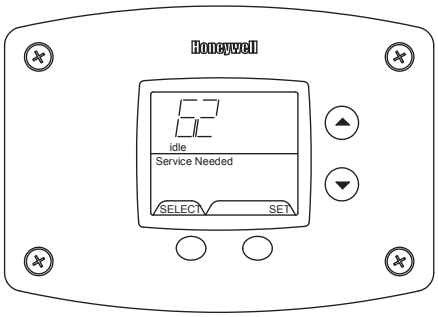


Step 5: Pressing “Select” button will return display to setpoint in format selected (°F or °C) immediately



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.



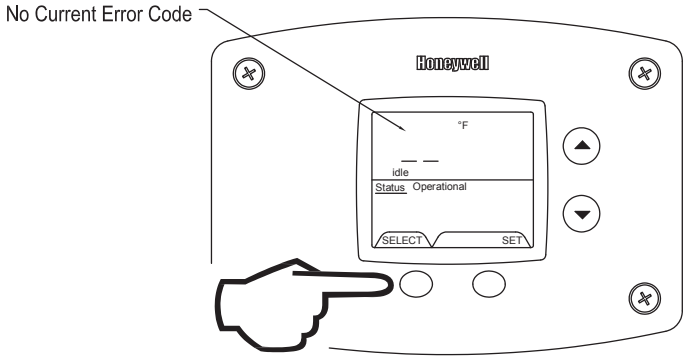
Example of Error Code in the Display

Error Code History:

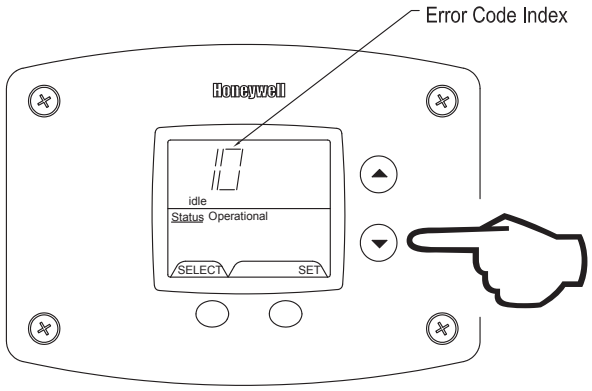
In “Service Mode” pressing the “Select” button after the “Software Version” (item 8 in the previously described sequence of service modes) will show an error code history, if there have been any previous operating problems with the water heater. If the display shows --, there is not a current error code.
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.

To view previous error codes:

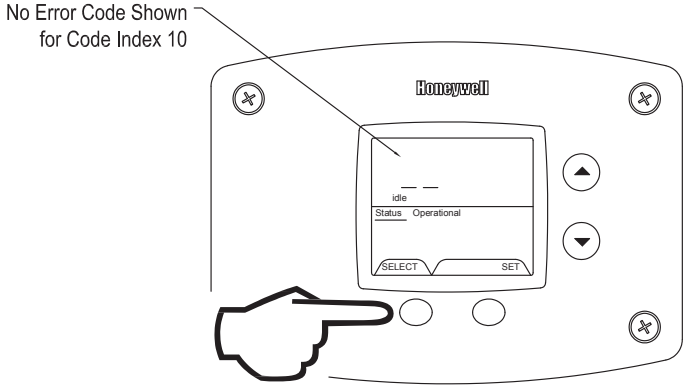
Step 1: In “Service Mode press the “Select” button until the next display after the “Software Version”. If there are no current error codes, the display will show -- .



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



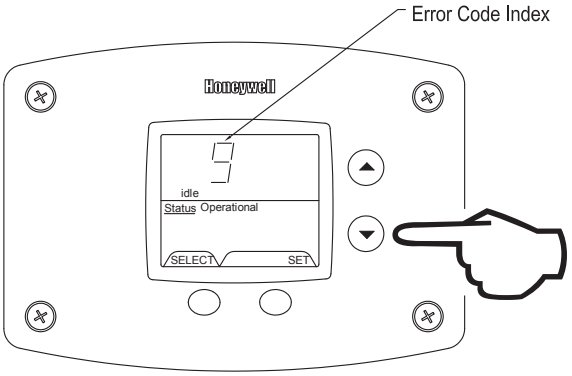
Step 3: Press the “Select” button to view the error code for “code 10”. If there is a number displayed, note what the number is. The label next to the water heater display will identify the code number. If no number is displayed with only a “--“ in the water heater display, then there has not been an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



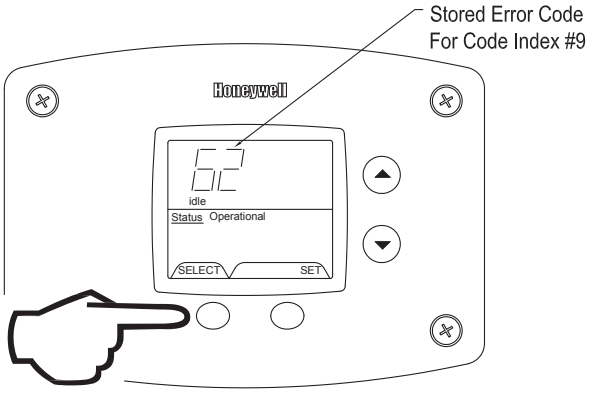
Troubleshooting

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.

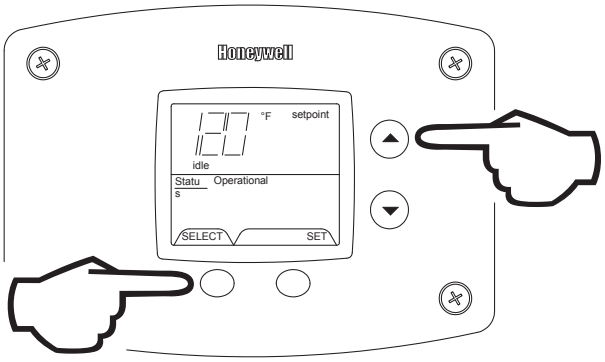


Step 5: Press the “Select” button for code index #9 to view if there are any code numbers.



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.

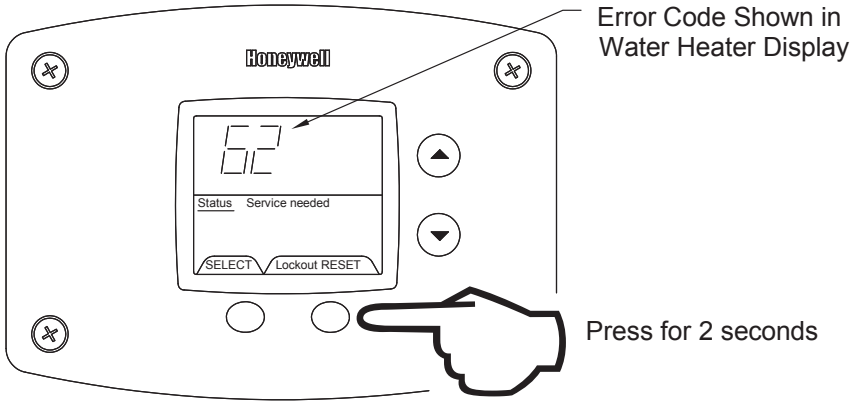
Troubleshooting

Resetting Error Codes
For models with Honeywell Integrated Control

⚠ WARNING

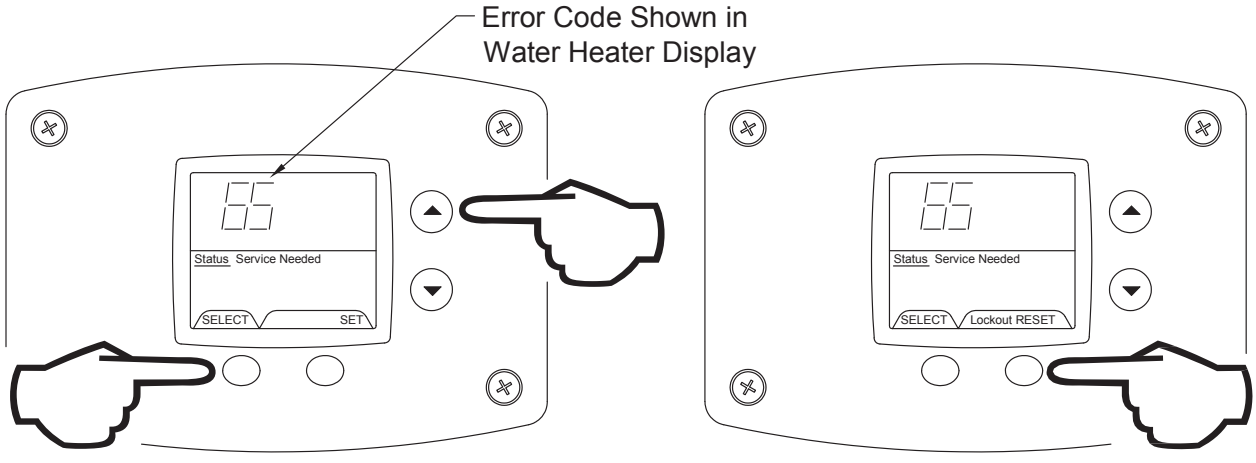
The following procedure is for service and installation personnel only. Resetting lockout conditions without correcting the malfunction can result in a hazardous condition.

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



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

Step 2: Press for 3 seconds to reset control in service mode.

SERVICE PROCEDURE EF-I
Thermostat Circuit Testing and Replacement

Serial Numbers including and AFTER GB13006174 and ALL EFR models (Excluding EF100T399 model series).

⚠ 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

IMPORTANT NOTE: This procedure assumes a cool tank

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

↓

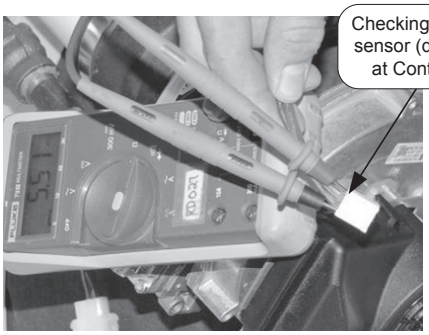
Turn power "OFF".
Draw water to cool tank below 120 °F

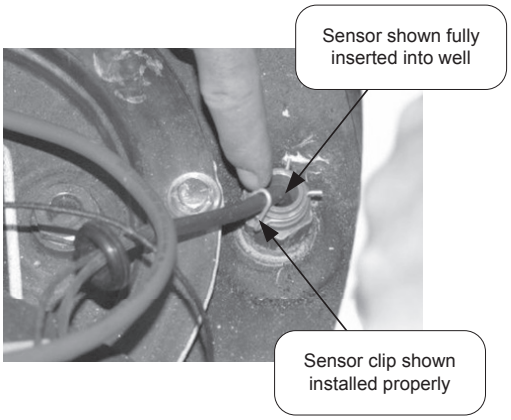
↓

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)





SERVICE PROCEDURE EF-I
Thermostat Circuit Testing and Replacement

Serial Numbers including and AFTER GB13006174 and ALL EFR models

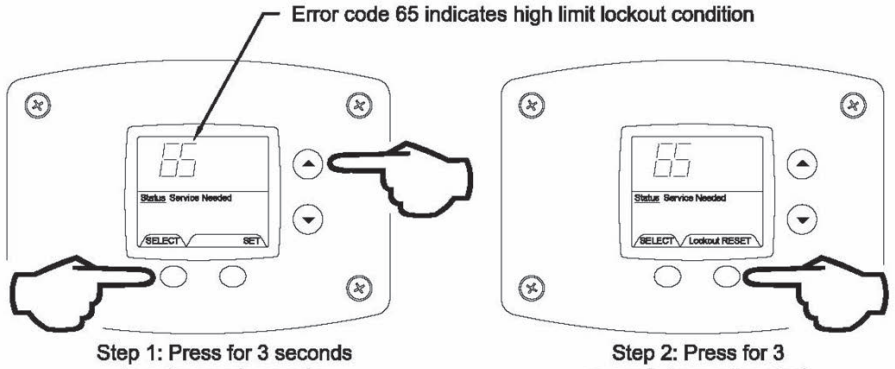
Condition: Water Heater Not Operating
Display shows error code "65"
High Water Temperature (over 200 °F)
(Continued from previous page)

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.



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

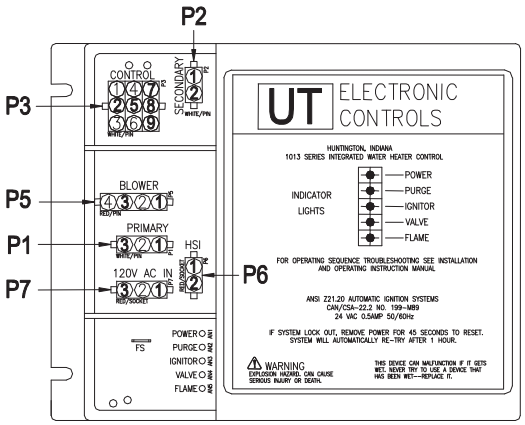
For models with Hot Surface Ignition

IMPORTANT NOTE: This procedure assumes a cool tank

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

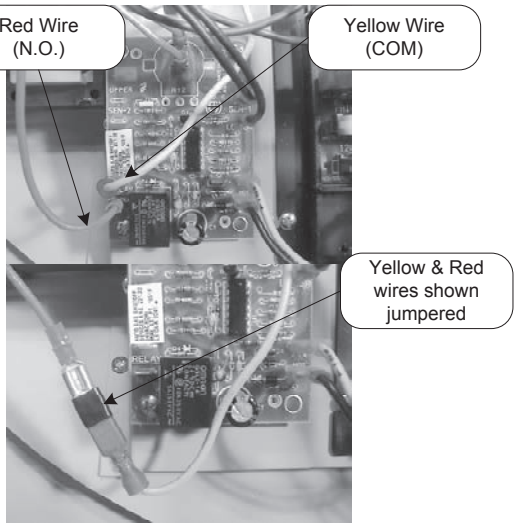
Rotate temperature dial to highest setting.

Refer to ignition module illustration, Is there 24VAC between **P3(7)** and **P3(8)**?
- Y → OK, thermostat is calling for heat.
- N → Thermostat not calling

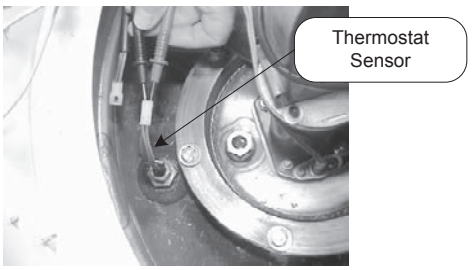


IGNITION MODULE

Turn off power to heater.
Disconnect YELLOW and RED wires from the thermostat board at location N.O. and COM shown in photo at right. Use a jumper to connect these two wires together as shown in photo at right.
Restore power to heater.
Did heater cycle on?
- N → See page 39
- Y ↓

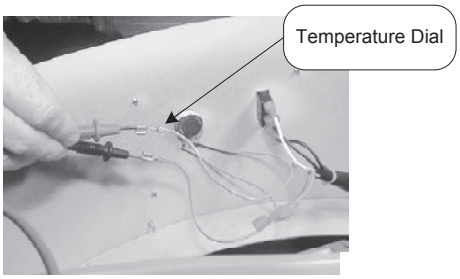


Check thermostat sensor for proper resistance (OHMS) across blue wires. (See Appendix A, sensor resistance)
Are readings correct? (see photo at right)
- N → Replace thermostat sensor. (see Thermostat Sensor Replacement Procedure)
- Y ↓



Check sensor harness continuity.
Is there continuity?
- N → Replace harness.
- Y ↓

Check temperature dial for proper resistance (OHMS) (See Appendix B, temperature dial resistance)
Are readings correct? (see photo at right)
- N → Replace temperature dial (potentiometer). (see Thermostat Potentiometer Replacement Procedure)
- Y ↓



Check temperature dial harness continuity.
Is there continuity?
- N → Replace harness.
- Y ↓

Replace thermostat circuit board. (see Thermostat Board Replacement Procedure)

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 5400-6600 Ohms at Minimum Setting
And 0-50 Ohms at Maximum.

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

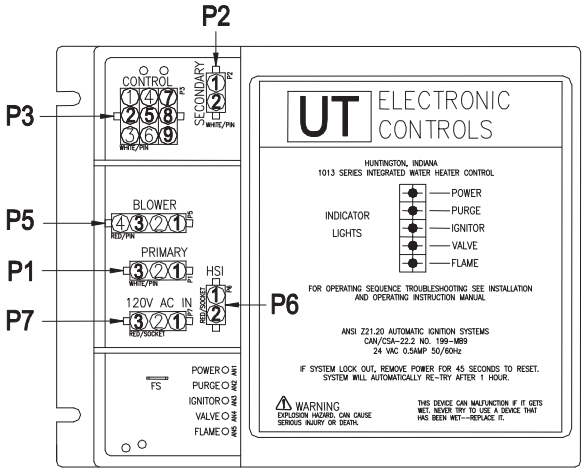
SERVICE PROCEDURE EF-I
Thermostat Circuit Testing and Replacement

For models with Hot Surface Ignition

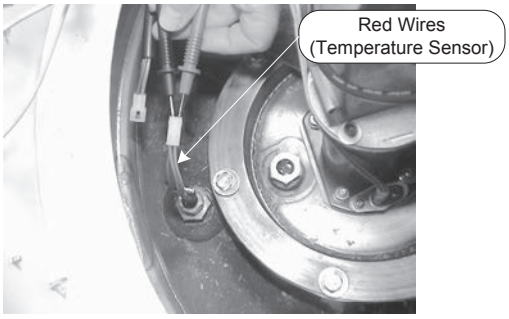
Thermostat circuit.
(continued from page 37)

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

Refer to ignition module illustration, Is there 120VAC between **P1(1)** and **P1(3)**?
- N → Refer to ignition module illustration, Is there 120VAC between **P7(3)** and **P7(1)**?
  - N → Check AC source to determine why there is no power.
  - Y → Replace ignition module. (see "Ignition Module Replacement")
- Y → Refer to ignition module illustration, Is there 22 - 27VAC between **P2(1)** and **P2(2)**?
  - N → Replace transformer. (see Transformer Replacement)
  - Y → Refer to ignition module illustration, Is there 24VAC between **P3(9)** and **P2(1)**.
    - Y → Check continuity through ECO, **red wires** of thermostat sensor. Check at temperature less than 160°F Is there continuity? (see photo at right)
      - N → Check wire harness continuity. Replace thermostat sensor or wire harness as necessary. (see "Thermostat Sensor Replacement Procedure")
      - Y → Replace thermostat circuit board. (see "Thermostat Board Replacement Procedure")
    - N → Replace ignition module. (see "Ignition Module Replacement")



IGNITION MODULE



Thermostat Board Replacement Procedure (Hot Surface Ignition)

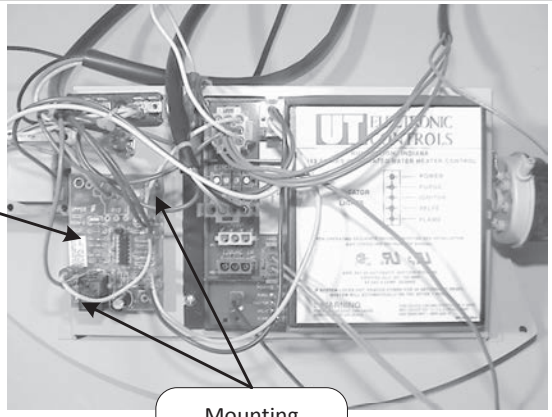
⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

Step 1. Position main power switch to "OFF"

Step 2. Disconnect (unplug) water heater from 120 volt power source.

Step 3. Un-latch 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.

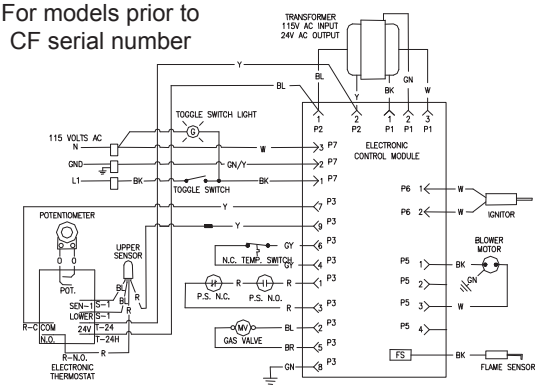
Step 8. Carefully reconnect wiring per the wire diagram below. Reconfirm wire connections are correct prior to putting heater back in service

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.

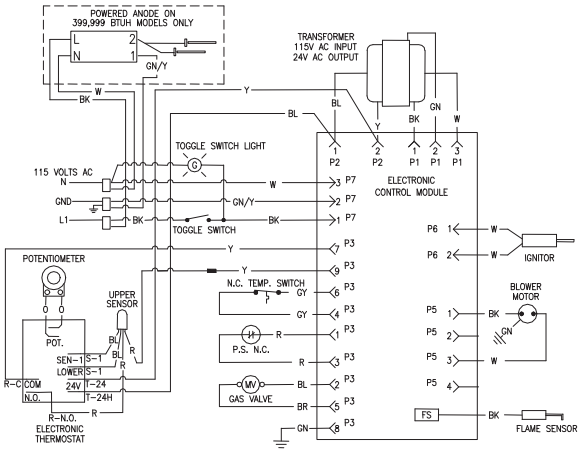
WIRING DIAGRAM

For models prior to CF serial number



WIRING DIAGRAM

For models starting with CF serial numbers and later.



Thermostat Potentiometer Replacement Procedure

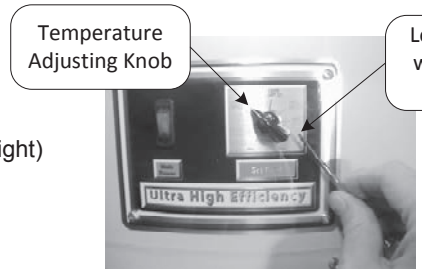
⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

Step 1. Position main power switch to "OFF"

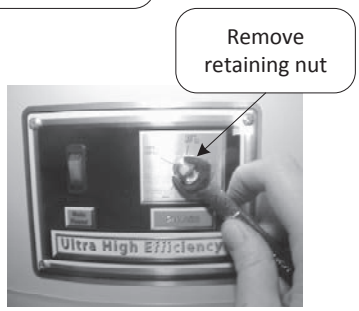
Step 2. Disconnect (unplug) water heater from 120 volt power source.

Step 3. Un-latch and remove top surround cover from top of heater.

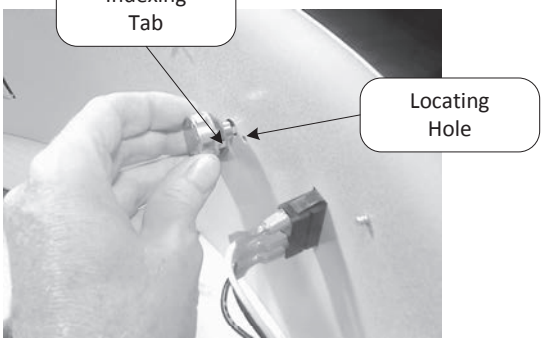
Step 4. Loosen set screw of adjusting knob (small blade screw driver) and remove adjusting knob from potentiometer. (see photos at right)

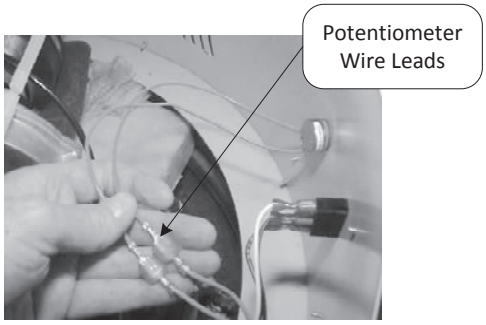


Step 5. Remove retaining nut (½" wrench) and washer from potentiometer. (see photos at right)



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)





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

⚠ 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"

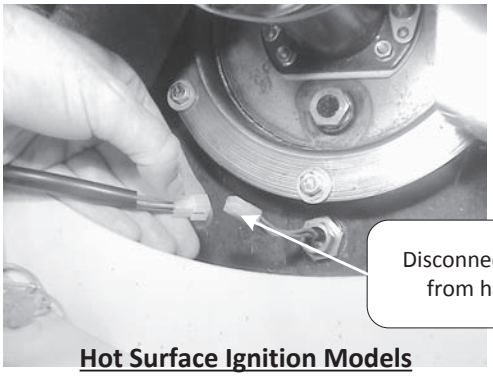
Step 2. Disconnect (unplug) water heater from 120 volt power source.

Step 3. **Hot Surface Ignition Models:** Drain water heater down to a point below the top of the tank.

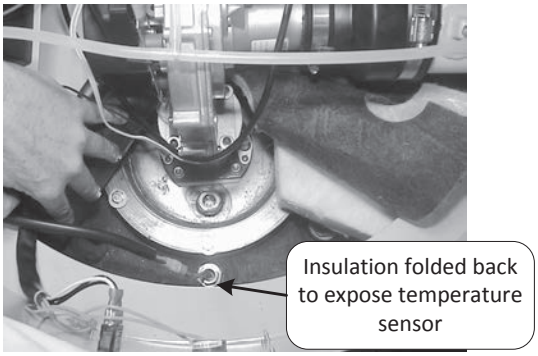
Step 4. Un-latch and remove top surround cover from top of heater.

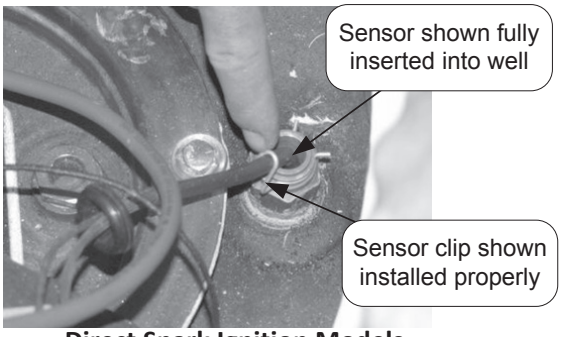
Step 5. Fold back insulation just in front of burner to expose temperature sensor (see photo below).

Step 6. Disconnect temperature sensor from harness (see photos at right).



Hot Surface Ignition Models





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 thread sealing 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.

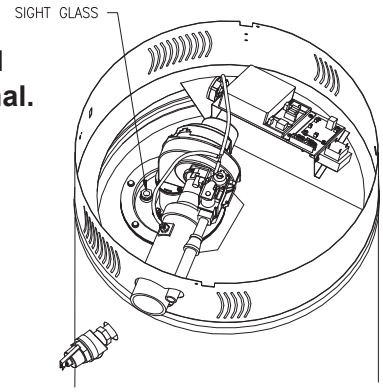
Step 10. Restore 120 volt power supply and water supply to water heater, check and repair any leaks found. Confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

Step 11. Replace surround cover on top of heater.

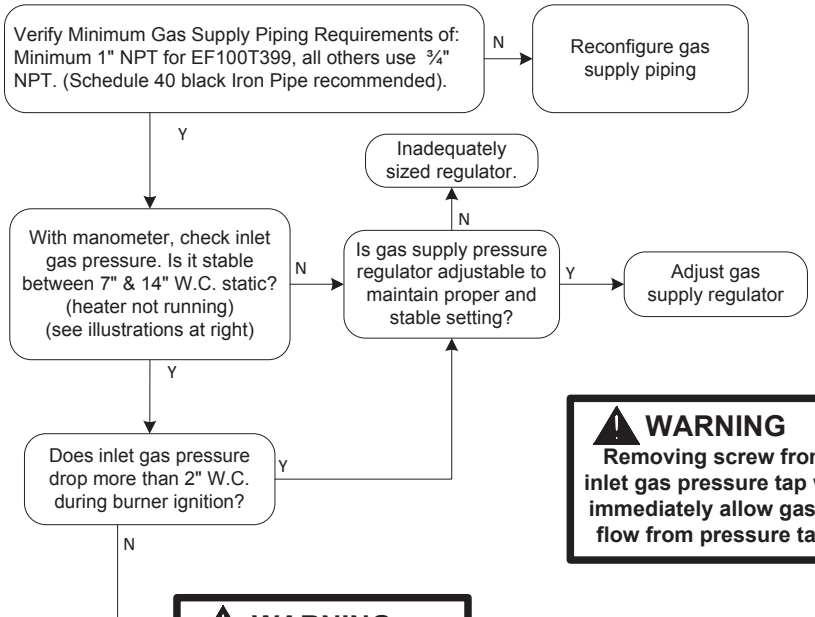
SERVICE PROCEDURE EF-II
Combustion System Testing and Replacement

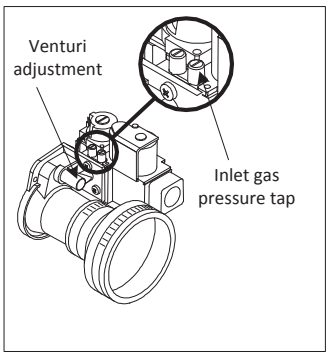
Observe burner operation through the sight glass located on the combustion insert mounting flange. Normal burner operation should ignite smoothly, without evidence of coughing or huffing upon ignition. The burner flame should be a blue flame near the burner surface in a uniform flame pattern. Occasional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

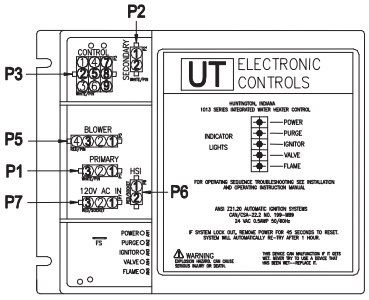
For models with Hot Surface Ignition System



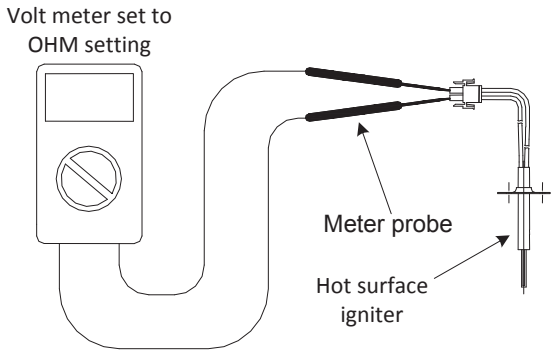
<u>Note:</u> On higher input models using metal fiber mesh burner (serial number "CK" and later) a red glow from the burner surface is normal.







<u>IGNITION MODULE</u>



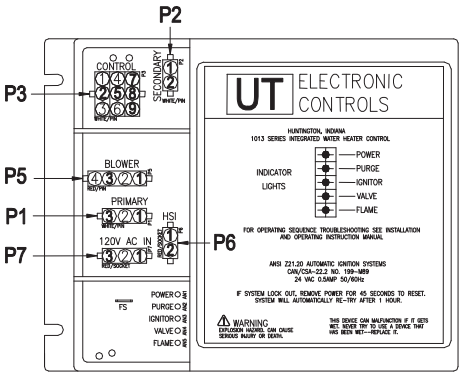
<u>CHECK IGNITER RESISTANCE</u>

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

Continued from previous page

Refer to ignition module illustration below, is there 24VAC between **P3(2)** and **P3(5)** (blue and brown wires) during the flame establishing period? (Note: Valve LED must be lit during this check)

N → Replace ignition module. (see "Ignition Module Replacement Procedure")

Y

Can you hear or feel gas valve energize?

N → Replace Rectifier harness and/or gas valve. (see "Gas Valve Replacement Procedure")

Y

Turn VENTURI set screw clockwise until its bottomed out. Turn screw counter-clockwise 6-½ turns from bottom (see illustration below). Note: EF100T399 models do not have a venturi screw. The gas regulator setting should be 1 - 1 ¼ turns out from bottom.

Y

Does burner light smoothly, without evidence of coughing or huffing?

N → Check for obstruction at inlet of gas valve. Is inlet free of obstruction?

N → Clear obstruction

N → Inspect burner tube, (see "Burner Tube Inspection and Replacement")

Y → Call for technical support

Y

Does flame LED on the module light and stay lit?

Y → Does burner operate normaly until thermostat is satisfied?

N → Y → System OK

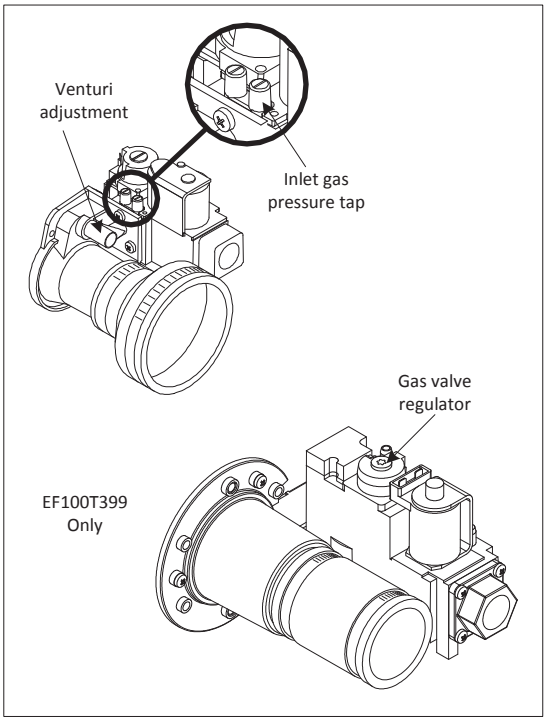
N

Check flame sensor, Is there 1 to 5 micro amps (min.) during 1.5 second flame proving period? (see "Flame Sensor Testing Procedure")

Y → System OK

N

Replace flame sensor (see "Flame Sensor Replacement Procedure")



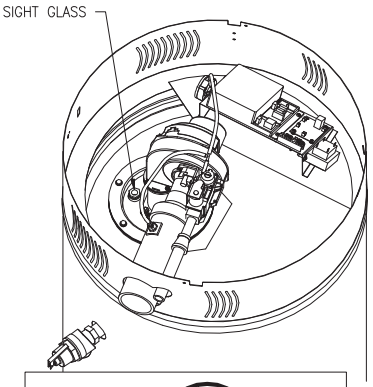
BRADFORD WHITE WATER HEATERS

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.

Serial Numbers including and AFTER GB13006174 and ALL EFR models

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



Verify Minimum Gas Supply Piping Requirements of: Minimum ¾" NPT. (Schedule 40 black Iron Pipe recommended).
N → Reconfigure gas supply piping
Y

With manometer, check inlet gas pressure. Is it stable between 7" & 14" W.C. static? (heater not running) (see illustrations at right)
N → Is gas supply pressure regulator adjustable to maintain proper and stable setting?
N → Inadequately sized regulator.
Y → Adjust gas supply regulator
Y

Does inlet gas pressure drop more than 2" W.C. during burner ignition?
Y
N

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

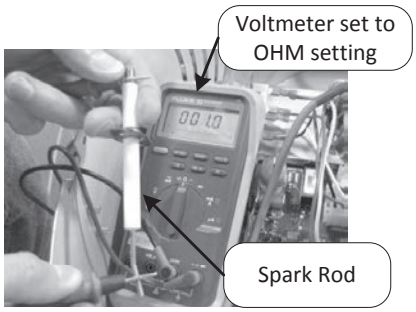
⚠ WARNING
120 volt potential exposure. Use caution making voltage checks to avoid personal injury.

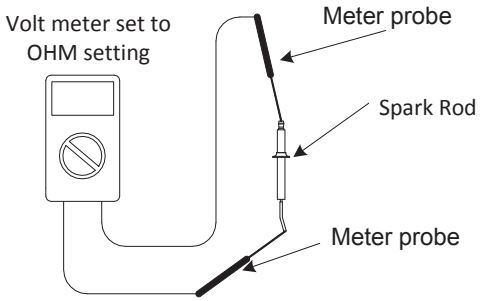
Can Sparking be seen/ heard at the spark rod to the burner?
N → Remove high voltage wire connected at the spark rod and hold approximately ¼" from metal ground with insulated pliers during the ignition cycle (3 second spark trial period). Is there spark to ground?
N → Check resistance of high voltage cable. Resistance should be 0-1 ohms. If resistance is high, replace spark cable. If spark cable is good, replace Control Board.
Y
Y

Check continuity of spark rod. Is reading 0-1 Ohm?
Y
N → Replace Spark Rod (see "Spark Rod Gap Inspection and Replacement"

Does main burner Light?
N → Check spark gap to burner (see "Spark Rod Gap Inspection")
Y

Proceed to next page





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.

Serial Numbers including and AFTER GB13006174 and ALL EFR models

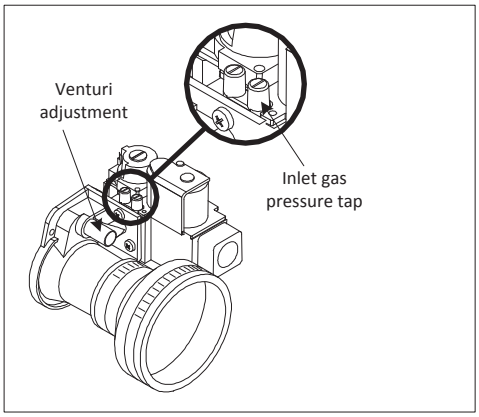
⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

Continued from previous page

Refer to control board illustration, is there 24VAC between **P5(5)** and **P5(8)** (blue and brown wires) during the flame establishing period? (Note: Control Display must show "Heating" for operating status)
- N → Replace Control Board
- Y ↓

Can you hear or feel gas valve energize?
- N → Replace Rectifier harness and/or gas valve. (see "Gas Valve Replacement Procedure")
- Y ↓

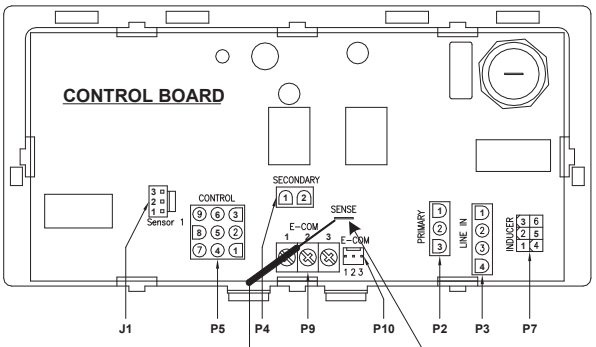
Turn VENTURI set screw clockwise until its bottomed out. Turn screw counter-clockwise 6-½ turns from bottom. (Note: Venturi adjustment screw is not on the EF100T399 models)



Does burner light smoothly, without evidence of coughing or huffing?
- N → Check for obstruction at inlet of gas valve. Is inlet free of obstruction?
  - N → Clear obstruction
    - N → Inspect burner tube, (see "Burner Tube Inspection")
  - Y ↓ Call for technical support
- Y ↓

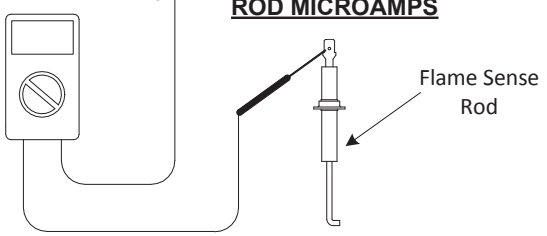
Does burner stay lit?
- Y → Does burner operate normaly until thermostat is satisfied?
  - N → Call for technical support
  - Y ↓
- N ↓

Check flame sensor, Is there 1 to 5 micro amps (min.) during 1.5 second flame proving period? (Value may be displayed on the control display by accessing "Service Mode")
- Y → System OK
- N ↓ Replace flame sensor (see "Flame Sensor Replacement Procedure")



Multimeter set to microamp (μA) setting

CHECK FLAME SENSE ROD MICROAMPS



BRADFORD WHITE WATER HEATERS

⚠ 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.

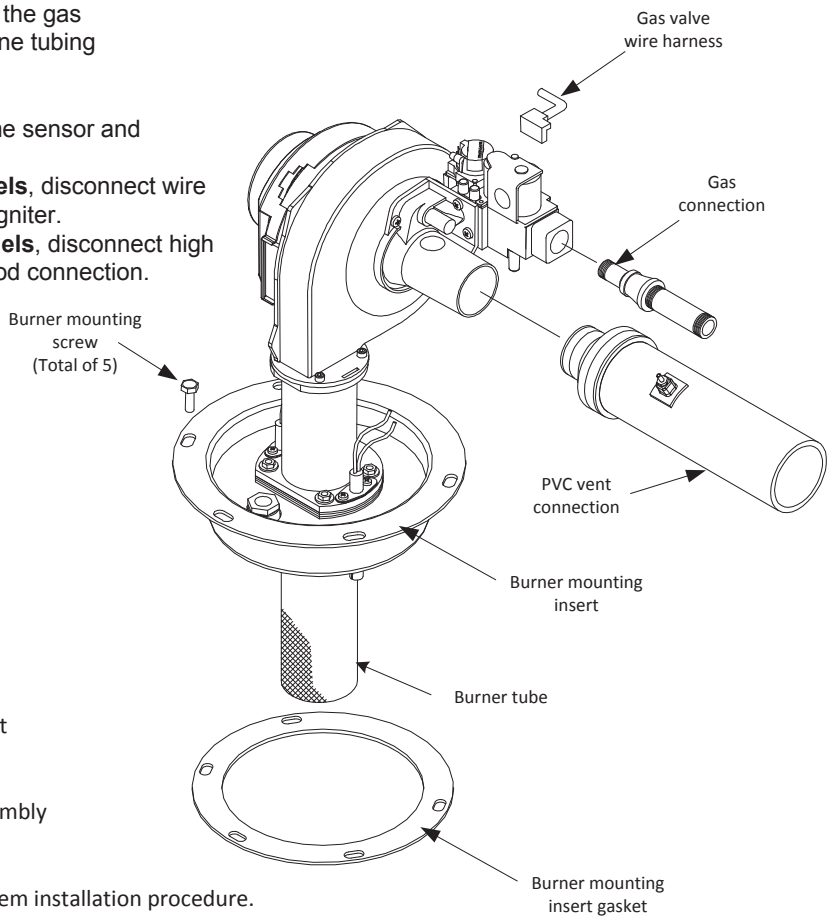
⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

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.



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.

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.

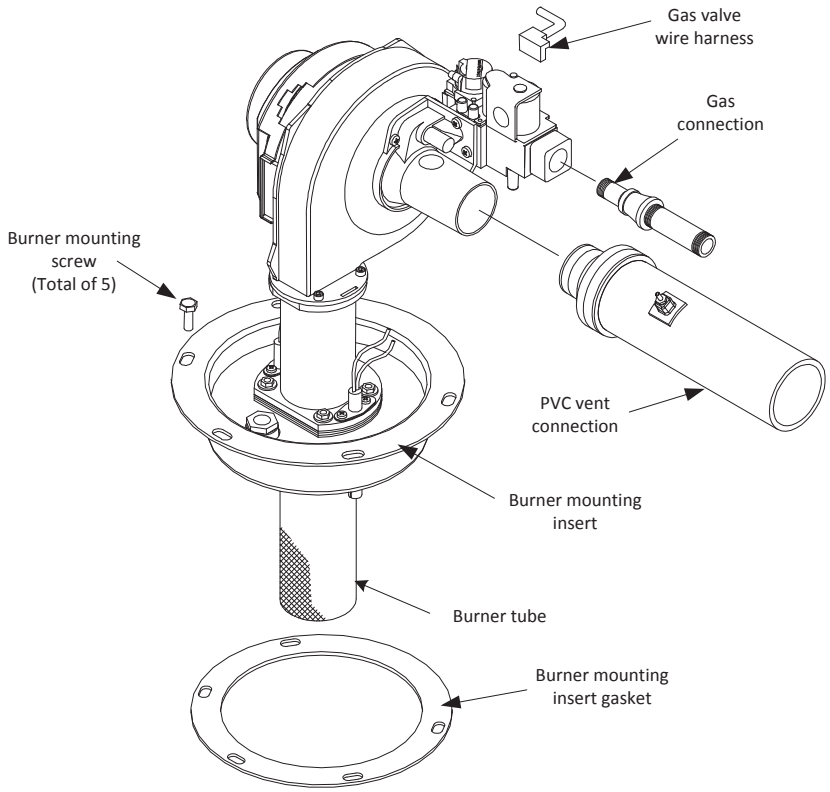
Step 2. Install combustion assembly using new gasket or fully inspected gasket from step 1. Secure combustion assembly at the burner mounting insert using screws from step 6 on previous page. Tighten screws evenly.

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

⚠ 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.

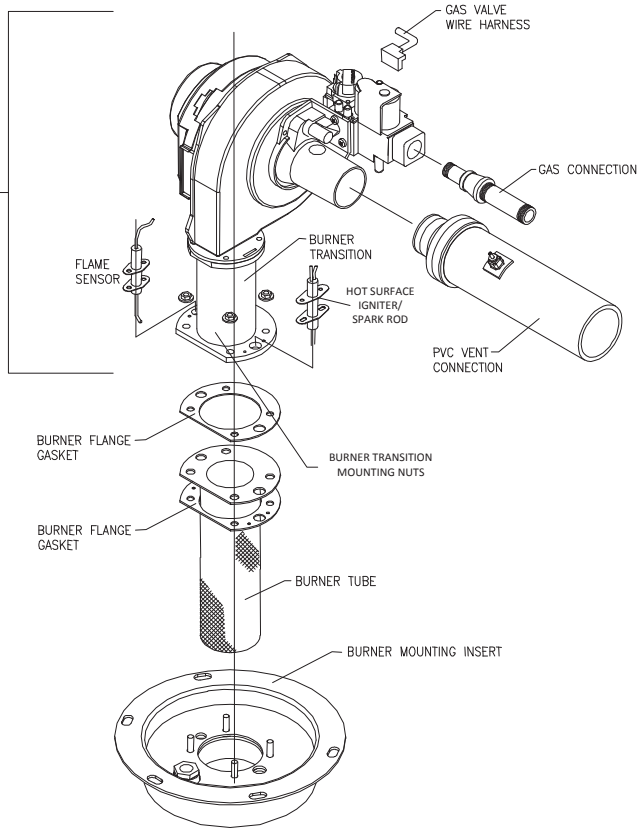
Step 5. From the gas valve, disconnect the gas connection, PVC venting, wire harness and silicone tubing.

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.



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

⚠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.

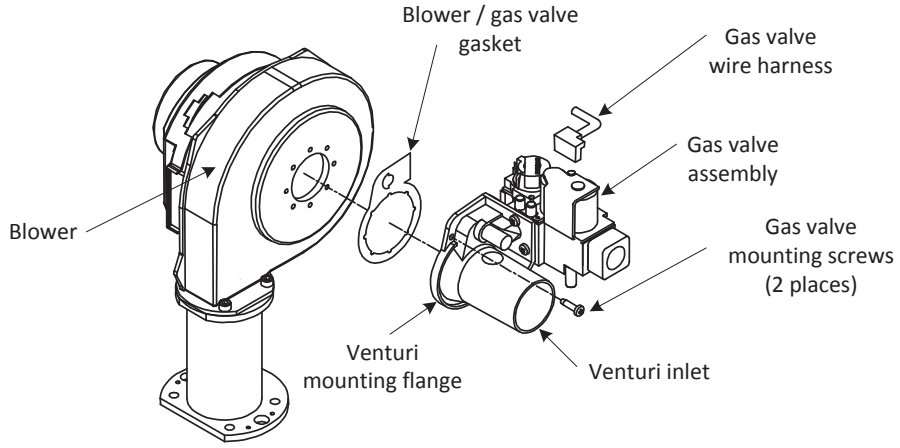
Step 3. Turn off gas supply to water heater.

Step 4. Un-latch & remove surround cover from top of heater.

Step 5. 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.



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

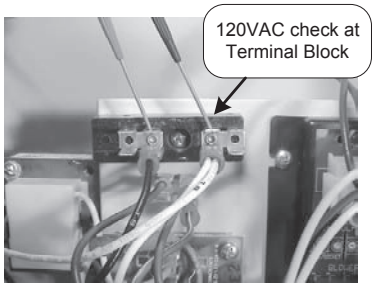
Does blower energize? (For Direct Spark Ignition models, ensure control display shows “Heating”, raise temperature setpoint if necessary)

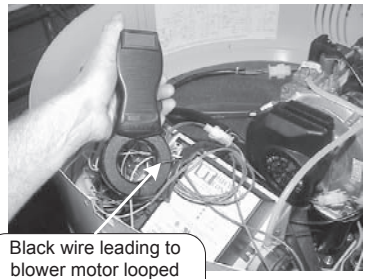
Y → Is there 120VAC across the white and black wires at the terminal block ? (see photo at right)

Y → Refer to ignition module/control board illustration.
Hot Surface Ignition Models:
Is there 120VAC between **P5(1)** and **P5(3)**?
Direct Spark Ignition Models:
Is there 120VAC between **P7(5)** and **P7(3)**?

N → Replace ignition module/ control board.

N → Determine power source problem and correct





N → Is there 120VAC across the white and black wires at the terminal block ?

N → Check amp draw through BLACK wire lead of blower motor. Is there .6 to 3.0 amps?

Y → Is Blower wheel secured to blower motor shaft?

Y → Call technical support.

N → Replace blower. (see “Blower Replacement Procedure”)

Y → Refer to ignition module/ control board illustration.
Hot Surface Ignition Models:
Is there 120VAC between **P5(1)** and **P5(3)**?
Direct Spark Ignition Models:
Is there 120VAC between **P7(5)** and **P7(3)**?

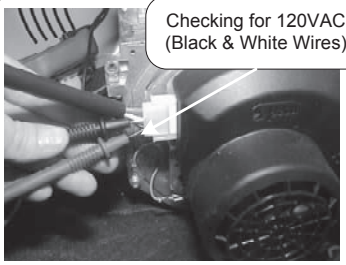
N → **Hot Surface Ignition Models ONLY:** Refer to ignition module, is there 24 VAC between **P3(7)** and ground?

N → Thermostat not calling for heat. (see “Thermostat Circuit Testing”)

Y → Hot Surface Ignition Models:
Are safety circuits in normal position?
Direct Spark Ignition Models:
Is collector high limit switch and pressure switch in normally closed position?

N → Correct safety circuit problem per safety circuit trace (section “Blocked Vent Pressure Switch Testing”).

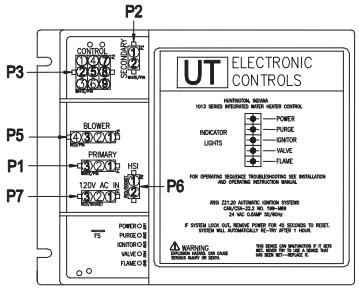
Y → Replace ignition module/ control board.



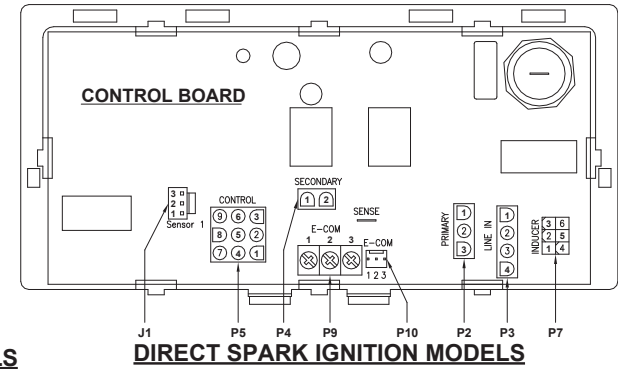
Y → Is there 120VAC across the white and black wires at the blower? (see photo at right)

N → Repair/replace wire harness.

Y → Replace blower. (see “Blower Replacement Procedure”)



IGNITION MODULE
HOT SURFACE IGNITION MODELS



DIRECT SPARK IGNITION MODELS

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.

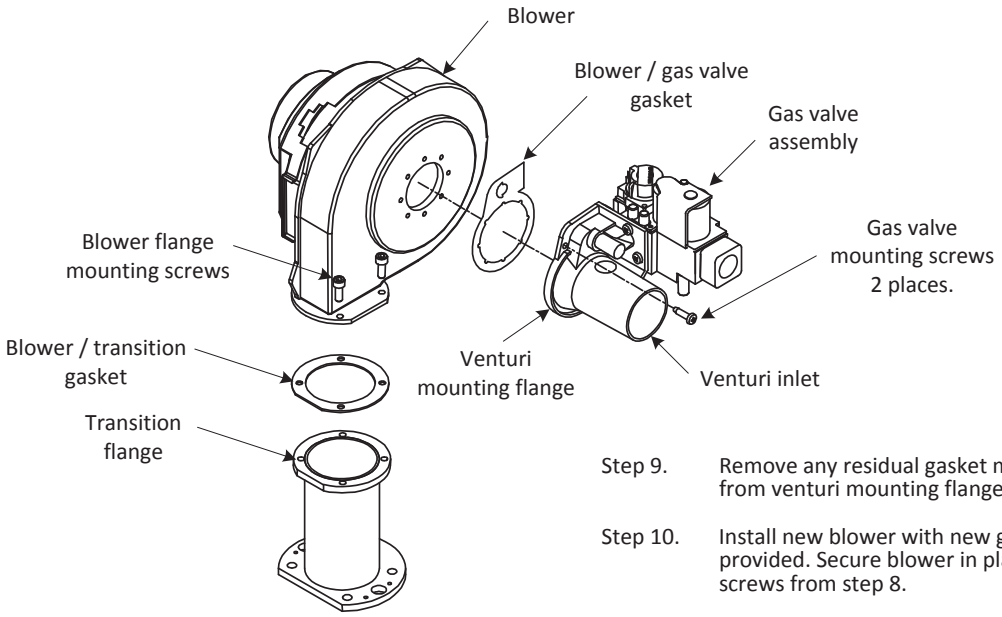
Step 4. Un-latch & remove surround cover from top of heater.

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.

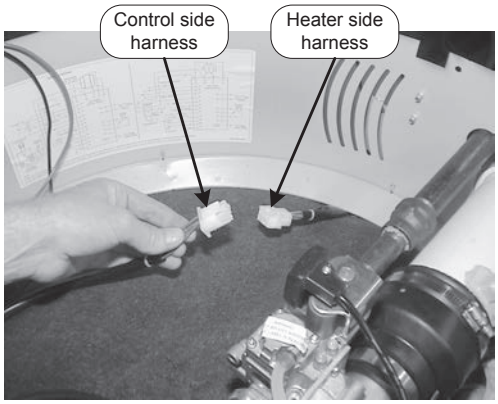
WARNING
120 volt potential exposure. Use caution making voltage checks to avoid personal injury.

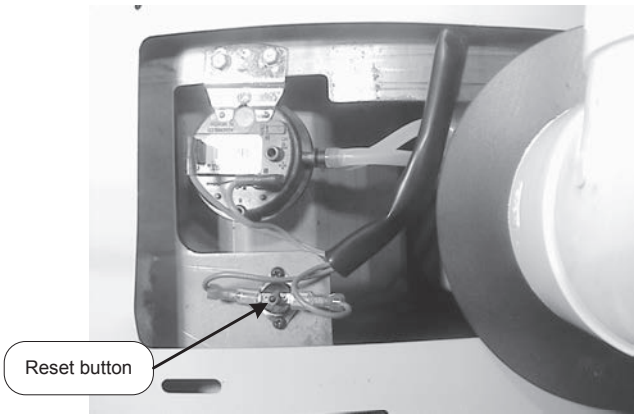
LED Status
Only power LED is on, or Purge LED flashing.

Does blower energize?
- N → Is there continuity Through GREY wire leads of heater side safety circuit harness? (see photo below)
  - Y → Is there continuity through RED wire leads of heater side safety circuit harness? (see photo below)
    - N → Safety Circuit OK, (see "Blower Testing & Replacement")
    - Y → Check PURGE LED status on ignition module, Flashing after 45 seconds?
      - Y → Replace exhaust pressure switch (see "Exhaust Pressure Switch Replacement Procedure")
  - N → Depress reset button on vent safety switch. Is there continuity across high limit switch? (see photo below)
    - Y → Does heater function?
      - N → Call technical support.
      - Y → Verify proper switch operation. (see "Vent Safety Switch Testing and Replacement")
    - N → Replace vent safety switch. (see "Vent Safety Switch Replacement Procedure")
- Y → Check PURGE LED status.

Safety Circuit Trace

Check PURGE LED status.
- On within 5 minutes?
  - Y → Pressure switch is OK.
  - N → Flashing after 5 minutes?
    - N → Call for technical support.
    - Y → Check blower for proper operation (see page 27) Is blower OK?
      - N → Correct blower problem (see "Blower Testing and Replacement")
      - Y → Refer to "Check Collector Pressure" (see next page)





Check Collector Pressure

Check exhaust collector pressure at the exhaust collector pressure tap location (see illustration below). Is there positive pressure equal to or greater than pressure switch settings below?

EXHAUST PRESSURE SWITCH SETTINGS

EF(60,100)T199	+2.58"	W.C.
EF100T150	+1.50"	W.C.(see note 1)
EF60T150,EF100T250	+1.22"	W.C.
EF60T125	+2.08"	W.C.
EF100T300	+0.55"	W.C.(see note 2)

Note 1: +5.6" W.C. on serials prior to AH5039107
Note 2: +0.8" W.C. on serials prior to AK5288269

Y → With monometer, take a reading at the ***exhaust tube pressure tap*** location. Is value negative (-)? (see illustration below).

N → Is exhaust venting system blocked or obstructed?

Y → Clear obstruction. Determine cause and correct.

N → Is vent system total length compliant with vent tables in the instruction manual?

N → Reconfigure vent system to be compliant with vent tables (see “Specifications”).

Y → Replace exhaust pressure switch. (see “Exhaust Pressure Switch Replacement Procedure”)

Y → Replace exhaust pressure switch. (see “Exhaust Pressure Switch Replacement Procedure”)

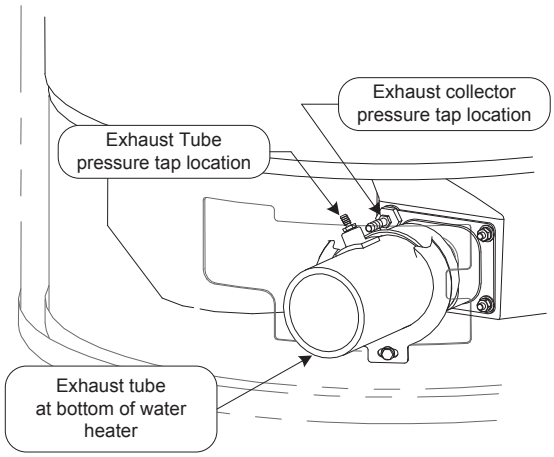
N → Inspect the area housing the combustion system and control panel located at the top of the heater. Does the area show signs of corrosion and/or exssesive heat?

Y → Call for technical support

N → Remove combustion assembly (see “Combustion System Removal Procedure”) Inspect combustion chamber for blockage or debris accumulation

Y → Clear obstruction. Determine cause and correct.

N → Call for technical support



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.

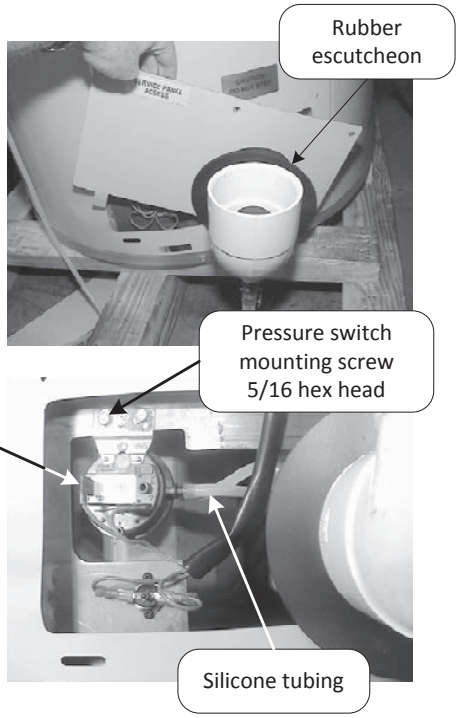
Step 3. Remove screws from service panel access cover (¼" nut driver) and remove cover from heater. (see photos at right)

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.

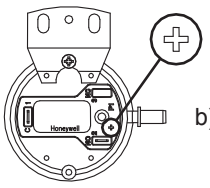
Step 7. Reconnect wire leads. Note: wire leads are interchangeable with either terminal.



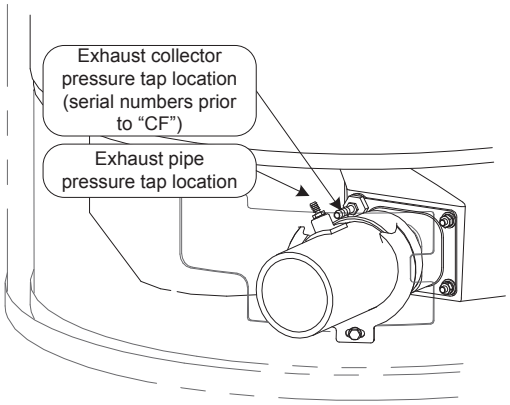
Step 8. Reconnect silicone tubing to pressure switch as follows:

a) Exhaust pipe tubing connects to negative (-) side of switch identified by the (-) symbol located on switch.

b) Exhaust collector tubing connects to positive (+) side of switch identified by the (+) symbol located on the switch.



Example of switch showing positive side identifier



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.

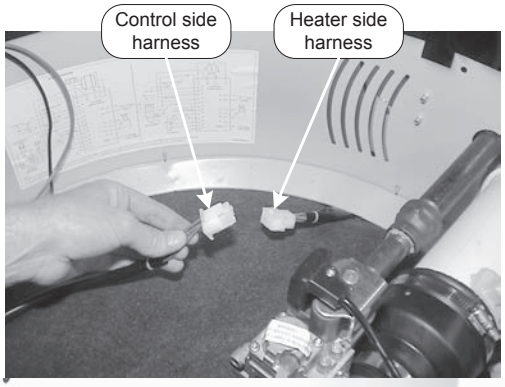
WARNING
120 volt potential exposure. Use caution making voltage checks to avoid personal injury.

LED Status
Only power LED is on, or Purge LED flashing.
Error Code 29 or 26
(Direct Spark Ignition Models)

Does blower energize?
- N → Is there continuity Through GREY wire leads of heater side safety circuit harness? (see photo below)
  - Y → Is there continuity through RED wire leads of heater side safety circuit harness? (see photo below)
    - N → Safety Circuit OK, (see "Blower Testing & Replacement")
    - Y → Check PURGE LED status on ignition module, Flashing after 45 seconds?
      - Y → Replace exhaust pressure switch (see "Exhaust Pressure Switch Replacement Procedure")
  - N → Depress reset button on vent safety switch. Is there continuity across high limit switch? (see photo below)
    - N → Replace vent safety switch. (see "Vent Safety Switch Replacement Procedure")
    - Y → Does heater function?
      - N → Call technical support.
      - Y → Verify proper switch operation. (see "Vent Safety Switch Testing and Replacement")
- Y → Hot Surface Ignition Models: Check PURGE LED status. Direct Spark Ignition Models: Check control display

Safety Circuit Trace

On within 5 minutes?
- Y → Pressure switch is OK.
- N → Flashing after 5 minutes? Error code 29 again?
  - N → Call for technical support.
  - Y → Check blower for proper operation (see "Blower Testing and Replacement") Is blower OK?
    - N → Correct blower problem (see "Blower Testing and Replacement")
    - Y → Refer to "Check Collector Pressure" (see next page)





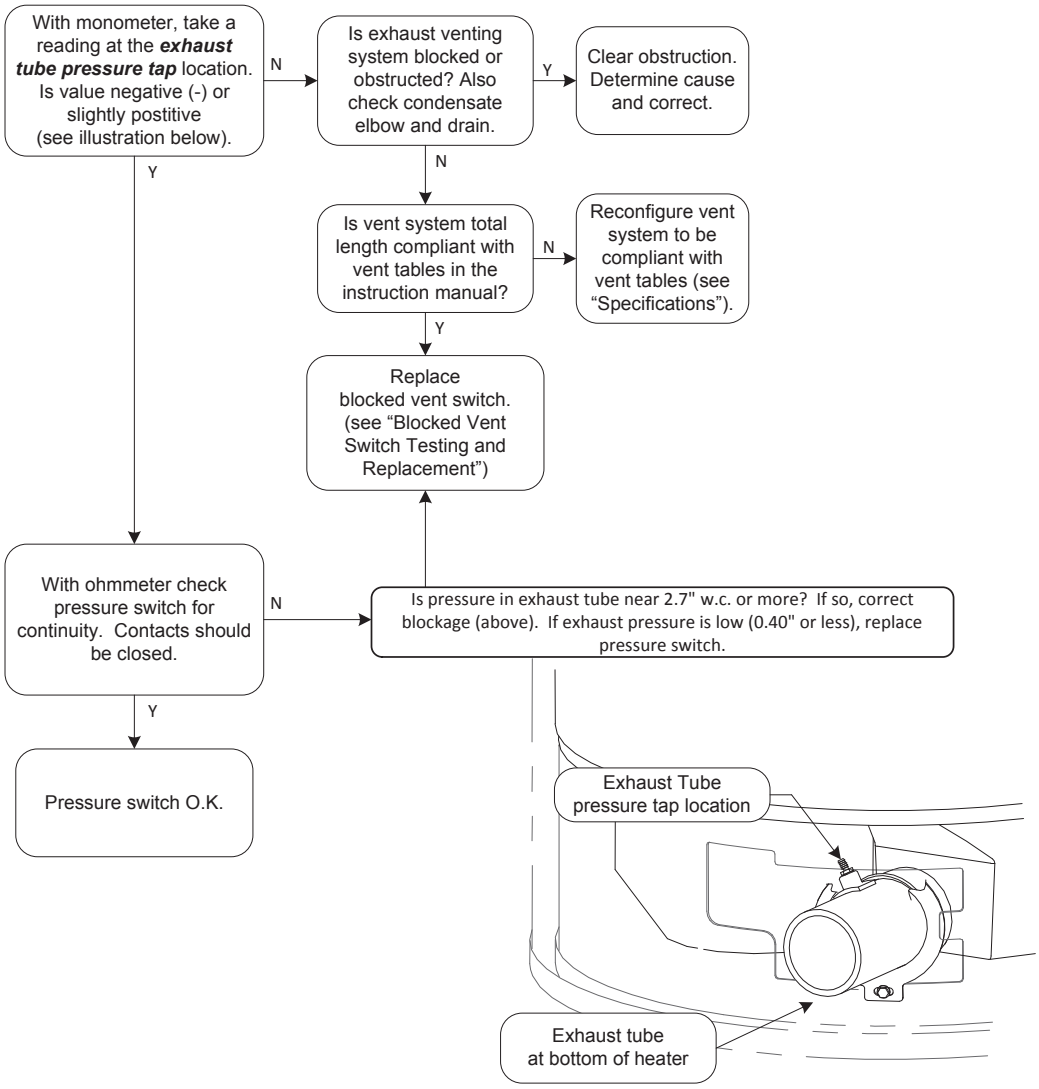
Note: HOT SURFACE IGNITION MODELS ONLY - The blocked vent pressure switch must be used with the revised ignition control, identified with a yellow label.

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-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 (¼" 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.

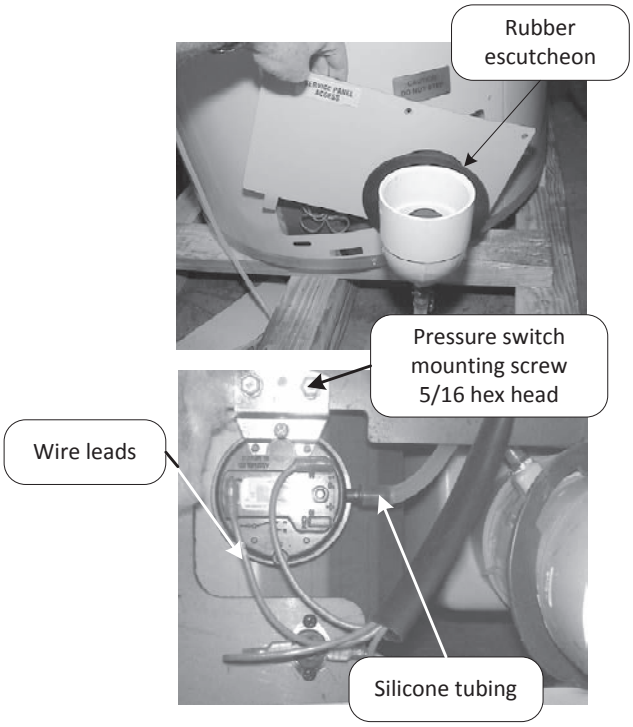
Step 7. Reconnect wire leads. Note: wire leads are interchangeable with either terminal.

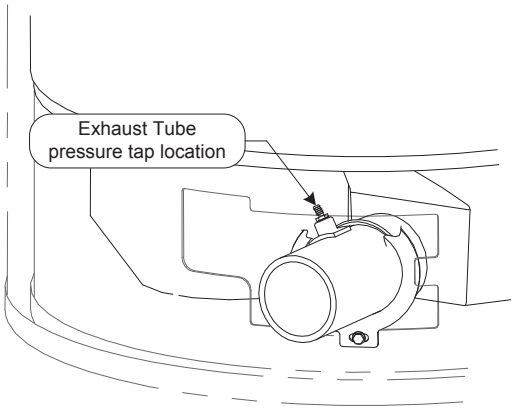
Step 8. Reconnect silicone tubing to pressure switch as follows:

a) Exhaust pipe tubing connects to single tap located on switch

Step 9. Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instructions located in the installation and operating instruction manual.

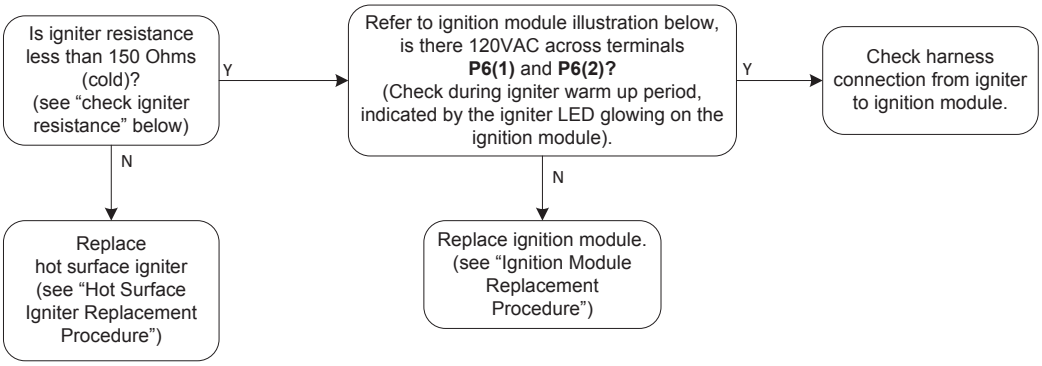
Step 10. Reinstall service panel access cover and rubber escutcheon.

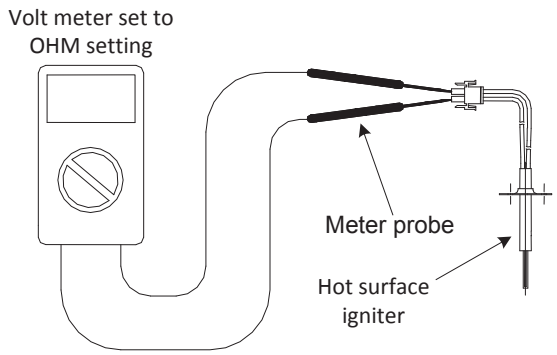




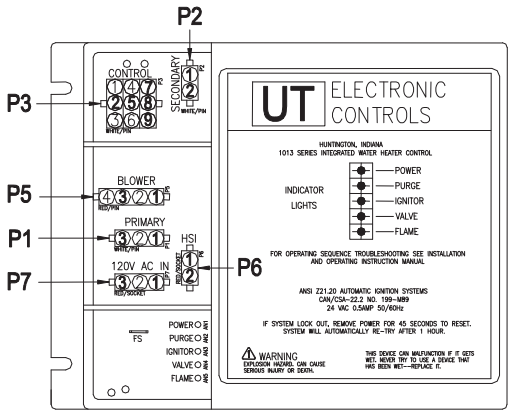
Hot surface Igniter Testing Procedure

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





CHECK IGNITER RESISTANCE



IGNITION MODULE

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.

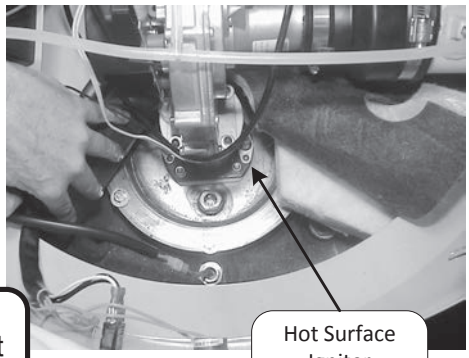
⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

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.

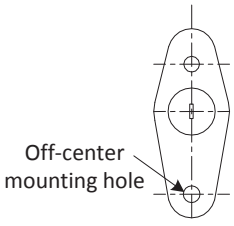
Step 7. Remove any residual gasket material from transition base flange.

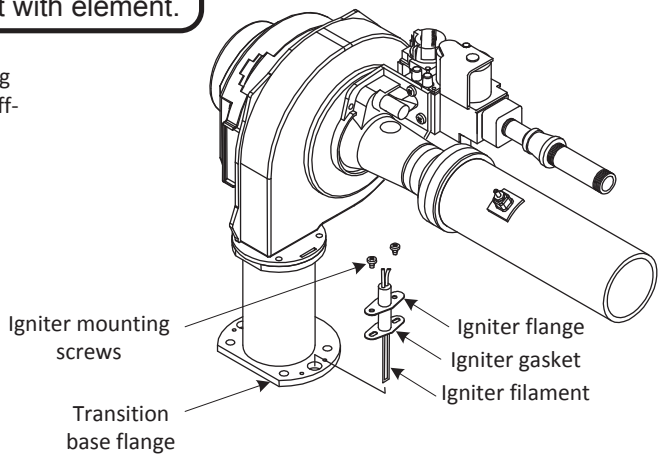


Note:
New replacement igniter will not have a shield over element. Handle carefully to prevent breakage.

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

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.





Step 9. Reconnect igniter wire harness.

Step 10. Fold insulation back into place. Be sure no wires are in contact with burner flange.

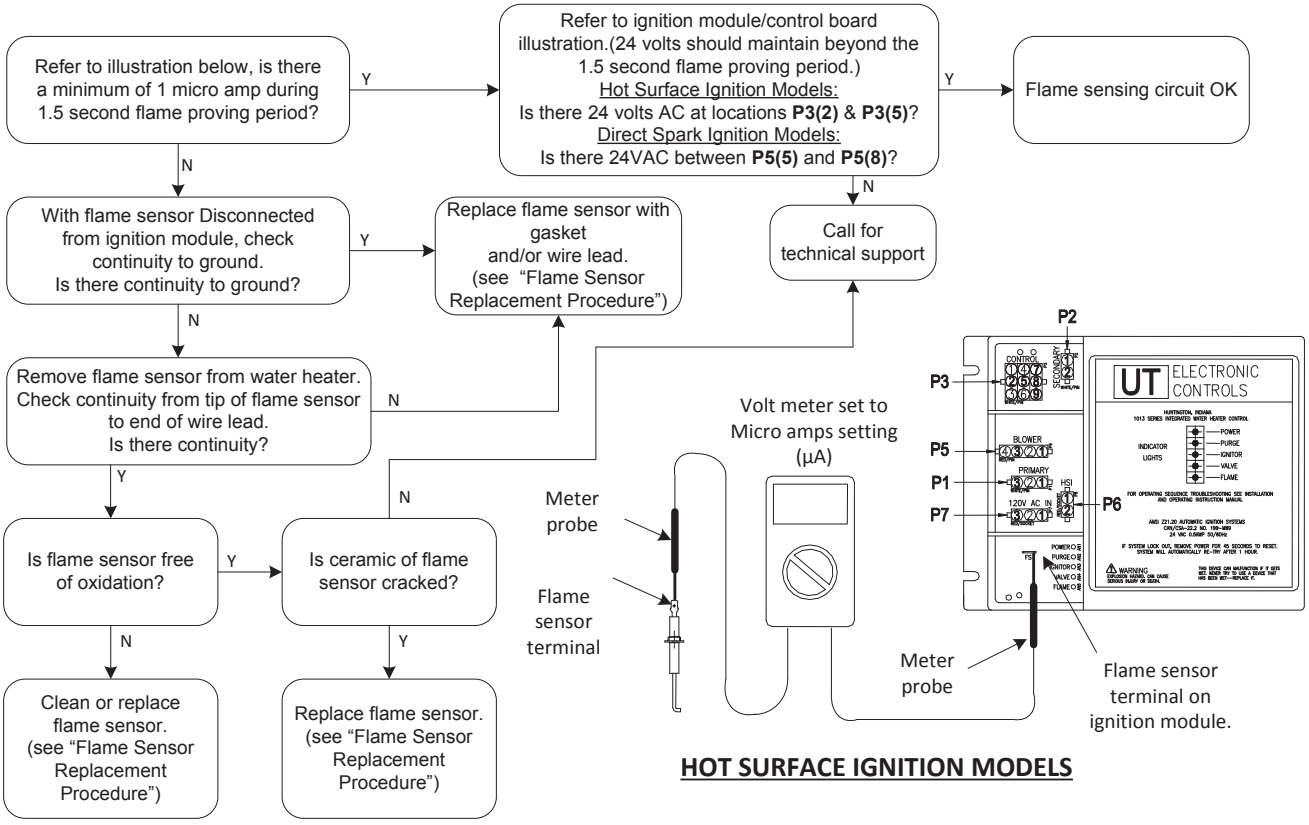
Step 11. Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instructions located in the installation and operating instruction manual.

Step 12. Replace surround cover on top of water heater.

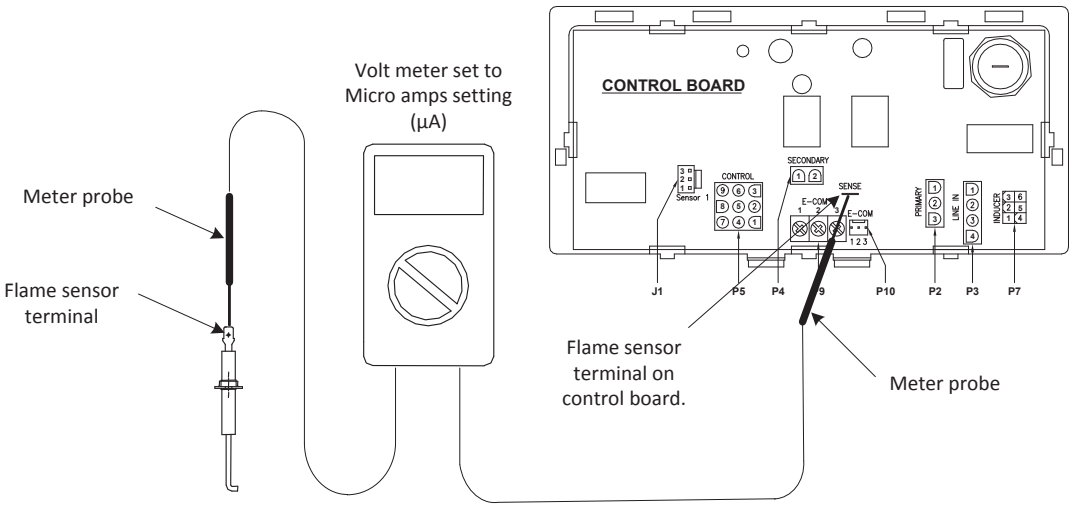
Service Procedure EF-VIII
Flame Sensor Testing and Replacement

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

Flame Sensor Replacement Procedure

Step 1. Position main power switch to “OFF”

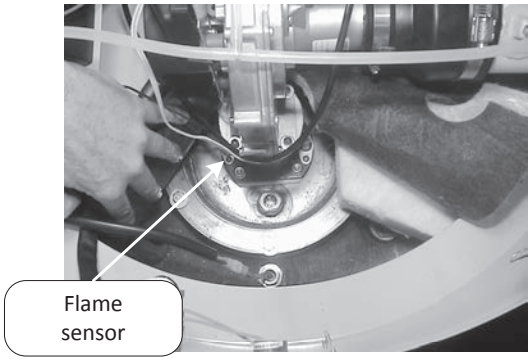
Step 2. Disconnect (unplug) water heater from 120 volt power source.

Step 3. Un-latch & remove surround cover from top of heater.

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

Step 4. Fold back insulation in front of combustion assembly to expose flame sensor. (see photo at right)

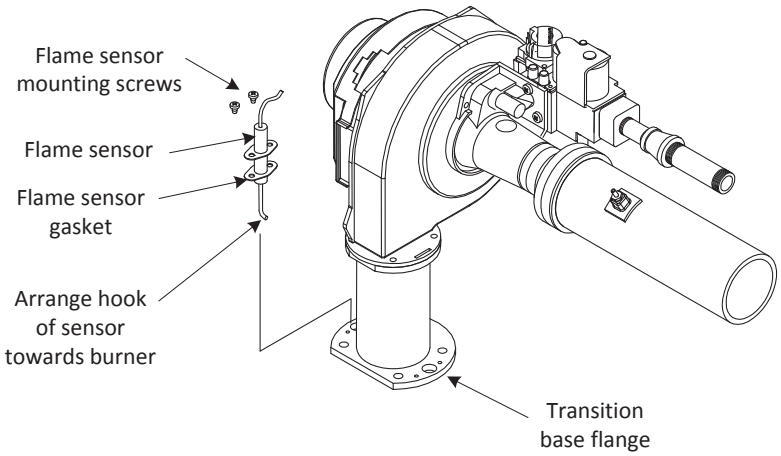
Step 5. Disconnect wire lead from flame sensor.



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.



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.

SERVICE PROCEDURE EF-IX
Spark Rod Gap Adjustment and Replacement

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.

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

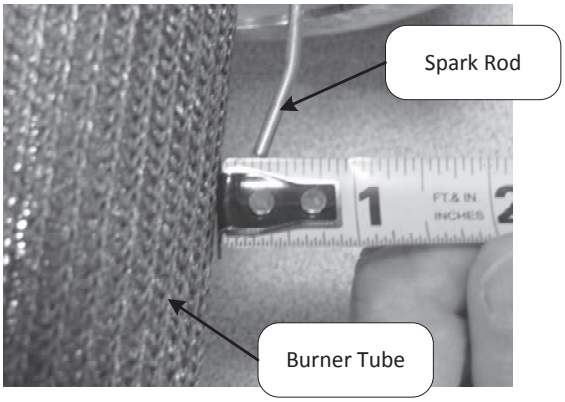
Step 1. Remove combustion system as described in "Combustion System Removal Procedure".

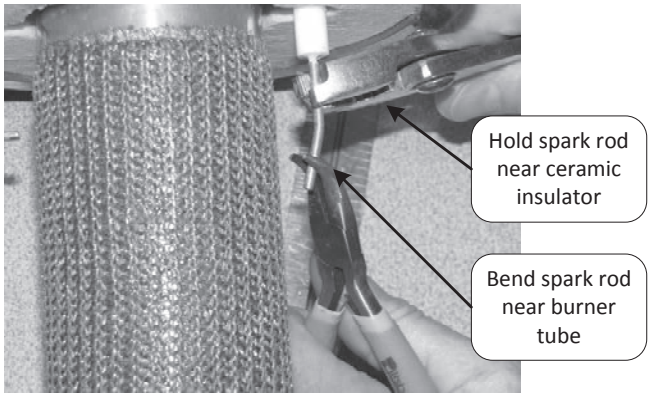
Step 2. Measure spark gap between the spark rod and burner tube. Acceptable spark gap is between 3/16" - 1/4" (see photo below).

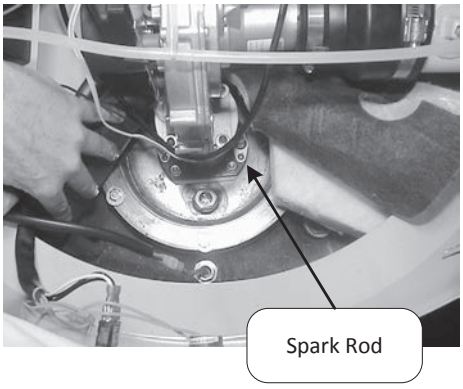
Step 3. If spark gap is not between 3/16" - 1/4", the spark rod may be carefully bent by supporting the end near the ceramic insulator with pliers and bending the end near the burner tube with needle nose pliers (see photo below).

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.







SERVICE PROCEDURE EF-IX
Spark Rod Gap Adjustment and Replacement

Spark Rod Replacement Procedure

⚠ 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 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.

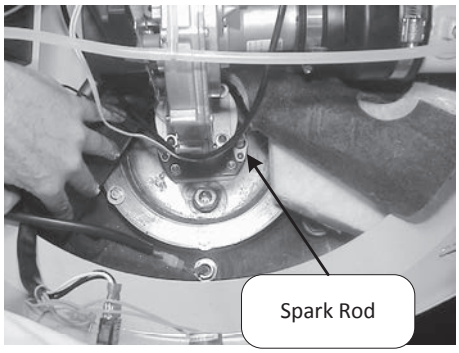
Step 4. Fold back insulation in front of combustion assembly to expose spark rod. (see photo at right)

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.

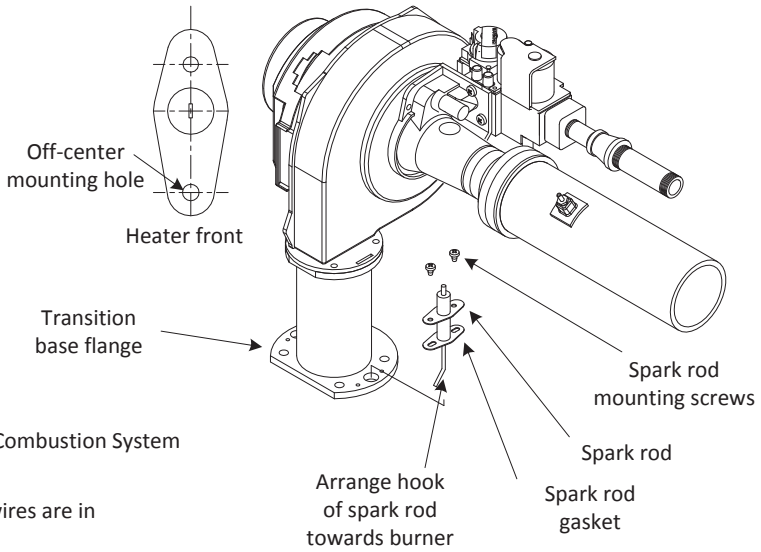
Step 7. Remove any residual gasket material from transition base flange.

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.



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.

Ignition Module Replacement Procedure

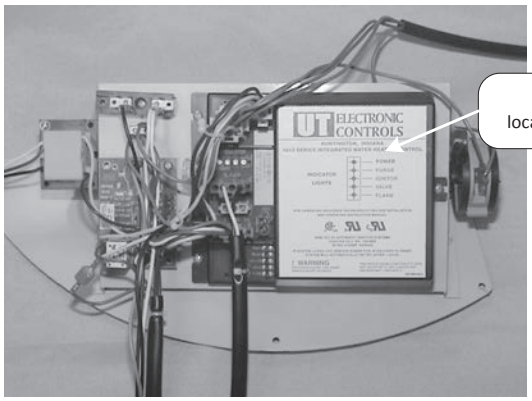
⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

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



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.

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

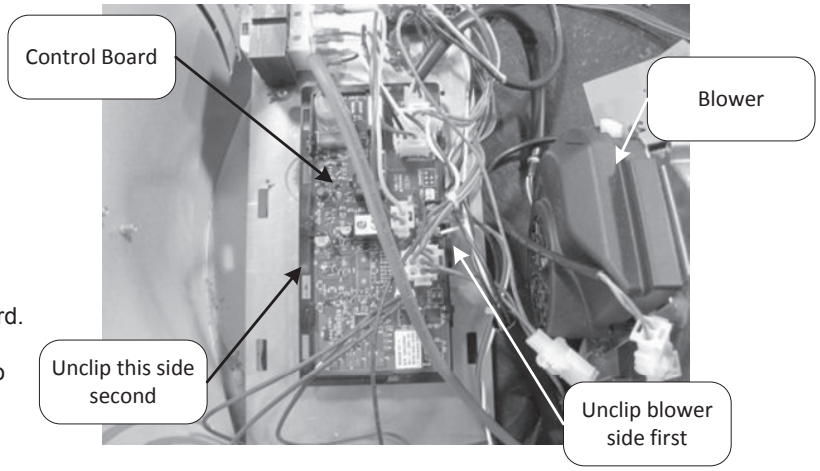
Step 1. Position main power switch to “OFF”

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.

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

Step 4. Locate control board.

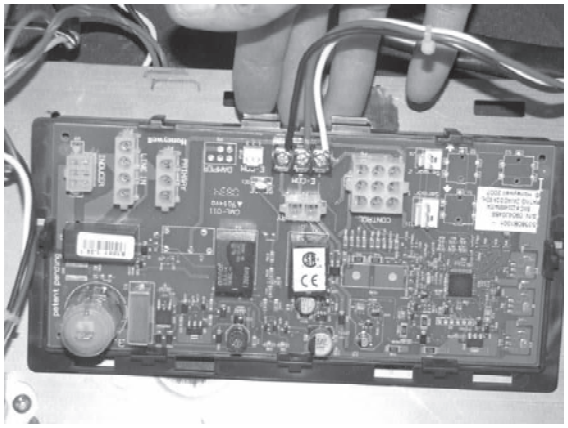


Step 5. Carefully disconnect all wire connections from control board.

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

Step 6. Depress the plastic tabs on the 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

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

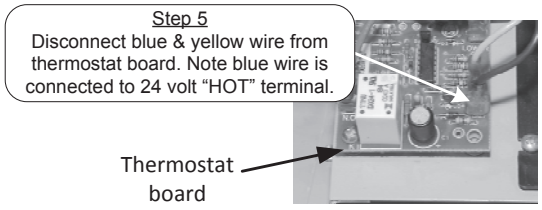
Step 1. Position main power switch to "OFF".

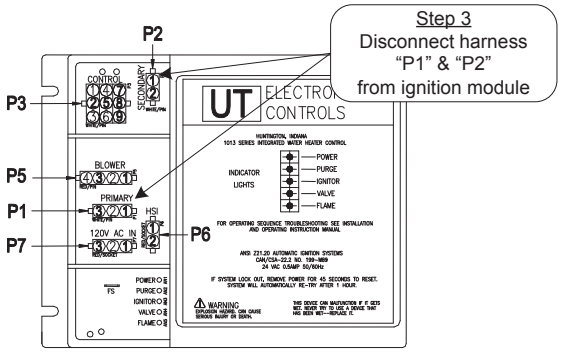
Step 2. Disconnect (Unplug) water heater from 120 Volt power source.

Step 3. Un-latch & remove surround cover from top of water heater.

Step 4. **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)

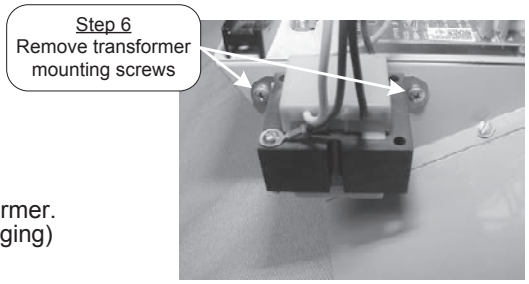




Ignition module

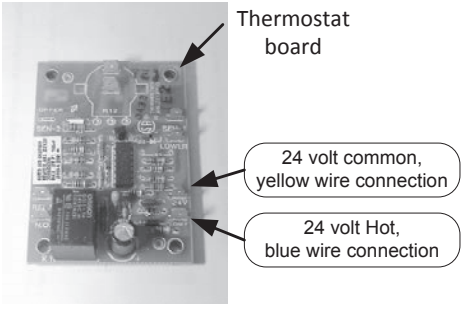
Step 6. Remove the 2 screws (short Phillips screw driver) holding the transformer in place and remove transformer from control panel. (see photo below)

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 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.

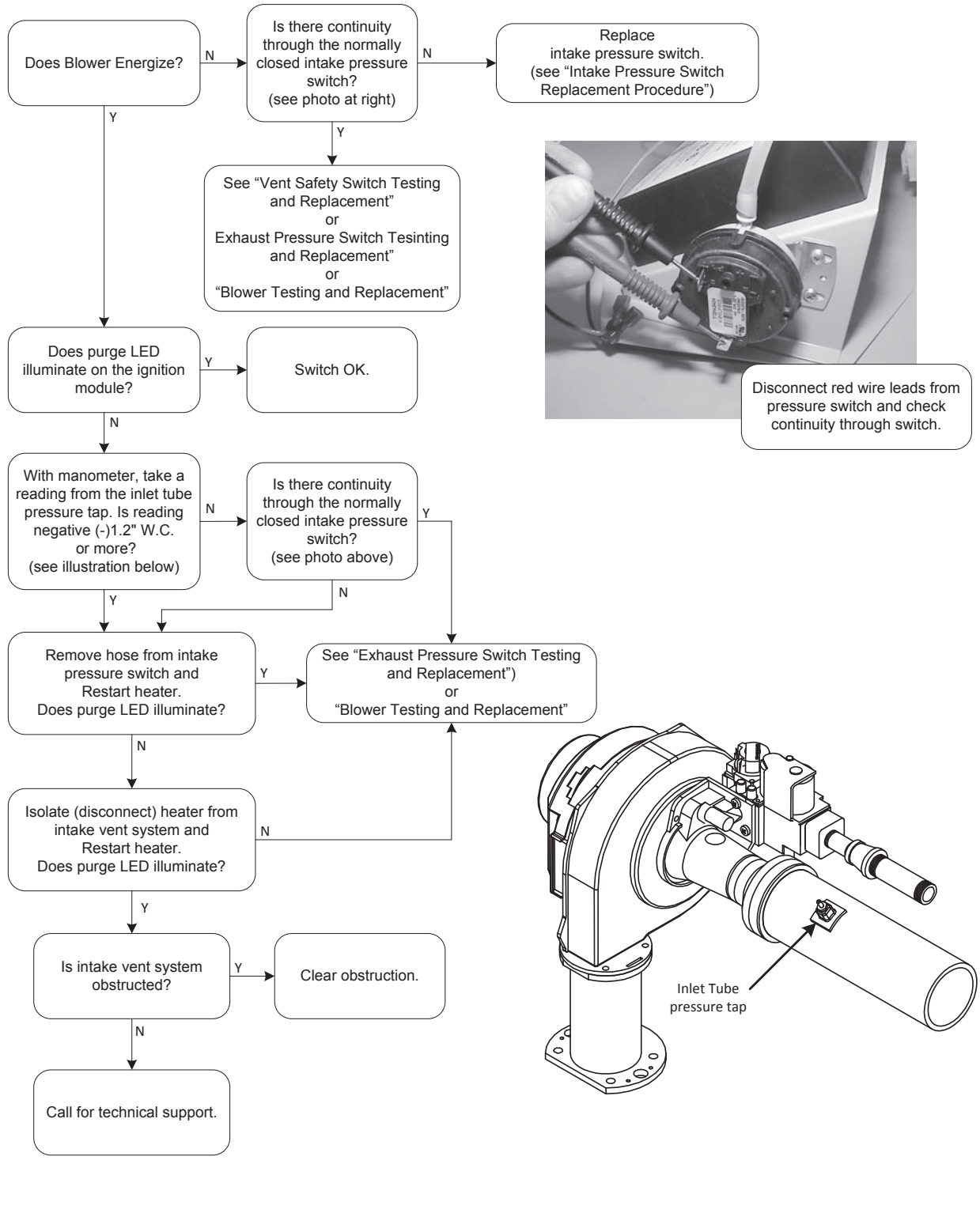
Service Procedure EF-XII

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.



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

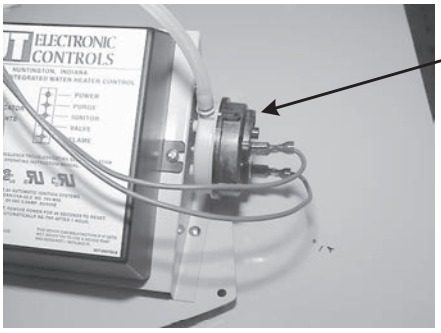
⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

Step 1. Position main power switch to "OFF".

Step 2. Disconnect (Unplug) water heater from 120 Volt power source.

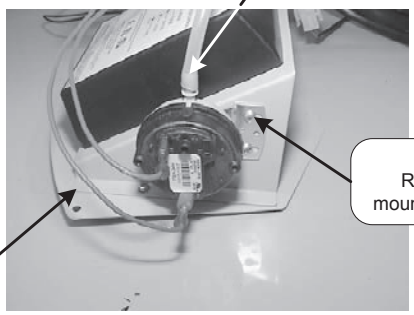
Step 3. Un-latch & remove surround cover from top of water heater.

Step 4. Locate intake pressure switch on control panel inside surround area (see photos below).



Intake pressure switch located on side of control panel

Step 6
Disconnect tubing from pressure switch



Step 7
Remove 2 mounting screws

Step 5
Disconnect red wires

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

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.

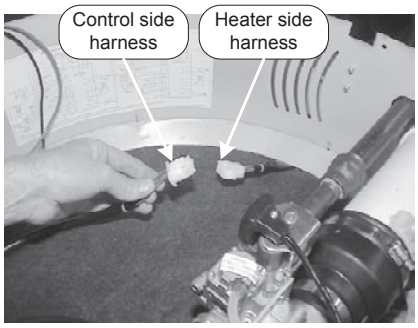
Step 11. Restore 120 volt power supply to heater & verify proper heater operation following the instructions on the lighting instruction label or the lighting instructions located in the installation & operation manual.

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.



Locate harness connection. (see photo at right)

Is there continuity Through GREY Lead wires of heater side harness? (see photo at right)
Y
N

Depress reset button on high limit switch. Is there continuity across high limit switch? (see photo below)
N
Y

Replace vent safety switch (see "Vent Safety Switch Replacement Procedure")

Does heater function?
N
Y

Call technical support.

Reset heater, observe heating cycle. Does switch open?
N
Y

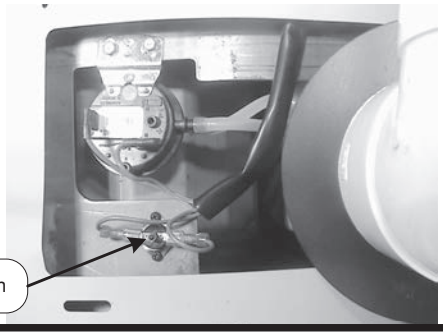
Is temp over 350°F?
Y
N

System OK

Does switch open prior to 350°F?
N
Y

DO NOT OPERATE HEATER
System over heating, immediately contact technical support.

Replace vent safety switch (see "Vent Safety Switch Replacement Procedure")



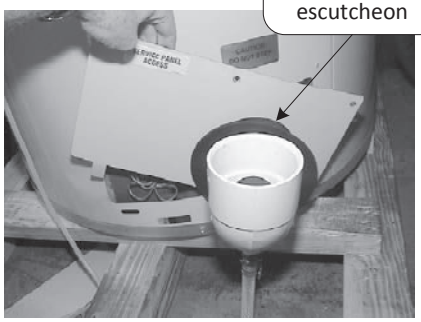
⚠ WARNING
Make sure exhaust collector compartment is not overheating (350°F) before resetting vent safety switch. If there is evidence the collector compartment is overheating, CALL TECHNICAL SUPPORT.

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 (¼" nut driver) and remove cover from heater (see photos at right)

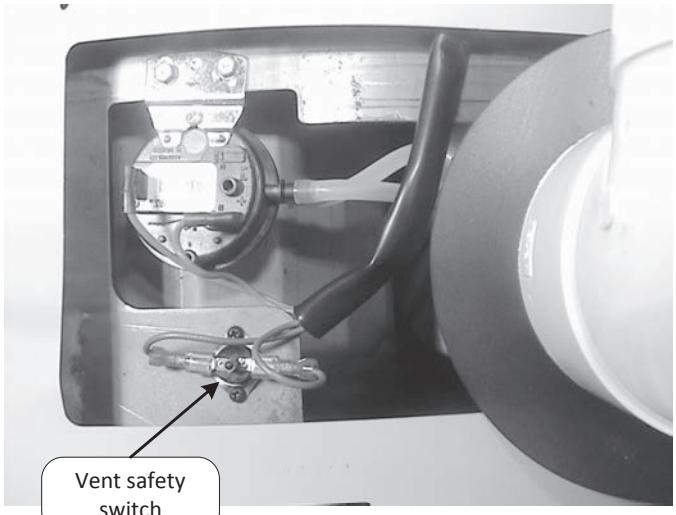


Step 4. Disconnect wire leads from vent safety switch (see photo at right).

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.

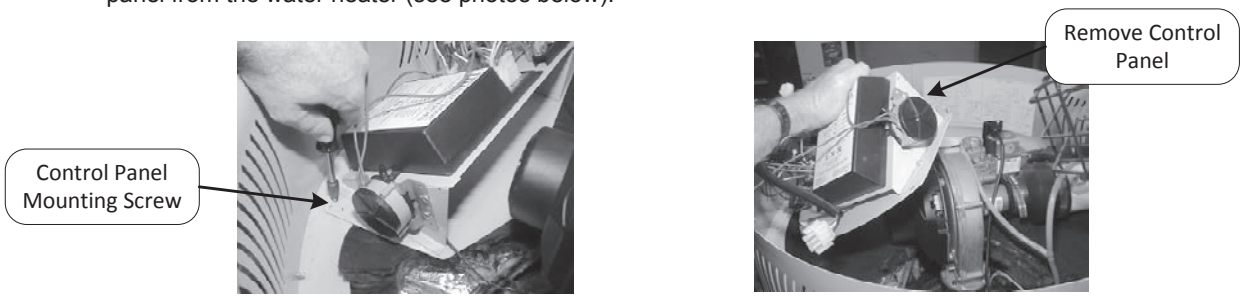
Step 1. Position main power switch to "OFF".

Step 2. Disconnect (Unplug) water heater from 120 Volt power source.

Step 3. Un-latch & remove surround cover from top of heater.

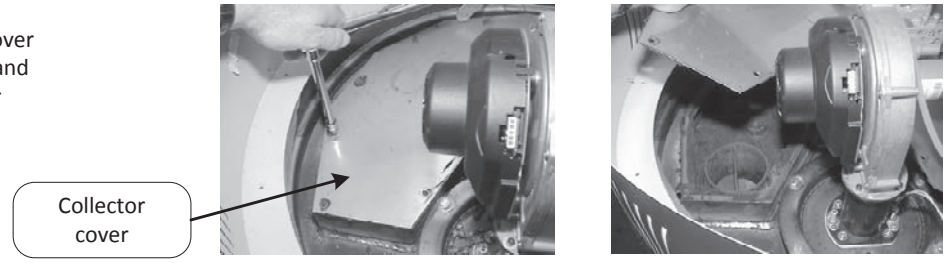
Step 4. Disconnect wire harnesses to allow for removal of control panel.
Note: Where ever possible, rather than disconnecting at the control panel, follow wire harness away from control panel and disconnect at control component location.

Step 5. Remove the three control panel mounting screws (¼" nut driver) and remove control panel from the water heater (see photos below).



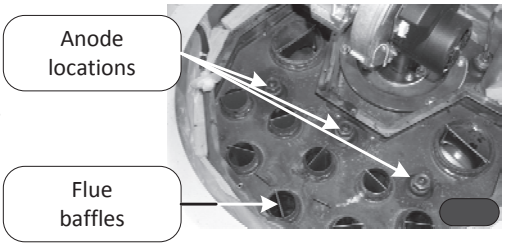
Step 6. Completely remove insulation (two pieces) from top of heater to expose collector cover

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



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"



Note: EF100T399 models have only 1 anode rod under the 2nd 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 ½ of the original diameter (approximately ¾" 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 thread sealing 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.

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.

Powered Anode Replacement EF100T399 models only

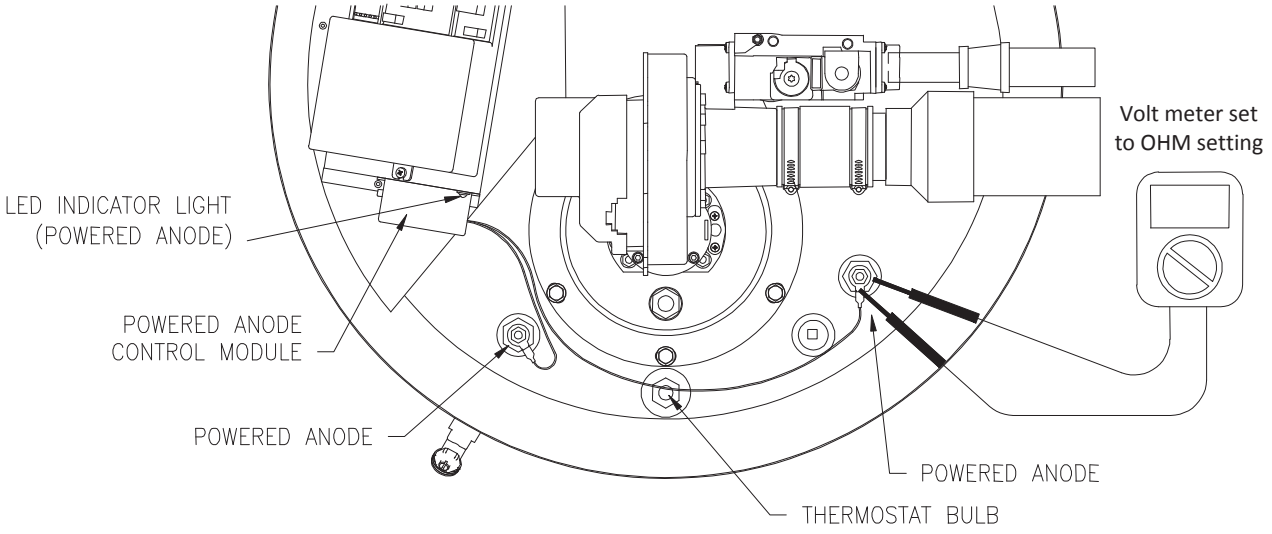
⚠ WARNING
Heater components may be HOT when performing the following steps in this procedure. Take necessary precaution to prevent personal injury.

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 ohmeter, check continuity between the powered anode terminal and the bushing. There should not be continuity. If there is continuity, replace the powered anode assembly.



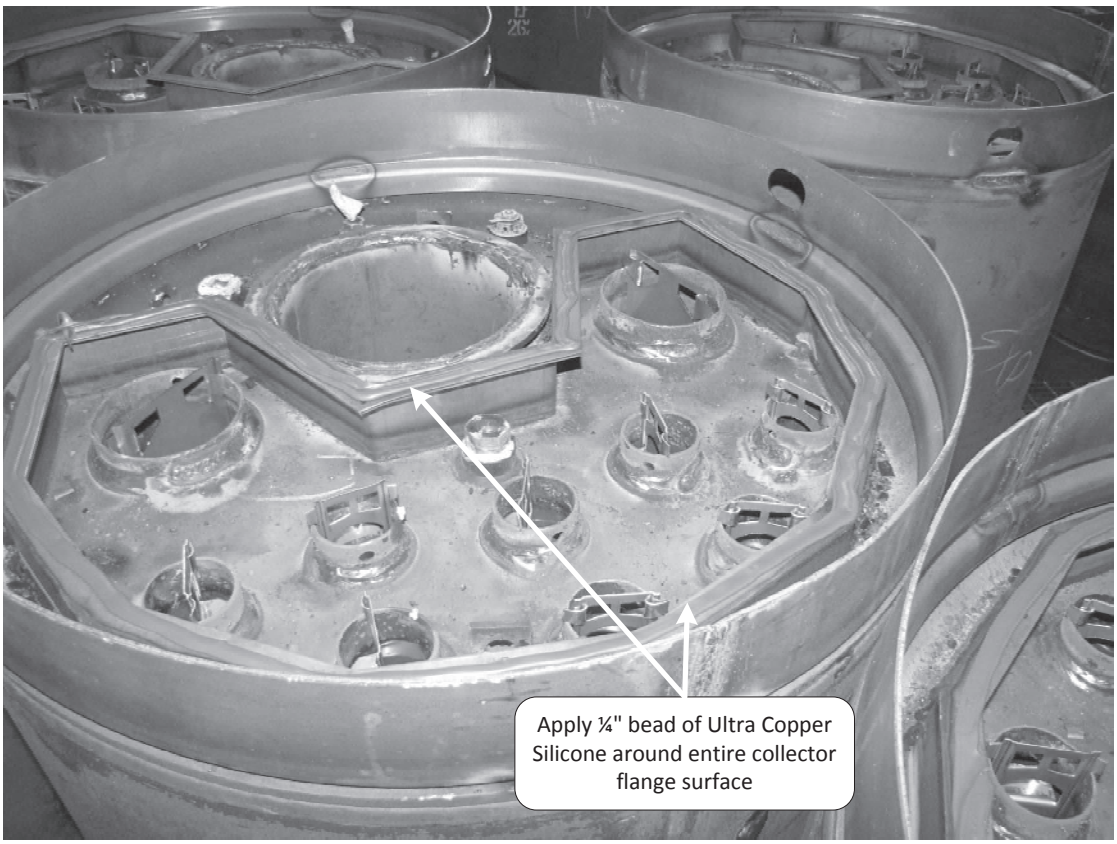
Collector Cover Installation Procedure

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, ¾" 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 ¼" 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

Balanced Direct Vent Systems PVC, CPVC

Total length of intake piping and exhaust piping added together must not exceed "Maximum Combined Length" Shown below

Maximum Combined Length (feet)

Model Number	2"	3"	4"
EFR-1-60T120	60'	120'	170'
EF60T125, EF100T150	30'	120'	170'
EF60T150, EF100T199	30'	100'	150'
EF60T199	30'	80'	130'
EF100T250	N/A	80'	130'
EF100T300	N/A	60'	110'
EF100T399	N/A	50'	100'

Unbalanced Direct Vent Systems
Air intake CAN NOT exceed exhaust by more than 30 feet

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.

Power Vented Systems PVC, CPVC

Total length of exhaust piping must not exceed "Maximum Vent Length" Shown below

Maximum Vent Length (feet)

Model Number	2"	3"	4"
EFR-1-60T120	60'	120'	170'
EF60T125, EF100T150	30'	120'	170'
EF60T150, EF100T199	30'	100'	150'
EF60T199	30'	80'	130'
EF100T250	N/A	80'	130'
EF100T300	N/A	60'	110'
EF100T399	N/A	50'	100'

WARNING! The EF100T250 and EF100T300 models are not approved for 2 inch diameter vent pipe. Venting with 2 inch pipe on these models may result in damage to the water heater or cause an unsafe condition. DO NOT use 2 inch Vent or Air Intake Pipe on EF100T250/300 models.

eF Series® 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:

CO2 _____ CO _____

Installation Site Name & Address:

_____

_____

_____

_____

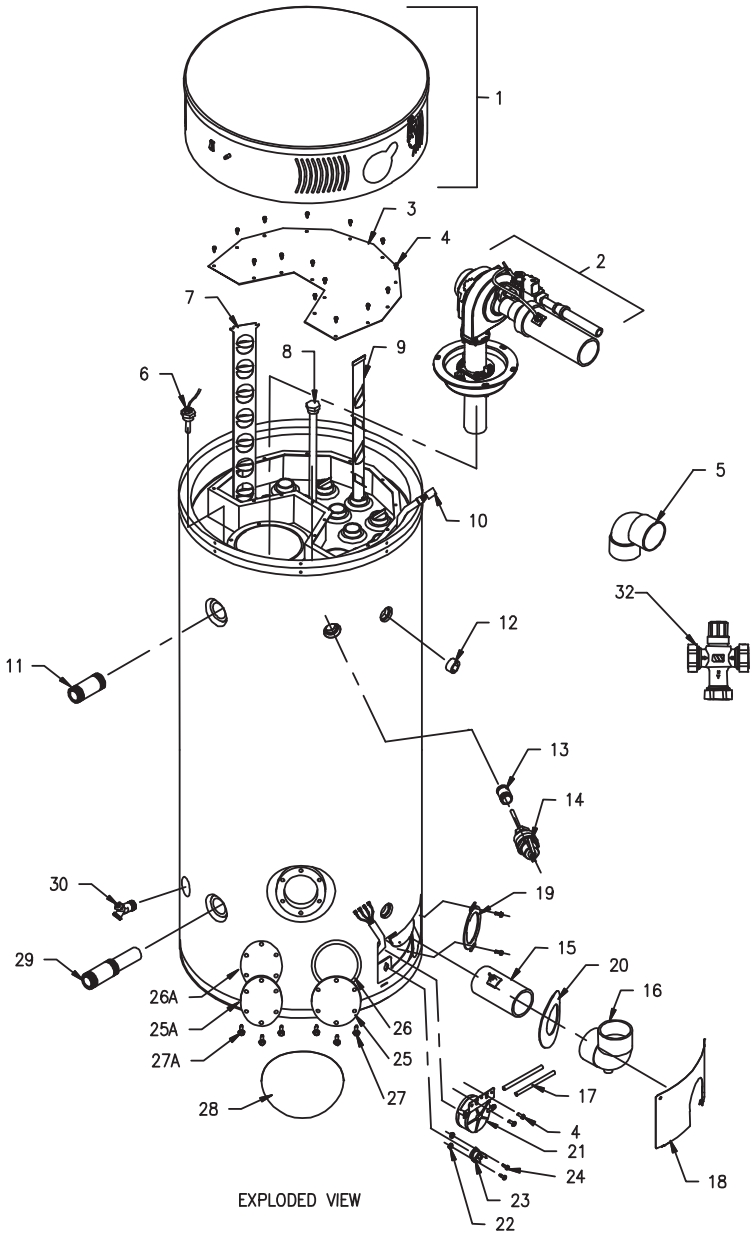
Installation Site Contact Name & Phone Number

_____

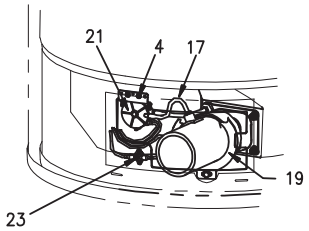
_____

_____

Parts List
Models prior to “CF” serial number



EXPLODED VIEW



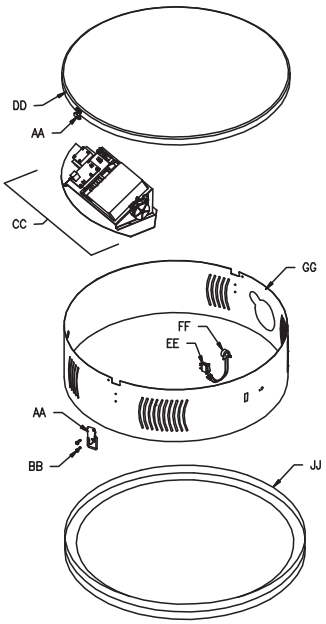
EXHAUST SERVICE AREA DETAIL
(ASSEMBLED)

1	Combustion Surround Assy.
2	Burner Assy
3	2nd 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 1-½" 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	Hi-Limit Switch
24	Screw 6-32x 3/8
25	Cleanout Access Cover
26	Cleanout Gasket
27	Screw 5/16-18 x ¾ 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

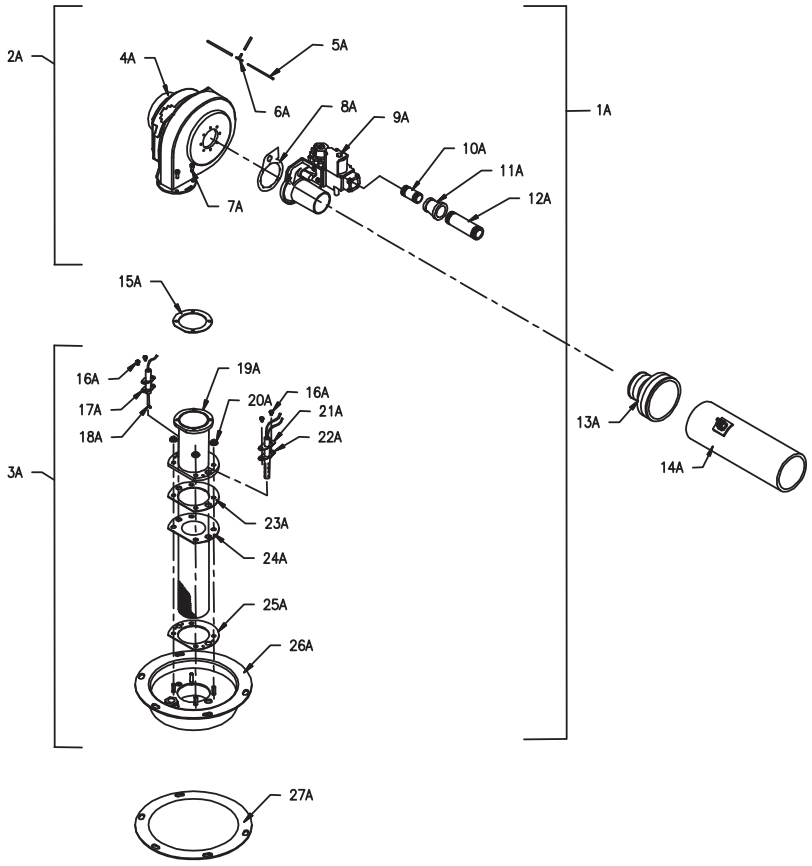
Customer must specify complete model number and serial number when ordering service parts.

Parts List
Models prior to "CF" serial number

AA	Latch Assy
BB	Screw 8-32 x ½ RHCR
CC	Ignition Control Assy
DD	Jacket Head
EE	Main Power Switch
FF	Potentiometer
GG	Combustion Surround
JJ	Surround Base

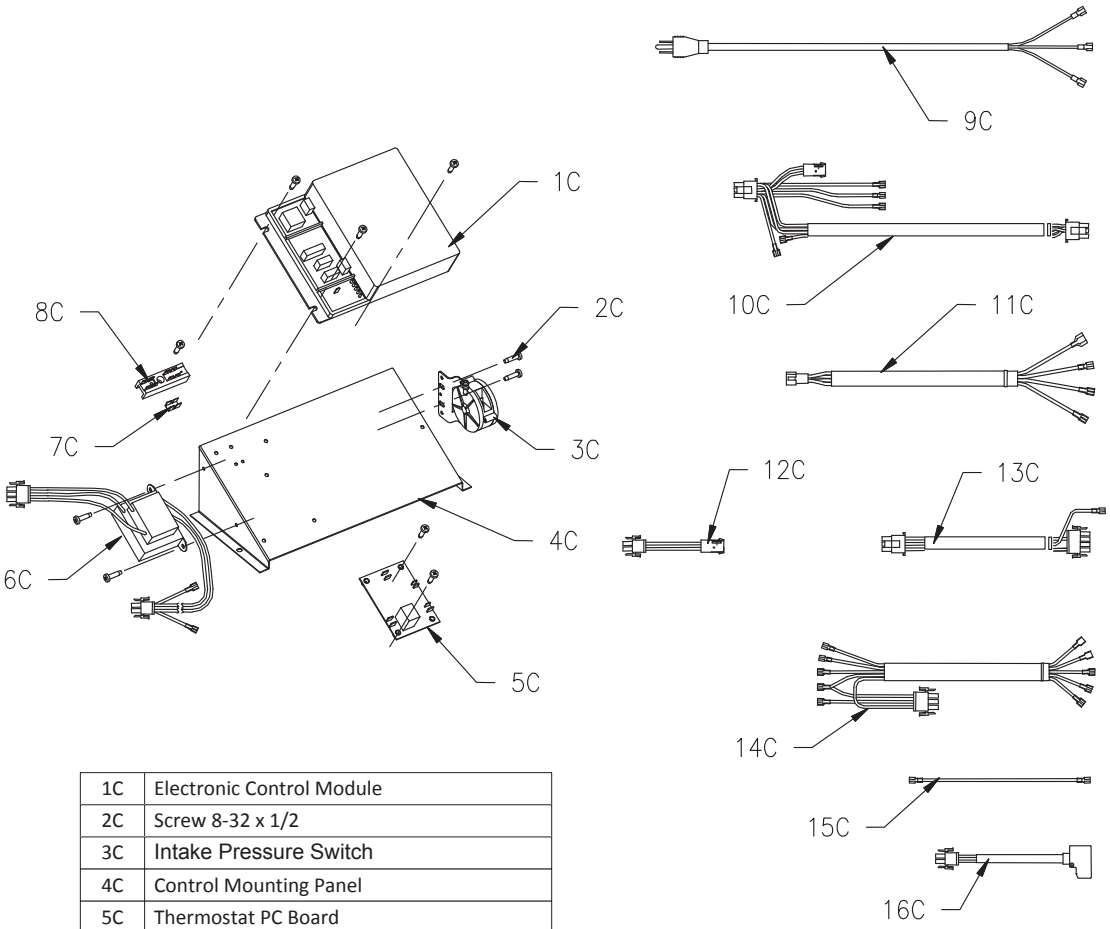


Customer must specify complete model number and serial number when ordering service parts.



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 ½" NPT X3"
11A	Reducer ¾ x ½ NPT
12A	Nipple ¾ NPT x 6"
13A	2" dia. Flex Reducer
14A	Inlet (PVC)
15A	Gasket Blower Transition
16A	Screw 8-32 x ¼ 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

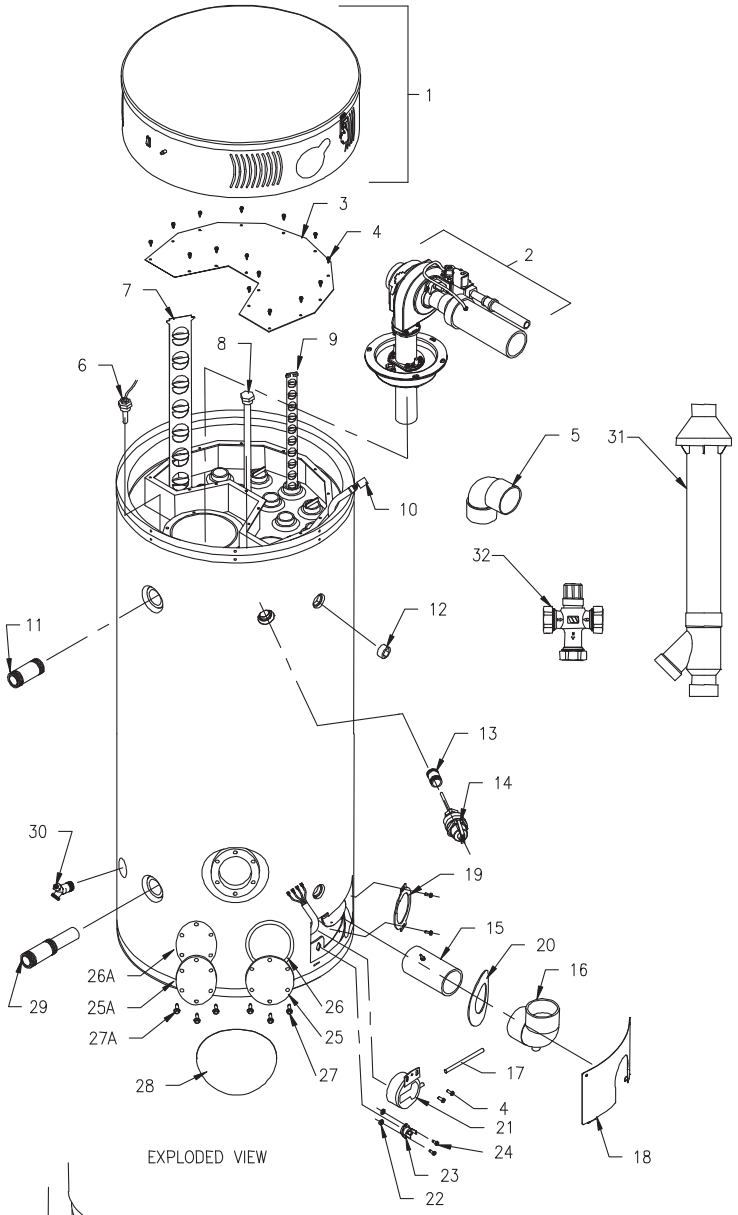
Parts List
Models prior to “CF” serial number



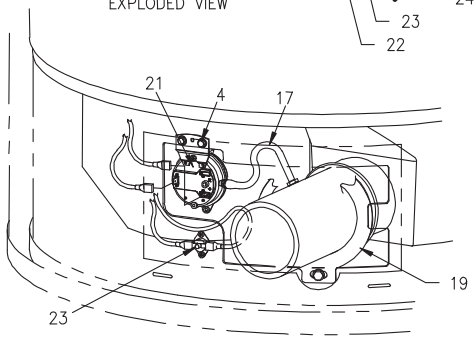
1C	Electronic Control Module
2C	Screw 8-32 x 1/2
3C	Intake Pressure Switch
4C	Control Mounting Panel
5C	Thermostat PC Board
6C	Transformer 120VAC x 24VAC x 40VA
7C	Terminal
8C	Terminal Strip
9C	Power Cord
10C	Control Wire Harness
11C	Thermostat Wire Harness
12C	Igniter Extension Wire
13C	Blower Wire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



EXPLODED VIEW



EXHAUST SERVICE AREA DETAIL
(ASSEMBLED)

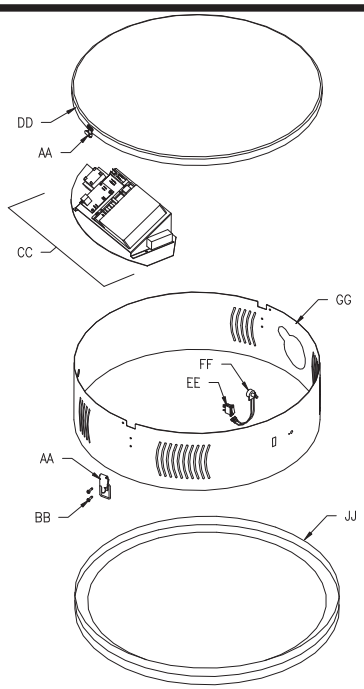
1	Combustion Surround Assy.
2	Burner Assy (specify model)
3	2nd Pass Top Collector Cover
4	Screw 10-16 x 3/4
5	Vent Termination Elbow
6	Thermostat Sensor Probe
7	Baffle 4" Flue (specify model)
8a	Anode Rod Assy
8b	Powered Anode (for EF100T399)
9	Baffle 2" Flue
10	Wire Harness Service Panel
11	Plastisert Nipple 1-½" 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 ¾ 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)

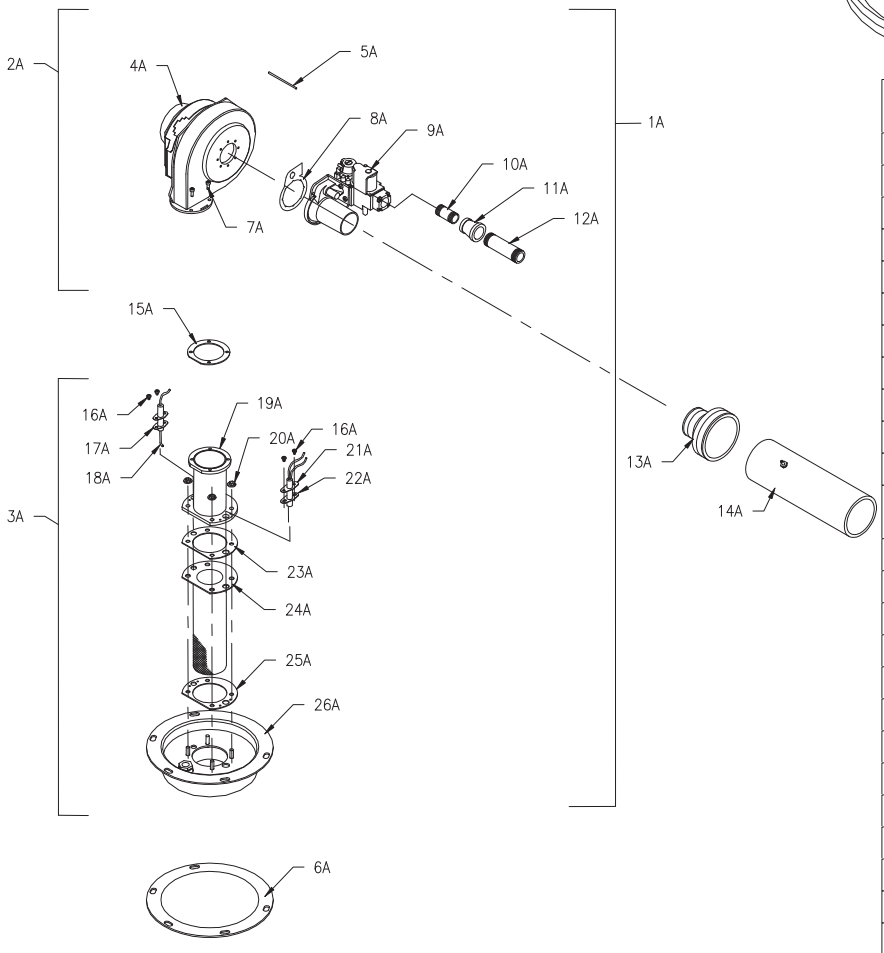
Customer must specify complete model number and serial number when ordering service parts.

Parts List
For models with “CF” serial or later.

AA	Latch Assy
BB	Screw 8-32 x ½ RHCR
CC	Ignition Control Assy
DD	Jacket Head
EE	Main Power Switch
FF	Potentiometer
GG	Combustion Surround
JJ	Surround Base

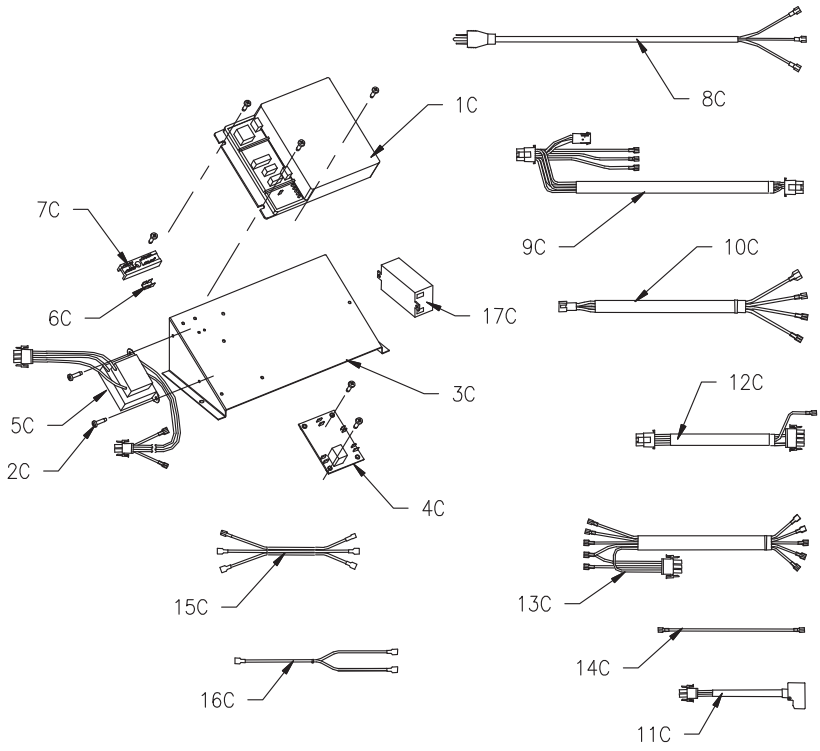
Customer must specify complete model number and serial number when ordering service parts.





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 ¼ 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

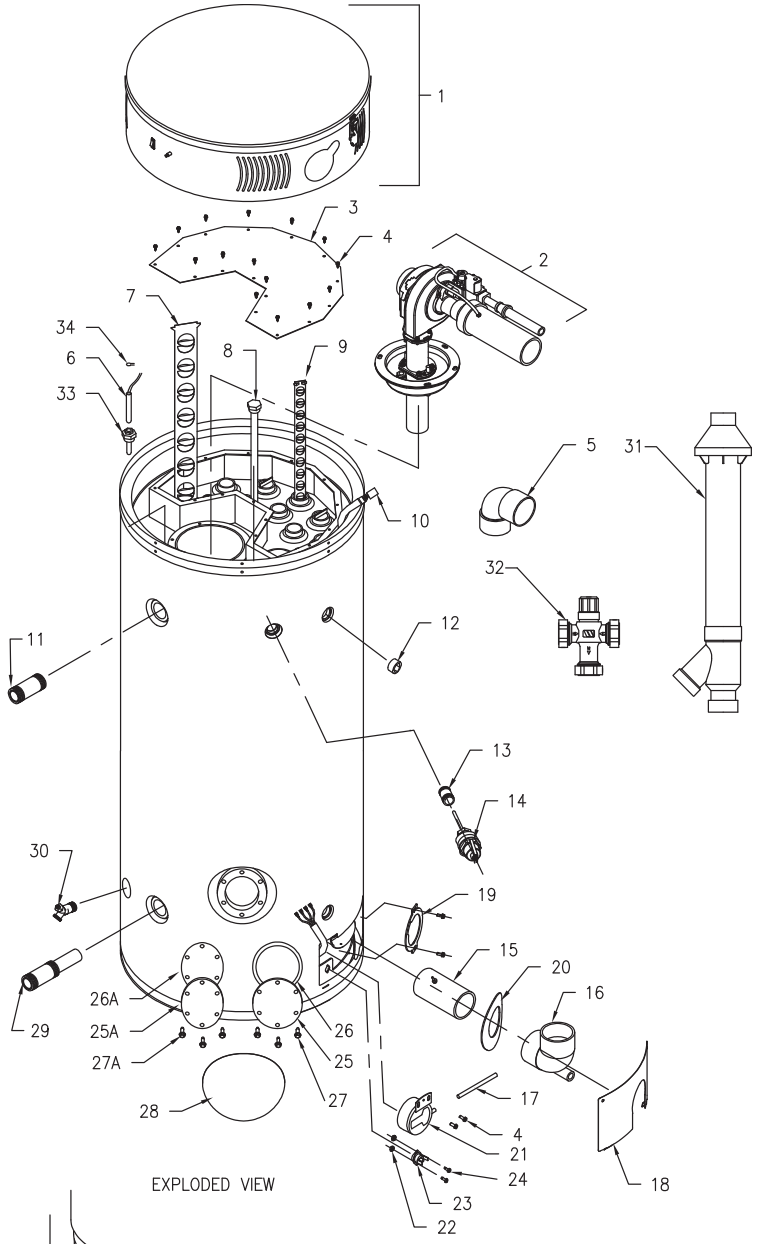
Parts List
For models with “CF” serial or later.



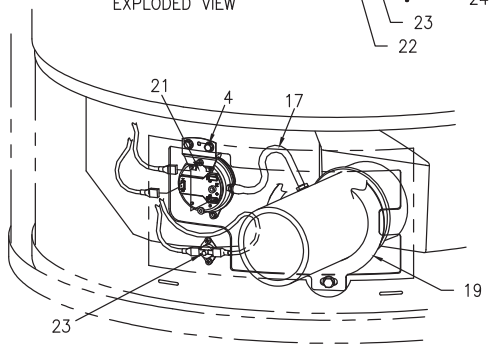
1C	Electronic Control Module
2C	Screw 8-32 x 1/2
3C	Control Mounting Panel
4C	Thermostat PC Board
5C	Transformer 120VAC x 24VAC x 40VA
6C	Terminal
7C	Terminal Strip
8C	Power Cord
9C	Control Wire Harness
10C	Thermostat Wire Harness
11C	Rectifier Harness (specify model)
12C	Blower Wire Harness (specify 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



EXPLODED VIEW



EXHAUST SERVICE AREA DETAIL
(ASSEMBLED)

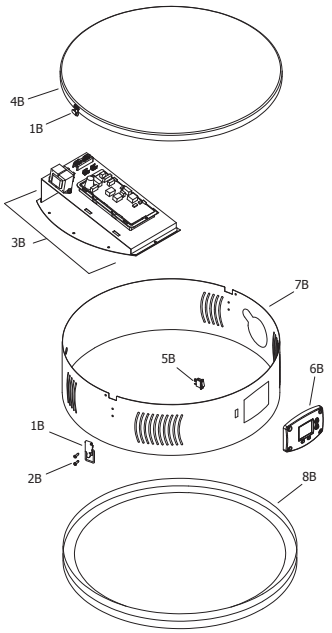
1	Combustion Surround Assembly
2	Burner Assembly (specify model)
3	2nd Pass Top Collector Cover
4	Screw 10-16 x 3/4
5	Vent Termination Elbow
6	Thermostat Sensor Probe
7	Baffle 4" Flue (specify model)
8	Anode Rod Assembly
9	Baffle 2" flue
10	Wire Harness Service Panel
11	Plastisert Nipple 1-½" NPT
12	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 ¾ 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	Thermal Well
34	Clip
35	Hole Closure
36	Reducer

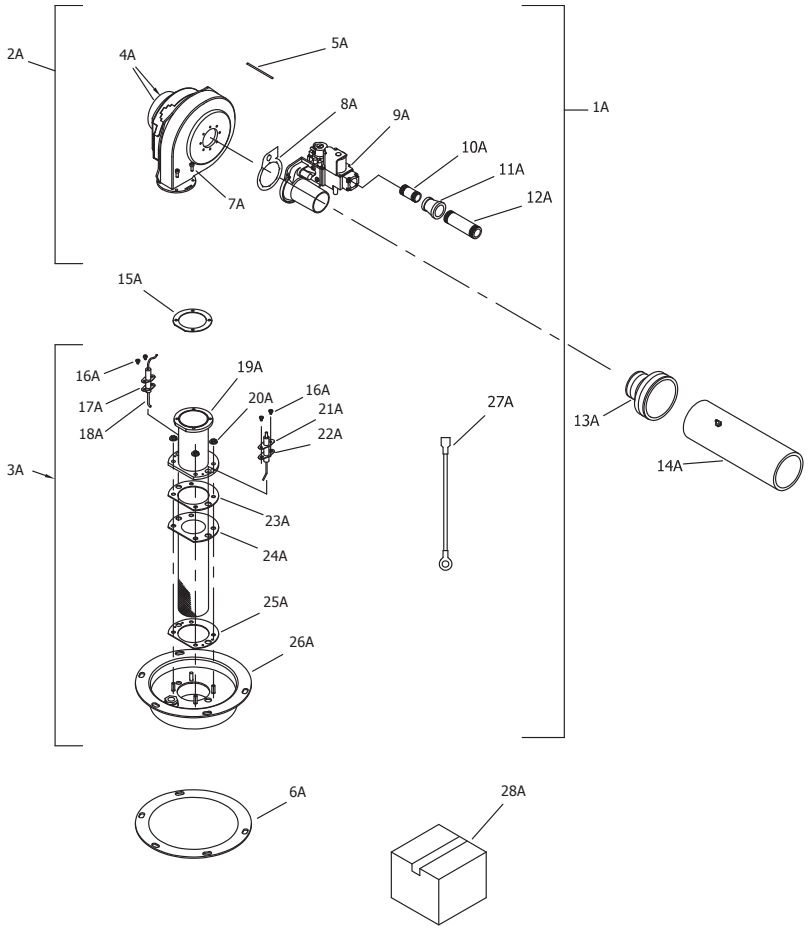
Customer must specify complete model number and serial number when ordering service parts.

Parts List
For models with Direct Spark Ignition

1B	Latch Assy
2B	Screw 8-32 x ½ RHCR
3B	Ignition Control Assy
4B	Jacket Head
5B	Main power switch
6B	Honeywell Control Display
7B	Combustion Surround
8B	Surround Base

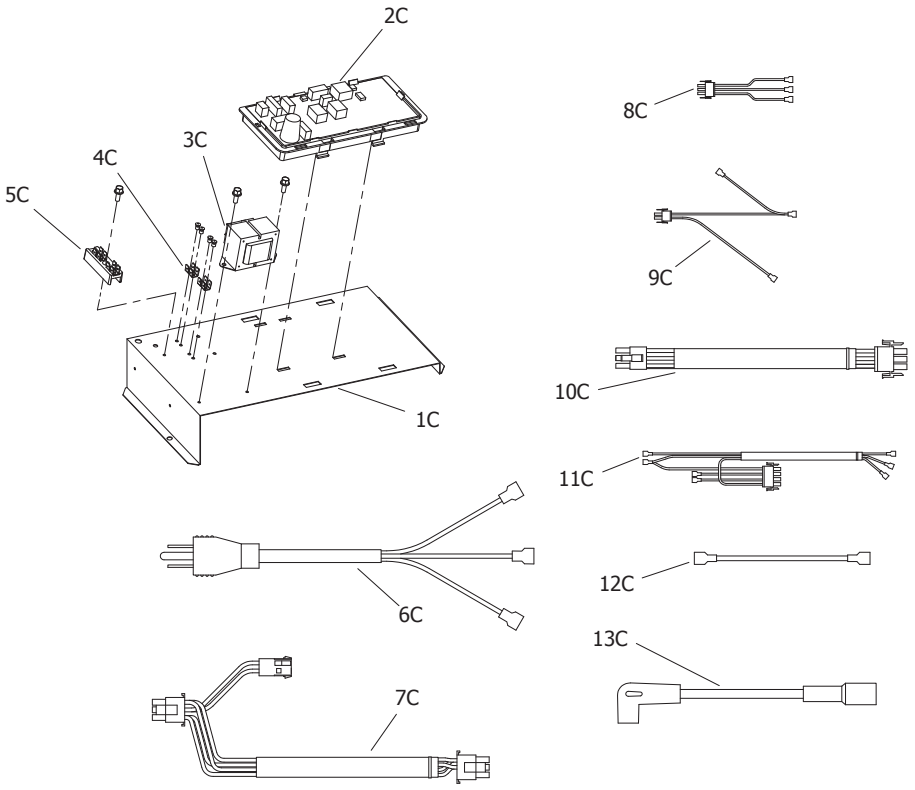
Customer must specify complete model number and serial number when ordering service parts.





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 ¼ 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.

AC	Alternating Current
BTU/H	British Thermal Units
CO	Carbon Monoxide
CO2	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
NOx	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

NOTES

NOTES

BRADFORD WHITE®
WATER HEATERS
Ambler, PA

For U.S. and Canada field service,
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***

BRADFORD WHITE-*CANADA® INC.*
Mississauga, ON

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

*Fax/**905-238-0105***

Technical Support/**800-334-3393**

Email
parts@bradfordwhite.com
techserv@bradfordwhite.com

www.bradfordwhite.com

eF Series® Installation Checklist and Venting Table

Important - Read the installation and operation manual before installing and operating this water heater.

- **Product Handling -** Carefully uncrate the heater. Move in place with a hand truck (don't use the venting pipes for handles). A 2 inch *(5 cm)* high installation pad is recommended.
- **Electrical Requirements -** Make sure there is a dedicated 120 volts line voltage and line power is properly polarized. Proper ground is required to this water heater.
- **Venting Requirements -** All venting must stay within the required lengths and diameters (see chart below). Proper support of the venting pipe is a **MUST** (every 5 feet *(1.5 m)* vertical and 3 feet *(.9 m)* horizontal). Terminations must be located to prevent re-circulation. Medium to long sweep 90º elbows are recommended.
- **Gas Requirements -** Supply proper gas piping size to this water heater (¾ inch *(1.9 cm)* NPT or equivalent is required for models 300,000 btu/hr *(87.8 kw)* or less, 1 inch *(2.5 cm)* NPT or equivalent is required for 399,000 btu/hr *(116.8 kw)* model). Install a properly sized regulator to supply an adequate volume of gas. 7 inches *(1741.9 Pa.)* W.C. of gas is required when the water heater is operating. Gas pressure must stay below 14 inches *(3483.8 Pa)* W.C. when unit is not operating. Pressure drop between non-operating and operating pressures should be less than 3 inch *(746.5 Pa)* W.C.
- **Condensate Requirements -** Condensate line must be properly sized and sloped to a suitable drain (¼ inch per foot *(.6 cm per .3 m)*). A condensate trap must be constructed as close to the water heater as possible. Protect the condensate line from freezing conditions. If using more than one heater AND using a common condensate line, make sure that the condensate line is sized correctly.
- **Service / Mechanical Room -** Provide adequate space for servicing the heater. Leave room to get to the bottom pressure switch as well as enough overhead room to remove the anode rods for servicing (18 inch *(45.7 cm)* min.).

Maximum Venting Lengths (Combined)

(Max. Vent = Exhaust + Intake)

Model Numbers	2 inch *(5.1 cm)* PVC, ABS & CPVC	3 inch *(7.6 cm)* PVC, ABS & CPVC	4 inch *(10.2 cm)* PVC, ABS & CPVC
EFR-60T-120	60 feet *(18.3 m)*	120 feet *(36.6 m)*	170 feet *(51.9 m)*
EF-60T-125	30 feet *(9.14 m)*	120 feet *(36.6 m)*	170 feet *(51.9 m)*
EF-60T-150	30 feet *(9.14 m)*	100 feet *(30.5 m)*	150 feet *(45.7 m)*
EF-60T-199	30 feet *(9.14 m)*	80 feet (*24.4 m)*	130 feet *(39.6 m)*
EF-100T-150	30 feet *(9.14 m)*	120 feet *(36.6 m)*	170 feet *(51.9 m)*
EF-100T-199	30 feet *(9.14 m)*	100 feet *(30.5 m)*	150 feet *(45.7 m)*
EF-100T-250	N/A	80 feet (*24.4 m)*	130 feet *(39.6 m)*
EF-100T-300	N/A	60 feet *(18.3 m)*	110 feet *(33.5 m)*
EF-100T-399	N/A	50 feet *(15.3 m)*	100 feet *(30.5 m)*

NOTE: 2 inch *(5.1 cm)*, 3 inch *(7.6 cm)* & 4 inch *(10.2 cm)* 90º Elbows = 5 feet *(1.5 m)* of pipe
2 inch *(5.1 cm)*, 3 inch *(7.6 cm)* & 4 inch *(10.2 cm)* 45º Elbows = 2.5 feet *(.7 m)* of pipe

For more detailed information, read the installation and operation manual provided with this water heater.

Questions? Contact Bradford White Technical Service at (800) 334-3393.

238-46101-00D REV 7/13

ULTRA HIGH EFFICIENCY COMMERCIAL GAS WATER HEATER
INSTALLATION & OPERATION MANUAL
WITH TROUBLESHOOTING GUIDE



⚠ WARNING

If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.

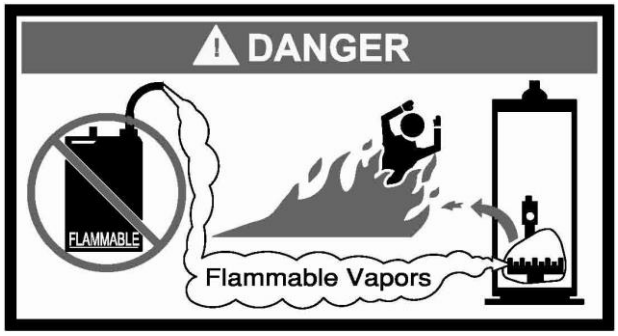
- **DO NOT store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.**

- **WHAT TO DO IF YOU SMELL GAS**
  - **DO NOT try to light any appliance.**
  - **DO NOT touch any electrical switch; DO NOT use any phone in your building.**
  - **Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.**
  - **If you cannot reach your gas supplier, call the fire department.**

For customer comfort, safety and convenience, it is recommended this water heater be installed and serviced by a plumbing professional.

⚠ WARNING
CANCER AND REPRODUCTIVE HARM
WWW.P65WARNINGS.CA.GOV

As required by the state of California Proposition 65.



KEEP THESE INSTRUCTIONS FOR FUTURE REFERENCE

238-48384-00P REV 4/20

SECTION I: IMPORTANT INFORMATION

READ CAREFULLY

This gas-fired water heater is design certified by CSA International under the American National Standard, Z21.10.3 (as indicated on the rating plate) and CAN/CGA 4.3-M (as indicated on the rating plate) available from CSA Standards Association, 5060 Spectrum Way, Mississauga, Ontario, CANADA L4W 5N6.
This water heater must be installed in accordance with local codes. In the absence of local codes, it must be installed in compliance with the National Fuel Gas Code (ANSI Z223.1-Latest Edition), or in Canada CAN/CGA B149.1 Natural Gas Installation Code (Latest Edition) or CAN/CGA B149.2 Propane Installation Code (Latest Edition).

The following terms are used throughout this manual to bring attention to the presence of hazards at various risk levels, or to important information concerning product life.

⚠ DANGER

Indicates an imminently hazardous situation, which, if not avoided, will result in death, serious injury or substantial property damage.

⚠ CAUTION

Indicates potentially hazardous situation, which, if not avoided, may result in moderate or minor injury or property damage.

⚠ WARNING

Indicates a potentially hazardous situation, which, if not avoided, could result in death, serious injury or substantial property damage.

NOTICE

Indicates special instructions on installation, operation or maintenance, which are important but not related to personal injury hazards.

NOTICE

This water heater has a limited warranty. The warranty for this water heater is valid only if the water heater has been installed, maintained, and operated in accordance with these instructions.

TABLE OF CONTENTS

SECTION I: IMPORTANT INFORMATION 2
SECTION II: SPECIFICATIONS 5
SECTION III: GENERAL INFORMATION 6
SECTION IV: INSTALLATION INSTRUCTIONS...9
SECTION V: WATER CONNECTIONS 15
SECTION VI: VENTING.....17
SECTION VII: GAS CONNECTIONS.....36
SECTION VIII: ELECTRICAL CONNECTIONS 388
SECTION IX: OPERATING INSTRUCTIONS ...399
SECTION X: MAINTENANCE 477
SECTION XI: DIAGNOSTIC AND TROUBLESHOOTING GUIDE 522
NOTES.....71

⚠ DANGER

DO NOT store or use gasoline or other flammable, combustible, or corrosive vapors and/or liquids in the vicinity of this or any other appliance.

DO NOT install any damaged venting system components. If damage is evident then please contact the supplier where the water heater was purchased, or the manufacturer listed on the rating plate for replacement parts.

Use only vent terminals provided or factory authorized terminals for venting this water heater.

This water heater is equipped with an adjustable thermostat to control water temperature. Hot water temperatures required for automatic dishwasher and laundry use can cause scald burns resulting in serious personal injury and/or death. The temperature at which injury occurs varies with the person's age and the time of exposure There is an increased hazard to disabled persons with slower response times. **NEVER** allow small children to use a hot water tap, or to draw their own bath water. **NEVER** leave a child or disabled person unattended in a bathtub or shower.

Failure to properly install the vent and air intake (if applicable) system could result in property damage, personal injury, or death.

⚠ WARNING

Improper installation, adjustments, alteration, service or maintenance can cause property damage, personal injury or loss of life. Failure to follow all instructions in the proper order can cause personal injury or death. Read and understand all instructions, including all those provided with the appliance before installing, starting-up, operating, maintaining or servicing this appliance. Keep this manual and literature in legible condition with this water heater for reference by owner and service technician.

This water heater requires regular maintenance and service to operate safely. Follow the instructions contained in this manual.

Installation, maintenance, and service must be performed only by a qualified, skilled and knowledgeable installer or service provider.

Installation is not complete unless a temperature and pressure relief valve is installed into the proper location at the top of this water heater.

It is the responsibility of the installing contractor to see that all controls are correctly installed and are properly operating when the installation is complete.

This water heater is suitable for installation on combustible flooring. **DO NOT** install water heater directly on carpeting.

DO NOT operate this water heater without first being certain it is filled with water.

DO NOT tamper with or alter the water heater and/or controls.

DO NOT operate water heater with jumpered or absent controls or safety devices.

DO NOT operate water heater if any external part has been under water. Immediately call a qualified service agency to inspect the appliance and to replace any part of the control system including gas controls, which has been under water.

DO NOT attempt to use this water heater with any gas other than the type listed on the rating plate. **DO NOT** attempt to convert this water heater for use with a gas other than the type for which it is equipped. Failure to use the proper gas can create an unsafe condition resulting in property damage, bodily injury, or death. Consult your local gas supplier or gas company if there are any questions.

DO NOT operate this water heater if the input rate exceeds the rate shown on the water heater rating plate.

This water heater contains very hot water under high pressure. **DO NOT** unscrew any pipe fittings nor attempt to disconnect any components of this water heater without positively assuring the water is cool and is not under pressure. Always wear protective clothing and equipment when installing, starting up or servicing this water heater to prevent scald injuries. **DO NOT** rely on the temperature gauges to determine the temperature. **DO NOT** touch any components unless they are cool.

This water heater must be properly vented and connected to an approved vent system in good condition. **DO NOT** operate water heater with the absence of an approved vent system. A clean and unobstructed vent system is necessary to allow noxious fumes that could cause injury or loss of life to vent safely and will contribute toward maintaining the water heater's efficiency.

⚠ WARNING

This water heater needs fresh air for safe operation and must be installed so there are provisions for adequate combustion and ventilation air. Insufficient air supply will cause a recirculation of combustion products resulting in contamination that may be hazardous to life. This will result in carboning or sooting of the combustion chamber, burners, and flue tubes and creates a risk of asphyxiation.

This water heater requires its own separate venting system. **DO NOT** connect the exhaust vent into an existing vent pipe or chimney.

Flammable items, pressurized containers or any other potential fire hazardous articles must never be placed on or adjacent to the water heater. Open containers of flammable material should not be stored or used in the same room with this water heater.

Insulation blankets are not required for this water heater. This water heater meets or exceeds the ASHRAE/IES 90.1b (latest edition) standards with respect to insulation and standby loss requirements.

Hydrogen gas can be produced in an operating water heater that has not had water drawn from the tank for a long period of time (generally two weeks or more). **HYDROGEN GAS IS EXTREMELY FLAMMABLE.** To prevent the possibility of injury under these conditions, we recommend the hot water faucet to be open for several minutes at the kitchen sink before you use any electrical appliance, which is connect to the hot water system. If hydrogen is present, there will be unusual sounds such as air escaping through the pipes as hot water begins to flow. **DO NOT** smoke or have open flame near the faucet at the time it is open.

⚠ WARNING

Prior to connecting the gas supply line to a gas fired water heater, ensure that the gas supply line does NOT have moisture/water or dirt/scale inside the gas line. Commonly this check is done at the lowest point in the gas distribution system prior to gas burning appliances.

Do **NOT** use this appliance if any external part to the tank has been submerged in water. You should contact a qualified service technician to inspect the appliance and to replace any part of the control system including the combination gas control which has been submerged in water. See the Gas Connections section of this manual before servicing or replacing a water heater that has had any external part to the tank submerged in water.

⚠ WARNING

Liquefied petroleum gases/propane gas is heavier than air and will remain at floor level if there is a leak. Basements, crawl spaces, closets and areas below ground level will serve as pockets for accumulation of leaking gas. Before lighting, smell all around the appliance area for gas. Be sure to smell next to the floor.

IF YOU SMELL GAS:

- **DO NOT** try to light any appliance.
- **DO NOT** touch any electric switch; **DO NOT** use any telephone in your building.
- Immediately call your gas supplier from a telephone in another building. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

DO NOT OPERATE THE APPLIANCE UNTIL THE LEAKAGE IS CORRECTED!

NSF Compliance

To comply with NSF requirements this water heater must be sealed to the floor with sealant, in a smooth and easily cleanable way.

SECTION II: SPECIFICATIONS

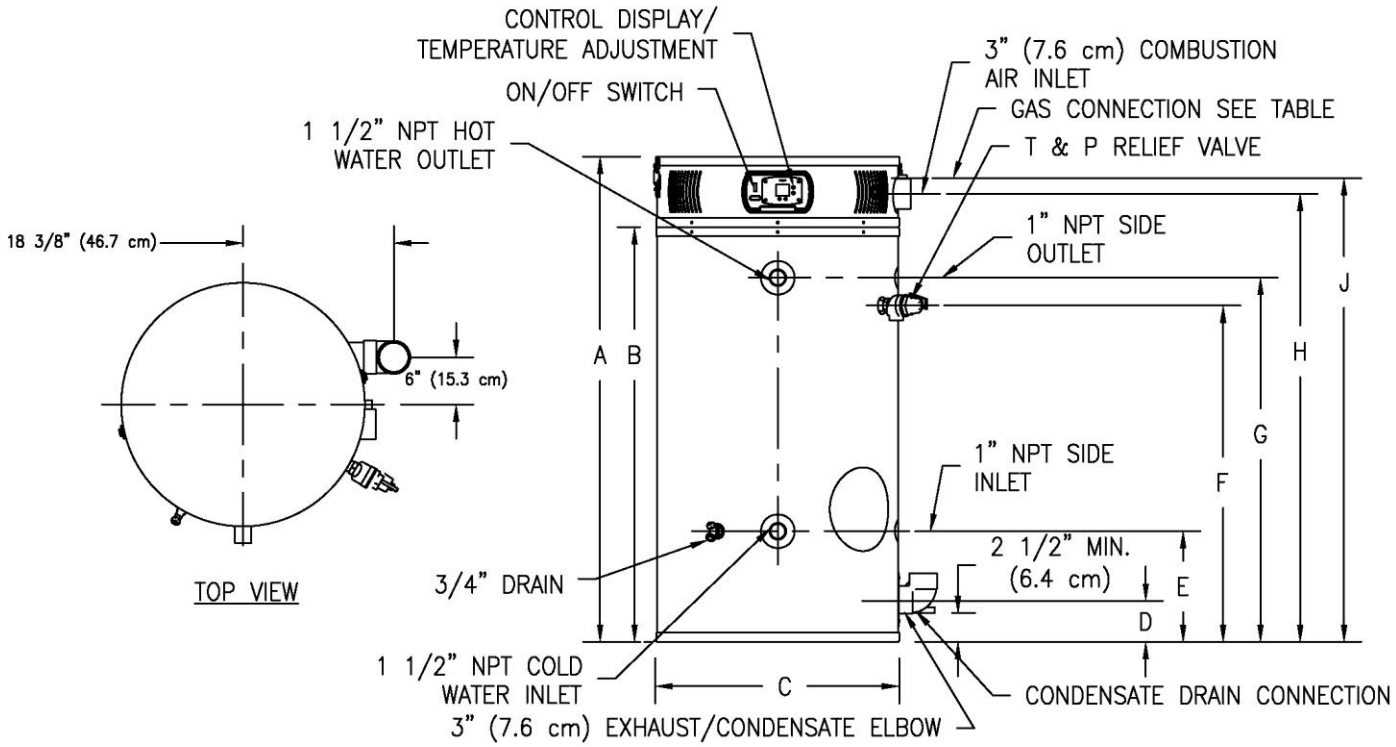


Figure 1 - Dimensional Layout

Table 1 - Specifications

			DIMENSIONS (INCHES)													
Model No.	**Input Rate BTU/h**	**Storage Capacity U.S. Gallons**	**A Height**	**B Floor to Top of Heater**	**C Jacket Dia.**	**D Floor to Vent Outlet**	**E Floor to Inlet Water Conn.**	**F Floor to T&P Valve Conn.**	**G Floor to Outlet Water. Conn.**	**H Floor to Air Intake**	**J Floor to Gas Conn.**	**Front Water Conn. Dia.**	**Space Heating Conn. Dia.**	**Gas Conn. Dia.**	**Relief Valve Open**	**Shipping Wt. (LBS)**
60T125	125,000	60	48 7/16	48 7/16	28 1/4	5	12 7/8	39 1/16	42 1/2	51 5/8	53 1/4	1 1/2	1	3/4	3/4	570
60T150	150,000	60	48 7/16	48 7/16	28 1/4	5	12 7/8	39 1/16	42 1/2	51 5/8	53 1/4	1 1/2	1	3/4	3/4	570
60T199	199,999	60	48 7/16	48 7/16	28 1/4	5	12 7/8	39 1/16	42 1/2	51 5/8	53 1/4	1 1/2	1	3/4	3/4	570
100T150	150,000	100	69 7/16	69 7/16	28 1/4	5	12 7/8	60 1/16	62 1/2	72 5/8	74 1/4	1 1/2	1	3/4	3/4	900
100T199	199,999	100	69 7/16	69 7/16	28 1/4	5	12 7/8	60 1/16	62 1/2	72 5/8	74 1/4	1 1/2	1	3/4	3/4	900
100T250	250,000	100	69 7/16	69 7/16	28 1/4	5	12 7/8	60 1/16	62 1/2	72 5/8	74 1/4	1 1/2	1	3/4	1	900
100T300	300,000	100	69 7/16	69 7/16	28 1/4	5	12 7/8	60 1/16	62 1/2	72 5/8	74 1/4	1 1/2	1	3/4	1	900
100T399	399,000	100	69 7/16	69 7/16	28 1/4	5	13	60 1/16	63	72 5/8	73 1/4	1 1/2	1	1	1	950

			DIMENSIONS (MILLIMETERS)													
Model No.	**Input Rate KW**	**Storage Capacity Liter**	**A Height**	**B Floor to Top of Heater**	**C Dia.**	**D Floor to Vent Outlet**	**E Floor to Inlet Water Conn.**	**F Floor to T&P Valve Conn.**	**G Floor to Outlet Water Conn.**	**H Floor to Air Intake**	**J Floor to Gas Conn.**	**Front Water Conn. Dia.**	**Space Heating Conn. Dia.**	**Gas Conn. Dia.**	**Relief Valve Open.**	**Shipping. Wt. (KG)**
60T125	36.6	227	1231	1231	718	127	327	992	1087	1334	1353	38	25	19	19	259
60T150	43.9	227	1231	1231	718	127	327	992	1087	1334	1353	38	25	19	19	259
60T199	58.6	227	1231	1231	718	127	327	992	1087	1334	1353	38	25	19	19	259
100T150	43.9	379	1764	1764	718	127	327	1526	1588	1857	1886	38	25	19	19	408
100T199	58.6	379	1764	1764	718	127	327	1526	1588	1857	1886	38	25	19	19	408
100T250	73.2	379	1764	1764	718	127	327	1526	1588	1857	1886	38	25	19	25	408
100T300	87.9	379	1764	1764	718	127	327	1526	1588	1857	1886	38	25	19	25	408
100T399	115.7	379	1764	1764	718	127	330	1526	1600	1857	1886	38	25	25	25	431

NOTICE

100T399 L.P. heaters use a different gas connection than listed above. L.P. heaters utilize a ¾" diameter gas connection. Natural 100T399 heaters utilize the 1" diameter gas connection listed above.

SECTION III: GENERAL INFORMATION

This water heater contains the following features:

Main Power On/Off Switch

The front panel of this water heater has a lighted ON/OFF switch, which is illuminated when the main power is turned on to indicate power to the water heater.

Combustion System

This water heater is equipped with a self-compensating negative pressure pre-mix combustion system. As the blower operates, air is drawn in through the air intake and into a venturi, which pulls gas from the gas valve. The gas and air are then mixed in the combustion blower and sent through the transition tube into the burner. The Direct Spark Ignition System (DSI) then ignites the gas/air fuel mixture to produce flue products (combustion). The flame sensor signals the ignition control board (described below), that a flame is present.

Honeywell Integrated Control

Consists of a control board and a water heater display. An attractive digital water heater display is on the top front of the water heater for precisely setting and displaying the temperature setpoint and monitoring the status of the water heater. Pressing the temperature UP and DOWN buttons changes the temperature setpoint. The temperature format may be displayed in degrees F or degrees C. The water heater display will show diagnostic codes in the event the water heater needs servicing. The temperature readings of the tank sensor can be monitored in Service Mode. In Service Mode, the display can also show up to 10 previous error codes to further aid in servicing the water heater.
The single control board has plug in wiring harnesses to reduce the chance of mis-wiring. The control board controls all ignition, temperature, and combustion blower functions. The control board controls the combustion blower, ignition timings, and gas valve to control the combustion system in order to maintain the desired tank temperature. The sequence of operation is described in detail in the Diagnostic Section (page 52).

Adjustable Thermostat

This water heater is equipped with an adjustable thermostat as part of the Integrated Control System to control water temperature. Hot water temperatures required for automatic dishwasher and laundry use can cause scald burns resulting in serious personal injury and/or death.

The temperature may be adjusted from about 70°F *(21°C)* to about 180°F *(82°C)*. The thermostat was adjusted to 70°F *(21°C)* before the water heater was shipped from the factory. It is recommended that lower temperatures be used to avoid the risk of scalding. Refer to the warnings and the section on Scalding in Section V: Water Connections (page 15). It is further recommended, in all cases, that the water temperature be set for the lowest temperature, which satisfies your hot water requirements for the installation. This will also provide the most energy efficient operation of the water heater and minimizes scale formation.

Setting the water heater temperature at 120°F *(49°C)* will reduce the risk of scalds. Some states require setting lower temperatures for specific installations.

The top immersion well of the single sensor control also contains a redundant sensor for the high limit (energy cutoff). The high limit circuit interrupts the main burner gas flow should the water temperature exceed approximately 207°F *(97.2°C)*. Error code 65 will be shown on the water heater control display if the high limit temperature has been exceeded.

Should the high limit switch activate, it must be manually reset. This should only be done by a service technician after the cause of overheating has been corrected. Refer to the section on Accessing Service Mode on the Display in the Diagnostic section (page 52).

Contact your qualified installing contractor, service provider or manufacturer listed on the rating plate if continued high limit operation occurs.

Service Panel

The service panel is located behind the service panel access cover, which is located by the exhaust elbow near the bottom of the water heater. This panel contains a pressure switch that monitors the pressure in the exhaust pipe in case the vent terminal becomes blocked. A collector high limit switch is used to monitor the ambient temperature between the first pass collector and the exhaust collector. This is a manually re-settable switch. If this switch continues to trip, please contact an authorized service agency.

Latches

The latches allow easy access for servicing the water heater from the top. Simply remove the two latches for servicing and re-latch upon completion. No tools are required to obtain access to the top of the water heater.

Temperature and Pressure Relief Valve

⚠ WARNING

Keep clear of the combination temperature and pressure relief valve discharge line outlet. The discharge may be hot enough to cause scald injury. The water is under pressure and may splash.

For protection against excessive temperatures and pressure, install temperature and pressure protective equipment required by local codes, but not less than a combination temperature and pressure relief valve certified by a nationally recognized testing laboratory that maintains periodic inspection of production of listed equipment or materials as meeting the requirements of the Standard for *Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems, ANSI Z21.22* and the Standard *CAN1-4.4 Temperature, Pressure, Temperature and Pressure Relief Valves and Vacuum Relief Valves*. The combination temperature and pressure relief valve must be marked with a maximum set pressure not to exceed the maximum working pressure of the water heater. The combination temperature and pressure relief valve rating must not be less than the hourly rating of the water heater.

Install the combination temperature and pressure relief valve into the opening provided and marked for this purpose on the water heater.

Note: Some models may already be equipped or supplied with an installed combination temperature and pressure relief valve. Verify that the combination temperature and pressure relief valve is in compliance with local codes. If the combination temperature and pressure relief valve does not comply with local codes, replace it with one that does. Follow the installation instructions above on this page.

Install a discharge line so that water discharged from the combination temperature and pressure relief valve will exit within 6 in *(15.2 cm)* above, or any distance below the structural floor and cannot contact any live electrical part. The discharge line is to be installed to allow for complete drainage of both the combination temperature and pressure relief valve and the discharge line. The discharge opening must not be subjected to blockage or freezing. DO NOT thread, plug or cap the discharge line. It is recommended that a minimum clearance of 4 in *(10.2 cm)* be provided on the side of the water heater for servicing and maintenance of the combination temperature and pressure relief valve.

DO NOT place a valve between the combination temperature and pressure relief valve and the tank.

Condensate Drain

The water heater should either be raised several inches above the floor on a concrete slab or use a low profile condensate pump to allow free drainage of condensate from the elbow drain fitting. This water heater is a condensing type unit and requires a drain to be located in close proximity to allow the condensate to drain safely. The condensate drains from the unit at the factory installed exhaust condensate elbow located near the bottom of the unit. Using an approved primer and cement (refer to Section VI: Venting, page 17), connect a 3/4" elbow or 3/4" coupling over the outside of the drain outlet and use 3/4" pipe for the drain trap and condensate line to a drain. Make sure the condensate drain line slopes down, away from the water heater at least 1/8 in/ft toward the drain. The condensate drain pipe must not be routed through an area subject to below freezing temperatures. The condensate build-up will block the exhaust outlet, which will cause improper operation. Refer to Figure 2 for the proper connection of an elbow to the drain outlet and a condensate trap.

⚠ CAUTION

Failure to properly install the condensate drain as directed above, as well as shown in Figure 2 may result in damage and/or cause improper operation of to the water heater. Any damage resulting from failure to install the condensate drain as directed will not be covered by the warranty.

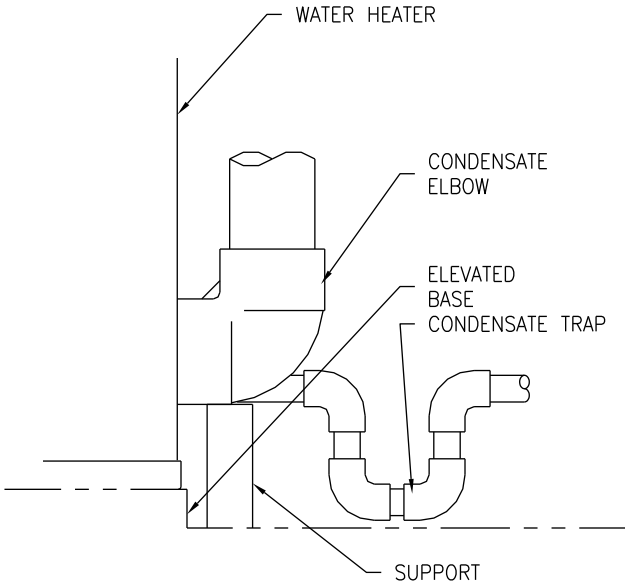


Figure 2 - Condensate Elbow With Trap

Cleanout

All models are equipped with a cleanout opening to aid in removal of hard water deposits from the tank bottom. If this water heater operates under hard water conditions, the following should be performed at least every 3 months: Turn OFF water supply and drain the water heater. Remove the cleanout jacket cover and tank cover. When cleaning the tank, care must be taken to avoid trying to break deposits loose as this could damage the glass lining and shorten the life of the water heater. After cleaning, re-install the cleanout tank cover and jacket cover, and refill with water. Refer to Section X: Maintenance (page 47) for the procedures for filling and draining the water heater.

Sacrificial Anodes

Four sacrificial anode rods have been installed in the tank head to extend tank life. The anode rods should be inspected periodically for corrosion and replaced when necessary to prolong tank life. Water conditions in your area will influence the time interval for inspection and replacement of the anode rods. The use of a water softener may increase the speed of anode consumption. More frequent inspection of the anodes is needed when using softened (or phosphate treated) water. Contact the installing contractor, or service provider that installed the water heater or the manufacturer listed on the rating plate for anode replacement information.

Powered Anode System (399,999 BTU/HR (117.2 kw) Model ONLY)

Two powered anodes and one magnesium anode rod are used on models with input ratings of 399,999 BTU/hr *(117.2 kw).* The powered anode system provides corrosion protection to the tank by supplying a low voltage current to the titanium anode rods and then periodically comparing this current with the potential between the anode rod and tank wall to make corrections. The powered anode system is designed to extend the tank life without requiring anode rod replacement. The powered anode system consists of two titanium powered anode rods located in the front top of the water heater tank and a powered anode control module located on the right side of the control panel. More details on the powered anode system are in Section X: Maintenance (page 47).

Dishwashing Machine Requirements

All dishwashing machines meeting the National Sanitation Foundation requirements are designed to operate with water flow pressures between 15 and 25 lbs./in^2. Flow pressures above 25 lbs./in^2, or below 15 lbs./in^2, will result in improperly sanitized dishes.

The National Sanitation Foundation also recommends circulation of 180°F *(82.2°C)* water. Where this is done, the circulation should be very gentle so that it does not cause any unnecessary turbulence inside the water heater. The circulation should be just enough to provide 180°F *(82.2°C)* water at the point of take-off to the dishwashing machine. Adjust flow by means of the valve in the circulation line.

SECTION IV: INSTALLATION INSTRUCTIONS

⚠ WARNING

INSTALLATION OF THIS WATER HEATER REQUIRES ABILITY EQUIVALENT TO THAT OF A LICENSED TRADESMAN IN THE FIELD INVOLVED. PLUMBING, AIR SUPPLY, VENTING, GAS SUPPLY AND ELECTRICAL WORK ARE REQUIRED.

DO NOT ATTEMPT TO LIGHT ANY GAS APPLIANCE IF YOU ARE NOT CERTAIN OF THE FOLLOWING:

- Liquefied petroleum gases/propane gas and natural gas have an odorant added by the gas supplier that aids in detection of the gas.
- Most people recognize this odor as a "sulfur" or "rotten egg" smell.
- Other conditions, such as "odorant fade" can cause the odorant to diminish in intensity, or "fade", and not be as readily detectable.
- If you have a diminished sense of smell or are in any way unsure of the presence of gas, immediately contact your gas supplier from a telephone in another building.
- Gas detectors are available. Contact your gas supplier or plumbing professional for more information.

Liquefied petroleum gases/propane gas is heavier than air and will remain at floor level if there is a leak. Basements, crawl spaces, closets and areas below ground level will serve as pockets for accumulation of leaking gas. Before lighting, smell all around the appliance area for gas. Be sure to smell next to the floor.

IF YOU SMELL GAS:

- **DO NOT** try to light any appliance.
- **DO NOT** touch any electric switch; **DO NOT** use any telephone in your building.
- Immediately call your gas supplier from a telephone in another building. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

DO NOT OPERATE THE APPLIANCE UNTIL THE LEAKAGE IS CORRECTED!

⚠ WARNING

This water heater must be located in an area where leakage of the tank, water line connections, or the combination temperature and pressure relief valve will not result in damage to the area adjacent to the water heater or to lower floors of the structure. When such locations cannot be avoided, a suitable drain pan must be installed under the water heater. The drain pan depth must be suitable for draining and collecting water and have a minimum length and width of at least 4 in *(10.2 cm)* measured from the jacket of the water heater. The drain pan, as described above, can be purchased from your plumbing professional. The drain pan must be piped to an adequate drain. The piping must be at least 3/4 in *(2 cm)* in diameter and pitched for proper drainage.

Sacrificial anode rods have been installed in the tank head of the water heater to extend tank life. The removal of these anodes, except for inspection and/or replacement, will nullify the warranty. In areas where water is unusually active, an odor may occur at the hot water faucet due to a reaction between the sacrificial anode and the impurities in the water. If this should happen, alternative anodes may be purchased from the supplier that installed this water heater. This will minimize the odor while protecting the tank. Additionally, the water heater should be flushed with appropriate dissolvers to eliminate any bacteria.

Note: For California installation this water heater must be braced, anchored, or strapped to avoid falling or moving during an earthquake. See instructions for correct installation procedures. Instructions may be obtained from the DSA Headquarters Office: 1102 Q Street, Suite 5100, Sacramento CA 95811.

THIS WATER HEATER MUST BE INSTALLED INDOORS OUT OF THE WIND AND WEATHER.

THIS WATER HEATER MUST NOT BE INSTALLED IN ANY LOCATION WHERE GASOLINE OR FLAMMABLE VAPORS ARE LIKELY TO BE PRESENT, UNLESS THE INSTALLATION IS SUCH TO ELIMINATE THE PROBABLE IGNITION OF GASOLINE OR FLAMMABLE VAPORS.

Unpacking

1. Inspect carefully for any signs of damage.
2. All equipment is carefully manufactured, inspected and packed.
3. Any claims for damage or shortage in shipment must be filed immediately with the shipper and noted on the Bill of Lading.
4. Remove all venting components from the combustion assembly compartment by removing the latches.

NOTICE

The vent terminals and the condensate elbow that is supplied with this water heater are stored at the top in the Combustion Assembly Compartment. To access the vent terminals and condensate elbow, unlatch the top lid and remove parts. Be sure to replace the top and relatch.

Locate Water Heater

1. Locate water heater in front of final position before removing crate.
2. **LOCATE** so that venting connections will be short and direct.
3. **THIS WATER HEATER IS SUITABLE FOR INSTALLATION ON COMBUSTIBLE FLOOR.** Do not install this water heater directly on carpeting. If the water heater is to be installed on carpeting, it must be installed on top of a metal or wood panel extending beyond the full width and depth of the appliance by at least three 3 in *(7.6 cm)* in any direction or, if the appliance is to be installed in an alcove or closet, the entire floor must be covered by the panel.
4. **FOR BASEMENT INSTALLATION,** provide a solid level elevated base such as concrete or other suitable pad to raise the water heater at least 3 in to provide a slope of 1/8 in to 1/4 in/ft *(.32 to .64 cm/m)* for the condensate line to a suitable drain.
5. Minimum clearance to combustible material is 0 in *(0 cm)* for the Top, Sides, and Rear of this water heater. However, it is recommended that **at least 18 in *(45.8 cm)* from the Top, 24 in *(61 cm)* from the Front, 4 in *(10.2 cm)* for the Left Side and Rear, and 12 in *(30.5 cm)* from the Right Side Exhaust Elbow of the water heater be provided for servicing.** Clearance for servicing may be reduced down to minimum clearance to combustible material, but service time and effort may be greatly increased.

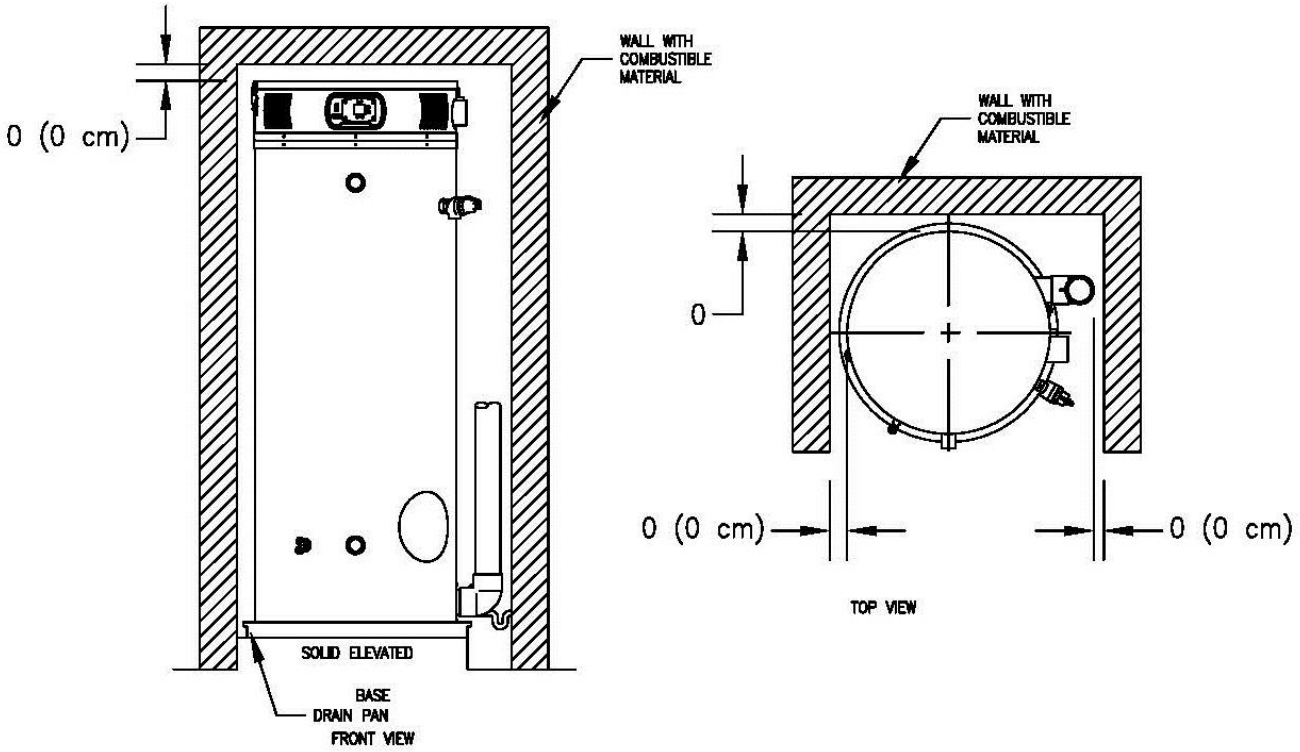


Figure 3a - Minimum Clearance To Combustible Material

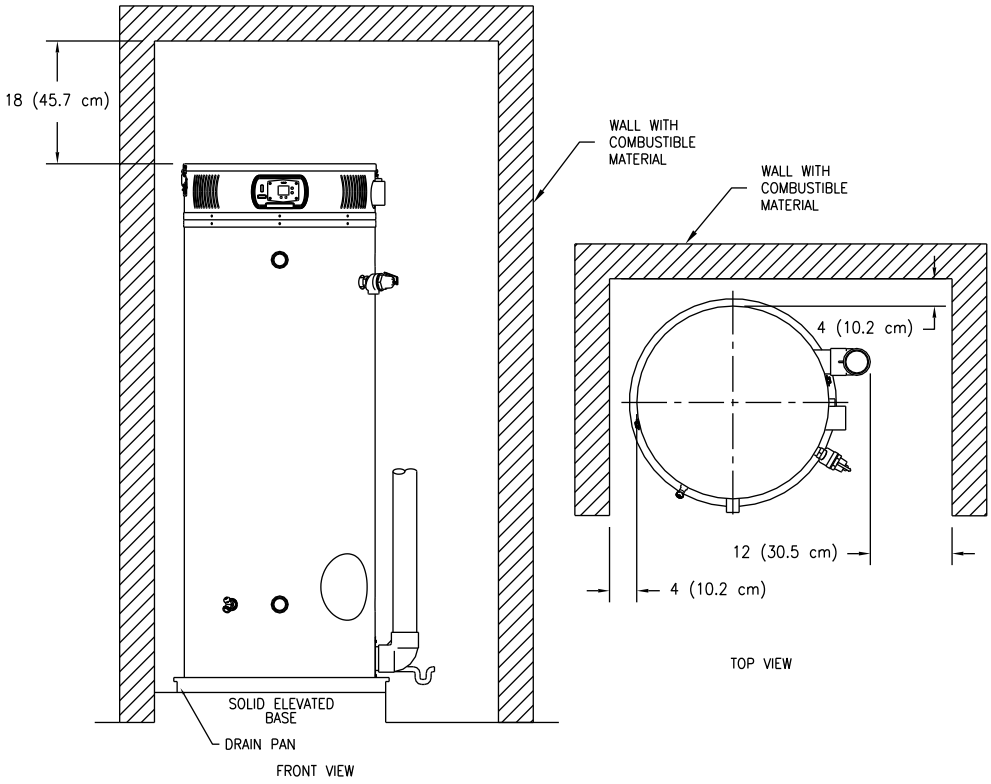


Figure 3b - Recommended Minimum Clearances For Service Access

Remove Crate

1. Remove all banding and pry off crate sides carefully so as to NOT damage the water heater.
2. Carefully roll/lift the water heater from the crate base.

⚠ CAUTION

DO NOT drop water heater. **DO NOT** bump water heater jacket against floor.

DO NOT bump exhaust vent pipe against crate or other objects. This will damage the heater and cause it to be inoperable or create nuisance problems.

Move Water Heater To Permanent Position

1. Move the water heater to permanent position by sliding or walking.
2. Place drain pan underneath water heater.

Install Temperature And Pressure Relief Valve (if not already installed)

⚠ DANGER

Temperature setting should not exceed safe temperature at fixtures. See water temperature control warning in Section V: Water Connections (page 15). If higher preheat temperatures are necessary to obtain adequate booster output, add an ASSE approved mixing device for hot water supplied to fixtures.

⚠ WARNING

Temperature and pressure relief valve discharge piping must be piped near floor to eliminate potential of severe burns. DO NOT pipe in any area where freezing could occur. DO NOT install any shut-off valves, plugs or caps to the temperature and pressure relief valve or piping.

⚠ CAUTION

If the building cold water supply has a back-flow preventer, check valve or water meter with check valve, provisions for thermal expansion of water in the hot water system must be provided.

Location

⚠ WARNING

KEEP APPLIANCE AREA CLEAR AND FREE OF COMBUSTIBLE MATERIALS, GASOLINE AND OTHER FLAMMABLE VAPORS AND LIQUIDS.

This water heater must be located in an area where the general public does **NOT** have access to set temperatures.

Air Requirements

1. **Do NOT** obstruct the flow of combustion and ventilating air.
2. For safe operation, adequate air is needed for combustion and ventilation. Sooting may result in serious damage to the water heater and risk of fire or explosion. It can also create a risk of asphyxiation. Such a condition will often result in a yellow, luminous burner flame, causing carboning or sooting of the combustion chamber, burner, and flue tubes.

Mechanical Exhausting Of Room Air

⚠ WARNING

Where an exhaust fan is installed in the same room with this water heater and combustion air is drawn from inside the room, sufficient openings for air must be provided in the walls. UNDERSIZED OPENINGS WILL CAUSE AIR TO BE DRAWN INTO THE ROOM THROUGH THE WATER HEATER'S VENTING SYSTEM, CAUSING POOR COMBUSTION THAT MAY BE HAZARDOUS TO LIFE. SOOTING MAY RESULT IN SERIOUS DAMAGE TO THE WATER HEATER AND RISK OF FIRE OR EXPLOSION, WHICH CAN ALSO CREATE A RISK OF ASPHYXIATION. Refer to local codes and /or National Fuel Gas Code for proper air opening sizing.

Unconfined Spaces
In unconfined spaces in buildings, infiltration may be adequate to provide air for combustion, ventilation, and dilution of flue gases. However, in buildings of tight construction (heavily insulated, weather stripping, caulked, vapor barrier, etc.) additional air may need to be provided using the methods described below.

Confined Spaces
Confined spaces are spaces defined as having less than 50 ft^3/1,000 BTU/hr *(4.8 m^3/kW)* of input.

All Air from Inside the Building: The confined space must be provided with two permanent openings communicating directly with an additional room(s) of sufficient volume, so that the combined volume of all spaces meets the criteria for an unconfined space. The total input of all gas utilization equipment installed in the combined space must be considered in making this determination.

Each opening must have a minimum free area of 1 in^2/1000 BTU/hr *(2200 mm^2/kW)* of the total input rating of all gas utilization equipment in the confined space, but not less than 100 $in.^2$ *(0.06 m^2)*. One opening must be within 12 in. *(31 cm)* of the top and one within 12 in. *(31 cm)* of the bottom of the enclosure.

All Air from Outdoors: Provide two permanent openings, one commencing within 12 in. *(31 cm)* of the top and one commencing within 12 in. *(31 cm)* from the bottom of the enclosure. The openings must communicate directly or by ducts with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors.

1. When communicating with the outdoors through vertical ducts, each opening must have a minimum free area of 1 in^2/4000 BTU/hr *(550 mm^2/kW)* of total input rating of all equipment in the enclosure.
2. When communicating with the outdoors through horizontal ducts, each opening must have a minimum free area of 1 in^2/2000 BTU/hr *(1100 mm^2/kW)* of total input rating of all equipment in the enclosure.
3. When ducts are used, they must be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts cannot be less than 3 in *(8 cm).*

Provide one permanent opening, commencing within 12 in *(31 cm)* of the top of the enclosure. The appliance must have clearance of at least 1 in *(3 cm)* from the sides and back and 6 in *(16 cm)* from the front of the appliance. The opening must communicate directly or by ducts with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors and has a minimum free area of the following:

1. 1 in^2/3000 BTU/hr *(700 mm^2/kW)* of the total input rating of all appliances located in the enclosure.
2. Not less than the sum of the areas of all vent connectors in the space.

Specially Engineered Installations
The requirements noted under Confined Spaces above will not necessarily govern when special engineering, approved by the authority having jurisdiction, provides an adequate supply of air for combustion, ventilation, and dilution of flue gases.

Chemical Vapor Corrosion

Corrosion of the flue ways and vent system will occur if air for combustion contains certain chemical vapors. Such corrosion may result in poor combustion and create a risk of asphyxiation, as well as reducing the life of the water heater. Spray can propellants, cleaning solvents, refrigerator and air conditioning refrigerants, swimming pool chemicals, calcium and sodium chloride, waxes and process chemicals are corrosive. Products of this sort should not be stored near the water heater or outside by the air intake (if applicable).

Typical Installation Illustration

⚠ CAUTION

If the building cold water supply has a back-flow preventer, check valve or water meter with check valve provisions for thermal expansion of water in the hot water system must be provided.

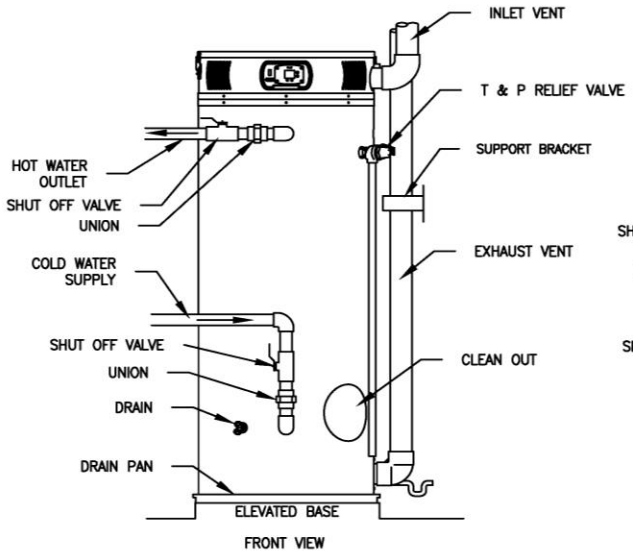


Figure 4 - Typical Front Inlet Connection

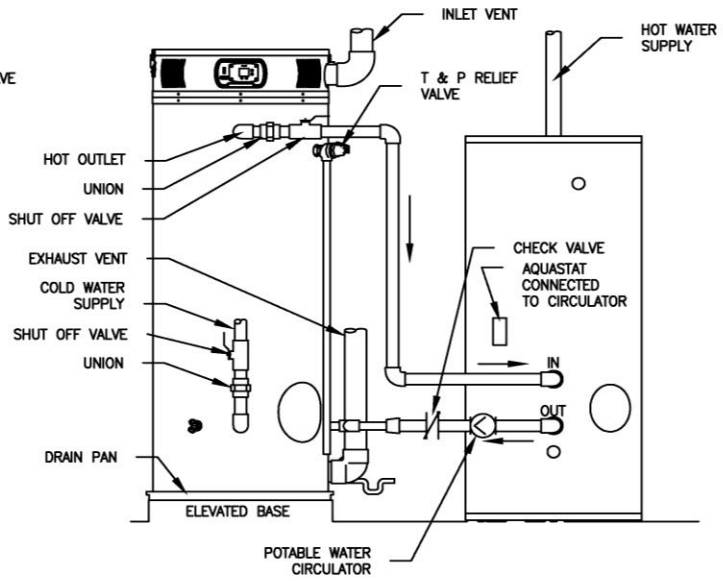


Figure 5 - Typical Front Inlet Connect with Storage Heater

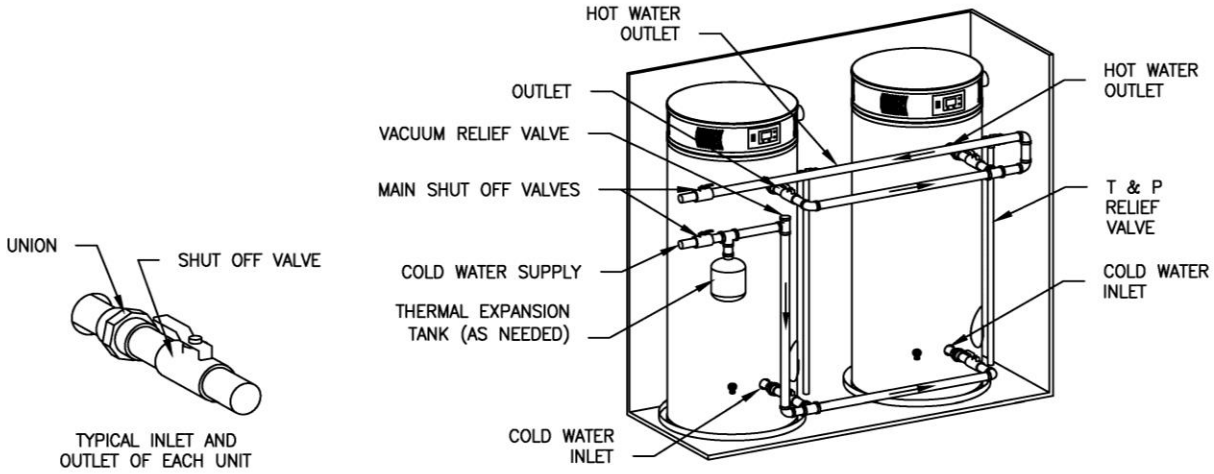


Figure 6 - Typical Two Water Heater Connection

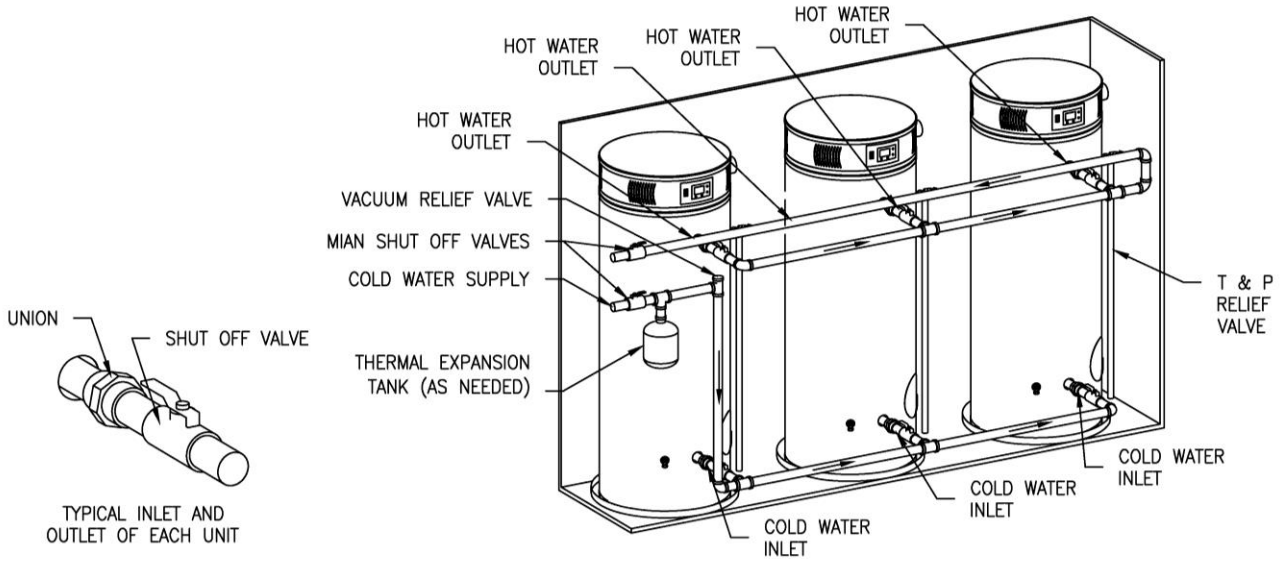


Figure 7 - Typical Three Water Heater Connection

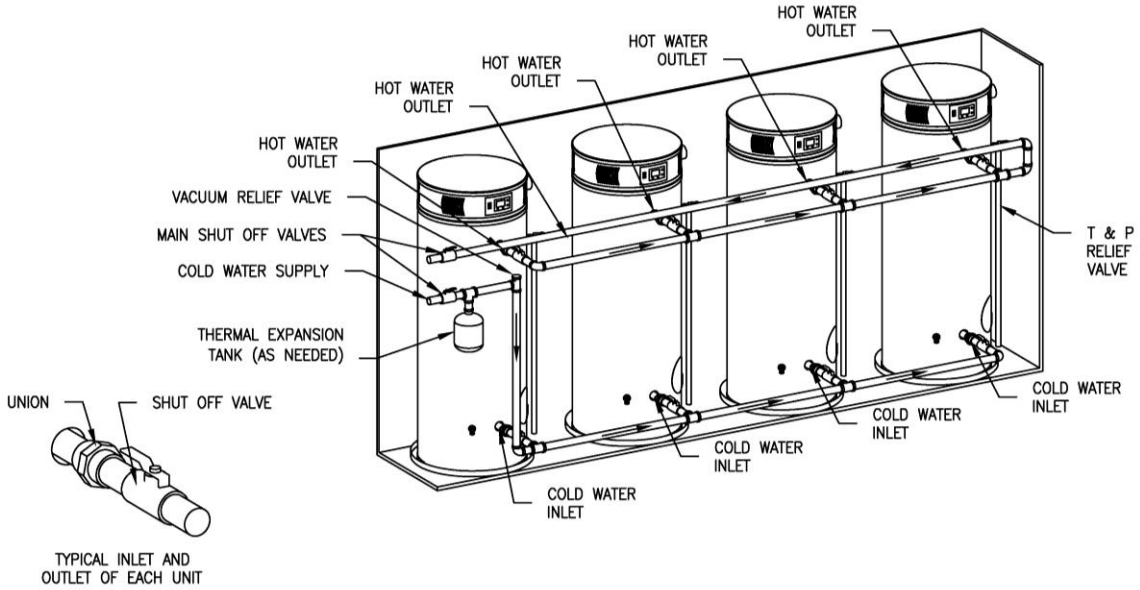


Figure 8 - Typical Four Water Heater Connection

SECTION V: WATER CONNECTIONS

⚠ WARNING

Failure to install and maintain a new, listed temperature and pressure relief valve will release the manufacturer from any claim, which might result from excessive temperature and pressures.

Hydrogen gas can be produced in an operating water heater that has not had water drawn from the tank for a long period of time (generally two weeks or more). **HYDROGEN GAS IS EXTREMELY FLAMMABLE.** To prevent the possibility of injury under these conditions, we recommend the hot water faucet to be open for several minutes at the kitchen sink before you use any electrical appliance, which is connected to the hot water system. If hydrogen is present, there will be an unusual sound such as air escaping through the pipes as hot water begins to flow. **DO NOT** smoke or have open flame near the faucet at the time it is open.

Keep clear of the combination temperature and pressure relief valve discharge line outlet. The discharge may be hot enough to cause scald injury. The water is under pressure and may splash.

⚠ CAUTION

If sweat fittings are to be used, **DO NOT** apply heat to the nipples in front or side of the water heater. Sweat the tubing to the adapter before fitting the adapter to the water connections. It is imperative that heat is not applied to the nipples containing a plastic liner.

Instructions for Connections

1. **BEFORE PROCEEDING WITH THE INSTALLATION, CLOSE THE MAIN WATER SUPPLY VALVE.** After shutting OFF the main water supply, open a faucet to relieve the water line pressure to prevent any water from leaking out of the pipes while making the water connections to the water heater. The COLD water inlet and HOT water outlet are identified on the water heater. Make the proper plumbing connections between the water heater and the plumbing system to the house. Install a shut-off valve in the cold water supply line.

2. If this water heater is installed in a closed water supply system, such as the one having a back-flow preventer in the cold water supply, provisions must be made to control thermal expansion. **Do NOT** operate this water heater in a closed system without provisions for controlling thermal expansion. Warranties **do NOT** cover damages from thermal expansion such as pressure bulges and/or deformities. Your water supplier or local plumbing inspector should be contacted on how to control this situation.

3. After installation of the water lines, open the main water supply valve and fill the water heater. While the water heater is filling, open several hot water faucets to allow air to escape from the water system. When a steady stream of water flows through the faucets, close them and check all water connections for possible leaks.

4. **Never operate the water heater without first being certain it is filled with water.**

Scalding

This water heater can deliver scalding temperature water at any faucet in the system. Be careful whenever using hot water to avoid scalding injury. Certain appliances such as dishwashers and automatic clothes washers may require increased temperature water. By setting the thermostat on this water heater to obtain the increased temperature water required by these appliances, you might create the potential for scald injury. To protect against injury, you should install an ASSE approved mixing valve in the water system. This valve will reduce point of discharge temperature by mixing cold and hot water in branch supply lines. Such valves are available from the local plumbing supplier. The following chart details the relationship of water temperature and time with regard to scald injury and may be used as a guide in determining the safest water temperature for your applications.

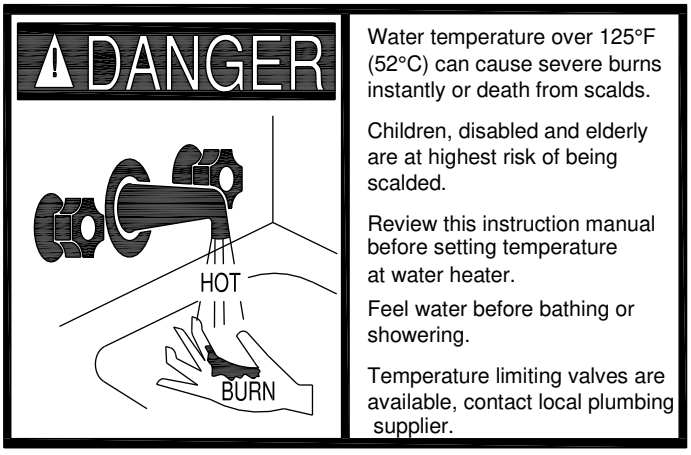


Table 2 Approximate Time/Temperature Scald Chart

APPROXIMATE TIME/TEMPERATURE RELATIONSHIPS IN SCALDS	
120°F *(49°C)*	More than 5 minutes
125°F *(52°C)*	1½ to 2 minutes
130°F *(54°C)*	About 30 seconds
135°F *(57°C)*	About 10 seconds
140°F *(60°C)*	Less than 5 seconds
145°F (*63°C*)	Less than 3 seconds
150°F *(66°C)*	About 1½ seconds
155°F *(68°C)*	About 1 second

Alternate Space Heating Water Connections

⚠ DANGER

Toxic chemical, such as those used for boiler treatment, must **NOT** be introduced into potable water used for space heating.

This water heater must **not** be connected to an existing heating system or component(s) previously used with a non-potable water heating appliance.

All piping components connected to this water heater for space heating applications must be suitable for use with potable water.

⚠ WARNING

When the system requires water for space heating at temperatures higher than required for other uses, a means such as an ASSE approved mixing valve shall be installed to temper the water for those uses in order to reduce scald hazard potential.

Failure to properly pipe this water heater may result in improper operation and damage to the water heater or structure.

Oxygen contamination of this water heater will cause corrosion of iron and steel components and can lead to water heater failure.

Connect the system supply and return piping to the water heater.

Refer to Figure 9 and Figure 10 for installation examples. Maintain a minimum 1/2 in clearance from hot water piping to combustible materials.

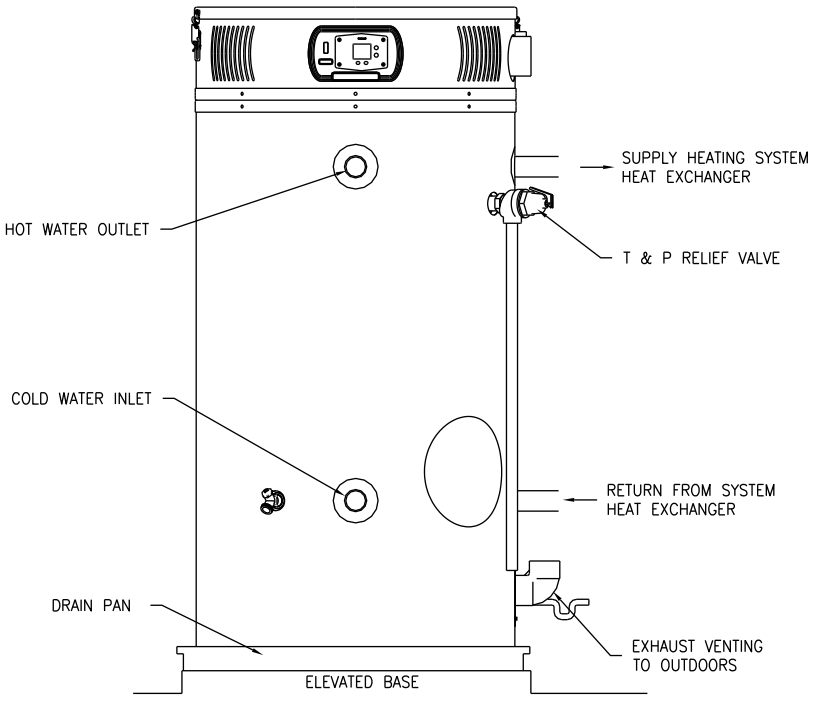


Figure 9 - Alternate Space Heating Connections

Water Connections continued-

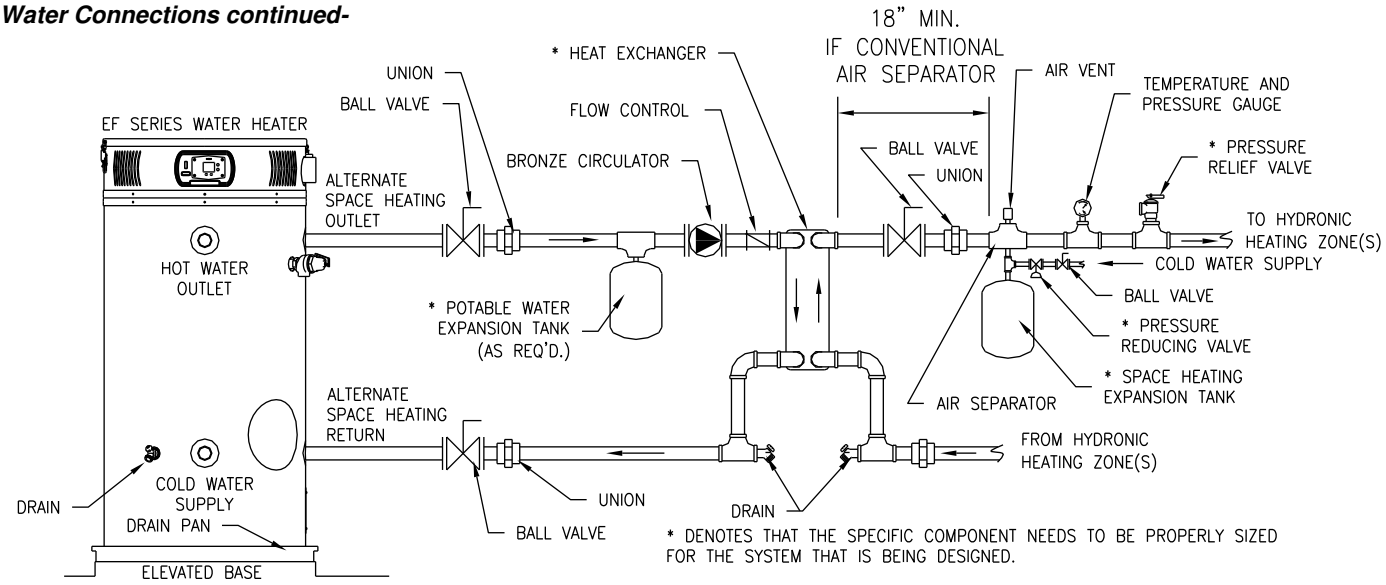


Figure 10 - Typical Plumbing Schematic for Zoned Heating

SECTION VI: VENTING

This water heater has a certified category IV, per latest ANSI Z 21.10.3-2015.CSA 4.3-2015 revision. Refer to the latest edition of the National Fuel Gas Code (ANSI Z223.1-latest edition), or in Canada, the Natural Gas and Propane installation Code (B149.1-00 latest edition).

⚠ WARNING
The vent system must be properly installed. Failure to properly install the vent system could result in property damage, personal injury, or death.
DO NOT install damaged venting system components. If damage is evident then please contact the supplier where the water heater was purchased, or the manufacturer listed on the rating plate for replacement parts.
Use only the vent terminals provided or factory authorized terminals for venting this water heater.
The water heater requires its own separate venting system. **DO NOT** connect the exhaust vent into an existing vent pipe or chimney.
All of the exhaust venting connections must be leak checked with a soap solution upon initial start-up of the water heater. Any leaks must be repaired before continuing operation of the water heater.
DO NOT terminate the venting where noise from the exhaust or intake will be objectionable. This includes locations close to or across from windows and doors. Avoid anchoring the vent and intake pipes directly to framed walls, floors, or ceilings unless rubber isolation pipe hangers are used. This prevents any vibrations from being transmitted into the living spaces.
DO NOT exceed the venting distances or the number of elbows listed in this manual. Exceeding the maximum venting distances may cause the water heater to malfunction or cause an unsafe condition.
DO NOT operate this water heater until the venting installation is complete and the piping completed. Failure to complete installation before operation can result in property damage, personal injury, or death.

⚠ WARNING
Risk of carbon monoxide poisoning or fire due to joint separation or pipe breakage.
This water heater must be properly vented and connected to an approved vent system in good condition. **DO NOT** operate water heater with the absence of an approved vent system. A clean and unobstructed vent system is necessary to allow noxious fumes that could cause injury or loss of life to vent safely and will contribute toward maintaining the water heater's efficiency. The acceptance of the venting system is dependent upon full compliance with these installation instructions.
Venting system must **NOT** pass through rated fire separations.
The venting system must be free to expand and contract. **This venting system must be supported in accordance with these instructions.**

NOTICE

For installations in Canada, field supplied vent piping must comply with CAN/CGA B149.1 (latest edition) and be certified to the Standard For Type BH, Class II, 65°C, Gas Venting Systems, ULC S636. Components of this listed system shall not be interchanged with other vent systems or unlisted pipe/fittings. All components and specified primers and cements of the certified vent system must be from a single system manufacturer and not intermixed with other system manufacturer's vent system parts. The supplied vent connector and vent termination are certified under ULC S636 and are also certified as part of the water heater. Refer to the following tables for approved venting materials, primers, and cements. All approved primers and cements are to be used within their marked time limitations.

Approved Venting Materials

For installations in the US only	For installations in CANADA
• PVC DWV (ASTM D-2665) • PVC Sch. 40 (ASTM-D1785) • CPVC Sch. 40 (ASTM-F441, ASTM-D2846) • PVC and CPVC (UL 1738, ULC S636) • ABS Sch. 40 DWV (ASTM-D2661) • Polypropylene (UL 1738, ULC S636) • Stainless Steel (UL 1738, ULC S636)	• ULC S636 approved PVC for flue gas venting rated Class II, 65°C • ULC S636 approved CPVC for flue gas venting rated Class II, 65°C • ULC S636 approved Polypropylene for flue gas venting rated Class II, 65°C • Stainless Steel (ULC S636)

Approved Primers and Cements

For installations in the US only	For installations in CANADA
• PVC and CPVC Primer (ASTM-F656) • PVC Cement (ASTM D-2564) • CPVC Cement (ASTM F493) • ABS Primer and Cement (ASTM D-2235)	• ULC S636 approved Primer and Cement for flue gas venting rated Class II, 65°C

NOTICE

Use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenosulfone) in non-metallic venting systems is prohibited and covering non-metallic venting with thermal insulation is prohibited.

NOTICE

Before beginning installation of any vent pipe, read the vent pipe manufacturer's installation instructions.

DO NOT install the water heater in any location where the ambient temperature may fall below freezing. Water heater **must** be protected from freezing downdrafts during shutdown periods.

Provide protection of the building materials from degradation by flue gases from the exhaust vent terminal.

⚠ CAUTION

Check to make sure flue gases **DO NOT** recirculate into the air intake terminal when using direct venting. If the water heater is having service issues, flue recirculation may be a contributing factor. Even when the minimum vent terminal separation distances are followed, recirculation may still occur depending upon the location outside the building, the distance from other buildings, proximity to corners, weather conditions, wind patterns, and snow depth. Periodically check to make sure that flue recirculation is not occurring. Signs of flue gas recirculation include frosted or frozen intake terminals, condensate in the intake terminal and venting system, oxidation or white chalk material on the flame sensor or igniter shield. Correction to flue recirculation may involve angling the intake away from the exhaust terminal, increasing the distance between them, relocating the air intake to another side of the building, or using inside air for combustion. Check to be sure the intake and exhaust terminals are not obstructed, especially during periods of below freezing weather.

⚠CAUTION

All intake and exhaust venting components **must** have the same diameter size. **DO NOT** use a different size on the intake and exhaust venting. For 2 in or 4 in venting, use the supplied 3 in vent terminals. If a 2 in vent terminal is preferred, use 2 in terminal (p/n 239-39831-00). This terminal is available from your supplier.

Be sure the condensate runs freely to a drain and does **NOT** accumulate inside the water heater. In cold climates, precautions may need to be taken to ensure that the condensate drain does not freeze. Make sure the condensate trap or drain loop is installed to prevent flue gases from being discharged into the room.

High levels of dust and debris such as road and construction dust, insects, and tree pollen may clog the burner resulting in poor performance and damage to the water heater. Avoid air intake locations where debris can be created such as exhaust ventilation hoods, gravel parking lots, and near outdoor spotlights that attract bugs. For these installations, an air intake filter kit (p/n 239-47330-00) is available as an accessory service part from the installer of this water heater. The air intake filter kit is **NOT** designed to filter out airborne contaminants or chemicals that may damage the water heater.

⚠CAUTION

The vent shall terminate a minimum of 12 in above expected snowfall level to prevent blockage of vent termination.

The horizontal centerline of the exhaust vent terminal (if applicable) **must NOT** be located lower than the horizontal centerline of the air intake terminal if vented through the same wall.

A service drain loop must be installed in the drain tubing to serve as a condensate trap to prevent flue gases from escaping into the room.

DO NOT position the air intake above the exhaust terminal.

NEVER locate the air intake where exhaust gases can be introduced.

Venting

The venting instructions must be followed to avoid restricted combustion or recirculation of flue gases. Such conditions cause sooting or risks of fire and asphyxiation.
This water heater can be installed as either a direct vent system or power vent (air from inside) system. If it is installed as a direct vent system, then the air intake and the exhaust vent are piped to the outside. If a power vented system is used, then air is drawn from inside and only the exhaust is piped to the outside. Determine which system is best for your application and install as described in the following sections.

Direct Vent Installation

Venting may be run horizontally through an outside wall or vertically through a roof through using either 2 in *(5.1 cm),* 3 in *(7.6 cm)* or 4 in *(10.2 cm)* diameter pipe. This water heater is supplied with a screened intake elbow and exhaust coupling referred to as the air intake terminal and the exhaust vent terminal.

⚠WARNING

The 100T250, 100T300, and 100T399 models are **NOT** approved for 2 in diameter vent pipe. Venting with 2 in pipe on these models may result in damage to the water heater or cause an unsafe condition. **DO NOT** use 2 in vent or air intake pipe on 100T250/300/399 models.

Direct Vent Terminal Location

Plan the vent system layout so that proper clearances are maintained from plumbing and wiring. Before the vent is installed, determine the vent pipe termination location as shown in Figure 11.

NOTICE

The air intake and exhaust terminals may be located on separate outside walls or one terminal may exit the roof while the other is through the wall. The total combined equivalent vent length must be within the limits specified in the venting tables and the intake length cannot exceed the exhaust by more than 30 ft. The minimum recommended vent separation distance between the intake and exhaust terminals is 36 in. Local conditions may require a need for greater vent separation distances.

Venting continued-

NOTICE

If 2 in pipe is used, then use a 2 in to 3 in reducer to adapt to the 3 in vent terminal size. If a 2 in vent terminal is preferred, use 2 in terminal (p/n 239-39831-00). This terminal is available from your supplier.

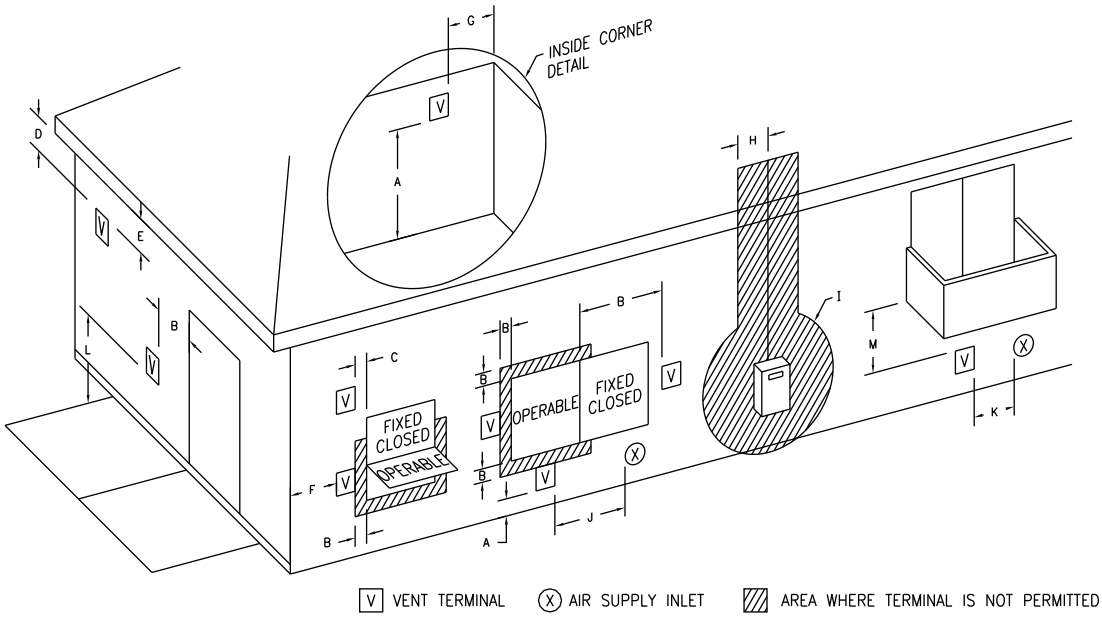


Figure 11a - Vent Terminal Clearances (Other than Direct Vent or Powered Direct Vent Installations)

		Canadian Installations[1]	US Installations[2]			Canadian Installations[1]	US Installations[2]
A=	Clearance above grade, veranda, porch, deck or balcony	12 inches *(30 cm)*	12 inches *(30 cm)*	**H=**	Clearance to each side of center line extended above meter/regulator assembly	3 feet *(91 cm)* within a height 15 feet *(4.6 m)* above the meter/regulator assembly	*b
B=	Clearance to window or door that may be opened	36 inches *(91 cm)*	4 feet *(1.2 m)* below or to the side of opening; 12 inches *(30 cm)* above opening	**I=**	Clearance to service regulator vent outlet or oil tank vent	36 inches *(91 cm)*	*b
C=	Clearance to permanently closed window	*b	*b	**J=**	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	36 inches *(91 cm)*	4 feet *(1.2 m)* below or to side of opening; 12 inches *(30 cm)* above opening.
D=	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (61 cm) from the center line of the terminal	*b	*b	**K=**	Clearance to a mechanical air supply inlet	6 feet *(1.83 m)*	3 feet *(91 cm)* above if within 10 feet horizontally
E=	Clearance to unventilated soffit	*b	*b	**L=**	Clearance above paved sidewalk or paved driveway located on public property	7 feet *(2.13 m)* †	7 feet *(2.13 m)* †
F=	Clearance to outside corner	*b	*b	**M=**	Clearance under a veranda, porch, deck, or balcony	12 inches *(30 cm)* ‡	*b
G=	Clearance to inside corner	36 inches *(91 cm)* *a	36 inches *(91 cm)* *a				

[1] In accordance with the current CAN/CGA-B149 *Installation Codes*.
[2] In accordance with the current ANSI Z223.1-(Latest Edition)/NFPA 54 *National Fuel Gas Code*.
† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single-family dwellings and serves both dwellings.
‡ Permitted only if a veranda, porch, deck or balcony is fully open on a minimum of two sides beneath the floor.
*a) A minimum clearance value determined by testing in accordance with section 2.20.
*b) "Clearance in accordance with local installation codes and the requirements of the gas supplier".

Venting continued-

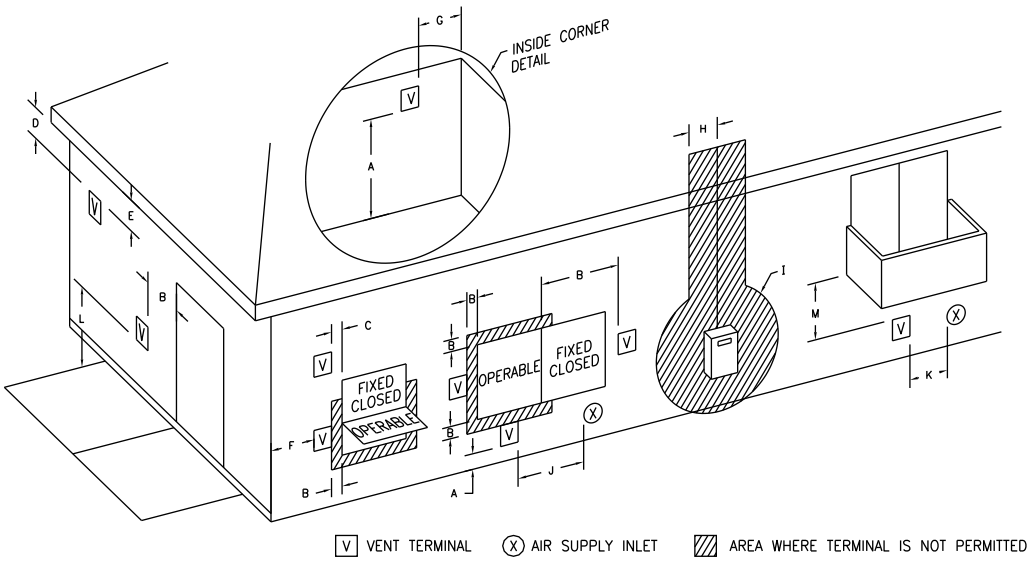


Figure 11b - Direct Vent and Powered Direct Vent Terminal Clearances

		Canadian Installations[1]	US Installations[2]			Canadian Installations[1]	US Installations[2]
A=	Clearance above grade, veranda, porch, deck or balcony	12 inches *(30 cm)*	12 inches *(30 cm)*	**H=**	Clearance to each side of center line extended above meter/regulator assembly	3 feet *(91 cm)* within a height 15 feet *(4.6 m)* above the meter/regulator assembly	*b
B=	Clearance to window or door that may be opened	36 inches *(91 cm)*	12 inches *(30 cm)*	**I=**	Clearance to service regulator vent outlet or oil tank vent	36 inches *(91 cm)*	*b
C=	Clearance to permanently closed window	*b	*b	**J=**	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	36 inches *(91 cm)*	12 inches *(30 cm)*
D=	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (61 cm) from the center line of the terminal	12 inches *(30 cm)* *a	12 inches *(30 cm)* *a	**K=**	Clearance to a mechanical air supply inlet	6 feet *(1.83 m)*	3 feet *(.91 m)* above if within 10 feet *(3.1 m)* horizontally
E=	Clearance to unventilated soffit	12 inches *(30 cm)* *a	12 inches *(30 cm)* *a	**L=**	Clearance above paved sidewalk or paved driveway located on public property	7 feet *(2.13 m)* †	*b
F=	Clearance to outside corner	*b	*b	**M=**	Clearance under a veranda, porch, deck, or balcony	12 inches *(30 cm)* ‡	12 inches *(30 cm)* ‡
G=	Clearance to inside corner	36 inches *(91 cm)* *a	36 inches *(91 cm)* *a				

[1] In accordance with the current CAN/CGA-B149 *Installation Codes*.
[2] In accordance with the current ANSI Z223.1-(Latest Edition)/NFPA 54 *National Fuel Gas Code*.
† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single-family dwellings and serves both dwellings.
‡ Permitted only if a veranda, porch, deck or balcony is fully open on a minimum of two sides beneath the floor.
*a) A minimum clearance value determined by testing in accordance with section 2.20.
*b) “Clearance in accordance with local installation codes and the requirements of the gas supplier”.

Venting continued-

The vent system must terminate so that proper clearances are maintained as cited in local codes or the latest edition of the National Fuel Gas Code, ANSI Z223.1:

1. Do not terminate near soffit vents or crawl space or other area where condensate or vapor could create a nuisance or hazard or cause property damage.
2. Do not terminate the exhaust vent terminal where condensate or vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.
3. Do not terminate the exhaust vent terminal over public area or walkways where condensate or vapor can cause nuisance or hazard.
4. The vent shall terminate a minimum of 12 in above expected snowfall level to prevent blockage of vent termination.
5. The manufacturer requires the centerline distances between the air intake and exhaust vent terminals to be a **minimum** of 36 in *(91.4 cm)* apart and the exhaust terminal must extend 6 in *(15.2 cm)* past the air intake terminal.

Vent pipes serving power vented appliances are classified by building codes as "vent connectors". Required clearances from combustible materials must be provided in accordance with information in this manual under LOCATION OF WATER HEATER and CLEARANCES, and with National Fuel Gas Code and local codes.

Clearance to combustibles for all venting pipes and terminals	
For installations in the US 0" minimum	**For installations in the CANADA** Refer to vent pipe and terminal manufacturer's installation instructions for clearances to combustibles.
DO NOT place insulation or other materials in the required clearance spaces between the venting to combustible material unless otherwise specified.	

Horizontal Installation

In a horizontal application, it is important that condensate not be allowed to buildup in the exhaust vent pipe. To prevent this from happening, the pipe should be installed with a slight upward slope so the condensate will run back toward the water heater. The vent system **must be** supported every 5 ft of vertical run and every 3 ft of horizontal run of vent pipe length.

⚠CAUTION

Failure to properly support the vent piping with hangers and clamps may result in damage to the water heater or venting system.

Stress levels in the pipe and fittings can be significantly increased by improper installation. If rigid pipe clamps are used to hold the pipe in place, or if the pipe cannot move freely through a wall penetration, the pipe may be directly stressed, or high thermal stresses may be formed when the pipe heats up and expands. Install accordingly to minimize such stresses.

Follow the following procedure for direct venting through the wall:

1. Cut two 2 1/2 in *(6.4 cm)* diameter holes for 2 in *(5.1 cm)* diameter pipe, two 3 1/2 in *(8.9 cm)* diameter holes (for 3 in *(7.6 cm)* diameter pipe), two 4 1/2 in *(11.4 cm)* diameter holes (for 4 in (*10.2 cm*) diameter pipe), or two 6 5/8 in (*15.5 cm*) diameter holes (for 6 in *(15.2 cm)* diameter pipe) in the wall with the centerline hole distances at least 36 in *(91.4 cm)* apart in the location where the exhaust vent and air intake terminals will exit the outside wall if vented on the same wall.

2. Use the proper cement to secure the exhaust vent and air intake terminals provided with the water heater to the pipes. The distance between the back edge of the exhaust vent terminal and the exterior wall (see Figure 12) must be 6 in *(15.2 cm)* more for the exhaust vent terminal than the air intake terminal. Use the proper cement or sealant and assembly procedures to secure the vent connector joints between the terminal and the blower outlet. Provide support brackets for every 3 ft *(.92 m)* of horizontal vent beyond the intake terminal.

Venting continued-

WARNING! DO NOT USE 2" VENT WITH 100T250/300/399 MODELS

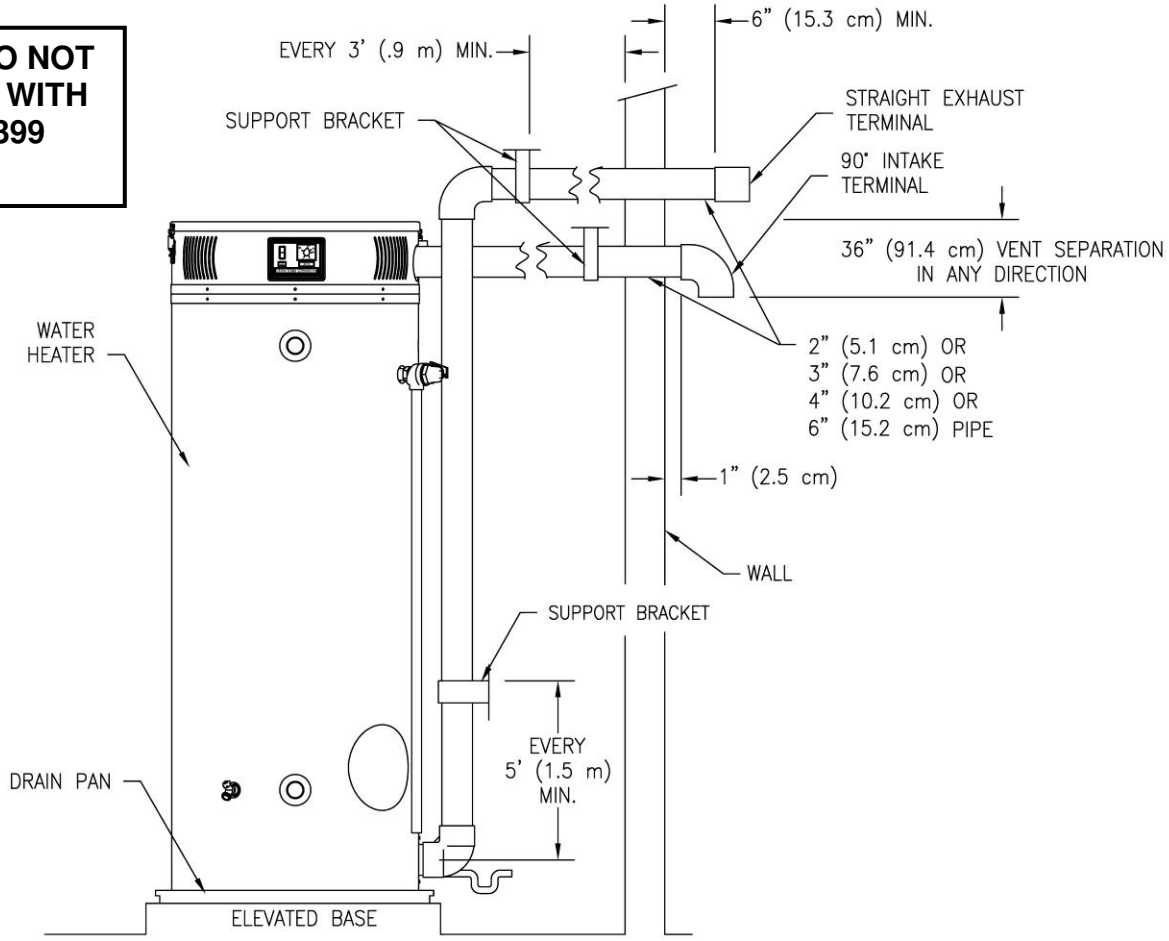


Figure 12 - Typical Horizontal Direct Vent System

Vertical Installation

Vertical venting system **must be** supported every 5 ft of vertical run and every 3 ft of horizontal run of vent pipe length.

⚠CAUTION

Failure to properly support the vent piping with hangers and clamps may result in damage to the water heater or venting system.

Stress levels in the pipe and fittings can be significantly increased by improper installation. If rigid pipe clamps are used to hold the pipe in place, or if the pipe cannot move freely through a wall penetration, the pipe may be directly stressed, or high thermal stresses may be formed when the pipe heats up and expands. Install accordingly to minimize such stresses.

Follow the following procedure for direct venting through the roof:

1. Cut the necessary holes through the roof and ceiling. Cut two 2 3/8 in *(6 cm)* diameter holes for 2 in *(5.1 cm)* diameter pipe, two 3 1/2 in *(8.9 cm)* diameter holes (for 3 in (*7.6 cm*) diameter pipe), two 4 1/2 in *(11.4 cm)* diameter holes (for 4 in (*10.2 cm*) diameter pipe), or 6 5/8 in (*15.5 cm*) diameter holes (for 6 in (*15.2 cm*) diameter pipe) in the ceiling and roof.
2. Install the exhaust vent and air intake plastic pipes as shown in Figure 13. Make sure that the installation meets the local codes and/or The National Fuel Gas Code ANSI Z223.1 (Latest Edition) or CGA/CAN B149 Installation Code.

Venting continued-

WARNING! DO NOT USE 2" VENT WITH 100T250/300/399 MODELS

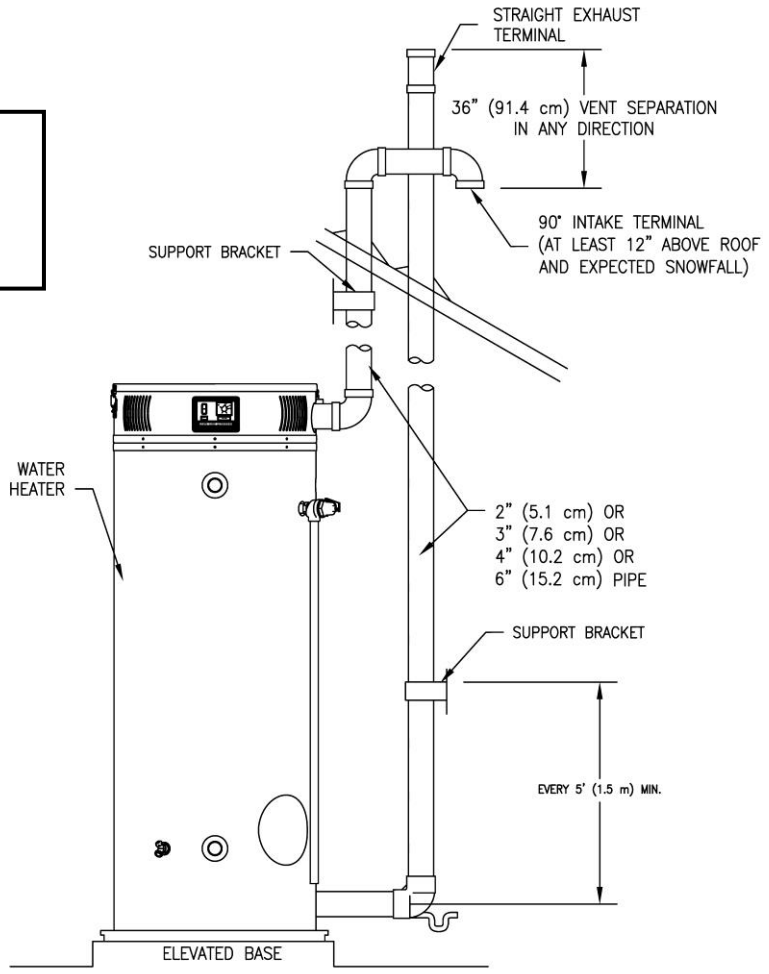


Figure 13 - Typical Vertical Direct Vent System Installation
(Note: Intake and exhaust terminals may be on different outside walls.)

Through the Wall Venting with Low Ground Clearance:

When venting cannot exit through the wall at a height greater than or equal to 12 in *(30.5 cm)* (and above expected snow level) from the ground, then the installation must be modified as shown below (see Figure 14). Refer to Tables 3 or 4 for maximum venting lengths using 2 in *(5.1 cm),* 3 in *(7.6 cm),* 4 in *(10.2 cm),* or 6 in *(15.2 cm)* diameter plastic pipe.

WARNING! DO NOT USE 2" VENT WITH 100T250/300/399 MODELS

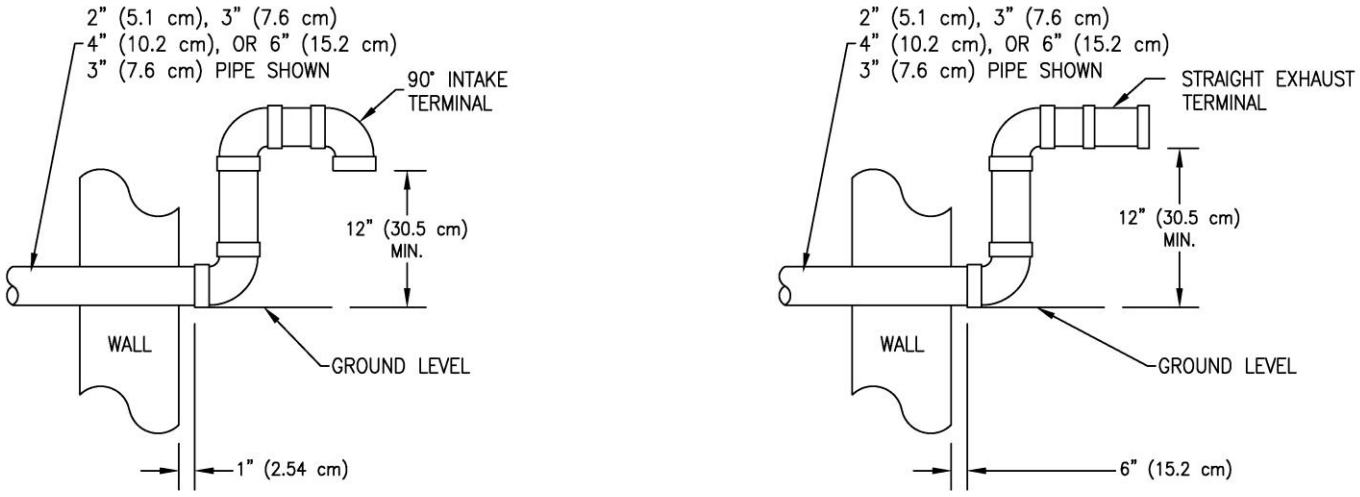


Figure 14 - Vent Terminal (Low Ground Clearance)

Maximum Vent Length

Table 3 - Maximum Vent Length (Combined Maximum Length for Intake and Exhaust)

	60T-125		60T-150 100T-150		60T-199 100T-199	
2" Vent Pipe	**Power Direct Vent**	**Power Vent**	**Power Direct Vent**	**Power Vent**	**Power Direct Vent**	**Power Vent**
Max. Intake Length	15 ft (4.5 m)	N/A	15 ft (4.5 m)	N/A	15 ft (4.5 m)	N/A
Max. Exhaust Length	15 ft (4.5 m)	15 ft (4.5 m)	15 ft (4.5 m)	15 ft (4.5 m)	15 ft (4.5 m)	15 ft (4.5 m)

	60T-125 100T-150		60T-150 100T-199		60T-199 100T-250		100T-300		100T-399	
3" Vent Pipe	**Power Direct Vent**	**Power Vent**	**Power Direct Vent**	**Power Vent**	**Power Direct Vent**	**Power Vent**	**Power Direct Vent**	**Power Vent**	**Power Direct Vent**	**Power Vent**
Max. Intake Length	60 ft (18.3 m)	N/A	50 ft (15.2 m)	N/A	40 ft (12.2 m)	N/A	30 ft (9.2 m)	N/A	25 ft (7.6 m)	N/A
Max. Exhaust Length	60 ft (18.3 m)	60 ft (18.3 m)	50 ft (15.2 m)	50 ft (15.2 m)	40 ft (12.2 m)	40 ft (12.2 m)	30 ft (9.2 m)	30 ft (9.2 m)	25 ft (7.6 m)	25 ft (7.6 m)
4" Vent Pipe	**Power Direct Vent**	**Power Vent**	**Power Direct Vent**	**Power Vent**	**Power Direct Vent**	**Power Vent**	**Power Direct Vent**	**Power Vent**	**Power Direct Vent**	**Power Vent**
Max. Intake Length	85 ft (25.9 m)	N/A	75 ft (22.8 m)	N/A	65 (19.8 m)	N/A	55 (16.7 m)	N/A	50 ft (15.2 m)	N/A
Max. Exhaust Length	85 ft (25.9 m)	85 ft (25.9 m)	75 ft (22.8 m)	75 ft (22.8 m)	65 (19.8 m)	65 (19.8 m)	55 (16.7 m)	55 (16.7 m)	50 ft (15.2 m)	50 ft (15.2 m)

	60T-125		60T-150		60T-199		100T-150	
6" Vent Pipe	**Power Direct Vent**	**Power Vent**	**Power Direct Vent**	**Power Vent**	**Power Direct Vent**	**Power Vent**	**Power Direct Vent**	**Power Vent**
Max. Intake Length	85 (25.9 m)	N/A	75 (22.8 m)	N/A	67.5 (20.6 m)	N/A	85 (25.9 m)	N/A
Max. Exhaust Length	85 (25.9 m)	120 (36.6 m)	75 (22.8 m)	150 (45.7 m)	67.5 (20.6 m)	135 (41.1 m)	85 (25.9 m)	170 (51.8 m)
	100T-199		**100T-250**		**100T-300**		**100T-399**	
6" Vent Pipe	**Power Direct Vent**	**Power Vent**	**Power Direct Vent**	**Power Vent**	**Power Direct Vent**	**Power Vent**	**Power Direct Vent**	**Power Vent**
Max. Intake Length	75 (22.8 m)	N/A	65 (19.8 m)	N/A	60 (18.3 m)	N/A	120 ft (36.6 m)	N/A
Max. Exhaust Length	75 (22.8 m)	150 (45.7 m)	65 (19.8 m)	130 (39.6 m)	60 (18.3 m)	120 (36.6 m)	120 ft (36.6 m)	120 ft (73.2 m)

⚠WARNING

The 100T250, 100T300, and 100T399 models are not approved for 2 in diameter vent pipe. Venting with 2 in pipe on these models may result in damage to the water heater or cause an unsafe condition. DO NOT use 2 in vent or air intake pipe on 100T250/300/399 models.

Note: The venting distance shown in the chart above is the combined maximum distance for the intake and exhaust pipe and elbows. The intake and exhaust vent terminals may be in different locations (i.e., different walls or one wall, one roof) provided the intake equivalent venting distance does not exceed the exhaust by more than 30 ft.

Determining Required Vent Length

1. Determine the total length of straight vent pipe (in feet) required for both the intake and the exhaust.
2. Add 5 ft of venting for every 90° elbow.
3. Add 2 1/2 ft of venting for every 45° elbow.
4. **Total vent length cannot exceed "Max Vent Length" in Table 3.**
5. **Air intake cannot exceed exhaust by more than 30 ft in any venting situation.**

Example of Total Direct Vent Length for 100T199

A 3 in venting system has a total of six 90° elbows and a total straight pipe length of 65 ft (includes both intake and exhaust pipe). Equivalent vent length for elbows: 6 x 5 ft = 30 ft. **Total equivalent vent distance = 65 ft + 30 ft = 95 ft total equivalent vent length. This is below the maximum allowed distance of 100 ft for this model using 3 in vent.**

Example Of Total Vent Length For 100T199 With A Power Vented Installation

A 3 in venting system has a total of six 90° elbows and a total straight pipe length of 55 ft. Equivalent vent length for elbows: 6 x 5 ft = 30 ft. **Total equivalent vent distance = 55 ft + 30 ft = 85 ft total equivalent vent length. This is below the maximum allowed distance of 100 ft for this model using 3 in vent.**

NOTICE
DO NOT include the 3 in condensate elbow or vent terminals in determining maximum vent length.

Power Vent Installation

Power venting is where the indoor air is used and the exhaust is vented to the outside. Venting may be run horizontally through an outside wall or vertically through a roof through using either 2 in *(5.1 cm),* 3 in *(7.6 cm),* 4 in *(10.2 cm),* or 6 in *(15.2 cm)* diameter pipe. This water heater is supplied with a 3 in *(7.6 cm)* diameter screened intake elbow and exhaust coupling referred to as the air intake terminal and the exhaust vent terminal.

Power Vent Terminal Location

Refer to the "Direct Vent Terminal Location" section previously mentioned to determine the proper exhaust vent location. Plan the vent system layout so that proper clearances are maintained from plumbing and wiring. Vent pipes serving power vented appliances are classified by building codes as "vent connectors". Required clearances from combustible materials must be provided in accordance with information in this manual under LOCATION OF WATER HEATER, and CLEARANCES, and with National Fuel Gas Code and local codes.

Clearance to combustibles for all venting pipes and terminals	
For installations in the US 0" minimum	**For installations in the CANADA** Refer to vent pipe and terminal manufacturer's installation instructions for clearances to combustibles.
DO NOT place insulation or other materials in the required clearance spaces between the venting to combustible material unless otherwise specified.	

Horizontal Installation

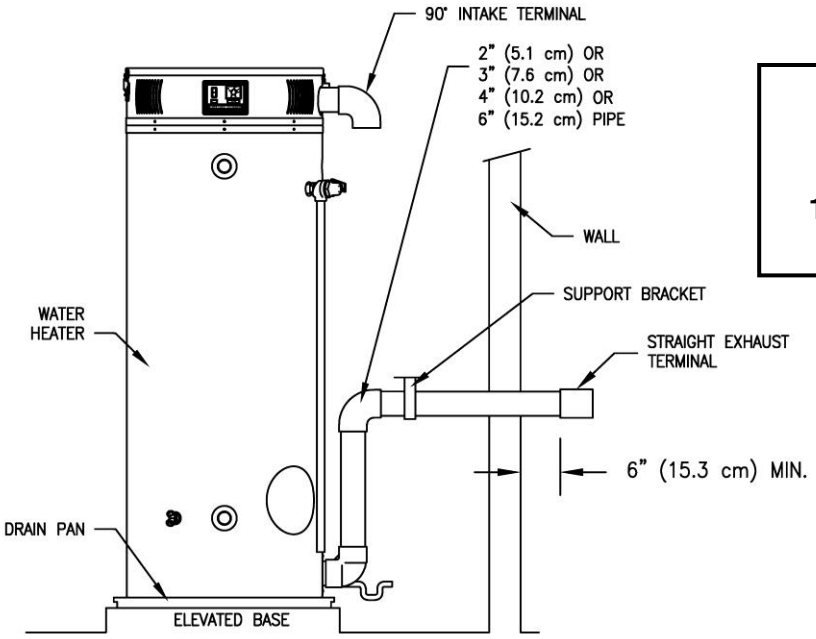
In a horizontal application, it is important that condensate not be allowed to buildup in the exhaust vent pipe. To prevent this from happening, the pipe should be installed with a slight upward slope of 1/4 in/ft. The vent system **must be** supported every 5 ft of vertical run and every 3 ft of horizontal run of vent pipe length.

⚠ CAUTION
Failure to properly support the vent piping with hangers and clamps may result in damage to the water heater or venting system.

Stress levels in the pipe and fittings can be significantly increased by improper installation. If rigid pipe clamps are used to hold the pipe in place, or if the pipe cannot move freely through a wall penetration, the pipe may be directly stressed, or high thermal stresses may be formed when the pipe heats up and expands. Install accordingly to minimize such stresses.

Follow the following procedure to vent through the wall:

1. Cut one 2 3/8 in *(6 cm),* diameter hole (for 2 in *(5.1 cm)* diameter pipe), one 3 1/2 in *(8.9 cm)* diameter hole (for 3 in *(7.6 cm)* diameter pipe) one 4 1/2 in *(11.5 cm)* diameter hole (for 4 in *(10.2 cm)* diameter pipe) or one 6 5/8 in *(15.5 cm)* diameter hole (for 6 in *(15.5 cm)* diameter pipe).
2. Use the proper cement or sealant to secure the exhaust vent terminal provided with the water heater to the plastic pipes. The distance between the back edge of the exhaust vent terminal and the exterior wall (see Figure 15) must be 6 in *(15.2 cm).* Use the proper cement and assembly procedures to secure the vent connector joints between the terminal and the blower outlet. Provide support brackets for every 3 ft *(1 m)* of horizontal vent.



WARNING!
DO NOT USE
2" VENT WITH
100T250/300/399
MODELS

Figure 15 - Typical Horizontal Power Vent System

Vertical Installation

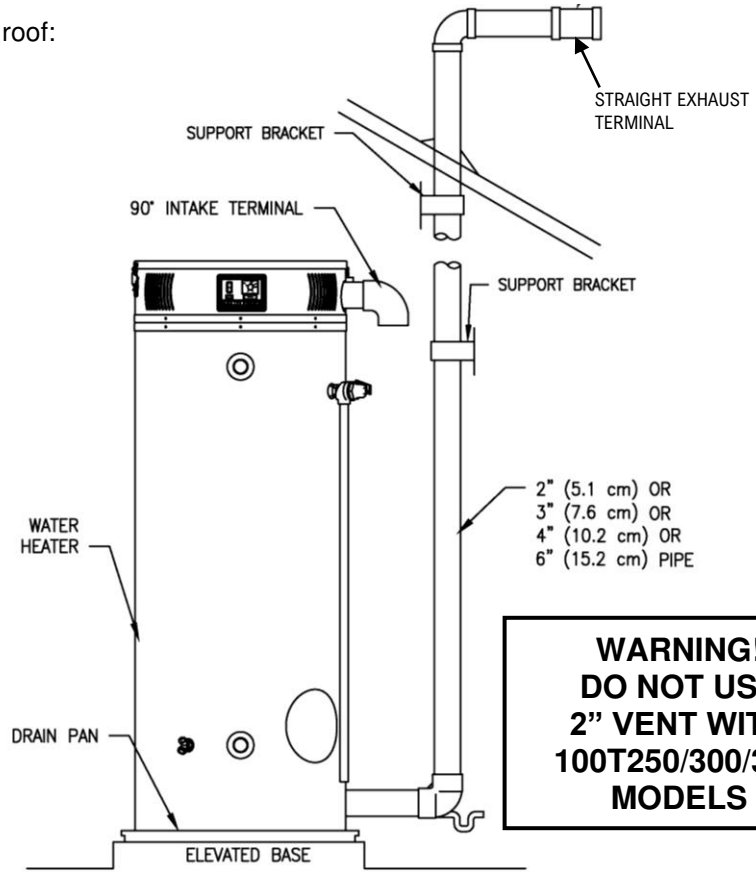
Vertical venting **must be** supported every 5 ft of vertical run and every 3 ft of horizontal run of vent pipe length. Stress levels in the pipe and fittings can be significantly increased by improper installation. If rigid pipe clamps are used to hold the pipe in place, or if the pipe cannot move freely through a wall penetration, the pipe may be directly stressed, or high thermal stresses may be formed when the pipe heats up and expands. Install accordingly to minimize such stresses.

⚠ CAUTION

Failure to properly support the vent piping with hangers and clamps may result in damage to the water heater or venting system.

Follow the following procedure to vent through the roof:

1. Cut the necessary holes through the roof and ceiling. Cut one 2 3/8 in *(6 cm),* diameter hole (for 2 in *(5.1 cm)* diameter pipe), one 3 1/2 in *(8.9 cm)* diameter hole (for 3 in *(7.6 cm)* diameter pipe) one 4 1/2 in *(11.5 cm)* diameter hole (for 4 in *(10.2 cm)* diameter pipe) or one 6 5/8 in *(16.5 cm)* (for 6 in *(15.2 cm)* diameter pipe).
2. Install the exhaust vent and air intake plastic pipes as shown in Figure 16. Make sure that the installation meets the local codes and/or The National Fuel Gas Code ANSI Z223.1 (Latest Edition) or CGA/CAN B149 Installation Code.



WARNING!
DO NOT USE
2" VENT WITH
100T250/300/399
MODELS

Figure 16 - Typical Vertical Power Vent System Installation

Through The Wall Venting With Low Ground Clearance

When venting cannot exit through the wall at a height greater than or equal to 12 in *(30.5 cm)* (and above expected snow level) from the ground, then the installation must be modified as shown below (see Figure 17). Refer to Tables 3 or 4 for maximum venting lengths using 2 in *(5.1 cm),* 3 in *(7.6 cm),* 4 in *(10.2 cm),* or 6 in *(15.2 cm)* diameter plastic pipe.

WARNING!
DO NOT USE
2" VENT WITH
100T250/300/399
MODELS

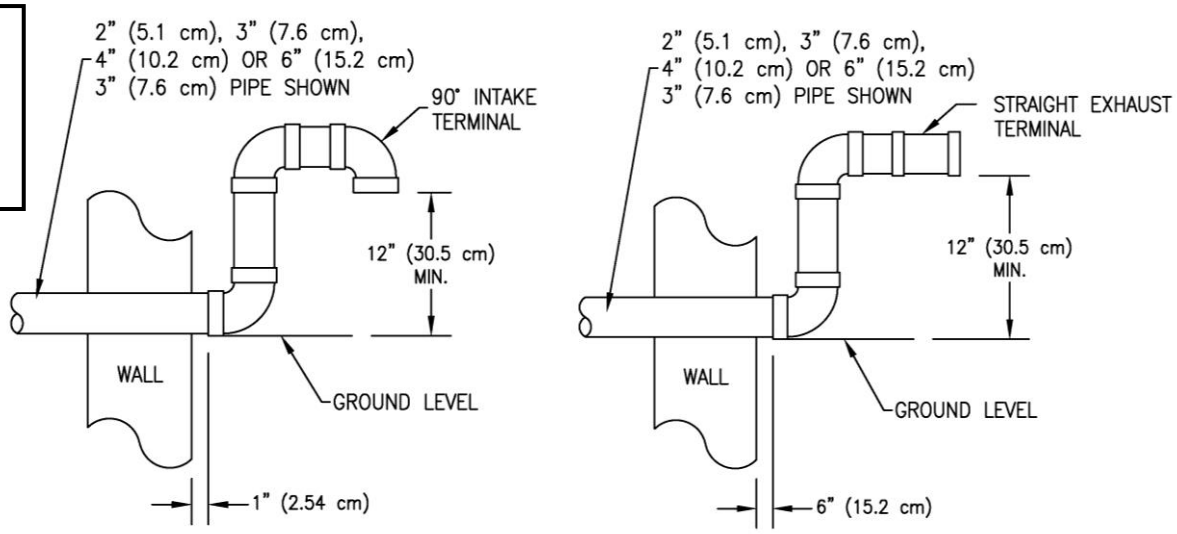


Figure 17 - Vent Terminal (Low Ground Clearance)

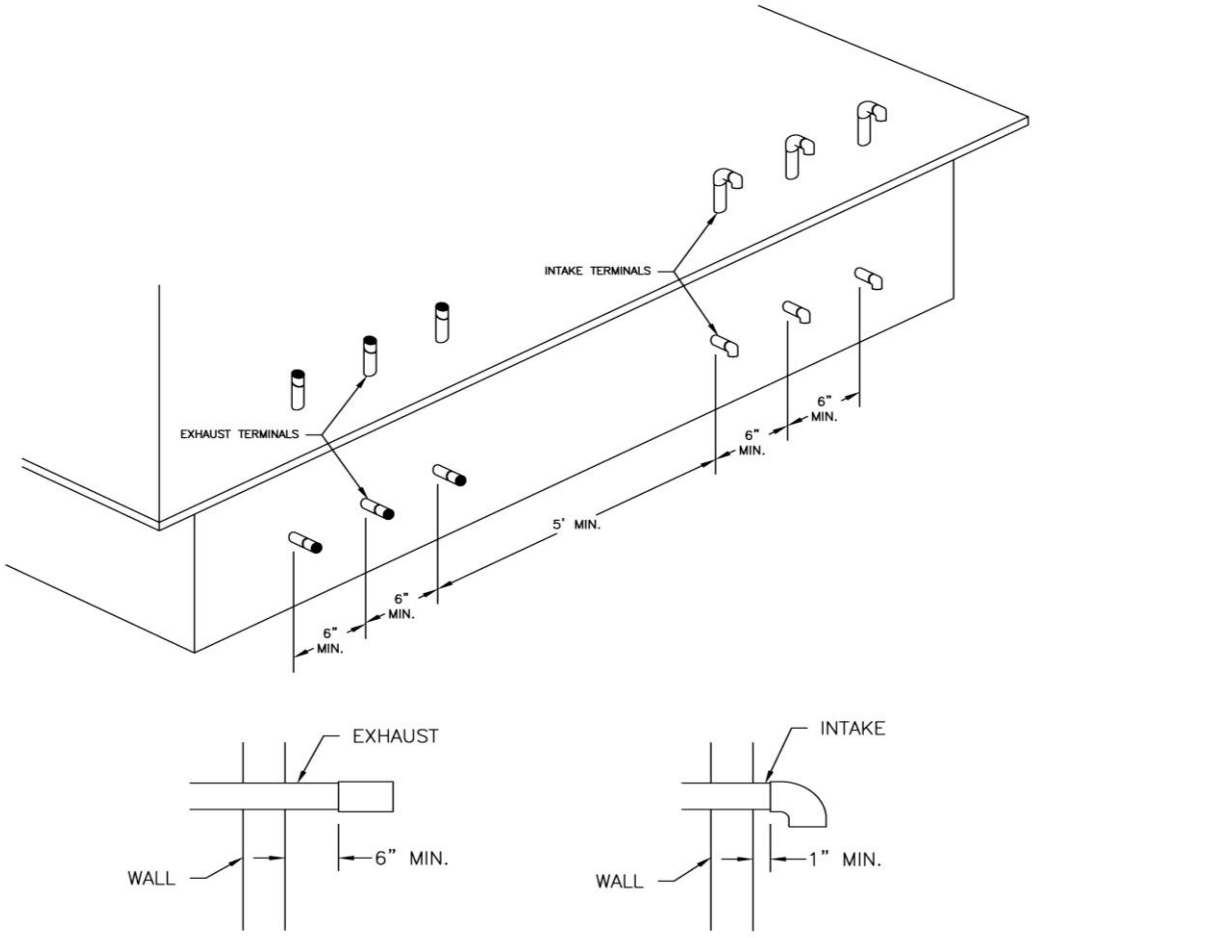


Figure 18 - Multiple Intake/Exhaust Terminal Separation Distances

Note: When installing multiple intake/exhaust terminals on the same wall of a building, the nearest intake terminal must be at least 5 ft *(1.5 m)* from the nearest exhaust terminal. Spacing requirements are the same for roof installation.

Concentric Vent Terminal Installation Procedure

⚠ WARNING

Improper installation, adjustment, service, or maintenance can cause property damage, personal injury, or death. Consult a qualified installer, service agency, or the gas supplier for information or assistance.

This kit must be used only for terminating this water heater. **DO NOT** use this termination kit for any other appliance. Using this kit on other appliances and/or water heaters can result in property damage, personal injury, or death.

DO NOT operate this water heater until the installation and assembly of this kit is complete and the piping completed. Failure to complete installation before operation can result in property damage, personal injury, or death.

Before beginning any installation, be sure the main electrical disconnect switch is in the **OFF** position. Electrical shock can cause personal injury or death.

DO NOT operate this water heater with the rain cap removed or recirculation of combustion products may occur. Water may also collect inside larger combustion-air pipe and flow to the burner assembly. Failure to follow this warning could result in product damage, or improper operation, personal injury or death.

⚠ CAUTION

DO NOT use field-supplied couplings to extend pipes. Airflow restriction will occur, and the water heater pressure switches may cause intermittent problems.

Vertical Installation (recommended)

Table 4 – Approved IPEX Concentric Terminals

Description	Bradford White Part Number	IPEX System (1738 or 636)	IPEX Part Number
2” Concentric Termination	239-44069-02	636	196005 (PVC), 197040 (CPVC)
2” Concentric Termination	---	1738	397005
3" Concentric Termination	239-44069-01	636	196006 (PVC), 197009 (CPVC)
3" Concentric Termination	---	1738	397006
4" Concentric Termination	---	636	196021 (PVC), 197021 (CPVC)
4" Concentric Termination	---	1738	397021

1. Become familiar with the concentric vent terminals listed in Table 4. Refer to instructions inside concentric vent kit. Refer to the previous section on determining the maximum venting distance and pipe diameter required for the installation.

⚠ WARNING

The 100T250, 100T300, and 100T399 models are NOT approved for 2 in diameter vent pipe. Venting with 2 in pipe on these models may result in damage to the water heater or cause an unsafe condition. DO NOT use 2 in vent or air intake pipe on 100T250/300/399 models.

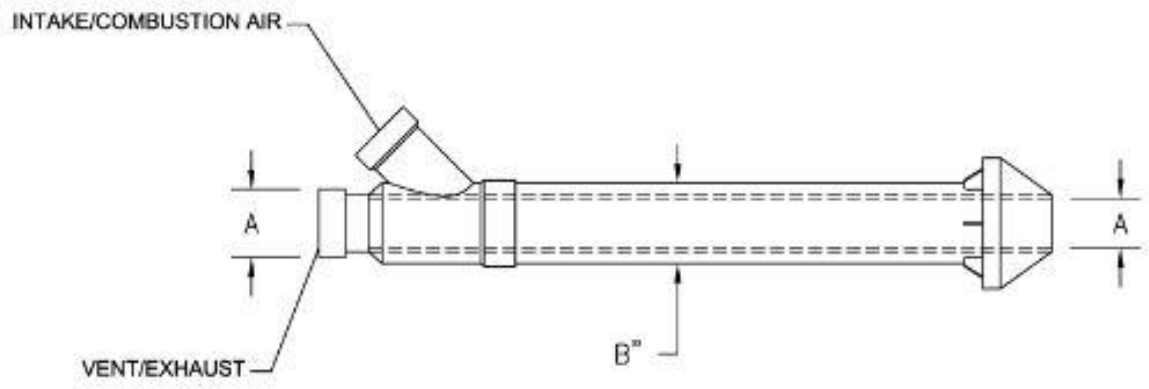


Figure 19 - Dimensional Layout of Concentric Vent Kits

Concentric Vent Size	(A) Nominal Pipe Size	(B) in inches
2 in	2 in	3 ½ in
3 in	3 in	4 ½ in
4 in	4 in	6 5/8 in

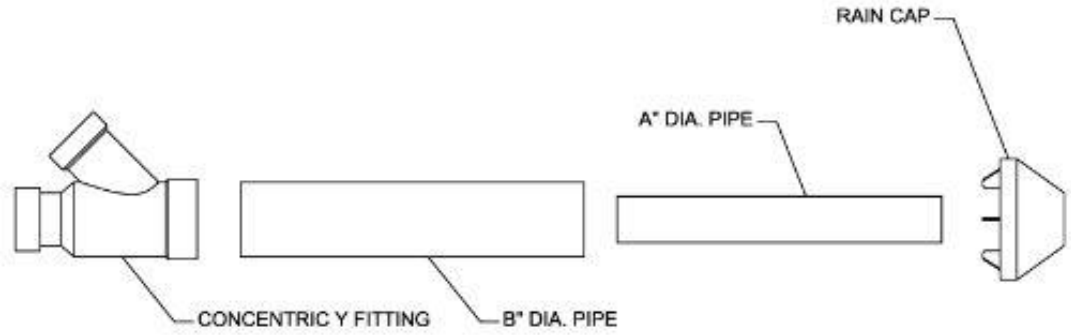
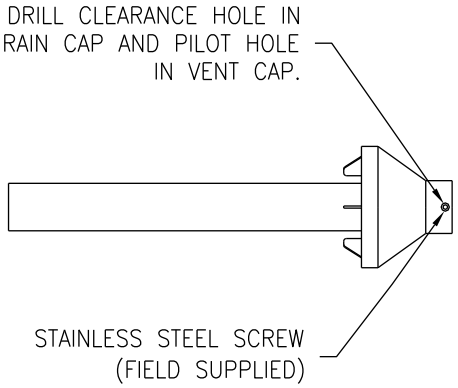


Figure 20 - Concentric Vent Kit Part Identification

Concentric Vent Size	(A) in inches	(B) in inches
2 in	2 in	3 ½ in
3 in	3 in	4 ½ in
4 in	4 ½ in	6 5/8 in

2. Determine the best location for the termination kit.
3. Cut the recommended 3 ½ in *(8.9 cm)* diameter hole for 2 in *(5.1 cm)* vent termination, 6 5/8 in *(16.9 cm)* diameter hole for 4 in *(10.2 cm)* vent termination, or 4 ½ in *(11.5 cm)* for 3 in *(7.6 cm)* vent termination.
4. Partially assemble vent kit by performing the following:
    a. Cement concentric Y fitting to larger diameter pipe (see Figure 20).
    b. Cement rain cap to smaller diameter pipe (see Figure 21).

Figure 21 - Rain Cap to Small Vent Pipe Assembly



Venting continued-

5. Install concentric Y fitting and pipe assembly through the structure's hole and field-supplied roof boot/flashing. Do not allow insulation or other materials to accumulate inside pipe assembly when installing through the hole.
6. Secure assembly to roof structure as shown in Figure 22 using field-supplied metal strapping or equivalent support material.

NOTICE
Ensure termination height is above the roof surface or anticipated snow level (see Figure 22).
If assembly is too short to meet height requirements, the two pipes supplied in the kit may be replaced by using the same diameter pipe. DO NOT extend the overall dimension by more than 60 in (see Figure 19).

7. Install rain cap and small diameter pipe assembly in roof penetration assembly. Ensure small diameter pipe is cemented and bottomed in Y concentric fitting.
8. Cement heater combustion-air and vent pipes to concentric y fitting assembly (see Figure 20). See Figure 22 for proper pipe attachment.
9. Operate heater through one cycle to ensure combustion-air and vent pipes are properly connected and sealed to concentric vent termination connections.

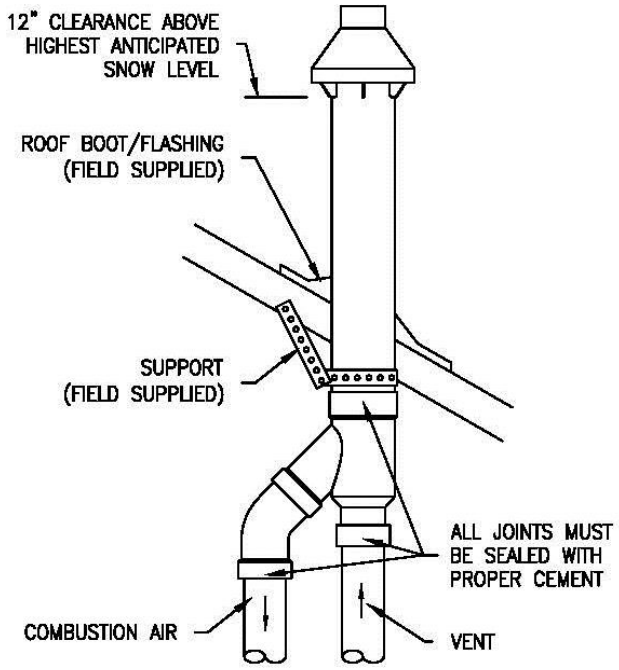


Figure 22 - Concentric Vent Roof Top Attachment

Horizontal Installation

1. Become familiar with the approved coaxial vent kits from IPEX, as shown in Table 4 and Figures 20 through 22.

⚠ WARNING
The 100T250, 100T300, and 100T399 models are not approved for 2 in diameter vent pipe. Venting with 2 in pipe on these models may result in damage to the water heater or cause an unsafe condition. **DO NOT** use 2 in Vent or Air Intake Pipe on 100T250/300/399 models.

2. Determine the best location for the termination kit.

NOTICE
Position termination where vent vapors will NOT damage plants/shrubs or air conditioning equipment.
Position termination where vent vapors will NOT be adversely affected by wind condition.
Position termination where it will NOT be damaged or be subjected to foreign objects.
Position termination where vapors will NOT be objectionable.

Venting continued-

3. Cut the recommended 3 ½ in *(8.9 cm)* diameter hole for 2 in *(5.1 cm)* vent terminations, 6 5/8 in *(16.9 cm)* diameter hole for 4 in *(10.2 cm)* vent termination, or 4 ½ in *(11.5 cm)* for 3 in *(7.6 cm)* vent termination.
4. Partially assemble vent kit.
    a. Cement Y concentric fitting to larger diameter kit pipe (see Figure 20).
    b. Cement rain cap to smaller diameter kit pipe (see Figure 21).
5. Install concentric Y fitting and pipe assembly through the structure's hole and field-supplied roof boot/flashing. Do **NOT** allow insulation or other materials to accumulate inside pipe assembly when installing through the hole.
6. Install rain cap and small diameter pipe assembly in concentric Y fitting and large pipe assembly. Ensure small diameter pipe is cemented and bottomed in concentric Y fitting.
7. Secure assembly to structure as shown in Figure 23. Ensure clearances as shown in Figure 24.
8. Cement heater combustion-air and vent pipes to concentric Y fitting termination assembly. See Figure 24 for proper pipe attachment.
9. Operate heater through one cycle to ensure combustion-air and vent pipes are properly connected and sealed to concentric vent termination connections.

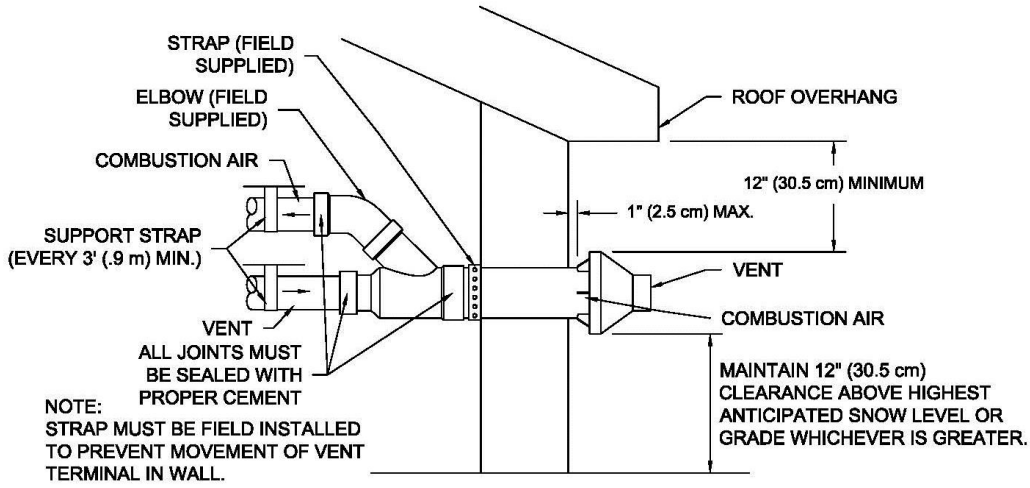


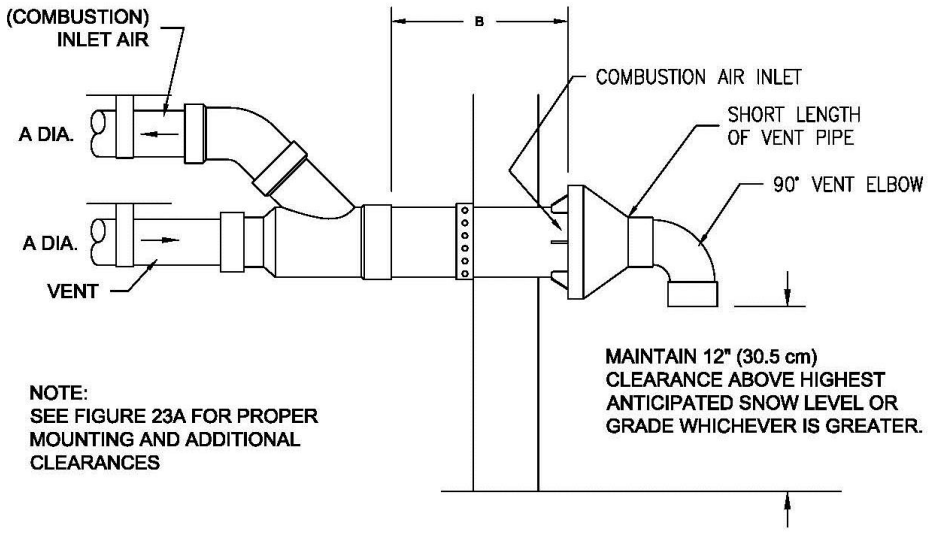
Figure 23A - Concentric Vent Side Wall Attachment

It is acceptable to install a 90° elbow on IPEX concentric vent terminations use with this power direct vent water heater (see Figure 23b). A short length of appropriate diameter vent pipe should be used to transition from the vent terminal to the 90° elbow. Approved venting materials along with primers and cements are listed at the beginning of this venting section. When the 90° elbow is used the equivalent length of the elbow and short length of vent pipe must be factored into the total vent/air intake pipe determinations (see Tables 3 and 4 for appropriate vent connector lengths).

WARNING!
DO NOT USE 2" VENT
WITH 100T250/300/399 MODELS

Figure 23B

(A) VENT DIAMETER	(B) DIMENSION	
	MIN	MAX
2 in *(5.1 cm)*	**12 in** *(30.5 cm)*	**40 in** *(101.6 cm)*
3 in *(7.6 cm)*	**12 in** *(30.5 cm)*	**44 in** *(111.8 cm)*



Low Profile Side Wall Termination Kit

The IPEX Low Profile side wall termination kits are fully certified for use with IPEX product only. IPEX System 636 PVC Low Profile vent kits are made from certified compound and IPEX System 1738 PVC Low Profile vent kits are made from a UL1738 certified PVC compound. Both are rated to a maximum temperature of 149°F *(65°C)*.

The vent termination **must** maintain all termination clearances and be installed in accordance with local building codes and/or The National Fuel Gas Code ANSI Z223.1 (Latest Edition) or CGA/CAN B149 Installation Code (see Figure 24).

Each kit contains: 1 Base (two holes), 1 Cap (one hole), 8 Stainless Steel Screws, and 4 Plastic Anchors.

Table 5 – Approved IPEX Low Profile Terminals

Description	Pipe O.D.	Hole Spacing (ctr to ctr)	IPEX System (1738 or 636)	IPEX Part Number
2” Low Profile	2.375”	5.6”	636	196984
2” Low Profile	2.375”	5.6”	1738	397984
3” Low Profile	3.5”	5.6”	636	196985
3” Low Profile	3.5”	5.6”	1738	397985
4” Low Profile	4.5”	5.6”	636	196986
4” Low Profile	4.5”	5.6”	1738	397086

⚠ WARNING

When locating the penetration of the vent and air pipe, ensure the termination is properly oriented as shown in Figure 25 and ensure that it maintains minimum clearance requirements as shown in Figure 24. For multiple vent terminations, ensure that a minimum clearance of 12 in *(30 cm)* is maintained between edge of air inlet and adjacent vent outlet and that all vent pipes and air inlets terminate at the same height to avoid the recirculation of flue gases and the possibility of causing severe personal injury, death, or substantial property damage (see Figure 27).

⚠ CAUTION

When installing the vent termination in a vertical configuration, ensure the vent piping is located above the air inlet piping. This will avoid the risk of flue gas products recirculating into the air inlet and building.

Installation Procedure

1. Once the proper location has been determined, cut 2 holes in the wall large enough to accommodate the pipe. Pipe diameters and distance between hole centers can be found in Table 5.
2. Slide both the intake and vent pipe through the holes. Solvent weld both pipes to the base of the vent termination kit (see Figure 24).
3. To fasten the base to the wall, use the supplied screws and anchors. A 3/16 in *(5 mm)* diameter, 1/16-3/16 in *(2-5 mm)* deep hole will need to be drilled for the anchors. Locate the anchor hole by using the base as a template and then drill the required holes.
4. Screw the cap to the base using the supplied screws.
5. Once the vent termination and pipes are secured, the wall penetrations will need to be sealed from the interior using a PVC compatible material.

Venting continued-

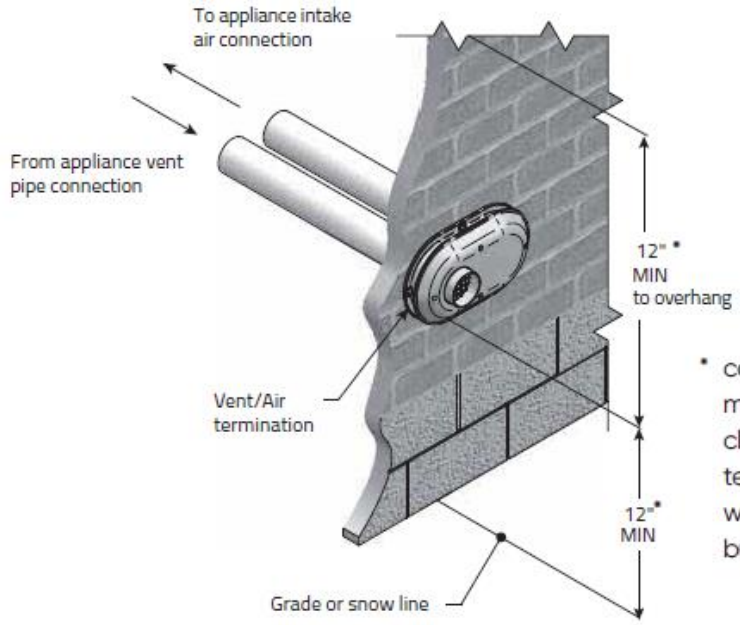


Figure 24 – Typical Side Wall Termination



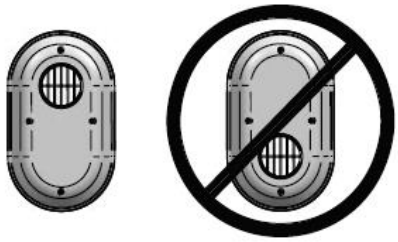


Figure 25 – Approved Installation Orientation

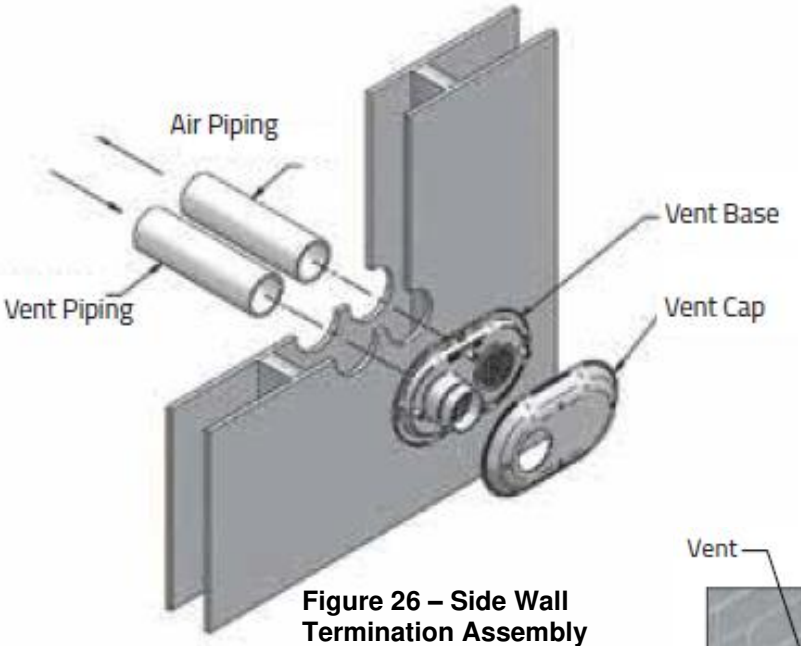


Figure 26 – Side Wall Termination Assembly

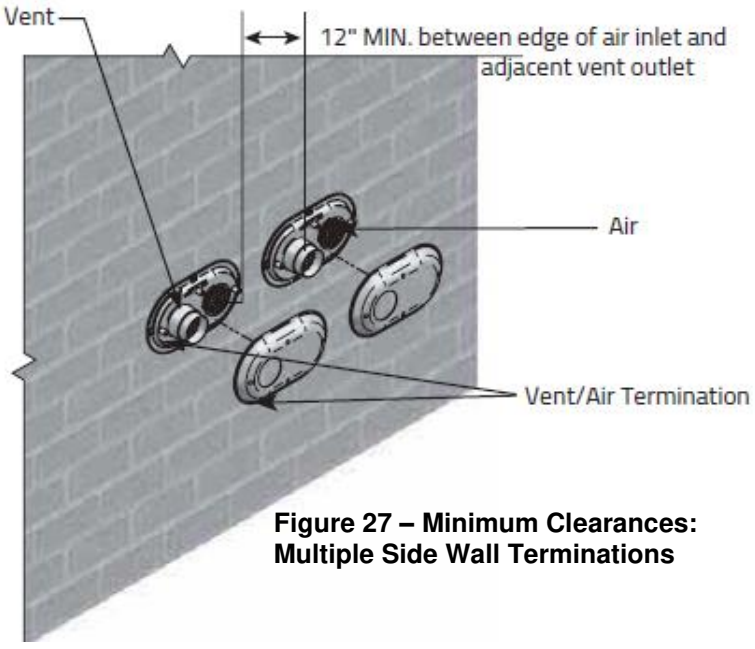


Figure 27 – Minimum Clearances: Multiple Side Wall Terminations

Vent Pipe Preparation

⚠ WARNING

DO NOT attempt to start this water heater until vent pipe solvent fumes completely clear from the room and inside the vent piping.

Vent Pipe Preparation and Joining

Most failures in vent systems result from improper preparation and joining of pipe and fittings. The guidelines below must be followed when installing the venting system. If you have any question about the application or installation of the venting system, contact the vent pipe manufacturer, supplier, or your plumbing professional.

1. Specific cleaners, solvents, primers and cements are available for PVC, CPVC, and ABS pipe. Be sure these materials match the type of pipe to be installed. The vent pipe manufacturers joining instructions must be followed in all cases. Never use all-purpose cements, commercial glues and adhesives or ABS cement to join PVC or CPVC pipe and fittings. Refer to the table at the beginning of the "Venting" section for approved primers and cements.
    a. **CLEANERS, SOLVENTS, PRIMERS AND CEMENTS ARE FLAMMABLE. Do not store or use these materials near heat or open flame, or in the vicinity of other appliances.**
2. Use proper cutting, deburring and applicator tools to ensure proper preparation and joining of pipe and fittings.
    a. Cutting Tools
        i. A square cut must be achieved with a miter box saw or pipe cutter to ensure a proper mating with the female. If a pipe cutter is used, the burr created at the outer edge of the pipe must be removed.
    b. Deburring Tools
        i. A file, knife or plastic deburring tool can be used to remove burrs. Burrs must be removed from the inside and outside edges of the pipe to ensure a proper seal.
    c. Applicator Tools
        i. A natural bristle paintbrush or roller may be used to apply cement. Prompt application of the cement is important due its fast drying properties.
3. Inspection, Cleaning, Priming and Cementing
    a. Inspect the pipe inside and out for dirt, dust, moisture or grease etc. Check pipe and fittings for splits or cracks and replace if found.
    b. Clean pipe and fittings are imperative for proper joining. Following cutting and deburring, wipe away any foreign material with a clean dry rag. If wiping fails to thoroughly clean surfaces, chemical cleaning is necessary.
    c. Primer must be applied to the pipe surface and fitting socket with a natural bristle brush. This serves to soften and prepare the pipe for cementing.
    d. Cementing must be done quickly to avoid over-drying before joining.
        i) Apply one coat to the outside end of the pipe at a width slightly greater than the depth of the socket.
        ii) Apply a coat around the inside of the fitting socket.
        iii) Apply a second coat around the end of the pipe.
4. Joining
    a. Joints should be made immediately after cement is applied.
    b. After fully inserting pipe into fitting socket, hold joint together for about 15 to 20 seconds.
    c. Remove excess cement from around pipe and fitting with a clean rag.
    d. Cement drying times may vary. Be sure to allow for the recommended drying time before disturbing joints.

For more specific and detailed information about the above, contact the vent pipe manufacturer, supplier, or competent professional.

SAFETY PRECAUTION: PRIMERS AND CEMENTS ARE EXTREMELY FLAMMABLE AND MUST NOT BE STORED OR USED NEAR HEAT OR OPEN FLAME. ALSO, USE ONLY IN A WELL VENTILATED AREA.

SECTION VII: GAS CONNECTIONS

⚠ WARNING

Connect this water heater ONLY to the type of gas as shown on the rating plate. Use clean black iron pipe or equivalent material approved by local codes and ordinances (dirt and scale from the pipe can enter the gas valve and cause it to malfunction). The inlet gas line must have at least a 3 in *(7.62 cm)* drip leg *(sediment trap)* installed as close to the water heater's gas valve as possible. A ground joint union must be installed in the gas supply line, as close to the water heater as possible, to permit servicing of the water heater. Compounds used on the threaded joints of the gas piping must be resistant to the action of liquefied petroleum gases/propane gas. **DO NOT** apply pipe dope to the gas valve inlet and make certain that no pipe dope has become lodged in the inlet screen of the gas valve. Extreme care must be taken to ensure no pipe dope enters the gas valve and to avoid excessive torque when tightening the gas supply line to the gas valve. Excessive torque may result in cracking of the gas valve housing. The suggested maximum torque is 31.5 ft lbs. *(4.4 kg-m).* The manufacturer of this water heater will not be liable for any damage or injury caused as a result of a cracked gas inlet as a result of excessive torque.

This water heater and its gas connection must be leak tested before placing the water heater in operation. Check for gas leaks with a soap and water solution and a brush or a commercial leak detector fluid. **NEVER USE A MATCH OR OPEN FLAME FOR TESTING!**

The water heater is not intended for operation at higher than 14 in water column (½ psi) supply gas pressure. Higher gas supply pressures require supplemental reducing service regulation. Exposure to higher gas supply pressure may cause damage to the gas controls, which could result in fire or explosion. If overpressure has occurred such as through improper testing of gas lines or emergency malfunction of the supply system, the gas valve must be checked for safe operation. Make sure that the outside vents on the supply regulators and the safety vent valves are protected against blockage. These are parts of the gas supply system, not the water heater.

⚠ CAUTION

The water heater and individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of the system at test pressures in excess of ½ psi *(3.5 kPa).* The water heater must be isolated from the gas supply piping system by closing its manual shutoff valve during any pressure testing of the gas supply system at test pressures equal to or less than ½ psi *(3.5 kPa).* The supply line must be capped when not connected to the water heater.

If copper supply lines are used, they must be internally tinned and certified for gas service.

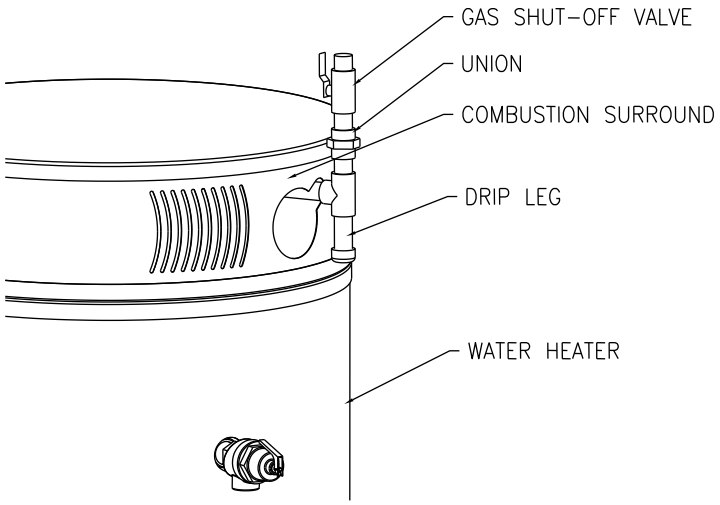


Figure 28 - Drip Leg

The gas supply lines must meet all requirements of the National Fuel Gas Code ANSI Z223.1 (Latest Edition), or in Canada CAN/CGA B149.1 Natural Gas Installation Code (Latest Edition) or CAN/CGA B149.2 Propane Installation Code (Latest Edition).

Gas Meter Size – Natural Gases Only

Be sure that the gas meter has sufficient capacity to supply the full rated gas input of the water heater as well as the requirements of all other gas fired equipment supplied by the meter. If the gas meter is too small, ask the gas company to install a larger meter having adequate capacity.

Gas Pressure Regulation

Main line gas pressure to the water heater should be between a maximum 14 in water column and a minimum supply pressure as shown on the rating plate. The inlet gas pressure must not exceed the maximum value. In some installations, a regulator sized for the input rating of the water heater will need to be installed just ahead of the inlet gas connection to the water heater to reduce excess gas pressure or surges in gas pressure.

NOTICE

100T399 ONLY

The inline gas regulator that is supplied with this water heater is stored at the top of the water heater in the combustion assembly compartment. To access the inline gas regulator, unlatch the top lid and then remove the regulator. After removing the inline gas regulator from the combustion assembly compartment be sure to latch the lid again.

Be sure to follow the instructions included with the inline gas regulator.

BEFORE PLACING THE WATER HEATER IN OPERATION, CHECK FOR GAS LEAKAGE. USE SOAP AND WATER SOLUTION OR OTHER MATERIAL ACCEPTABLE FOR THE PURPOSE OF LOCATING GAS LEAKS**.**

⚠ WARNING

DO NOT use matches, candles, flame or other sources of ignition for this purpose.

SECTION VIII: ELECTRICAL CONNECTIONS

⚠ WARNING

Turn OFF or disconnect the electrical power supply to the water heater before servicing. Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

All electrical wiring must be installed and grounded in accordance with local codes, or in the absence of local codes, the National Electrical Code, ANSI/NFPA 70 and/or CSA C22.2 Electrical Code.

The water heater must be wired to a 120 VAC, 60 Hz, 15A power supply. The water heater **must be** wired on a separate circuit and breaker. If a flexible line cord and plug is permitted by local code, then provide a three wire grounding type receptacle within reach of the line cord provided on the control box. **DO NOT** plug the line cord into a receptacle that can have the power supply interrupted by a switch that is used to control lights or another appliance.

If wiring in conduit is required, cut the line cord close to the control board and make the appropriate wiring connections. Install an electrical conduit connector on the outside jacket of the water heater. Refer to the wiring diagram for the correct connections to each wire lead.

⚠ CAUTION

This water heater **must be** wired on a separate circuit. Failure to wire on a separate circuit may cause improper operation or failure of the electrical components of the water heater. Refer to the Section VIII: Electrical Connections (page 38) for complete instructions on electrical wiring and connections to the water heater.

DO NOT energize the electric circuit before the water heater tank is filled with water.

This controller is polarity sensitive. If the Hot and Neutral Supply voltage is reversed, the controller will **not** sense flame and the water heater will **not** operate. Verify polarity before connecting the water heater.

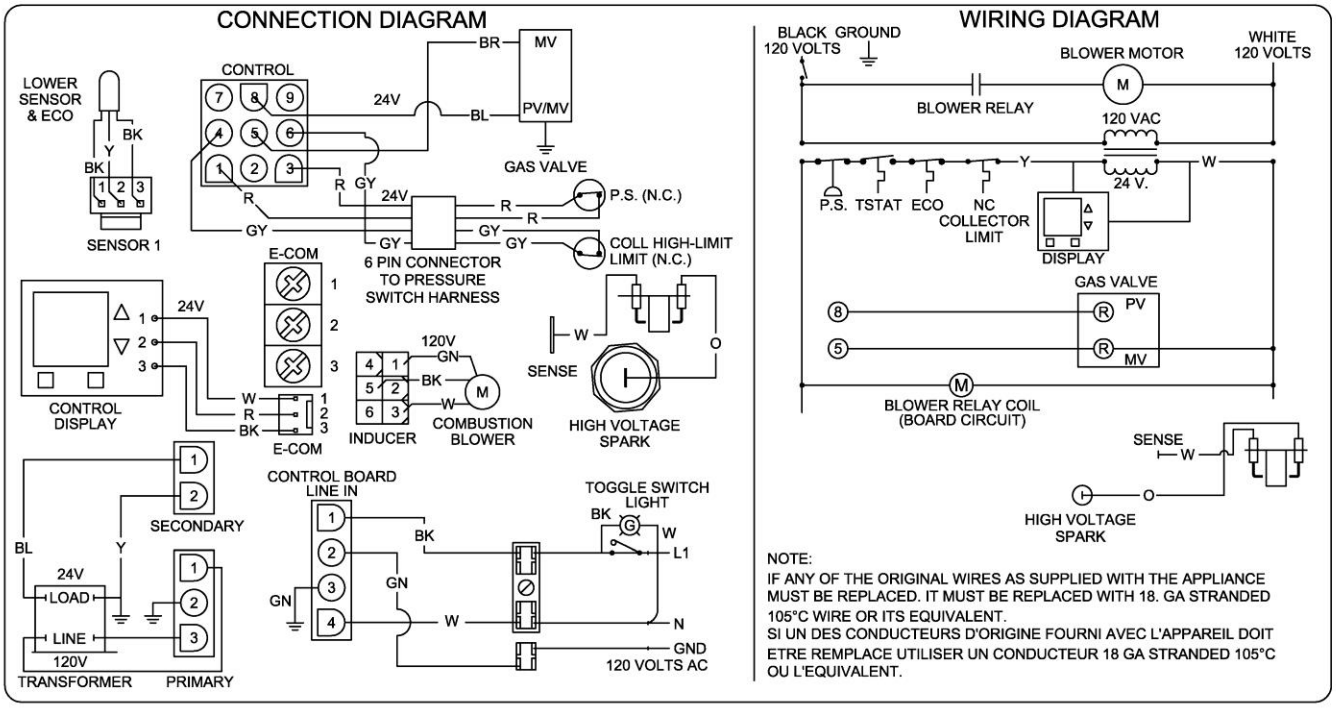


Figure 29 - Wiring Diagram and Schematic
(300,000 BTU/hr and below)
See supplement included with 399,999 BTU/hr models for this information

SECTION IX: OPERATING INSTRUCTIONS

⚠ WARNING

Water heaters are heat-producing appliances. To avoid damage or injury there must be no materials stored against the water heater or direct vent system, and proper care must be taken to avoid unnecessary contact (especially by children) with the water heater and direct vent system. **UNDER NO CIRCUMSTANCES SHOULD FLAMMABLE MATERIALS, SUCH AS GASOLINE OR PAINT THINNER BE USED OR STORED IN THE VICINITY OF THIS WATER HEATER OR IN ANY LOCATION FROM WHICH FUMES COULD REACH THE WATER HEATER.**

Installation or service of this water heater requires ability equivalent to that of a licensed tradesman in the field involved. Plumbing, air supply, venting, gas supply and electrical work are required.

Light the unit in accordance with the operating instructions label attached to the water heater.

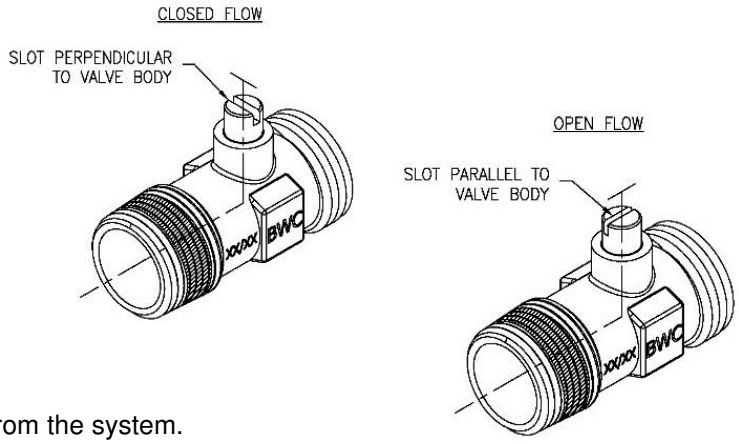
Under no circumstances should the input rate exceed the input rate shown on the water heater rating plate. Over firing could result in damage or sooting of the water heater.

If the unit is exposed to the following, do not operate water heater until all corrective steps have been made by a factory authorized independent service contractor or qualified service professional.

1. Flooding to or above the level of the burner or controls
2. External firing
3. Damage
4. Firing without water
5. Sooting

NEVER OPERATE THE WATER HEATER WITHOUT FIRST BEING CERTAIN IT IS FILLED WITH WATER AND A TEMPERATURE AND PRESSURE RELIEF VALVE IS INSTALLED IN THE RELIEF VALVE OPENING OF THE WATER HEATER.

General Instructions



To Fill The Water Heater

1. Close the water heater drain valve. This water heater utilizes a ball valve; when closing the valve, the stem will spin indefinitely. Confirm it is closed by ensuring the slot on the stem is perpendicular to the valve body. If alternative water connections are provided but not used, make certain they are plugged (i.e. space heating & alternate top connections).
2. Open the cold water supply shut-off valve.
3. Open several hot water faucets to allow air to escape from the system.
4. When a steady stream of water flows from the faucets, the water heater is filled. Close the faucets and check for water leaks at the water heater drain valve, combination temperature and pressure relief valve and the hot and cold water connections.

Sequence Of Operation

1. Thermostat starts with heating cycle
2. Blower ON
3. Blower pre-purge
4. Spark rod sparks to the burner and gas valve opens – burner ignition
5. Main burner ON
6. Flame signal confirmed
7. Thermostat satisfied
8. Gas valve closes - Main burner OFF
9. Blower post-purge

Lighting & Shutdown Instructions

FOR YOUR SAFETY READ BEFORE LIGHTING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the appliance for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS:

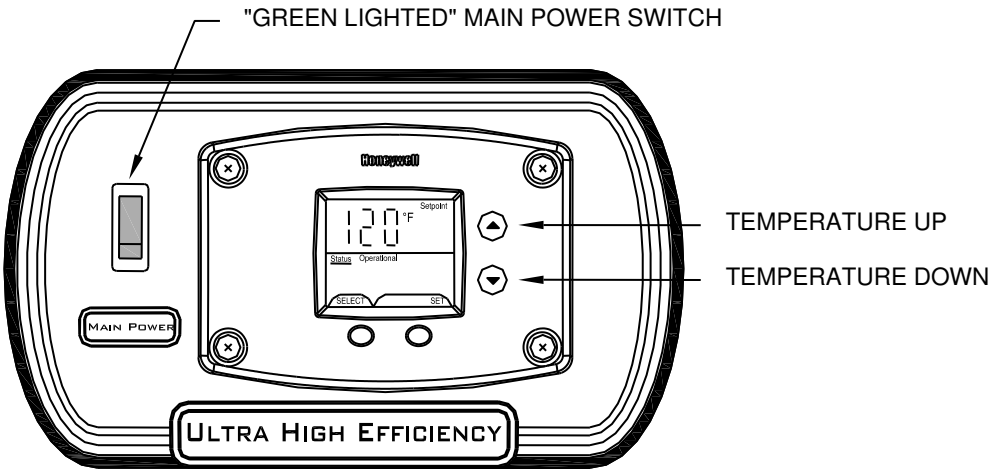
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier call the fire department.

C. Turn off main power to the water heater.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

LIGHTING INSTRUCTIONS

1. **STOP!** read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electrical power to the appliance.
4. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Turn off the main power switch.
6. Wait (5) minutes to clear out any gas. If you then smell gas, **STOP!** Follow "B" in the safety information above on this label if you don't smell gas, go to next step.
7. Turn on main power.
8. Set the thermostat to desired setting.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off the main power switch.

Figure 30 - Lighting Instruction Label

Temperature Adjustment

Table 5 Approximate Time/Temperature Scald Chart

APPROXIMATE TIME/TEMPERATURE RELATIONSHIPS IN SCALDS	
120°F *(49°C)*	More than 5 minutes
125°F *(52°C)*	1½ to 2 minutes
130°F *(54°C)*	About 30 seconds
135°F *(57°C)*	About 10 seconds
140°F *(60°C)*	Less than 5 seconds
145°F (*63°C*)	Less than 3 seconds
150°F *(66°C)*	About 1½ seconds
155°F *(68°C)*	About 1 second

⚠ CAUTION

This water heater, when set at a lower temperature setting, is **NOT** capable of producing hot water of sufficient temperature for sanitizing purposes.

This water heater is equipped with an energy cut out device to prevent overheating. Should overheating occur or the gas supply fails to shut off, turn OFF the control panel power switch to the appliance and call a qualified service agency.

NOTICE

The lower the temperature setting, the greater the energy efficiency, both to heat the water and to maintain the storage temperature during standby periods. Lower water temperatures also extend tank life. Remember, no water heating system will provide exact temperatures at all times. Allow a few days of operation at this setting to determine the correct temperature setting consistent with the requirements for the installation.

The water heater temperature setting is adjusted by using the control display mounted to control surround jacket of the water heater. The water heater thermostat is set at the lowest setpoint of 70°F *(21°C)* when shipped from the factory. The control display shows the temperature setpoint in degrees Fahrenheit (°F) or degrees Celsius (°C), and the status of the water heater ("Idle" or "Heating"). If the water heater is functioning normally, the display will also show "Operational".

For energy efficient operation of your water heater, the suggested initial temperature setting is 120°F *(49°C)*. During the winter season, or any cold period, you may desire a higher temperature setting to adjust for the colder incoming water. This adjustment, however, may cause additional condensation to form on the cooler tank surface. This does not mean the tank is leaking. During summer months, the warmer incoming water temperatures will benefit the performance of your water heater and reduce the amount of condensation developed.

Condensation does not mean your tank is leaking. Most of reported tank leaks on installation are proven to be condensation. To avoid unnecessary inconvenience and expense, make sure the tank is leaking before calling an independent servicing contractor or qualified service professional.

If the water heater is to remain idle for 30 days or more or is subjected to freezing temperatures while shut off, the water heater and piping should be fully drained, and the drain valve should be left fully open. Refer to the "General Operation" section of this Installation and Operation Manual for the procedure on draining the water heater.

⚠ DANGER

Hotter water increases the risk of scald injury. Scalding may occur within 5 seconds at a temperature setting of 140°F *(60°C).* To protect against hot water injury, install an ASSE approved mixing valve in the water system. This valve will reduce point of discharge temperature by mixing cold and hot water in branch water lines. A licensed plumbing professional or local plumbing authority should be consulted.

⚠ WARNING

If the water heater display does not show "Operational" in the "Status" indicator, there may be an operating malfunction with the water heater. If this is the case, a numeric code will be displayed. Refer to the label next to the display for the definition of the error code and call your plumbing professional or service agent to service the water heater. **DO NOT** try to reset the water heater without having a qualified service person to diagnose and correct the problem. If the display is blank or does not show an error code, make sure there is power to the water heater.

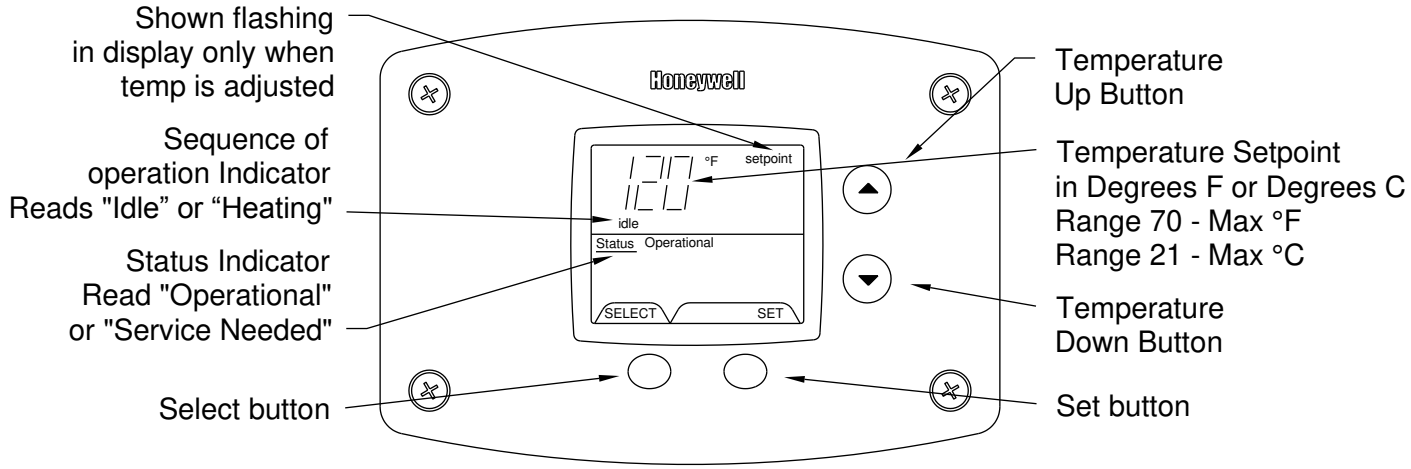
⚠ WARNING

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. See following section to change the maximum setpoint limit (max setpoint). Make sure the water heater control display is not in a public area that can result in the temperature settings being improperly adjusted. See previous warning on scalds and an ASSE approved mixing valve.

NOTICE

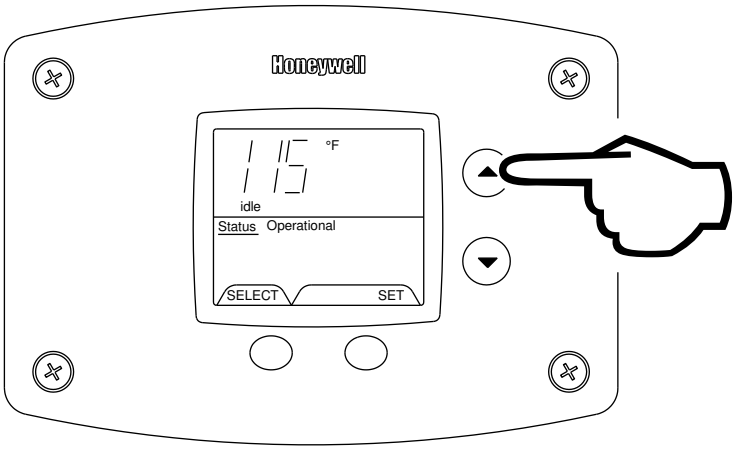
When the maximum setpoint is reached, the display will show “Max Setpoint” without the setpoint value.
The maximum setting is equal to approximately 180˚F *(82˚C)*.
The default temperature setpoint from the factory is 70˚F *(21˚C)*.

Water Heater Display and Control Buttons

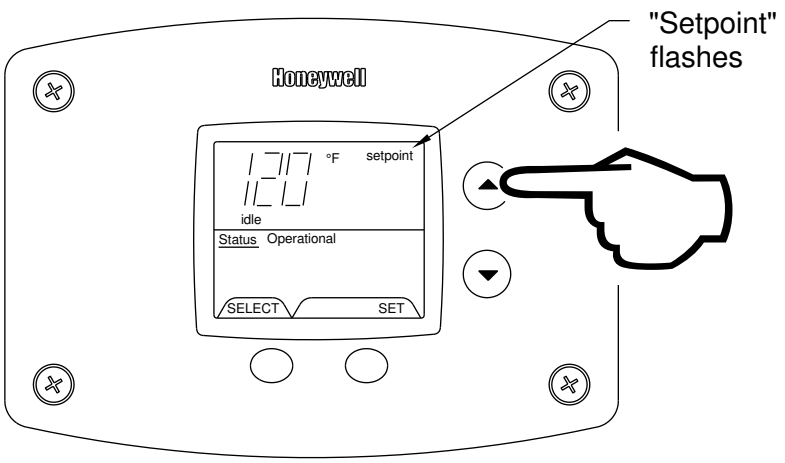


To Increase Setpoint Temperature

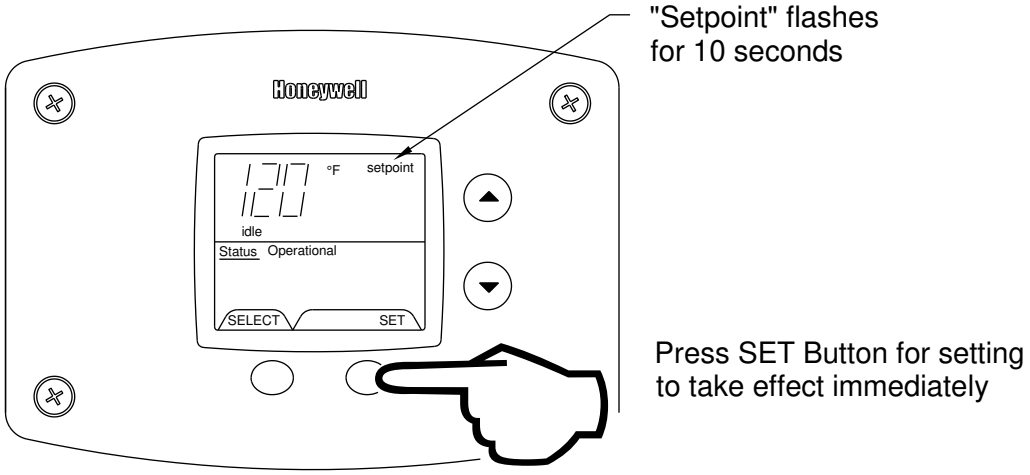
Step 1: Depress and hold “Temperature Up” button until desired setpoint temperature appears in the display.



Step 2: “Setpoint” indicator begins flashing in the display after pressing “Temperature Up” button.

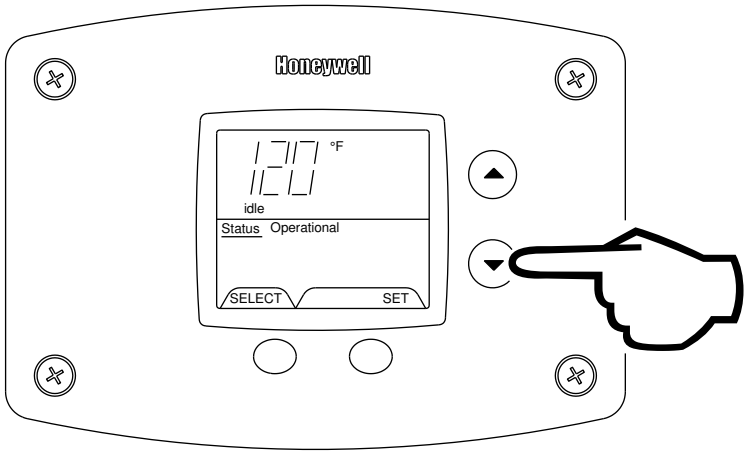


Step 3: Press “SET” button for new setting to take effect immediately. “Setpoint” will stop flashing. If the “SET” button is not pressed, the new temperature setting will take effect in approximately 10 seconds.

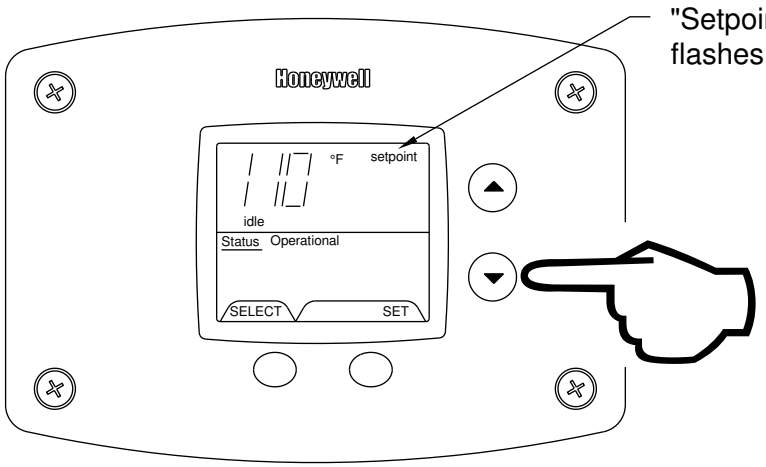


To Decrease Setpoint Temperature

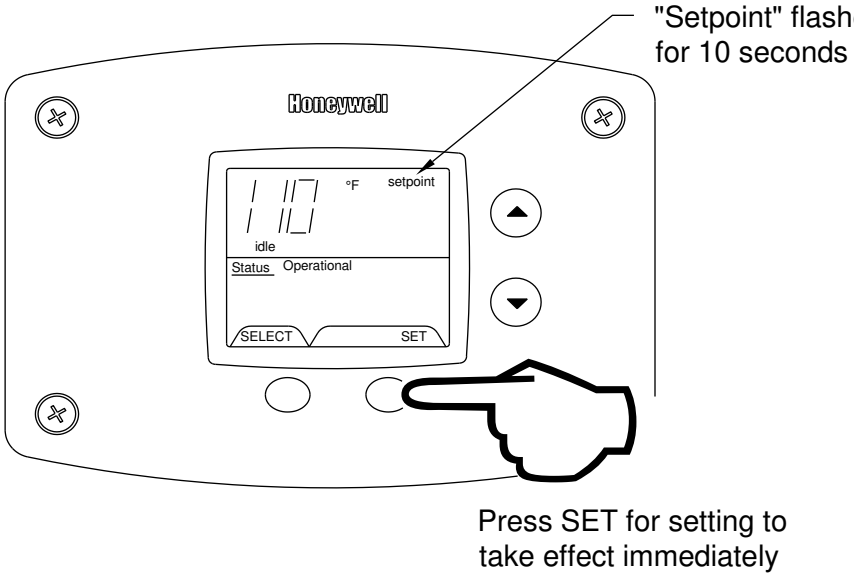
Step 1: Depress and hold “Temperature Down” button until desired setpoint temperature appears in the display.



Step 2: “Setpoint” indicator begins flashing in the display after pressing “Temperature Down” button.



Step 3: Press “SET” button for new setting to take effect immediately. The setpoint will stop flashing. If the “SET” button is not pressed, the new temperature setting will take effect in approximately 10 seconds.

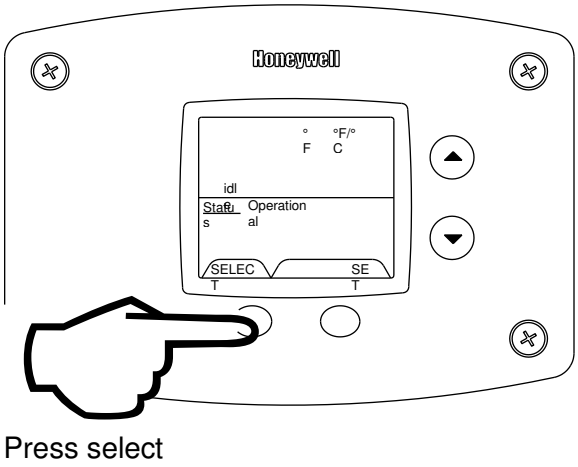


To Change Temperature Format in Display from °F to °C or ˚C to ˚F

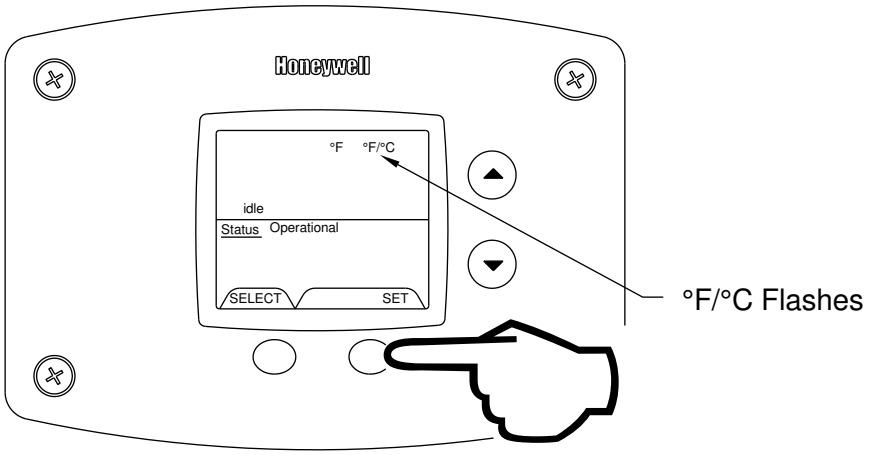
(300,000 BTU/hr and below)

See supplement included with 399,999 BTU/hr models for this information

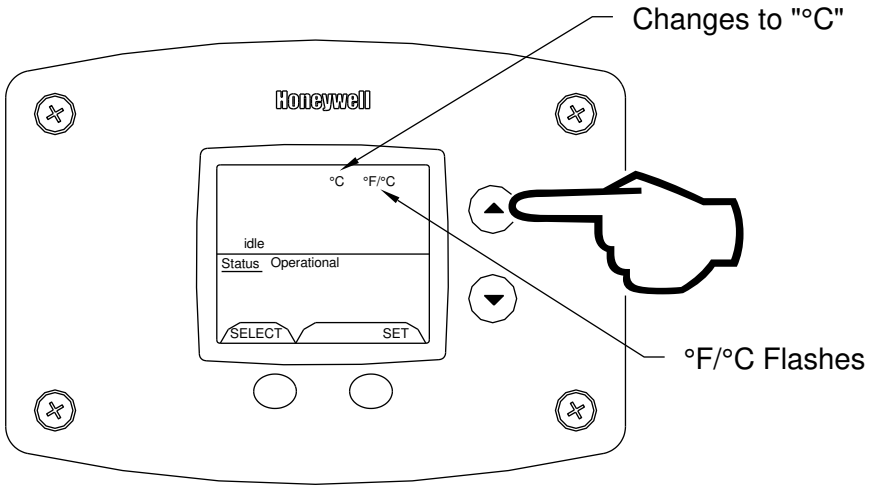
Step 1: Press “SELECT” button until °F/°C is displayed.



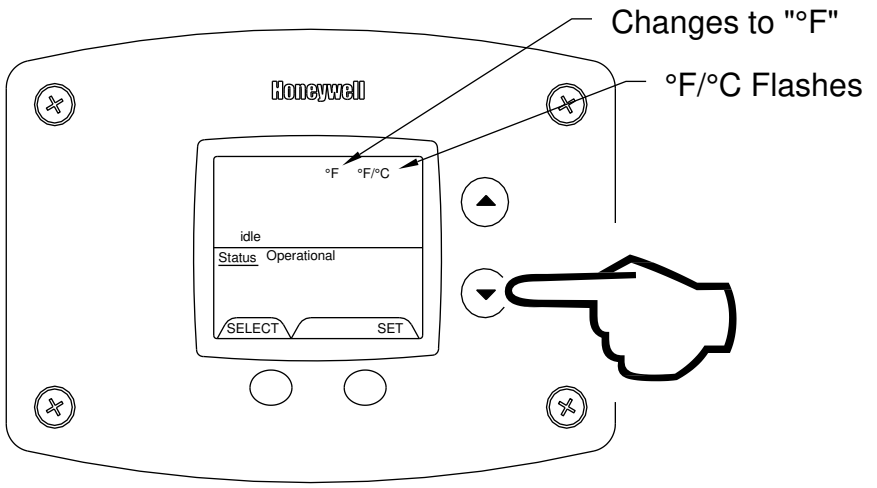
Step 2: Press “SET” button to change temperature format. Symbol °F/°C will flash.



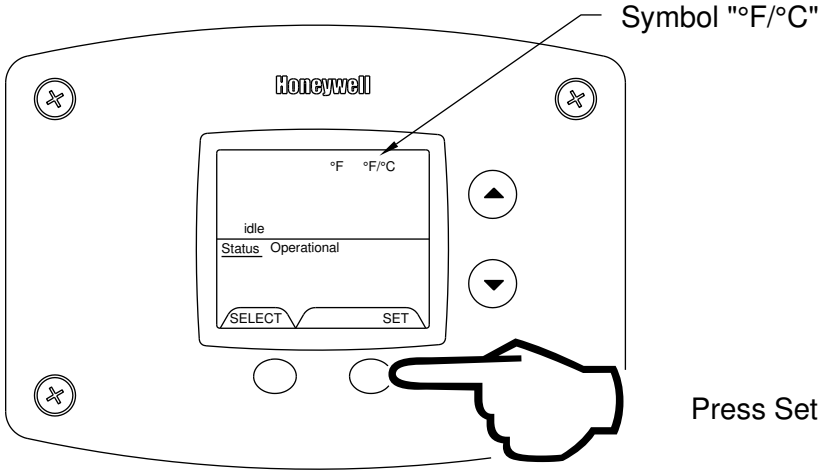
Step 3a: Press “Temperature Up” button to change temperature format to °C.



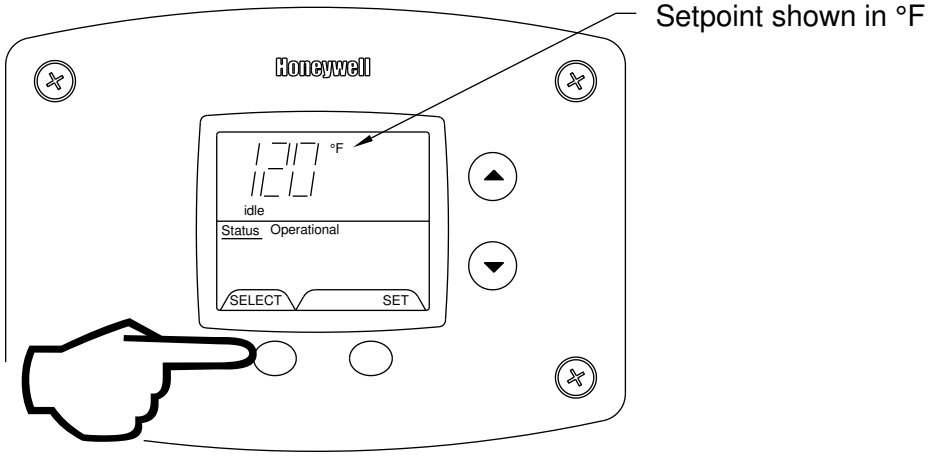
Step 3b: Press “Temperature Down” button to change temperature format to °F.



Step 4: Press “SET” button to confirm ˚F or ˚C format. °F/°C will stop flashing. Setpoint display will appear in the format selected (˚F or ˚C) in 10 seconds.



Step 5: Pressing “SELECT” button will return display to setpoint in format selected (˚F or ˚C) immediately.



Press select

An energy cut out (ECO) is incorporated in the sensor and control board which will shut off all gas supply to the burner if the water heater temperature exceeds 200°F (*93°C*). Should the ECO function (open), the water temperature should be reduced to approximately 120°F (*49°C*) and call a qualified service agent to place the water heater in operation. The water heater must have the problem corrected by a qualified service person before putting the water heater back in operation. It is recommended that all service work be performed by a qualified service agency.

If the water heater is to remain idle for 30 days or more or is subjected to freezing temperatures while shut off, the water heater and piping should be fully drained (See “To Drain the Water Heater”) and the drain valve should be left fully open.

⚠ WARNING

Hydrogen gas can be produced in an operating water heater that has not had water drawn from the tank for a long period of time (generally two weeks or more). **HYDROGEN GAS IS EXTREMELY FLAMMABLE.** To prevent the possibility of injury under these conditions, we recommend the hot water faucet to be open for several minutes at the kitchen sink before you use any electrical appliance which is connected to the hot water system. If hydrogen is present, there will be an unusual sound such as air escaping through the pipes as hot water begins to flow. **DO NOT smoke or have open flame near the faucet at the time it is open.**

⚠ WARNING

DO NOT run out of propane gas. Damage to the water heater may occur.

SECTION X: MAINTENANCE

⚠ DANGER
DO NOT attempt to repair gas valve.
DO NOT attempt to repair ignition module.
DO NOT attempt to repair venturi.
DO NOT attempt to repair thermostat board.
DO NOT attempt to repair transformer.
DO NOT attempt to repair pressure switch.

General

NOTE: *KEEP APPLIANCE AREA CLEAR AND FREE FROM COMBUSTIBLE MATERIALS, GASOLINE AND OTHER FLAMMABLE VAPORS AND LIQUIDS.*

Water heater maintenance includes periodic tank flushing and cleaning, and removal of lime scale. The unit should be inspected and adjusted to maintain proper combustion. Refer to Table 5, Suggested Maintenance Schedule (next page). A periodic inspection of the venting system should be made.

Burner Flame Check

At the time of installation and at monthly intervals, a visual check of the burner flames should be made to determine if they are burning properly. The main burner may be seen through the sight glass window on the front of the combustion insert mounting bracket (see Figure 31). The burner flames should be a blue flame near the burner surface in a uniform flame pattern. Occasional yellow or white streaks are normal.

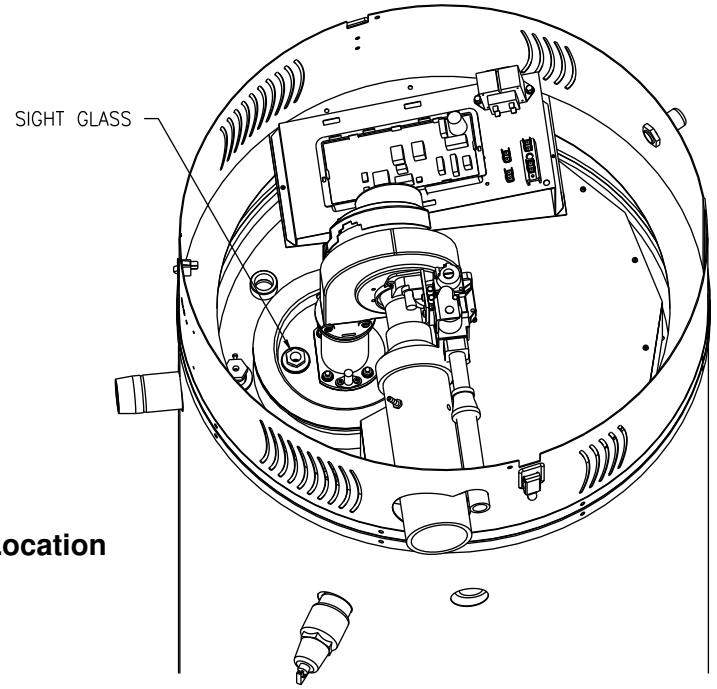


Figure 31 - Sight Glass Location

Maintenance Schedule

⚠ WARNING
Water heaters are heat producing appliances. To avoid damage or injury there must be no materials stored against the water heater or vent-air intake system, and proper care must be taken to avoid unnecessary contact (especially by children) with the water heater and vent-air intake system. **UNDER NO CIRCUMSTANCES SHOULD FLAMMABLE MATERIALS, SUCH AS GASOLINE OR PAINT THINNER BE USED OR STORED IN THE VICINITY OF THIS WATER HEATER, VENT-AIR INTAKE SYSTEM OR IN ANY LOCATION FROM WHICH FUMES COULD REACH THE WATER HEATER OR VENT-AIR INTAKE SYSTEM.**

IMPORTANT

The water heater should be inspected at a minimum annually by a qualified service technician for damaged components and/or joints not sealed. **DO NOT** operate this water heater if any part is found damaged or if any joint is found not sealed.

The following are instructions for performing some of the recommended maintenance. Unit inspection and adjustment should be performed by a qualified technician.

Table 6 - Suggested Maintenance Schedule

Service Interval	Component	Operation	Action
1 Month:	Tank	Sediment removal	Drain off several gallons of water.
	Condensate Line	Inspect & clean	Clear drainline and trap, verify proper pitch.
1 Year:	Powered Anode System	Check LED/inspect rods	1st year: check rods to determine service interval; check LED annually.
	Relief Valve	Function test	Operate lever, inspect for blockage or corrosion.
	Vent & Air Intake System	Inspect	Inspect joint seals/vent supports; clean air filter accessory kit if used.
	Vent Terminals	Free of blockage & debris	Clear intake and exhaust terminals, clean terminal screens.
	Combustion System	Inspect & clean	Clean flame sensor, igniter, & inspect burner.

Flushing Water Heater

1. Turn OFF the water heater electrical disconnect switch.
2. Open the drain valve and allow water to flow until it runs clean.
3. Close the drain valve when finished flushing.
4. Turn ON the water heater electrical disconnect switch.

Draining Water Heater

The water heater must be drained if it is to be shut down and exposed to freezing temperatures. Maintenance and service procedures may also require draining the water heater.

1. Turn OFF the water heater electrical disconnect switch.
2. Connect a hose to the drain valve.
3. Locate hose discharge in an area where hot water will not cause any damage or injury.
4. Close the cold water inlet valve to water heater.
5. Open a nearby hot water faucet to vent the system.
6. Open the heater drain valve.
7. If the water heater is being drained for an extended shutdown, it is suggested the drain valve be left open during this period.

Filling Water Heater

1. Close the water heater drain valve. This water heater utilizes a ball valve; when closing the valve, the stem will spin indefinitely. Confirm it is closed by ensuring the slot on the stem is perpendicular to the valve body. If alternative water connections are provided but not used, make certain they are plugged (i.e. space heating & alternate top connections).
2. Open the cold water supply shut-off valve.
3. Open several hot water faucets to allow air to escape from the system.
4. When a steady stream of water flows from the faucets, the water heater is filled. Close the faucets and check for water leaks at the water heater drain valve, combination temperature and pressure relief valve and the hot and cold water connections.

Sediment and Lime Scale Removal

Waterborne impurities consist of the particles of soil and sand, which settle out and form a layer of sediment on the bottom of the tank. The amount of calcium carbonate (lime) released from water is in direct proportion to water temperature and usage. The higher the water temperature or water usage, the more lime deposits are dropped out of the water. This is the lime scale, which forms in pipes, water heaters and on cooking utensils. Lime accumulation not only reduces the life of the equipment but also reduces efficiency of the water heater and increases fuel consumption.

The usage of water softening equipment greatly reduces the hardness of the water. However, this equipment does not always remove all of the hardness (lime). For this reason, it is recommended that a regular schedule of deliming be maintained. The depth of the buildup should be measured periodically. Water heaters will have about 3 in of lime buildup when the level of lime has reached the bottom of the cleanout opening or about 1 inch of lime buildup if it has reached the drain valve opening. A schedule for deliming should be set up, based on the amount of time it would take for a 1/2 in buildup of lime. For example, if an initial inspection shows a 1/2 in of lime accumulation, the water heater can be delimed once a year.

To Remove Sediment and Lime Scale

1. Drain the heater. Refer to Draining The Water instructions in this section.
2. Remove outer cover plate from lower side of water heater jacket.
3. Remove cover and gasket from cleanout opening.
4. Remove lime, scale or sediment using care not to damage the glass-lining.
5. Inspect cleanout plate gasket: Replace gasket if necessary (contact local distributor for correct part number).
6. Install gasket and cleanout plate. Be sure to draw plate up tight by tightening screws securely.
7. Close the drain valve. Open a hot water fixture to allow air to escape. Open the cold water supply to water heater and allow the tank to fill. Follow the lighting instructions.
8. Check for water leakage.
9. Install outer jacket cover plate.

Anode Inspection and Replacement

This water heater is equipped with multiple sacrificial anodes. Anodes protect the glass-lined tank from corrosion by sacrificing themselves through electrolysis. When the anode material is consumed, there is no more protection and corrosion of the tank accelerates. Inspection of the anode every 6 months allows you to identify the rate of anode degradation. The anode should be replaced when its diameter is 3/8 in, or annually whichever is first. Aggressive, very hot and softened water causes rapid consumption of the anode requiring frequent inspections. The replacement anodes rods are available from your Bradford White distributor.

To Inspect or Replace An Anode

The anodes on this water heater are easily accessible from the top of the water heater making replacement simple and quick. Use the following procedure to remove and inspect the anodes.

1. Drain the heater. Refer to Draining The Water Heater instructions in this section.
2. Flush the heater. Refer to Flushing The Water Heater instructions in this section.
3. Remove the combustion surround top by unlatching.
4. Remove the second pass access cover (If equipped).
5. Remove the second pass insulation.
6. Remove the second pass collector cover.
7. Remove the anode using a socket of the appropriate size. Sometimes a breaker bar will need to be used. **DO NOT** use an impact wrench.
8. Inspect and replace the anode as required. Use pipe tape or sealant when reinstalling the anode.
9. Close the drain valve. Open a hot water fixture to allow air to escape. Open the cold water supply to water heater and allow the tank to fill.
10. Check your anode and drain valve for leaks.
11. Replace second pass collector cover. Make sure to clean off any sealant and reseal before fastening.
12. Replace second pass insulation.
13. Replace second pass access cover.
14. Replace combustion surround top and latch it securely in place.
15. Follow the lighting instructions.

Powered Anode System For 100 Gallon 399,999 BTU/Hr *(117.2 Kw)* Input Models

Models with input ratings of 399,999 BTU/hr *(117.2 kw)* are equipped with a powered anode system. The powered anode system provides corrosion protection to the tank by supplying a low voltage current to the titanium anode rods and then periodically comparing this current with the potential between the anode rod and tank wall to make corrections. The powered anode system is designed to extend the tank life without requiring anode rod replacement. The powered anode system consists of two titanium powered anode rods (31 7/8 in *(81 cm)* long), located in the front top of the water heater tank, and the powered anode control module located on the right side of the control panel. In addition, there is one additional magnesium anode rod (non-powered) located under the top flue collector for additional back-up protection.

The powered anode rod must have the electrical power supply connected at all times in order to provide corrosion protection to the water heater tank. If the electrical supply to the water heater is to be off for an extended period of time, the water heater must be drained. Turning off the lighted switch on the front panel to shut off the water heater will not turn off the powered anode system, as long as the line cord is plugged in and the breaker is left on.

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

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

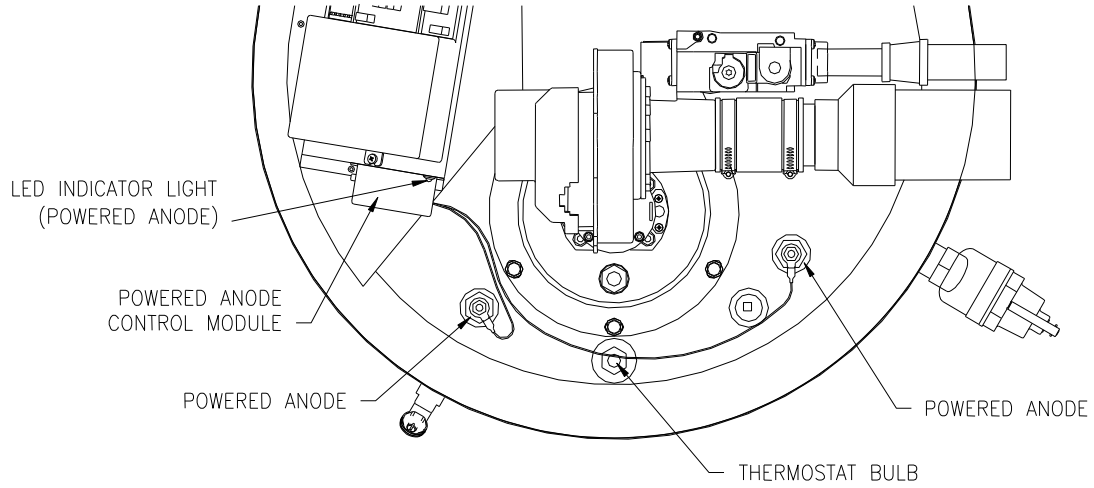


Figure 32 - Powered Anode Locations

Drain Valve and Tank Access Panel

The water heaters are equipped with a 3/4 in drain valve.
An access panel covers the cleanout opening in the tank, which is sealed by a gasket and cover.

Relief Valve

At least twice a year, the temperature and pressure relief valve should be checked to ensure that it is in operating condition. To check the relief valve, lift the lever at the end of the valve several times. The valve should seat properly and operate freely.

If water does not flow, remove and inspect for obstructions or corrosion. Replace with a new valve of the recommended size as necessary. A thorough inspection of the valve should be performed at least every three years by removing the temperature and relief valve from the tank. **DO NOT** attempt to repair the valve, as this could result in improper operation and a tank explosion. In areas with poor water conditions, it may be necessary to inspect the T&P valve more often than the recommended maintenance schedule.

Relief Valve continued-

⚠ CAUTION

Before manually operating the valve, make sure that a drain line has been attached to the valve to direct the discharge to an open drain. Failure to take this precaution could mean contact with extremely hot water passing out the valve during this checking operation.

If the temperature and pressure relief valve on the water heater discharges periodically or continuously, it may be due to thermal expansion of water in a closed water supply system, or, it may be due to a faulty relief valve.

Thermal expansion is the normal response of water when it is heated. In a closed system, thermal expansion will cause the system pressure to build until the relief valve actuation pressure is equaled. Then, the relief valve will open, allowing some water to escape, slightly lowering the pressure.

Contact your water supplier or local plumbing inspector on how to control this situation.

⚠ WARNING

Above all, DO NOT plug the temperature and pressure relief valve. This is NOT a solution and can create a hazardous situation.

Vent and Air Intake System

Examine the vent and air intake system every 3 months. Points of inspection are as follows:

1. Check for obstructions and/or deterioration of vent piping and vent terminal. Replace immediately where needed.
2. Vent pipe and vent terminal screen should be cleaned of any foreign material. The screen is located inside the vent terminal outlet and is accessible from the outside of the vent terminal elbow. DO NOT reach inside the vent terminal when the water heater is in operation.
3. Check all venting system connections for leakage and reseal as required.

Combustion System Inspection

Inspect the operation of the combustion system monthly. Use the following procedure to inspect the combustion system.

1. Turn OFF the main power switch of the water heater.
2. Adjust the thermostat to the minimum setting.
3. Remove the top of the combustion surround by unlatching it.
4. While observing the ignition module, turn on the main power switch.
5. Adjust thermostat to the maximum setting.
6. Watch the LED's light as the controller goes through the sequence of operations as previously described.
7. Upon ignition, observe the main burner flame.
8. Readjust thermostat to previous setting.
9. Replace combustion surround top and latch it securely in place.

⚠ WARNING

DO NOT run out of propane gas. Damage to the water heater may occur.

SECTION XI: DIAGNOSTIC AND TROUBLESHOOTING GUIDE

Direct Spark Honeywell Integrated Control System
Sequence of Operation

1. When the tank temperature drops below the temperature setpoint on the display, the control sends power to the combustion blower for a 30 second pre-purge period.

2. At the end of the pre-purge period, the control sends high voltage through the spark cable to the spark rod to spark to the burner and the gas valve also opens.

3. If the burner lights, a microamp current is generated through the flame sense rod allowing the control to detect burner flame.

4. The sparking then ceases, and the flame is monitored by the flame sense circuit until the tank temperature reaches the thermostat setpoint and turns off the gas valve.

5. If the burner fails to light, the gas valve closes, sparking to the burner stops, and the combustion blower continues to operate for 60 seconds to purge the heat exchanger of unburned gas.

6. The ignition trial is repeated. The control will make 3 attempts to ignite the burner. If the burner fails to light after the third attempt, the control enters “Soft Lockout”, which is an idle period for 60 minutes.

7. There will be an error code 62 or 63 shown on the water heater display indicating that the control cycled through the maximum number of ignition retries for ignition. The control will make another 3 ignition attempts after the 1 hour waiting period.

8. If the exhaust vent terminal should become blocked or the condensate drain becomes plugged, the exhaust vent pressure switch will open and the gas valve closes. The combustion blower will continue to operate. An error code 29 is shown on the water heater display.

9. Removing the blockage will resume normal operation.

10. The burner flame is monitored by the flame sense circuit and if the flame should extinguish, the gas valve closes, and the combustion blower will operate to purge the heat exchanger before making an attempt to relight the burner. There may be 3 attempts to relight the burner before going into the Soft Lockout period explained previously.

11. The burner will continue to operate during the heating cycle until the tank temperature reaches the setpoint. The gas valve opens and the combustion blower continues to operate for 30 seconds to purge the heat exchanger of flue gases.

12. If for some reason, the tank temperature should exceed 200°F (*93°C*), then the control closes the gas valve and goes into a “Hard Lockout” state and will not operate until reset by a qualified service person. The display will read error code “65”, which indicates the tank high limit temperature has been exceeded. **NO** attempt should be made to reset the control until a service person has corrected the cause of the high limit condition.

13. Refer to the diagnostic service section at the end of this Installation and Operation Manual.

Accessing Service Mode On The Water Heater Display (For Service Personnel Only) (300,000 BTU/hr and below)

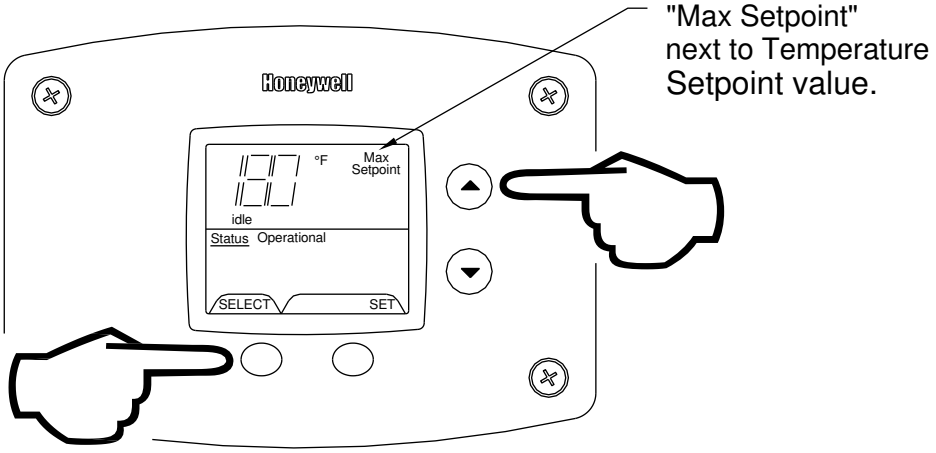
See supplement included with 399,999 BTU/hr models for this information

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:

⚠ WARNING

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

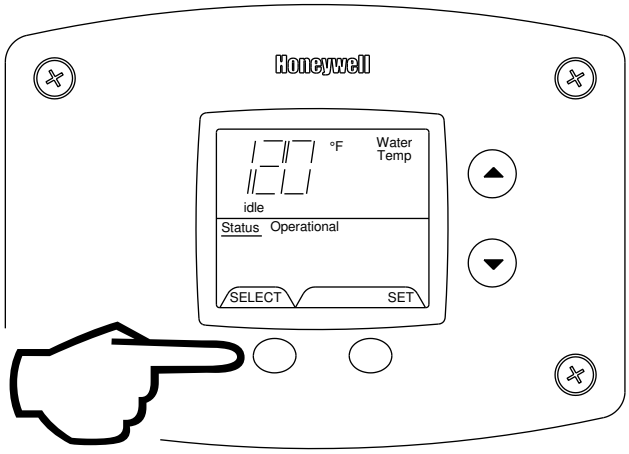
Step 1: Press “Select” and “Temperature Up” buttons together and hold for 3 seconds until “Max Setpoint” is shown in the display.



NOTICE

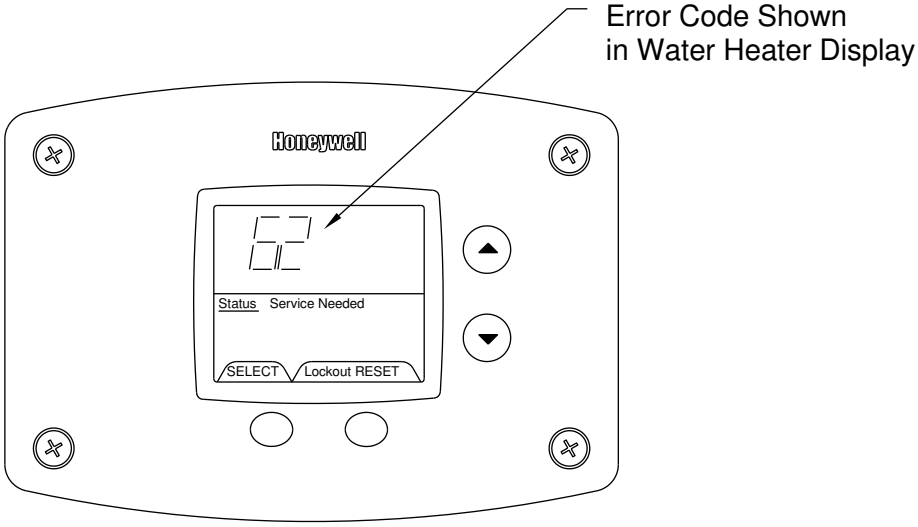
12.5 minutes after the last button press, the display will automatically return to the “User Mode”. Simultaneously pressing the “Select” and “Temperature Up” buttons will switch the display immediately to the “User Mode”.

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

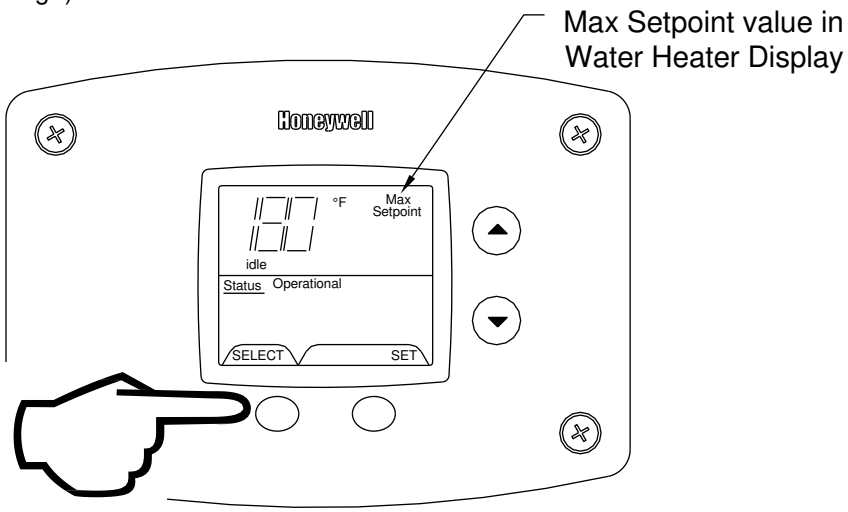


Sequence Of Modes Available In “Service Mode” By Pressing The “Select” Button

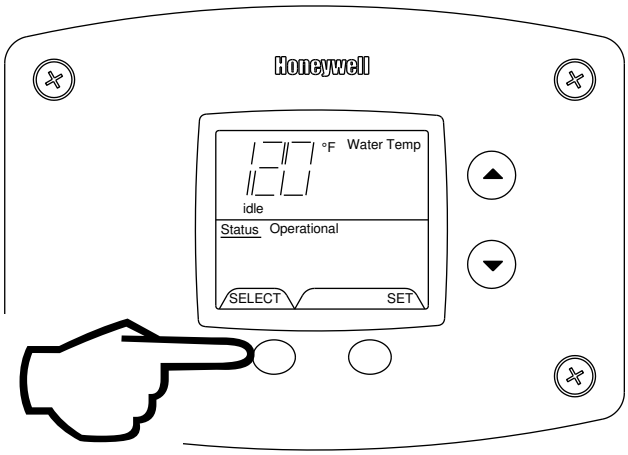
Error Code Number (Display/Reset). This is only shown if there is an operating error in the “User Mode”.



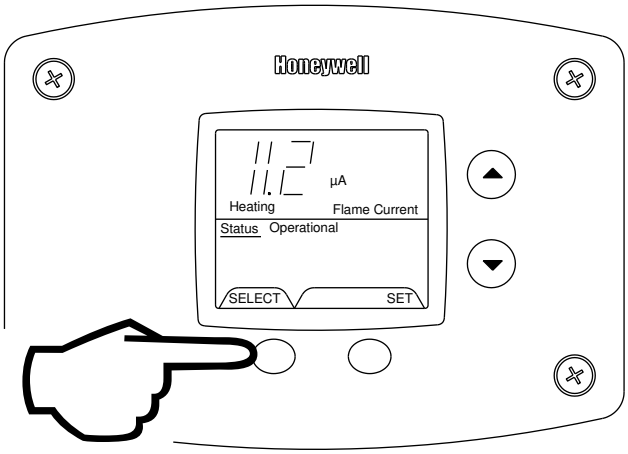
1. Max Setpoint (Display/Change)



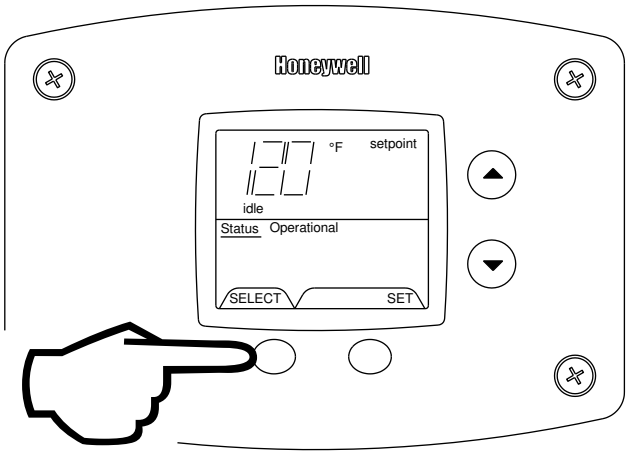
2. Water Temperature Sensor Reading



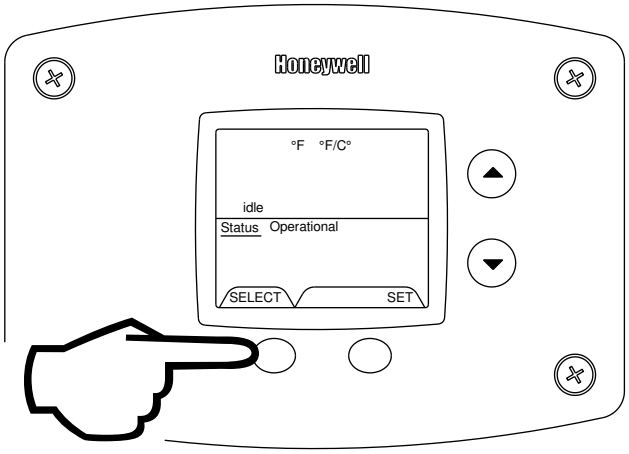
3. Flame Current of Pilot Flame Sensor (Displays only in the Heating Cycle)



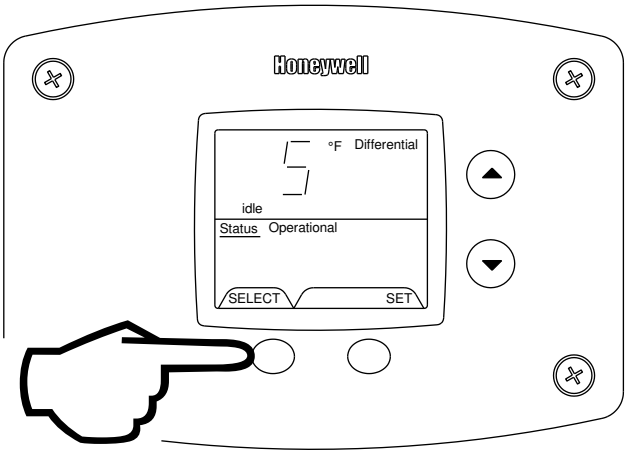
4. Setpoint (Display/Change)



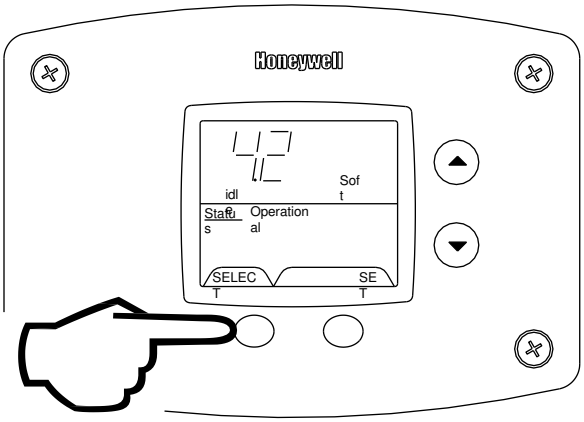
5. ˚F/˚C (Display/Change)



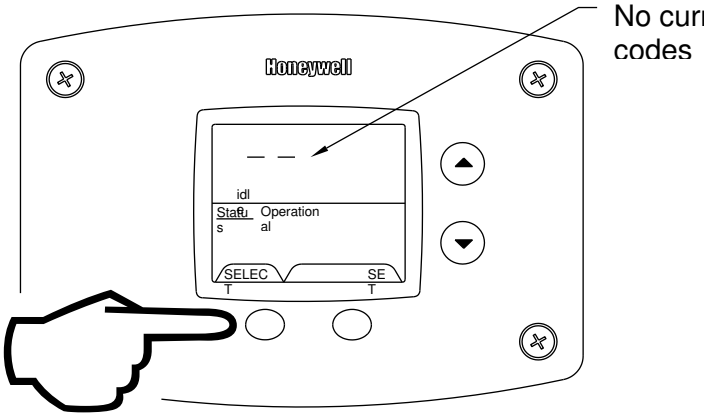
6. Differential (Display only – shows the differential of the thermostat)



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 -- if there are no error codes.

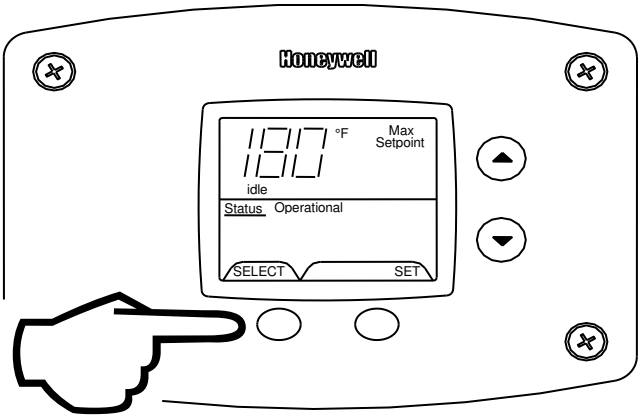


To Change The Maximum Setpoint Limit (Max Setpoint) For The Temperature Setpoint

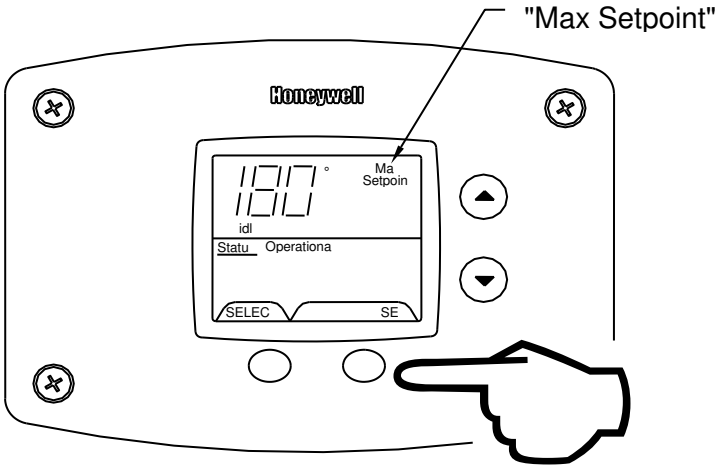
⚠ WARNING

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. See following section to change the maximum setpoint limit (max setpoint). Make sure the water heater control display is not in a public area that can result in the temperature settings being improperly adjusted. See previous warning on scalds and an ASSE approved mixing valve.

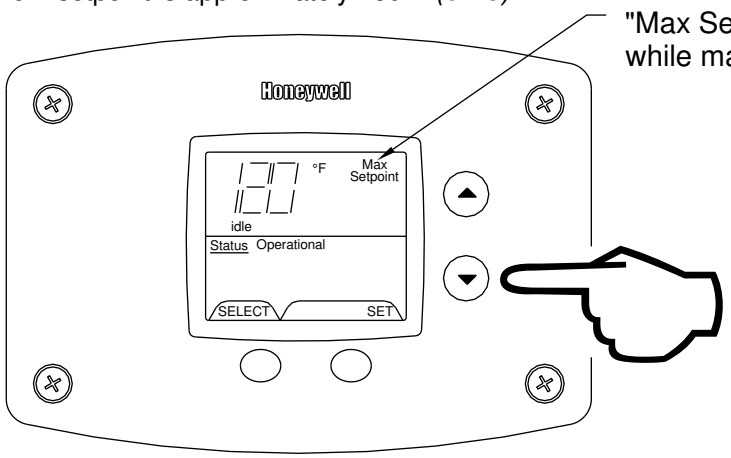
Step 1: In service mode press the “Select” button until “Max Setpoint” is displayed.



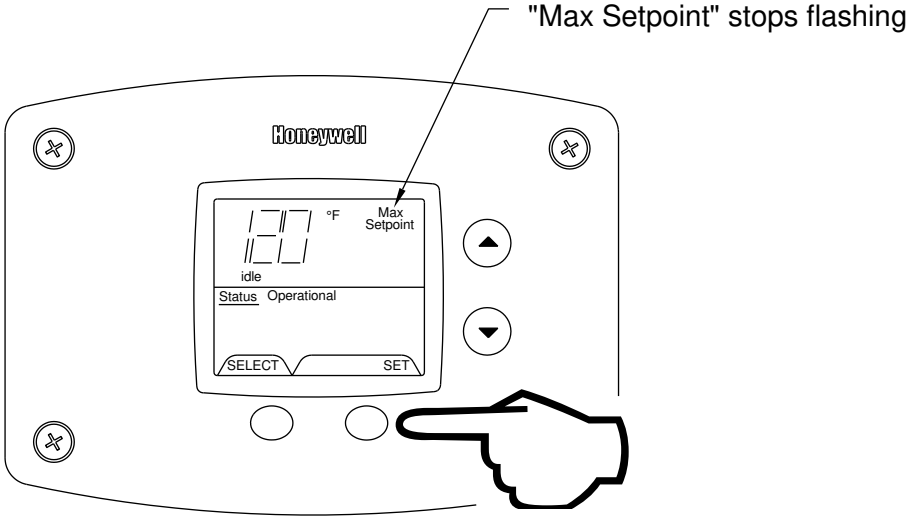
Step 2: Press “Set” button to enter setting mode. “Max Setpoint” will flash to indicate setting mode.



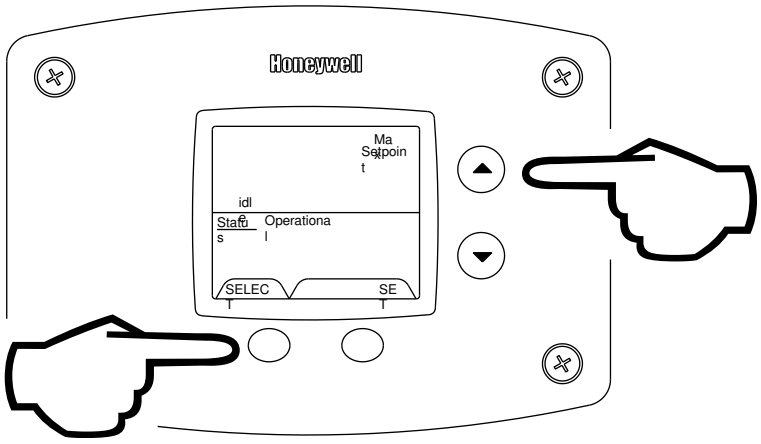
Step 3: Press the “UP” or “DOWN” buttons to change the maximum setpoint value. This will limit the maximum setpoint the user can select. Note: The maximum setpoint is approximately 180˚F *(82˚C)*.



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



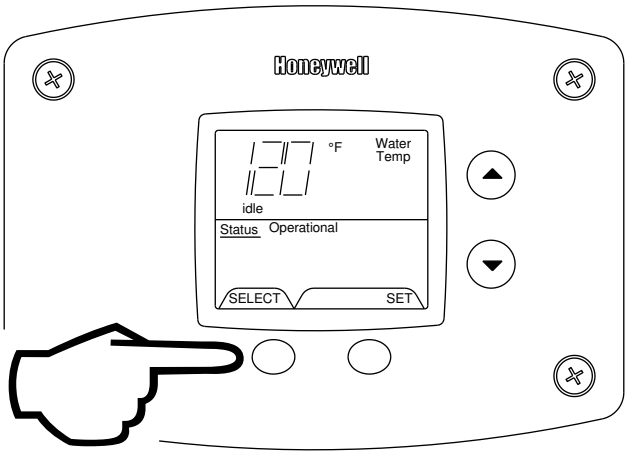
Step 5: 12.5 minutes after the last button press, the Water Heater Display will go back to “User Mode”. It will read “Max Setpoint” without showing a temperature value if the temperature setpoint is at the maximum setting. The Water Heater Display can be set back to the “User Mode” immediately by pressing both the “Temperature Up” and “Select” buttons together for 3 seconds.



Exiting Service Mode

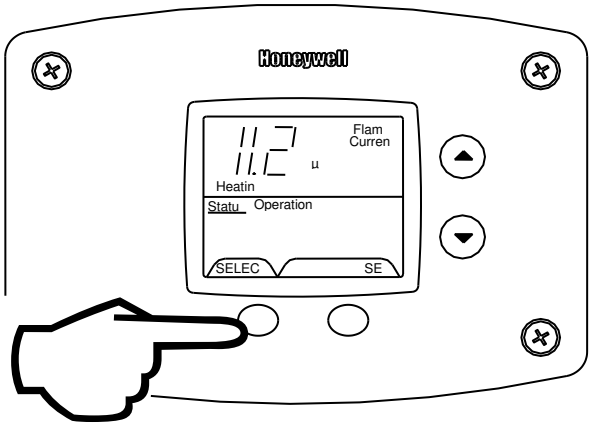
Display of Water Temperature

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 tank sensor.



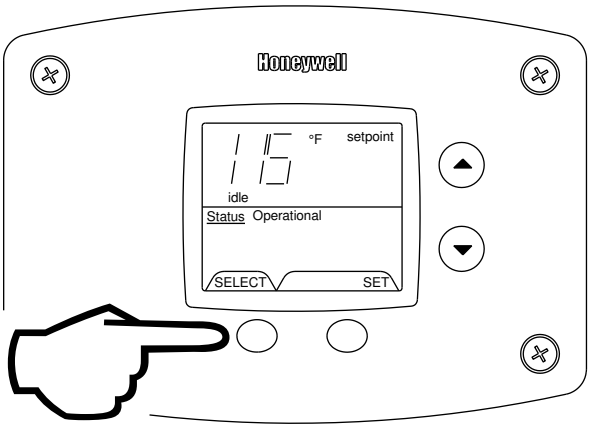
To Display Flame Sense Current of the Pilot Flame Sensor

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 (µA).

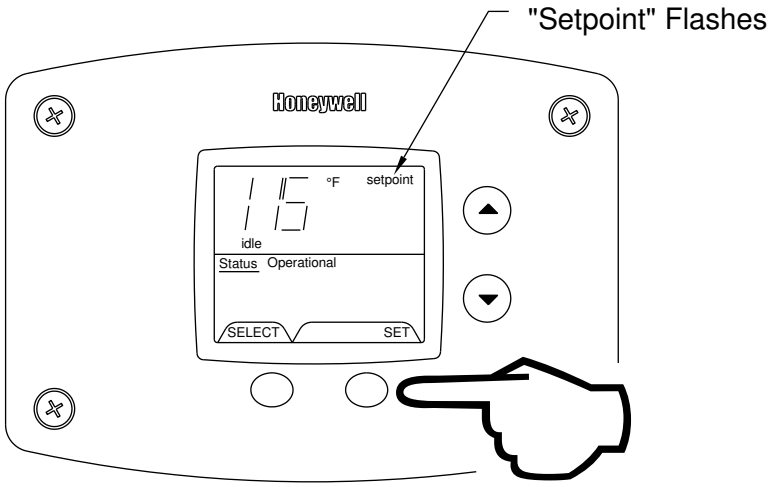


To Display and Change Temperature Setpoint

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



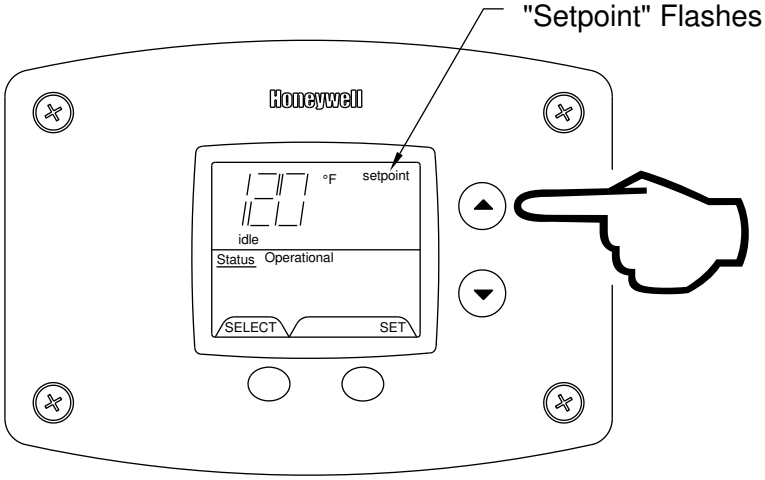
Step 2: Press the “Set” button to enter the setting mode. “Setpoint” will flash in the water heater display.



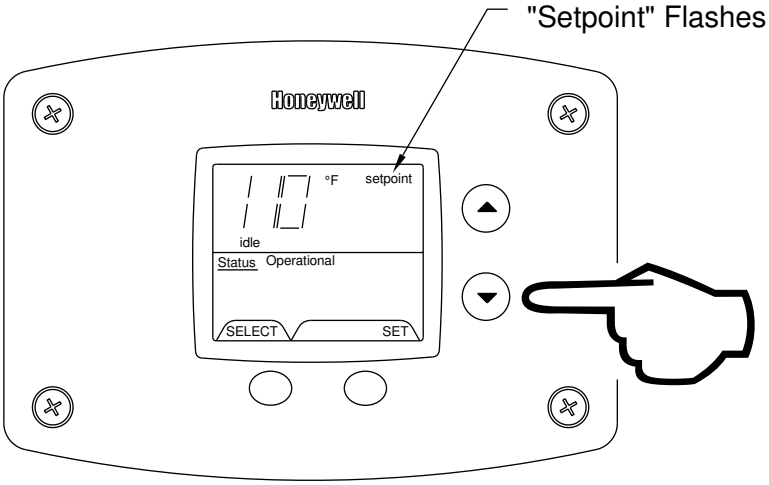
NOTICE

Note: 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”.

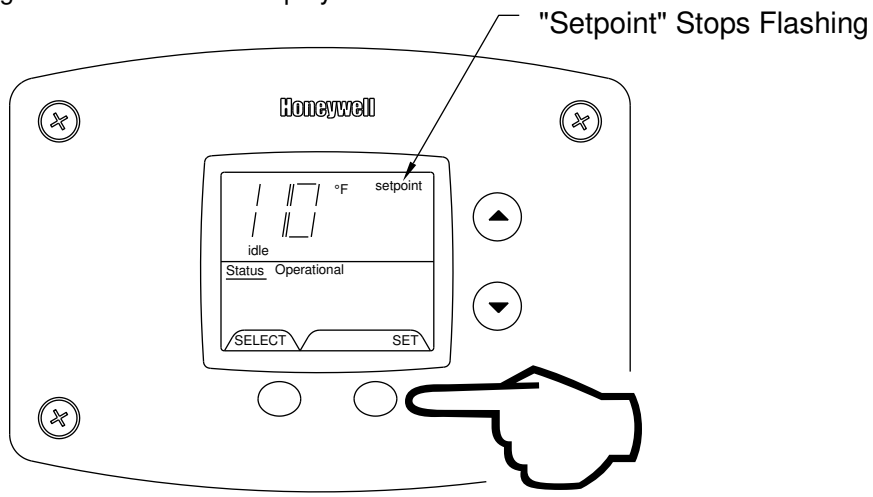
Step 3: To raise the temperature setpoint, press the “Temperature Up” button until the desired temperature is shown on the water heater display.



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

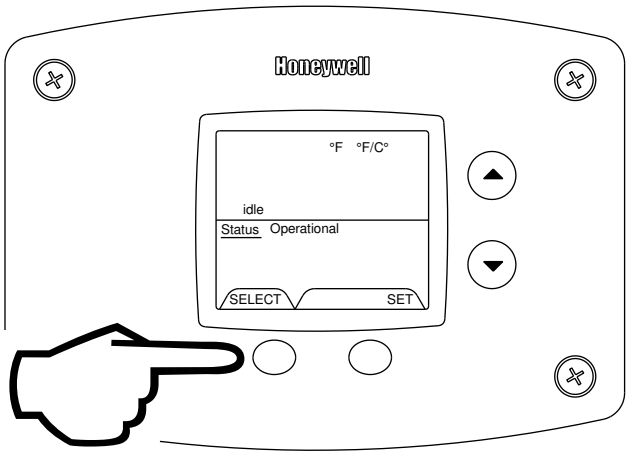


Step 5: When the desired setpoint is reached on the water heater display, press the “Set” button to confirm the new setpoint. “Setpoint” stops flashing in the water heater display.

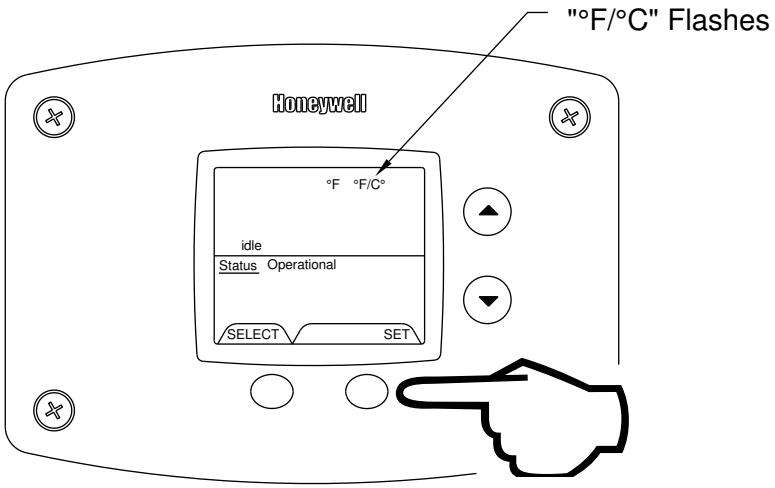


To Change Temperature Format in Display from ˚F to ˚C or ˚C to ˚F

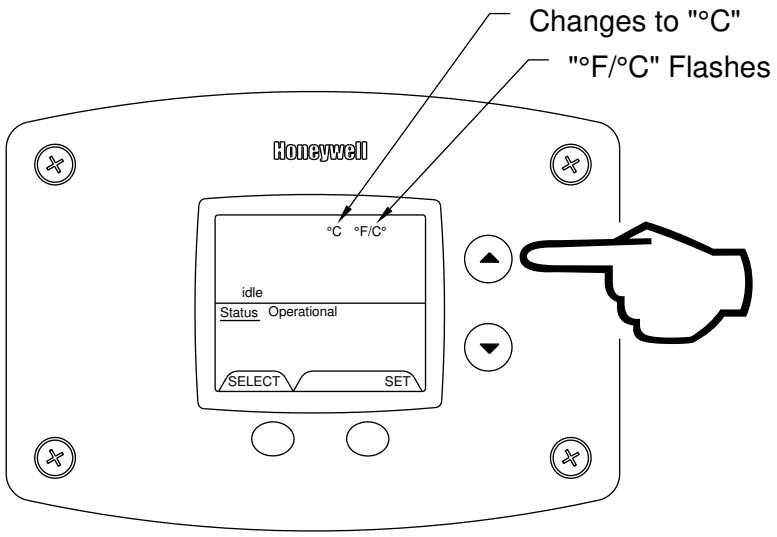
Step 1: While in “Service Mode”, press “Select” button until “˚F/˚C” is shown in the upper right portion of the water heater display.



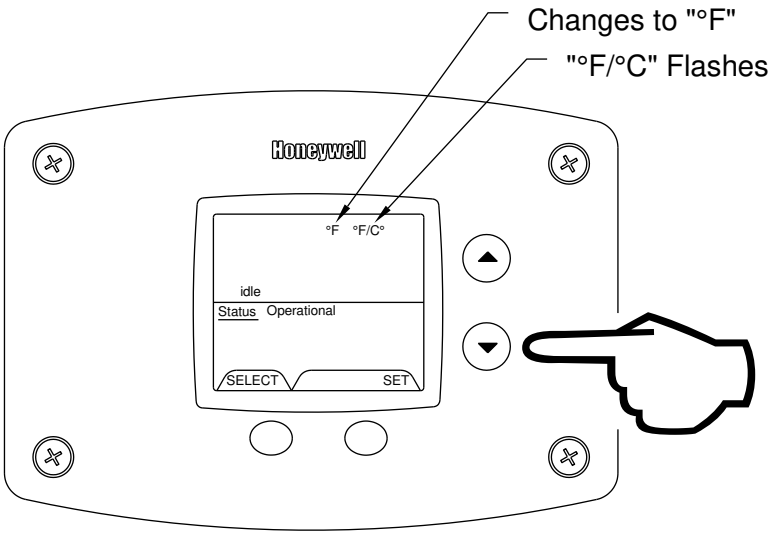
Step 2: Press “Set” button to change temperature format. “˚F/˚C” symbol will flash in the water heater display.



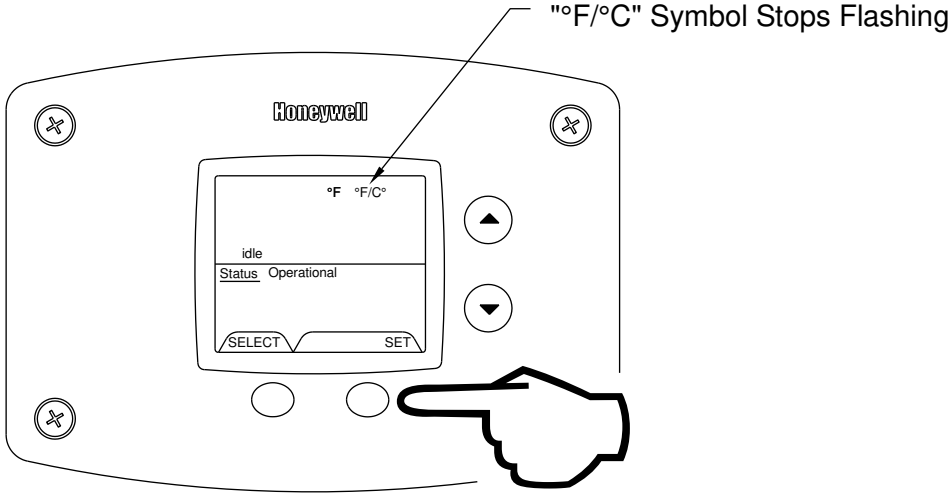
Step 3a: Press “Temperature Up” button to change temperature format to ˚C.



Step 3b: Press “Temperature Down” button to change temperature format to ˚F.



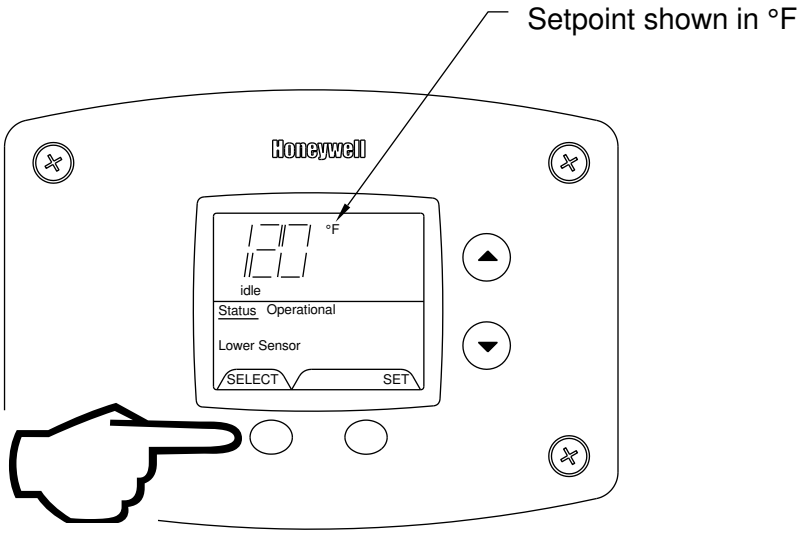
Step 4: Press “Set” button to confirm ˚F or ˚C format. ˚F/˚C will stop flashing.



⚠ WARNING

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

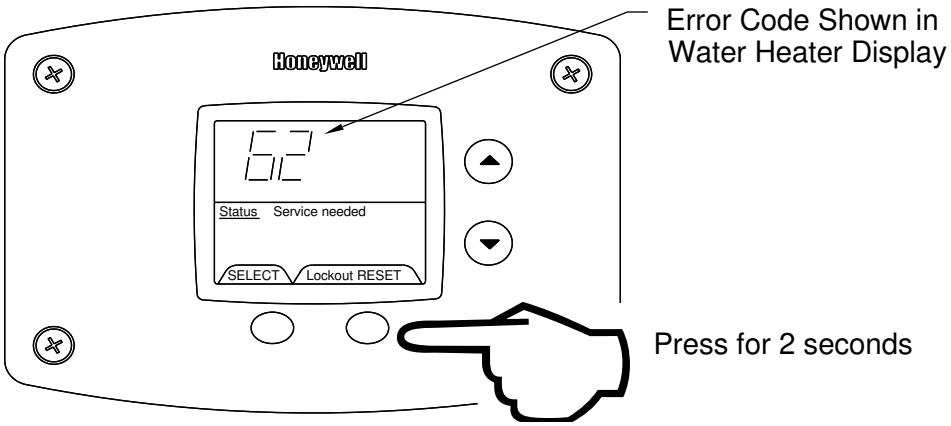
Step 5: Pressing "Select" button will return display to setpoint in format selected (˚F or ˚C) immediately.



How To Reset The Control From Lockout Conditions

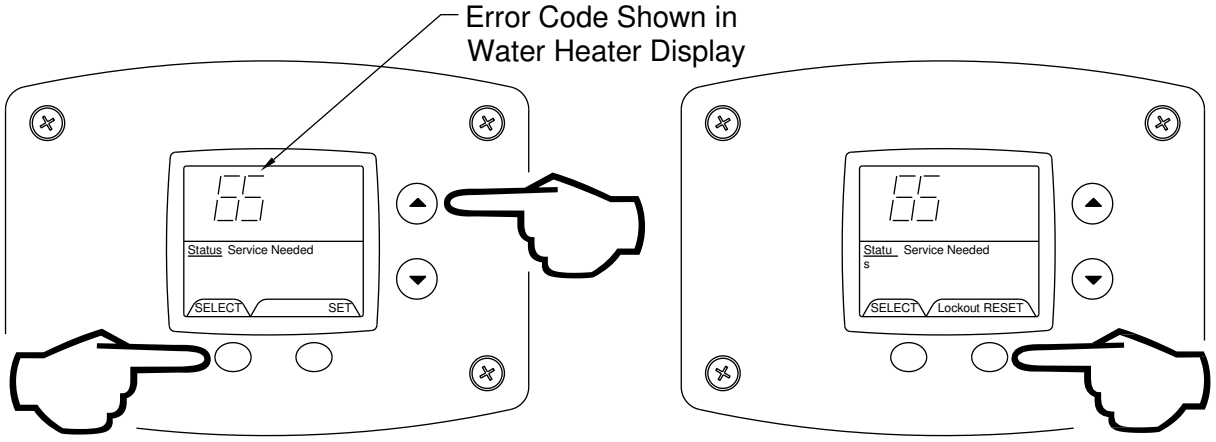
If an error code is displayed (except for #4, low flame sense current), the water heater will be in a "lockout condition" with the water heater display showing the error code number and "Service Needed" in the status section of the display window. Error codes 62 (maximum number of retries detected) and 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.

Resetting Error Codes in 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



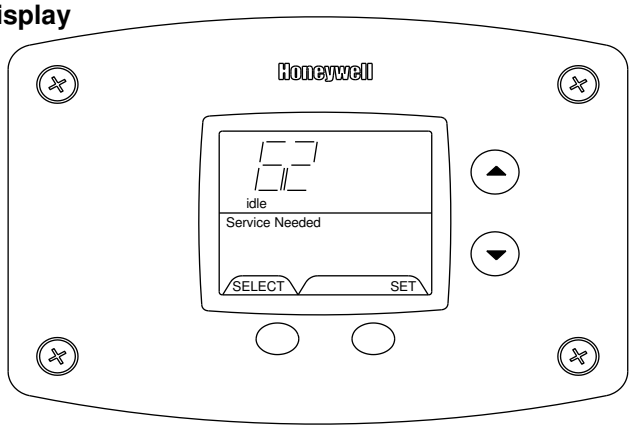
Step 1: Press for 3 seconds to enter service mode.

Step 2: Press for 3 seconds to reset control in service mode.

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 below the water heater display and the following section in this Installation and Operation Manual explains the error codes with corrective actions to repair the water heater.

Example of Error Code in the Display

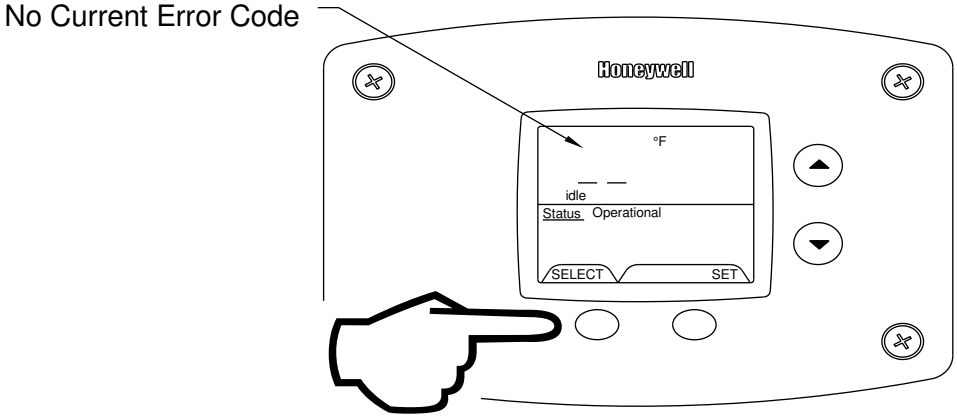


Error Code History

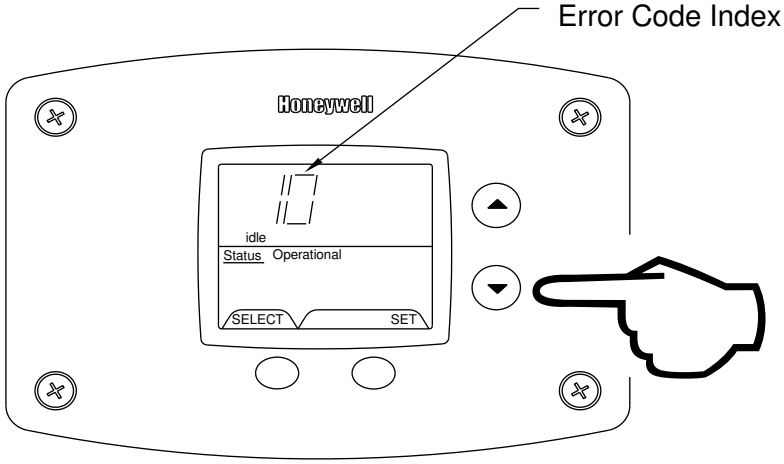
In “Service Mode” pressing the “Select” button after the “Software Version” (item 8 in the previously described sequence of service modes) will show an error code history, if there have been any previous operating problems with the water heater. If the display shows --, there is not a current error code.
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 (if there are 10 error codes).

To View Previous Error Codes:

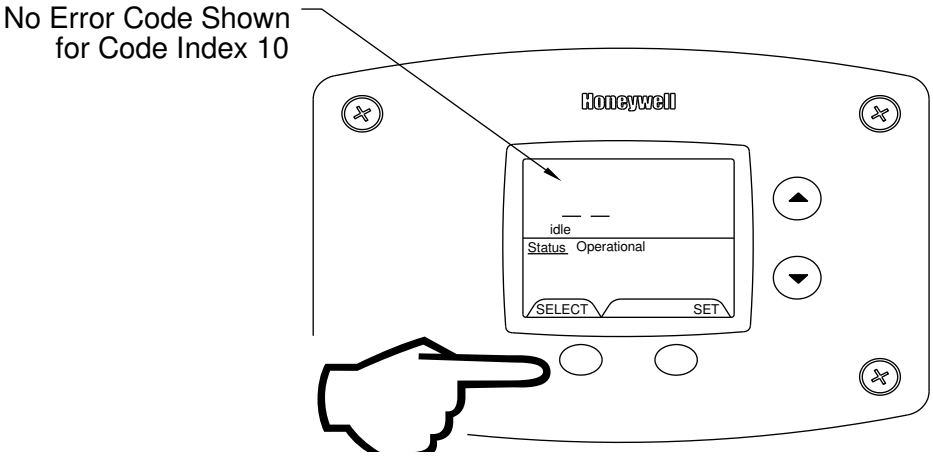
Step 1: In “Service Mode” press the “Select” button until the next display after the “Software Version”. If there are no current error codes, the display will show “--“.



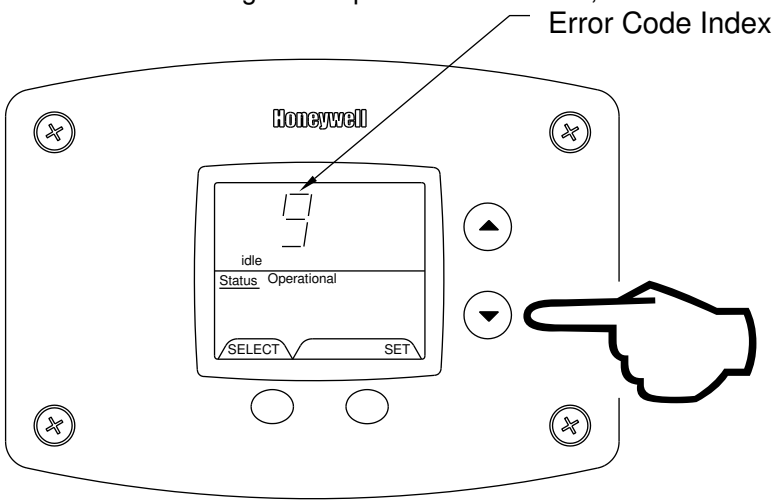
Step 2: Press the “Temperature Down” button to select the error code index, starting with the most recent error code “10”.



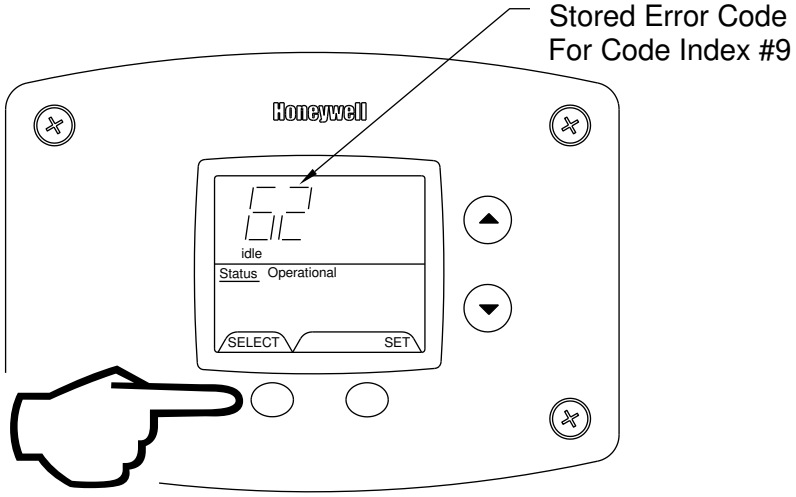
Step 3: Press the “Select” button to view the error code for “code 10”. If there is a number displayed, note what the number is. The label next to the water heater display will identify the code number. If no number is displayed with only a “--” in the water heater display, then there has not been an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



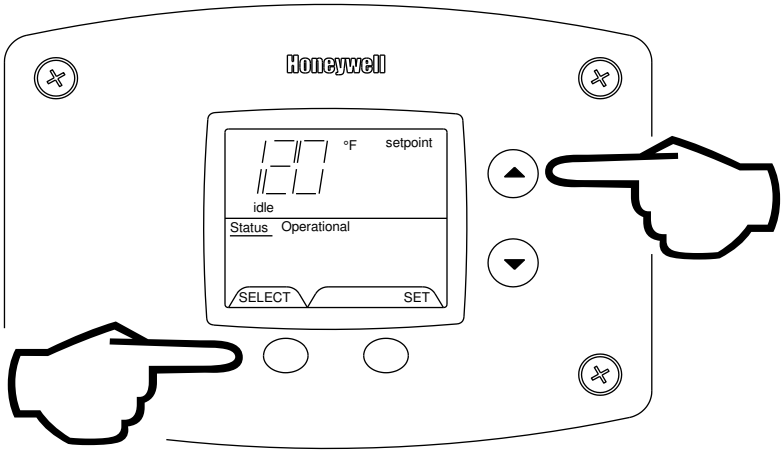
Step 4: Press the “Temperature Down” button to change to the previous code index, code #9.



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.



Exiting Service Mode

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, press Temperature Up button and Select Button for 3 seconds.

Diagnostic Error Codes And Troubleshooting Procedures For Ef Models With Honeywell Integrated Direct Spark Igniton Control System

(300,000 BTU/hr and below)

See supplement included with 399,999 BTU/hr models for this information

Error Code	Definition of Code	Cause of Problem and Actions Taken to Correct
No code – blank display		• Check power supply to the water heater. • Make sure water heater is plugged in and the breaker is on. • Check if there is 120 volts power supply to the LINE connections on the control board. • If 120 volts is present, check for 24 volts output to SECONDARY terminals on the Control Board. • Check for loose wires, defective transformer. • Check wire harness connections from display to the control board.
4	Low Flame Sense Current	• Determine flame sense current in the Service Mode with the water heater operating. • If less than 4.0 microamps, check burner flame sense rod and wire. Clean flame sense rod with emery cloth. • If problem is not solved, check for debris clogging burner or replace flame sense rod.
6	Flame Sensed Out of Normal Sequence (Before Opening Gas Valve or After Closing Gas Valve)	• Check to make sure gas valve has closed. • No voltage should be present at the gas valve before or after ignition cycle. • Make sure wire positions on the wire harness are correct. • If gas valve is stuck open, replace.
23	Flame Detected Before Ignition	• Check to make sure gas valve has closed. • No voltage should be present at the gas valve before the ignition cycle. • Make sure wire positions on the wire harness are correct. • If gas valve is stuck open, replace.
24	Flame Detected After Heating Cycle Completes	• Check to make sure gas valve has closed. • No voltage should be present at the gas valve before the ignition cycle. • Make sure wire positions on the wire harness are correct. • If gas valve is stuck open, replace.
26	Exhaust Collector Limit Switch Open	• Check to see if the exhaust collector high limit switch, located in the exhaust collector area near the pressure switch has opened. • Depress the red manual reset button on the high limit switch. • If it resets with a “click”, the switch has opened. • Check for evidence of high temperatures in this compartment. • If there is evidence of high temperatures, call Tech Support. • Do not continue to operate the water heater if high temperature is occurring in this area.
29	Pressure Switch Failed to Close	• The blocked vent pressure switch contacts have opened. • Check to make sure the venting system is not blocked. • Check to make sure the condensate drain is not clogged and is sloping toward the drain. • Make sure the vent length does not exceed the specified limits. • Make sure the vent terminal is not blocked. • Check to make sure the pressure switch tubing is clear. • Replace the pressure switch if the venting system has checked out O.K. Control will reset once problem is corrected.
32	Lower Sensor Readings Faulty	• Resistance of lower sensor out of operating range. • Check continuity of wire harness to lower sensor, and if O.K., replace lower sensor.
57	Flame Rod Shorted to Ground	• Pilot flame sensor rod is shorted to ground. • Check to see if flame sensor wire has bare spots touching metal parts of if flame sensor rod is touching the burner or other metal parts. • Replace if flame sense wire is damaged or flame rod is bent.

58	AC Line Frequency Error – Signal Too Noisy or Frequency Incorrect	• Check line voltage frequency to the water heater. • Determine if there are wide fluctuations. • Call an electrician if the problem persists. • The water heater should be on a separate line.
59	Line Voltage Too Low or High	• Check line voltage to the water heater. • Determine cause of low or high voltage. • Call an electrician or your utility. • The water heater should be on a separate line.
61	DC Output Voltage Unstable	• Check line voltage to the water heater for erratic readings. • Also check wiring to make sure there are no shorts. • If power supply and wiring are O.K., replace control board.
62	Maximum Number of Retries Detected	• Burner is either not lighting or not staying lit during ignition cycle. • Check inlet gas pressure for minimum pressure on rating label. • Can you hear sparking to the burner? • Check high voltage cable connections. • Check inlet gas pressure to the gas valve making sure the pressure is within the limits specified on the rating label. • Check gas valve wire harness for broken wires or shorts. • Check outlet gas pressure. • If 24 volts is present to the terminals at the gas valve, replace gas valve. • Check for voltage output to the blue gas valve wires on the control board pins. • If during the ignition trial period, there is no voltage present at the control board pin terminals for the blue wires leading to the gas valve, then replace the control board. • Replace spark rod if insulator is damaged or rod is loose. • Check to make sure combustion blower is operating when thermostat calls for heat. • If blower is not running check for 120 volts to blower harness and then at blower pin connections. • Replace control, wire harness, or blower if defective. • Check to make sure vent terminals are clear of debris or snow and ice. Make sure the condensate drain flows freely.
63	Maximum Number of Ignition Recycles Detected	• Burner flame is lost during run cycle, then re-established on ignition cycle. • Check inlet gas pressure. • Is gas pressure dropping below the minimum operating pressure on the rating label after the gas valve opens? • Is the gas pipe size to the water heater adequate? • Check the condition of the burner. • Clean or replace as needed. • Check the burner flame and observe the microamp output on the run cycle. • Replace burner if clogged with dirt and debris. • Replace spark rod or flame sensor if damaged. • Check to make sure vent terminals are clear of debris or snow and ice. Make sure the condensate drain flows freely.
64	Electronics Failure	• Replace control board.
65	High Water Temperature (Over 200°F *(93°C)*)	• Water temperature in tank has exceeded 200°F *(93°C)*. • Check tank sensor. • Make sure sensor is fully inserted into the well (clip on sensor wire secures sensor in place). • Check sensor reading. • If not within specifications, replace sensor. • If sensor and wire harnesses check O.K., replace control board.

Procedure for Checking Thermostat Sensors

Set the thermostat above water temperature (see temperature adjustment section) and observe system through one (1) complete cycle. Make sure system operates as desired.

To check the sensor assembly, compare the resistance of the sensor wires (either outside black to center wire with yellow marking) as measured by an ohmmeter to the water temperature as measured by an accurate thermometer. Thermistor resistance increases as the temperature decreases. The tables below show the correct sensor resistance at various temperatures. Both thermistors in the sensor assembly should have approximately the same readings. Replace the sensor if the ohm reading in the chart does not approximate the reading from the sensor at the temperature measured in the tank. Use a thermometer or thermocouple to measure the temperature from the hot water outlet or Temperature and Pressure Relief Valve.

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	3697	3643	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	1567	1509	1481	1454	1427
170	1402	1376	1351	1327	1303	1280	1257	1235	1213	1191
180	1170	1150	1129	1110	1090	1071	1053	1035	1017	999
190	982	965	949	933	917	901	886	871	857	842
200	828	814	801	788	775	762	749	737	725	713

In Degrees C										
°C	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0	32648	31026	29495	28049	26682	25389	24166	23010	21915	20879
10	19898	18968	18088	17253	16461	15710	14998	14322	13680	13071
20	12492	11942	11419	10922	10450	10000	9572	9165	8778	8409
30	8057	7722	7403	7099	6808	8532	6268	6016	5775	5546
40	5327	5117	4917	4726	4543	4368	4201	4042	3889	3742
50	3602	3468	3340	3217	3099	2986	2878	2774	2675	2579
60	2488	2400	2316	2235	2157	2083	2011	1942	1876	1813
70	1752	1693	1637	1582	1530	1480	1432	1385	1340	1297
80	1256	1216	1177	1140	1105	1070	1037	1005	974	944
90	916	888	861	835	810	786	763	741	719	698

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

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

Model No.: _____

Serial No.: _____

Service Phone

Days: _____ Nights: _____

Address: _____

Supplier: _____

Supplier Phone No.: _____

Refer to the parts list on www.bradfordwhite.com for a complete parts listing and expanded views of the models covered in this manual.

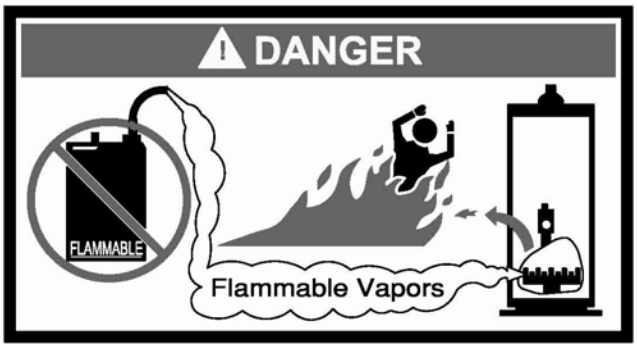
NOTES

NOTES

100T399-SOLA SUPPLEMENT TO INSTALLATION & OPERATION MANUAL INCLUDED WITH WATER HEATER

(SERIAL NUMBERS BEGINNING LK AND LATER)





⚠ WARNING

If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.

- **Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.**

- **WHAT TO DO IF YOU SMELL GAS**
  - **Do not try to light any appliance.**
  - **Do not touch any electrical switch; do not use any phone in your building.**
  - **Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.**
  - **If you cannot reach your gas supplier, call the fire department.**

- **For your family's comfort, safety and convenience, it is recommended this water heater be installed and serviced by a plumbing professional.**

P/N 238-50688-00A 9/14

SECTION III: GENERAL INFORMATION

LOW FIRE START CONTROL FEATURES:
(In addition to pg. 6 of installation & operation manual.)

- Honeywell R7910B1009 Control board controls ignition functions, combustion blower, gas valve, tank temperature, and monitors safety functions in a single control.
- An attractive digital display on the top front of the water heater provides for setting and displaying the temperature setpoint and monitoring the status of the water heater.
- Durable direct spark ignition system.
- The temperature adjustment range is 70˚F to 180˚F.
- Combustion blower speed is reduced prior to ignition to light smoothly at a lower input rating.
- Temperature setting may be viewed in either ˚F or ˚C
- In Diagnostic Mode the tank temperature and flame sense current can be monitored for service.
- Error codes will be displayed in the event the water heater needs service.

SECTION VIII: ELECTRICAL CONNECTIONS

(Replaces pg. 38 of installation & operation manual.)

⚠ WARNING

Turn off or disconnect the electrical power supply to the water heater before servicing. Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

All electrical wiring must be installed and grounded in accordance with local codes, or in the absence of local codes, the National Electrical Code, ANSI/NFPA 70 and/or CSA C22.2 Electrical Code.

The water heater must be wired to a 120 VAC, 60 Hz, 15A power supply. The water heater **must be** wired on a separate circuit and breaker. If a flexible line cord and plug is permitted by local code, then provide a three wire grounding type receptacle within reach of the line cord provided on the control box. Do not plug the line cord into a receptacle that can have the power supply interrupted by a switch that is used to control lights or another appliance.

If wiring in conduit is required, cut the line cord close to the control board and make the appropriate wiring connections. Install an electrical conduit connector on the outside jacket of the water heater. Refer to the wiring diagram for the correct connections to each wire lead.

⚠ CAUTION

This water heater **must** be wired on a separate circuit. Failure to wire on a separate circuit may cause improper operation or failure of the electrical components of the water heater. Refer to the "Electrical Connections" section of the Installation and Operation Manual for complete instructions on electrical wiring and connections to the water heater.

Do not energize the electric circuit before the water heater tank is filled with water.

This control is polarity sensitive. If the hot and neutral supply voltage is reversed, the control will not sense flame and the water heater will not operate. Verify polarity before connecting the water heater.

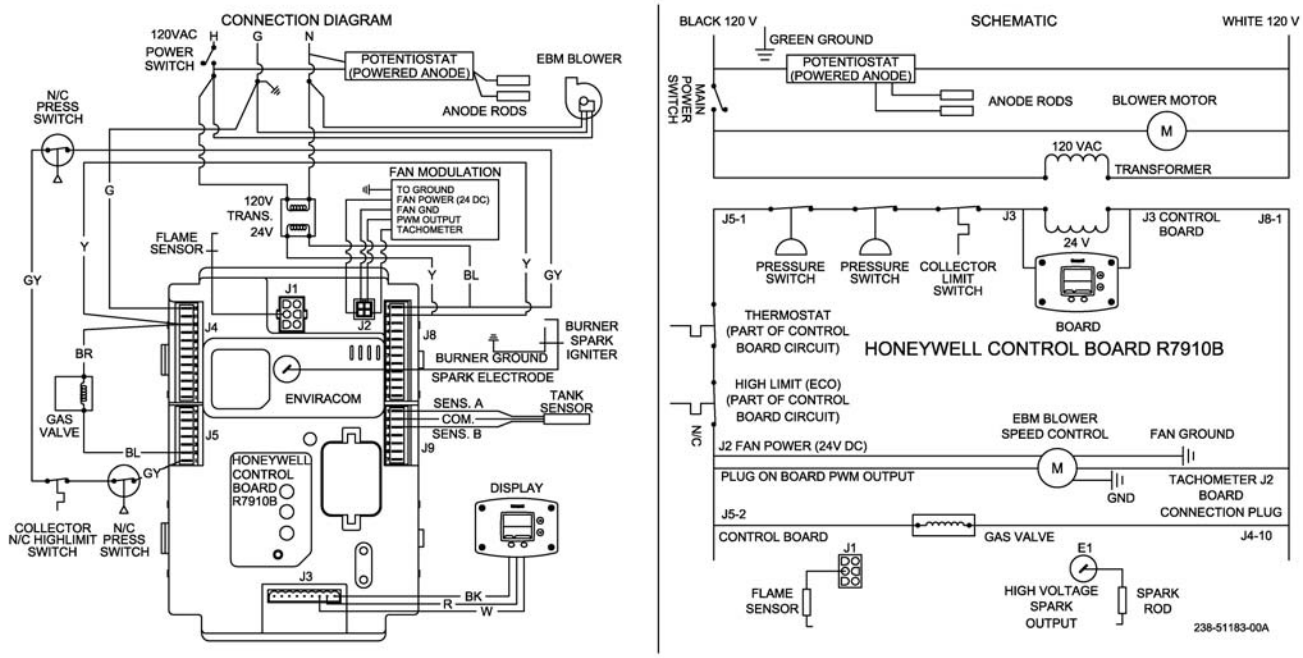


Figure 25. Wiring Diagram and Schematic

SECTION IX: OPERATING INSTRUCTIONS

SEQUENCE OF OPERATION
(Replaces SEQUENCE OF OPERATION section on pg. 39 of installation & operation manual)

1. Thermostat calls for heat.
2. Blower ON.
3. Blower pre purge at reduced speed.
4. Spark rod sparks to the burner and gas valve opens – burner ignition.
5. Flame signal confirmed.
6. Blower remains at reduced speed for a short time to stabilize flame.
7. Blower increases to full speed for full input rate.
8. Thermostat satisfied.
9. Gas valve closes - Main burner OFF.
10. Blower post purge, then OFF.

LIGHTING AND SHUT DOWN INSTRUCTIONS
(Replaces pg. 40-46 of installation & operation manual.)

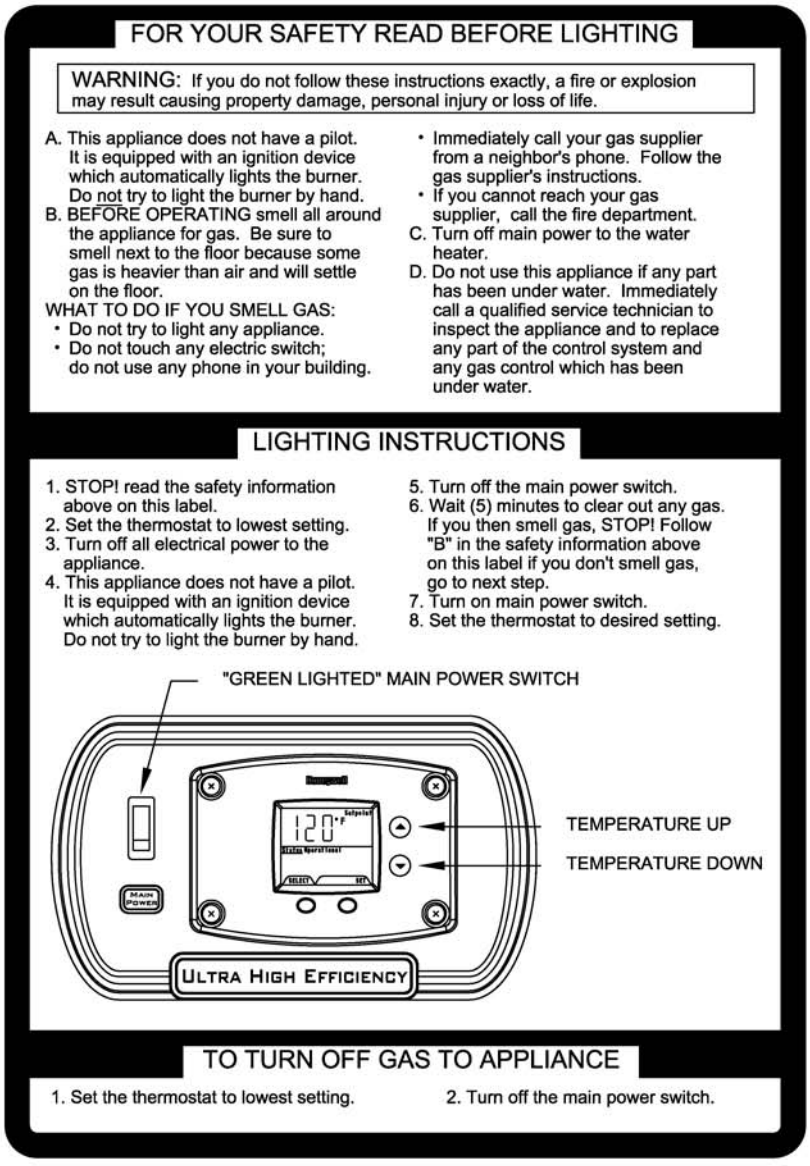


Figure 26. Lighting Instruction Label.

TEMPERATURE ADJUSTMENT

APPROXIMATE TIME/TEMPERATURE RELATIONSHIPS IN SCALDS	
120°F *(49°C)*	More than 5 minutes
125°F *(52°C)*	1½ to 2 minutes
130°F *(54°C)*	About 30 seconds
135°F *(57°C)*	About 10 seconds
140°F *(60°C)*	Less than 5 seconds
145°F (*63°C*)	Less than 3 seconds
150°F *(66°C)*	About 1½ seconds
155°F *(68°C)*	About 1 second

⚠ CAUTION

This water heater, when set at a lower temperature setting is not capable of producing hot water of sufficient temperature for sanitizing purposes.

This water heater is equipped with an energy cut out device to prevent overheating. Should overheating occur or the gas supply fails to shut off, turn off the control panel power switch to the appliance and call a qualified service agency.

NOTICE

The lower the temperature setting, the greater the energy efficiency, both to heat the water and to maintain the storage temperature during standby periods. Lower water temperatures also extend tank life. Remember, no water heating system will provide exact temperatures at all times. Allow a few days of operation at this setting to determine the correct temperature setting consistent with the requirements for the installation.

The water heater temperature setting is adjusted by using the control display mounted to the control surround jacket of the water heater. The water heater thermostat is set at the lowest setpoint of 70°F *(21°C)* when shipped from the factory. The control display shows the temperature setpoint in degrees Fahrenheit *(°F)* or degrees *Celsius (°C)*, and the status of the water heater ("Standby" or "Run").

For energy efficient operation of your water heater, the suggested initial temperature setting is 120°F *(49°C)*. During the winter season, or any cold period, you may desire a higher temperature setting to adjust for the colder incoming water. This adjustment, however, may cause additional condensation to form on the cooler tank surface. This does not mean the tank is leaking. During summer months, the warmer incoming water temperatures will benefit the performance of your water heater and reduce the amount of condensation developed.

Condensation does not mean your tank is leaking. Most of reported tank leaks on installation are proven to be condensation. To avoid unnecessary inconvenience and expense, make sure the tank is leaking before calling an independent servicing contractor or qualified service professional.

If the water heater is to remain idle for 30 days or more or is subjected to freezing temperatures while shut off, the water heater and piping should be fully drained and the drain valve should be left fully open. Refer to the "General Operation" section of this Installation and Operation Manual for the procedure on draining the water heater.

⚠ DANGER

Hotter water increases the risk of scald injury. Scalding may occur within 5 seconds at a temperature setting of 140°F *(60°C).* To protect against hot water injury, install an ASSE approved mixing valve in the water system. This valve will reduce point of discharge temperature by mixing cold and hot water in branch water lines. A licensed plumbing professional or local plumbing authority should be consulted.

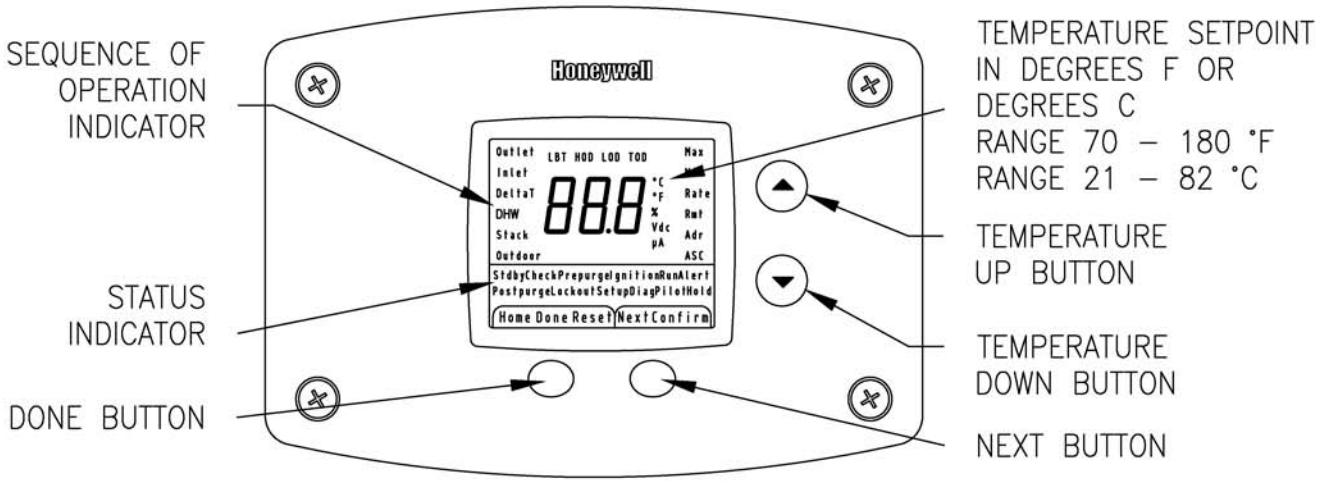
⚠ WARNING

If the water heater display does not show “Standby” or “Run”, there may be an operating malfunction with the water heater. If this is the case, a numeric code will be displayed. Refer to the label next to the display for the definition of the error code and call your plumbing professional or service agent to service the water heater. Do not try to reset the water heater without having a qualified service person to diagnose and correct the problem. If the display is blank or does not show an error code, make sure there is power to the water heater.

Setting the water temperature to the maximum setpoint can result in scalding hot water delivered to the faucets. It is highly recommended that the 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. See previous warning on scalds and an ASSE approved mixing valve.

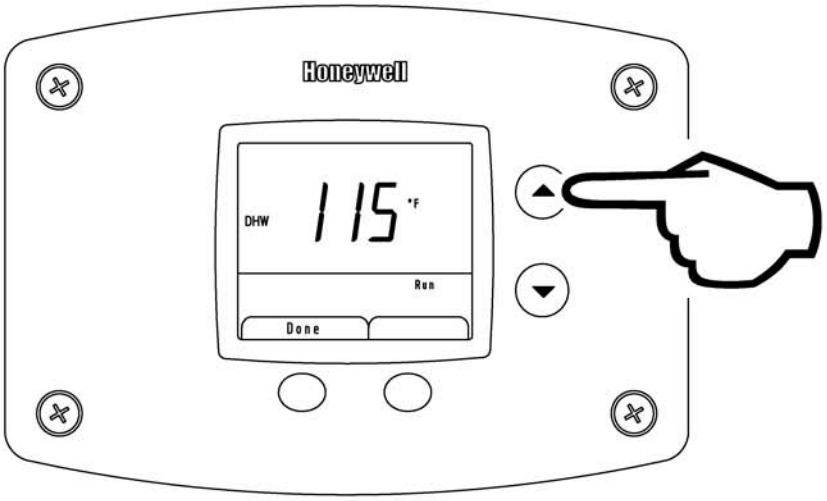
NOTICE

If the water heater display does not show “Standby” or “Run”, there may be an operating malfunction with the water heater. If this is the case, a numeric code will be displayed. Refer to the label next to the display for the definition of the error code and call your plumbing professional or service agent to service the water heater. Do not try to reset the water heater without having a qualified service person to diagnose and correct the problem. If the display is blank or does not show an error code, make sure there is power to the water heater.

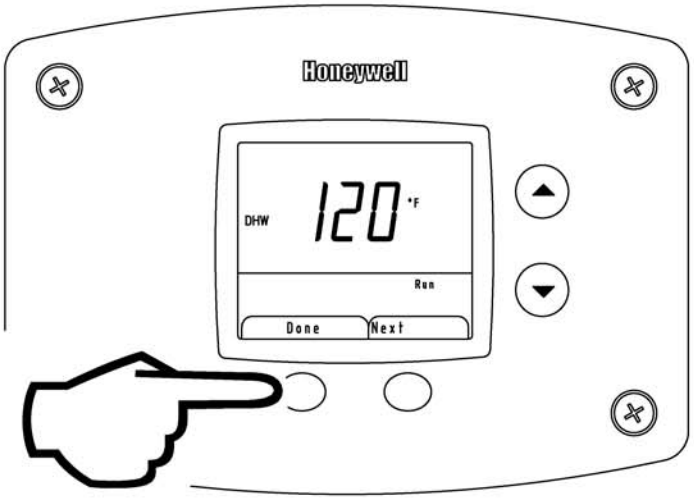


To Increase Setpoint Temperature:

Step 1: Depress and hold “Temperature Up” button until desired setpoint temperature appears in the display.



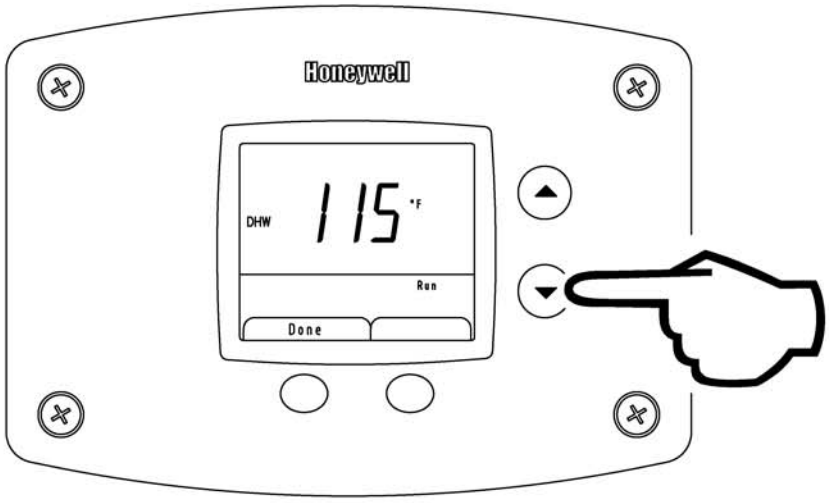
Step 2: Press “DONE” button for new setting to take effect immediately. If the “DONE” button is not pressed, the new temperature setting will take effect in approximately 10 seconds.



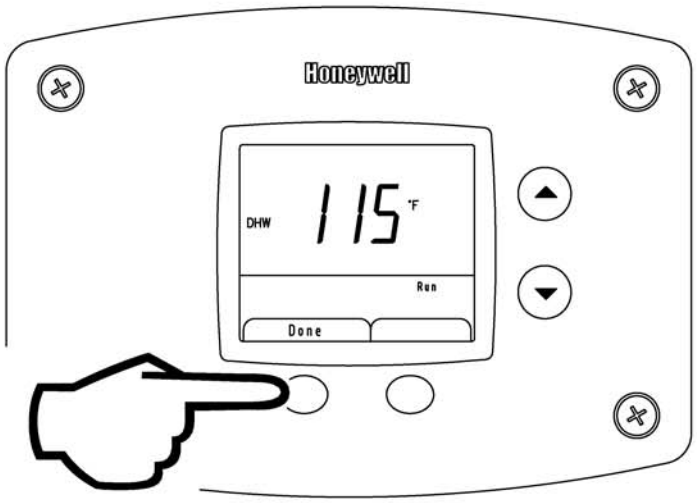
PRESS DONE BUTTON FOR SETTING TO
TO TAKE EFFECT IMMEDIATELY

To Decrease Temperature Setpoint:

Step 1: Depress and hold “Temperature Down” button until desired setpoint temperature appears in the display.



Step 2: Press “DONE” button for new setting to take effect immediately. If the “DONE” button is not pressed, the new temperature setting will take effect in approximately 10 seconds.



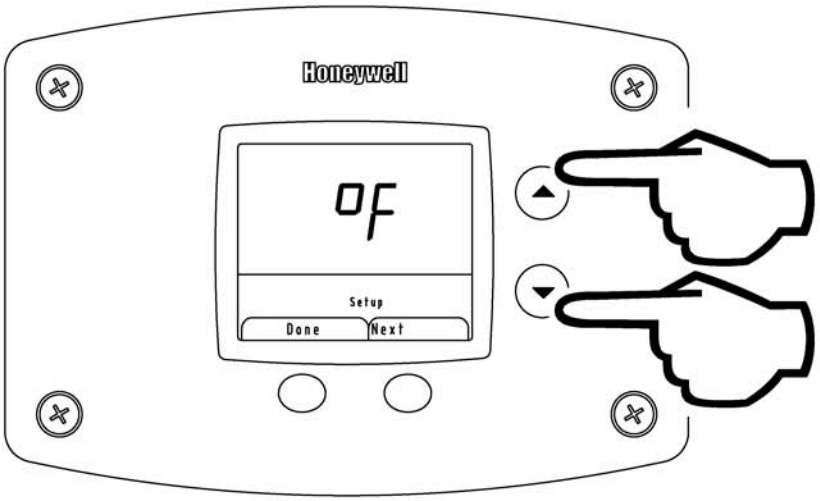
PRESS DONE FOR SETTING TO
TO TAKE EFFECT IMMEDIATELY

NOTICE

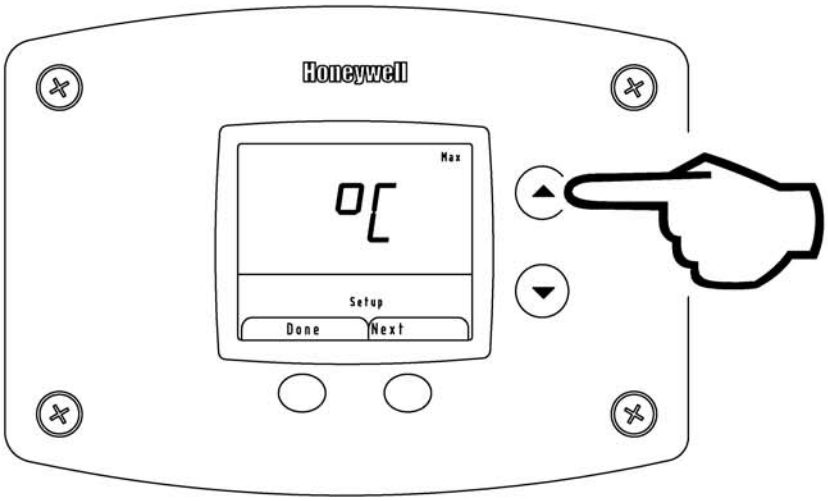
Pressing the “NEXT” button instead of “DONE” will enter the display to show unused screens such as “Stack ----˚F, Outdoor ----˚F, % Rate (Shows percentage of full input rate for Lightoff rate), Outlet ----˚F, Inlet ----˚F, Delta T ----˚F. **These screens are not used in our application.** Press DONE to exit this screen back to the DHW setpoint display.

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

Step 1: Enter “Set-UP Mode” by pressing both UP/DOWN buttons together for 3 seconds.



Step 2: Pressing either UP or DOWN buttons will toggle between ˚F or ˚C. Press “DONE” when selection is complete. Display will revert back to DHW setpoint.



NOTICE

Pressing the “NEXT” button instead of “DONE” will enter the display to show “RMT” for Remote Firing Control. This is for a future feature that is not currently used. The screen may show OFF or ON. If ON, it may display a number for an address. Press DONE to exit this screen back to the DHW setpoint display.

SECTION XI: DIAGNOSTIC AND TROUBLESHOOTING GUIDE

(Replaces pg. 53-71 of installation & operation manual)

LOW FIRE START CONTROL SYSTEM WITH DIRECT SPARK IGNITION SEQUENCE OF OPERATION

1. When the tank temperature drops below the temperature setpoint on the display, the control sends power to the combustion blower for a 15 second pre purge period. The combustion blower runs at full speed during this period to purge the combustion chamber of any unburned gases.
2. The blower speed decreases to the reduced light-off rate speed. Once this reduced speed has stabilized, the control is ready to start the trial for ignition period to light the burner.
3. After the light-off speed on the combustion blower has stabilized, the control sends high voltage through the spark cable to the spark rod to spark to the burner and the gas valve also opens.
4. After the burner lights, a microamp current is generated through the flame sense rod allowing the control to detect burner flame.
5. The sparking then ceases and the flame is monitored by the flame sense circuit until the tank temperature reaches the thermostat setpoint and turns off the gas valve.
6. After the burner ignites, the blower remains at the reduced light-off rate speed for 10 seconds to allow the flame to stabilize. After this period, the combustion blower will gradually increase to full speed to allow full input to the burner.
7. If the burner fails to light, the gas valve closes, sparking to the burner stops, and the combustion blower increases to full prepurge speed for 15 seconds to purge the heat exchanger of unburned gas.
8. The blower reduces to light-off rate speed and the trial for ignition is repeated. The control will make 3 retries to ignite the burner. If the burner fails to light after the third retry, the control enters a Hold period which is an idle period for 15 minutes.
9. There will be a flashing code 110 alternating with the DHW tank temperature shown on the water heater display indicating that the control cycled through the maximum number of ignition retries for ignition. The control will make another 4 ignition attempts after the 15 minute waiting period.
10. If the exhaust vent terminal should become blocked or the condensate drain becomes plugged, the exhaust vent pressure switch will open and the gas valve closes. The combustion blower will postpurge for 30 seconds and then stop. A lockout code 67 will be displayed on the water heater display.
11. When the blockage is removed, the control can be reset by pressing the lower left button under “Reset”.
12. The burner flame is monitored by the flame sense circuit. If the flame should extinguish, the gas valve closes and the combustion blower will operate at full speed to purge the heat exchanger before making an attempt to relight the burner. There may be up to 4 attempts to light the burner before going into the 15 minute ignition hold period explained previously.
13. The burner will continue to operate during the heating cycle until the thermostat satisfies. The gas valve closes and the combustion blower continues to operate for 30 seconds to purge the heat exchanger of flue gases.
14. If the tank temperature exceeds 200°F (*93°C*), the control closes the gas valve and goes into a “Lockout” state and will not operate until reset by a qualified service person. The display will read lockout code “79”, which indicates the tank high limit temperature has been exceeded. No attempt should be made to reset the control until a service person has corrected the cause of the high limit condition.
15. Refer to the diagnostic service section at the end of this Installation and Operation Manual.

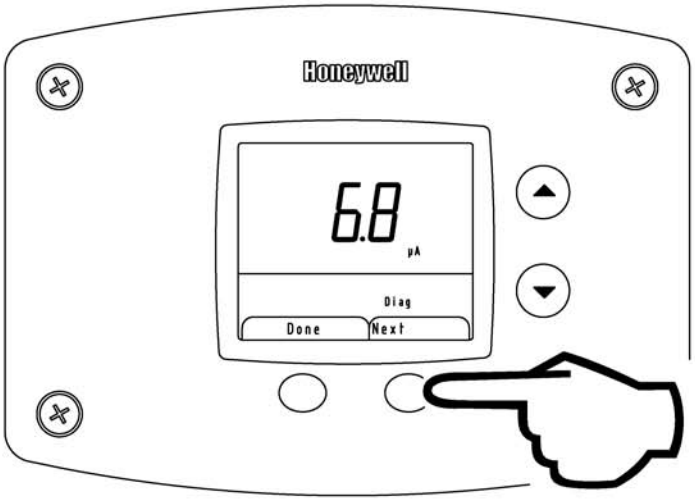
ACCESSING DIAGNOSTIC MODE ON THE WATER HEATER DISPLAY (FOR SERVICE PERSONNEL ONLY)

The display has a “Diagnostic Mode” for accessing information in aiding servicing of the water heater. This procedure is for service and installation personnel only. To enter the Diagnostic Mode, follow the steps illustrated below:

⚠ WARNING

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

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



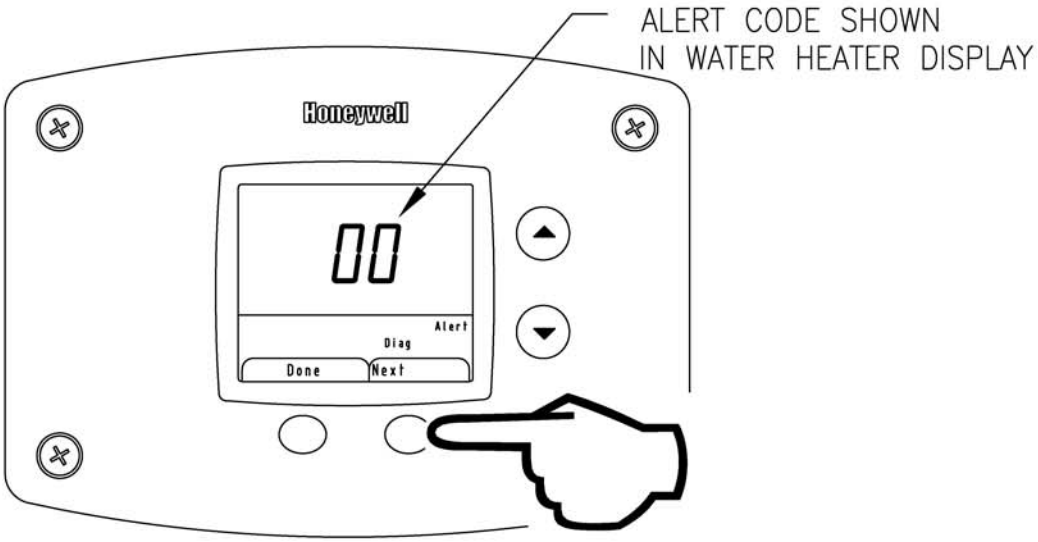
PRESS NEXT BUTTON FOR
3 SECONDS TO ENTER

NOTICE

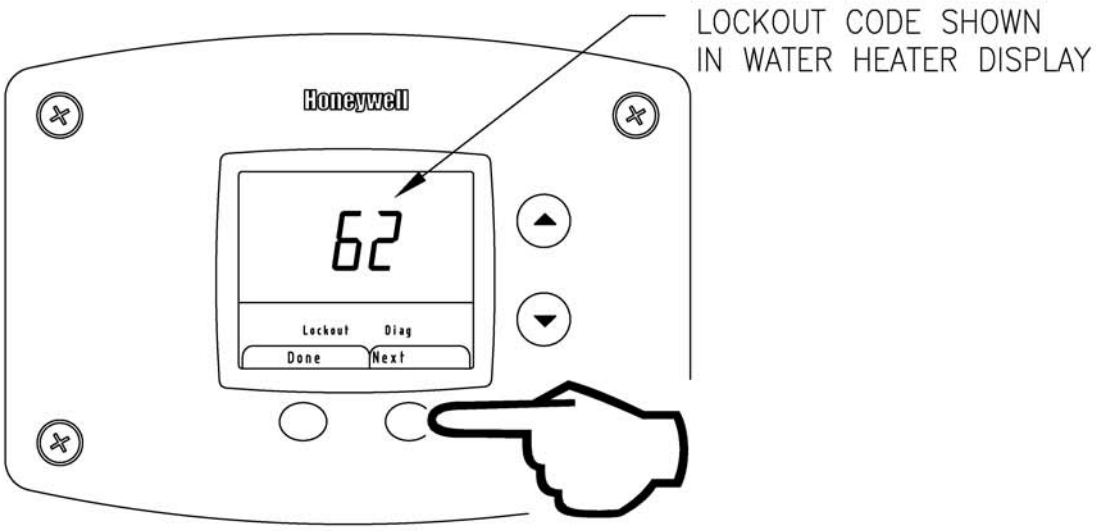
The screens will stay in the Diagnostic Mode for 12.5 minutes after the last button press for viewing unless “Done” button is pressed to exit Diagnostic Mode.

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

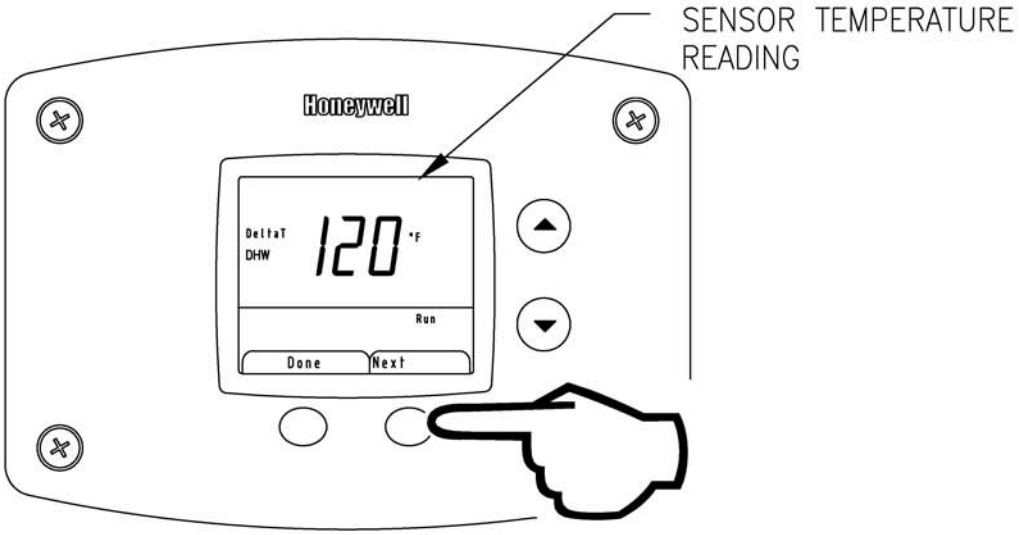
Step 3: Press the lower right “Next” button and the display will show flash and show the number of any Alert codes. These are not currently used.



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



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



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

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

DIAGNOSTIC ERROR CODES AND TROUBLESHOOTING PROCEDURES FOR 100T399 MODELS WITH HONEYWELL LOW FIRE START CONTROL SYSTEM

Error Code	Definition of Code	Cause of Problem and Actions Taken to Correct
No code – blank display		• Check power supply to the water heater. • Make sure water heater is plugged in and the breaker is on. • Check if there is 120 volts power supply to the LINE connections on the control board. • If 120 volts is present, check for 24 volts output to SECONDARY terminals on the Control Board. • Check for loose wires, defective transformer. • Check wire harness connections from display to the control board.
3-48, 58-60	Internal Faults	• Verify wiring to the wiring diagram. • Check power supply to make sure voltage and frequency is correct. • Check for 24 volts from the transformer to the control board. • Reset module by interrupting power or pressing the reset button on the module.
49	Voltage too low or high	• Measure the incoming line voltage. • Voltage should be 115-125 volts. • If the voltage is not within this range or there is drastic fluctuation, then have the incoming power supply checked. • If the line voltage is satisfactory, check the output from the transformer to make sure it is 22-26 volts. • Replace transformer or wiring if defective.
53	AC Inputs phase reversed	• Check the module and display connections. • Check the module power supply and make sure that frequency, voltage and VA capacity of the transformer meet specifications. • Check to make sure the wiring connections on the control module from terminals J4-10 and J8-2 are connected together.
62	Fan speed not proved	• Check the PWM wire harness connection from the blower to the control module. • Make sure the pin terminals make solid contact. • Measure the resistance of each wire in the wire harness from the terminal ends. • Replace wire harness if defective.
67	ILK Off (Interlock Off)	• Check wiring to the normally closed blocked vent pressure switches and vent limit switch. • Use a voltmeter to find out if either pressure switch or the high limit switch has opened. • If so, determine the cause (blocked vent terminal, clogged condensate drain, high temperature in compartment). • If limit switches are closed, check wiring for shorts. • Measure continuity. • If limit switches and wiring check O.K., replace control module.
80	High Limit (Overheat Condition)	• Check the wiring from the sensor to the control module. • Measure the resistance of each outside wire to the center wire. • If either outside wire has a much different resistance reading, replace the sensor. • Make sure the sensor is securely held inside the well with the clip. • If the problem persists and the sensor and wiring check O.K., then replace the control module.
93	DHW Sensor Fault	• Check the sensor wire harness from the sensor to the control module. • Make sure there are no loose connections to the control plug. • Check the resistance reading from each of the outside wires to the center (common) wire. • If the ohm readings are not fairly close, replace the sensor. • Replace the control module if the problem persists and the sensor and wire connections are not defective.

Error Code	Definition of Code	Cause of Problem and Actions Taken to Correct
105	Flame detected out of sequence	• Check to see if flame is present inside the combustion chamber before or after the ignition cycle. • If so, check to make sure the gas valve is wired correctly. • Check for voltage at the gas valve connection. • Replace the gas valve if defective. • If no flame is visible outside of the ignition sequence/run cycle, then make sure the flame sensor is wired to the correct terminal. • Make sure the ignition cable is not crossing the flame sensor wire or ignition ground wires. • If problem persists and all other checks have been verified, replace the control module.
110	Ignition Failure Occurred.	• Burner failed to light or stay lit after 3 retries. • Hold condition – will reattempt ignition after 15 minute waiting period. • Check gas valve wiring and gas valve operation during the ignition cycle. • If burner lights but quickly goes out, check the flame sensor wire or the flame sensor. • If the flame sensor rod is badly corroded with deposits, clean with sandpaper or replace. • Check the inlet gas supply to make sure the pressure is sufficient and does not drop after the gas valve opens. • Make sure the combustion blower is operating during the ignition and run cycle. • Check the venting system to make sure the inlet and exhaust terminals and venting system is not blocked.
122	Light-off Rate Proving Failed	• If blower speed is not verified from the PWM (Pulse Width Modulation) signal within 5 minutes, the previously described error code “62” changes from a hold condition to this lockout code condition. • Check the harness and pin terminals for a good connection to the control module. • Replace the blower or control module if the wire harness is good.

Procedure for Checking Thermostat Sensor

Set the thermostat above water temperature (see temperature adjustment section) and observe system through one (1) complete cycle. Make sure system operates as desired.

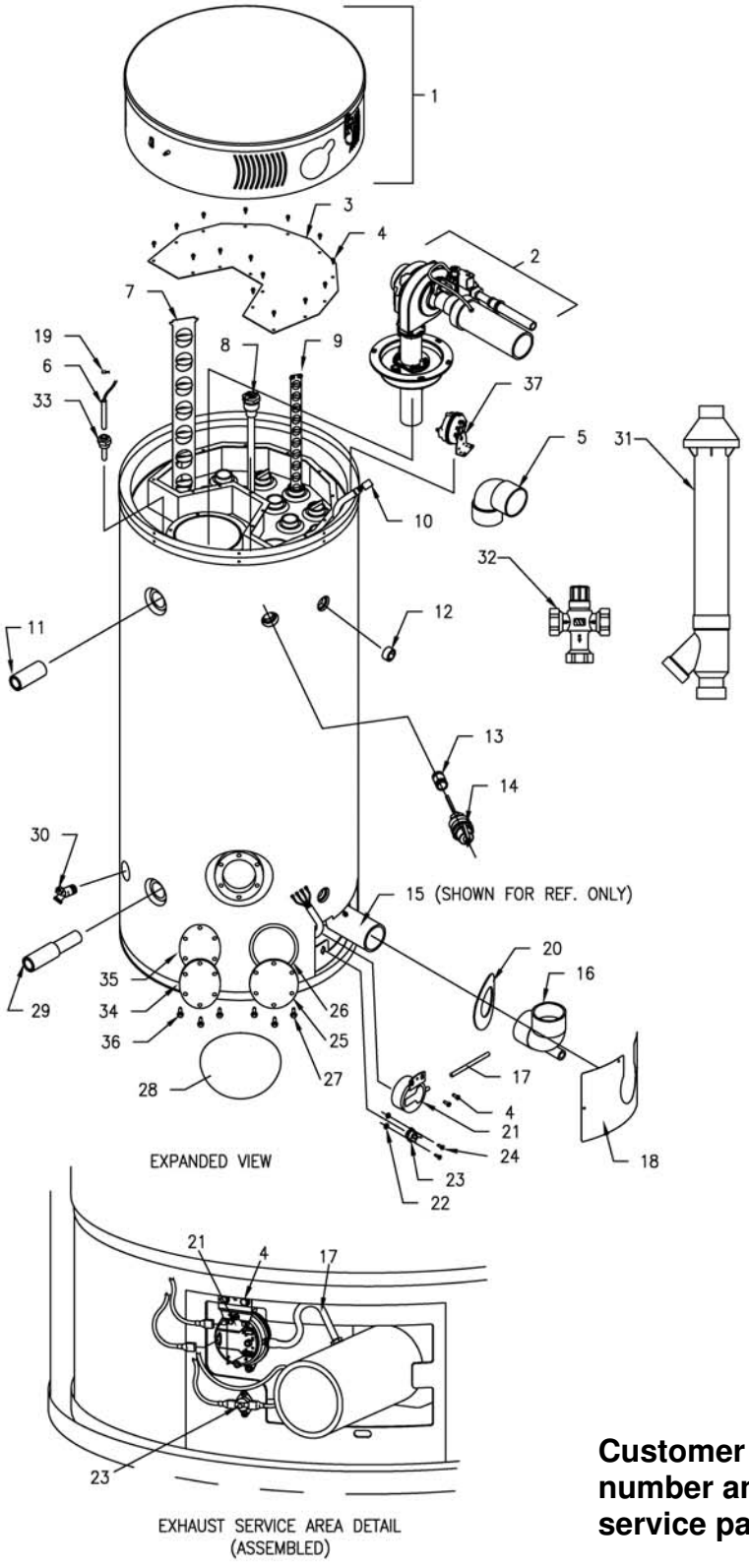
To check the sensor, compare the resistance of the sensor wires (either outside black to center wire with yellow marking) as measured by an ohmmeter to the water temperature as measured by an accurate thermometer. Thermistor resistance increases as the temperature decreases. The tables below show the correct sensor resistance at various temperatures. Both thermistors in the sensor assembly should have approximately the same readings. Replace the sensor if the ohm reading in the chart does not approximate the reading from the sensor at the temperature measured in the tank. Use a thermometer or thermocouple to measure the temperature from the hot water outlet or T&P valve.

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	3697	3643	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	1567	1509	1481	1454	1427
170	1402	1376	1351	1327	1303	1280	1257	1235	1213	1191
180	1170	1150	1129	1110	1090	1071	1053	1035	1017	999
190	982	965	949	933	917	901	886	871	857	842
200	828	814	801	788	775	762	749	737	725	713

In Degrees C										
°C	0	1	2	3	4	5	6	7	8	9
0	32648	31026	29495	28049	26682	25389	24166	23010	21915	20879
10	19898	18968	18088	17253	16461	15710	14998	14322	13680	13071
20	12492	11942	11419	10922	10450	10000	9572	9165	8778	8409
30	8057	7722	7403	7099	6808	8532	6268	6016	5775	5546
40	5327	5117	4917	4726	4543	4368	4201	4042	3889	3742
50	3602	3468	3340	3217	3099	2986	2878	2774	2675	2579
60	2488	2400	2316	2235	2157	2083	2011	1942	1876	1813
70	1752	1693	1637	1582	1530	1480	1432	1385	1340	1297
80	1256	1216	1177	1140	1105	1070	1037	1005	974	944
90	916	888	861	835	810	786	763	741	719	698

SECTION XII: PARTS LIST

(Replaces pg. 72-74 of installation and operation manual.)



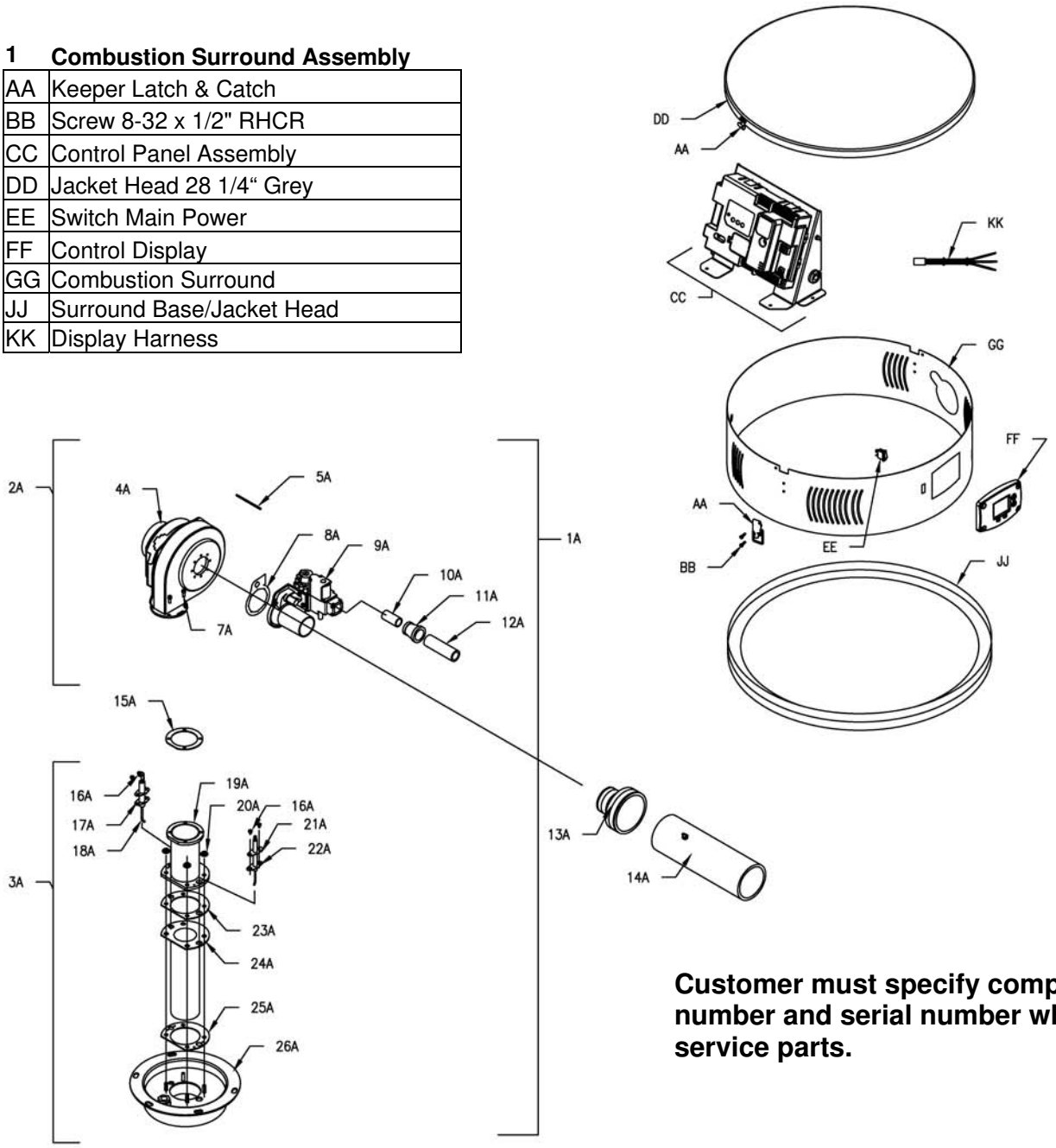
Water Heater Full Assembly

1	Combustion Surround Assembly
2	Burner Assembly (Specify model)
3	2nd 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	Power Anode (2 PLS.)
9	Baffle 2” Flue
10	Wire Harness-Service Panel
11	Plastisert Nipple 1” NPT
12	Plug
13	Nipple
14	T&P Relief Valve
15	Exhaust Collector
16	Condensate Trap Elbow
17	Silicone hose
18	Outer Door Service Panel (Specify model)
19	Clip
20	NSF Escutcheon
21	Exhaust Pressure Switch
22	Nuts
23	Collector Limit Switch
24	Screw 6-32 x 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	Thermostatic Mixing Valve (Optional)
33	Thermal Well
34	ASME Cleanout Access Cover
35	ASME Cleanout Gasket
36	ASME Screw 5/16 - 18 x 3/4" HH Grade 5
37	Intake Pressure Switch

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

1 Combustion Surround Assembly

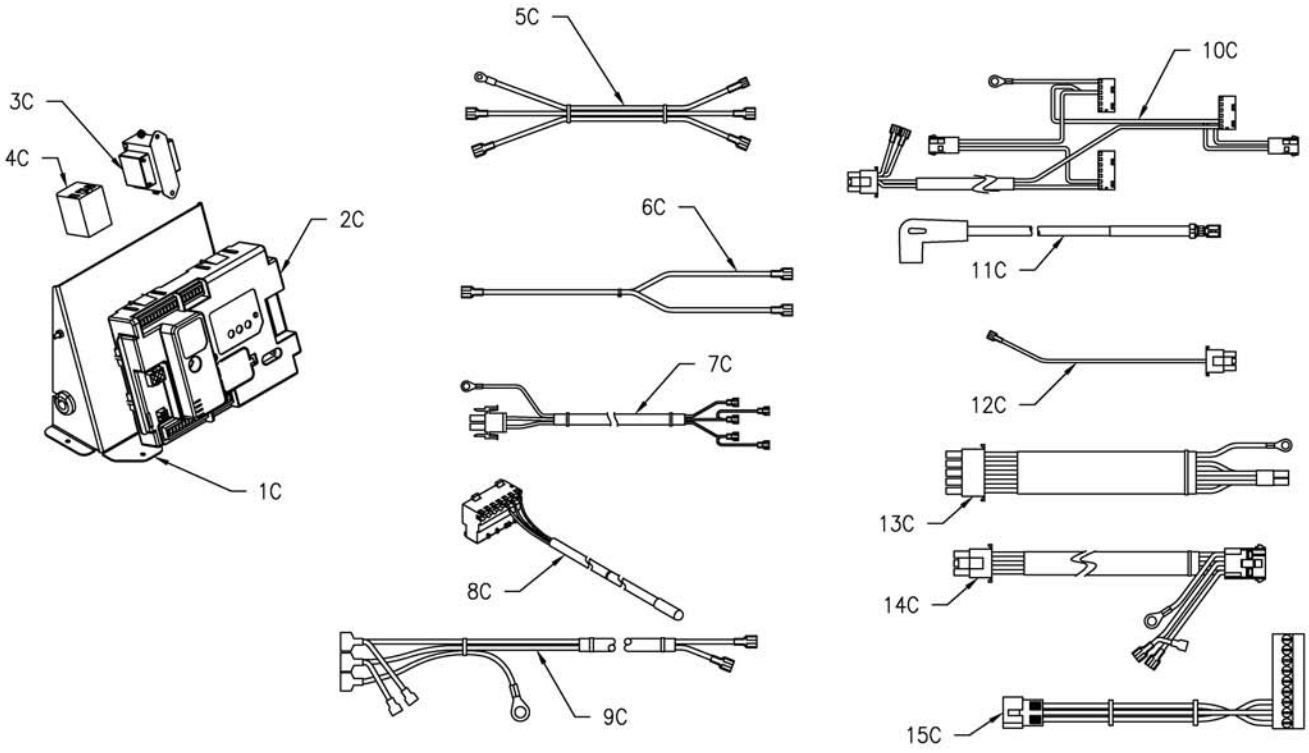
AA	Keeper Latch & Catch
BB	Screw 8-32 x 1/2" RHCR
CC	Control Panel Assembly
DD	Jacket Head 28 1/4“ Grey
EE	Switch Main Power
FF	Control Display
GG	Combustion Surround
JJ	Surround Base/Jacket Head
KK	Display Harness



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

2 Combustion Assembly

1A	Combustion Ass’y (Specify model)	14A	Inlet Pipe
2A	Blower/Gas Valve Ass’y (Specify model)	15A	Gasket Blower Transition (Specify model)
3A	Burner Ass’y (Specify model)	16A	Screw 8 -32 x 1/4" RHCR
4A	Blower (Specify model)	17A	Gasket Flame Sensor
5A	Silicone Hose	18A	Flame Sensor
6A	Burner Mounting Insert Gasket	19A	Transition Tube
7A	Screw 10-32 x 3/4"SHCS	20A	Nut Hex Washer
8A	Gasket & Screw	21A	Gasket Igniter
9A	Gas Valve (Specify model)	22A	Spark Rod
10A	Nipple	23A	Burner Mounting Gasket
11A	Reducer	24A	Burner (Specific Model)
12A	Nipple	25A	Burner Mounting Gasket
13A	Flex Reducer	26A	Burner Mounting Insert



CC	Ignition Control Assembly		
1C	Control Mounting Panel	9C	Power Cord Harness
2C	Ignition Control	10C	Low Fire Start Control Harness
3C	Transformer – 120/24 VAC	11C	Direct Spark Igniter Harness
4C	Powered Anode Module	12C	Flame Sensor Harness
5C	Powered Anode Module Harness	13C	Blower Control Harness
6C	Powered Anode Harness	14C	Blower Power Supply Harness
7C	Gas Valve Control Harness	15C	Display Board Harness
8C	Temperature Sensor Probe		

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

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

NOTES

NOTES

SUPPLEMENT – VENTING INSTRUCTIONS FOR INSTALLATION AND OPERATION INSTRUCTION MANUALS FOR THE FOLLOWING PRODUCT TYPES:

HIGH EFFICIENCY CONDENSING COMMERCIAL, COMMERCIAL POWER DIRECT VENT, LIGHT DUTY COMMERCIAL POWER DIRECT VENT, LIGHT DUTY COMMERCIAL POWER VENT, RESIDENTIAL POWER DIRECT VENT, RESIDENTIAL POWER VENT MODEL SERIES, ULTRA LOW NOx RESIDENTIAL POWER DIRECT VENT, ULTRA LOW NOx LIGHT DUTY POWER DIRECT VENT, ULTRA LOW NOx RESIDENTIAL POWER VENT, ULTRA LOW NOx LIGHT DUTY POWER VENT, HIGH PERFORMANCE SERIES POWER VENT, COMBI POWER VENT, SOLAR POWER VENT GAS BACKUP.

INSTALLATION OF CENTROTHERM INNOFLUE® SINGLE WALL POLYPROPYLENE VENTING SYSTEMS

This supplement is for the installation of polypropylene single wall venting system manufactured by Centrotherm ECO Systems, LLC. The Centrotherm venting system is a CSA approved alternative to the PVC, ABS, and CPVC venting components for the High Efficiency Condensing Commercial, Commercial Power Direct Vent, Light Duty Commercial Power Direct Vent, Light Duty Commercial Power Vent, Residential Power Direct Vent, Residential Power Vent Model Series, Ultra Low NOx Residential Power Direct Vent, Ultra Low NOx Light Duty Power Direct Vent, Ultra Low NOx Residential Power Vent, Ultra Low NOx Light Duty Power Vent, High Performance Series Power vent, Combi Power Vent, Solar Power Vent Gas Backup Model Series.

The Centrotherm venting system components are ULC S636 approved and listed by a recognized agency and may be installed in the U.S. and Canada. All components used must be from the same manufacturer and are designed for use with the above noted products. The Centrotherm components may be purchased from plumbing supply distributors. The vent size diameter and maximum vent lengths must be followed as detailed in the Installation and Operating Instruction Manual that was supplied with the water heater. Thoroughly read and understand the venting section of the instruction manual supplied with the water heater before proceeding with the following instructions in this supplement. The vent terminals supplied with the water heater or the factory approved accessory vent terminal kits must be used with this venting system.

⚠ WARNING
The venting system must be properly installed. Failure to properly install the vent system could result in property damage, personal injury, or death.
DO NOT install damaged venting system components. If damage is evident then please contact the supplier where the water heater or venting system components were purchased for replacement parts.
Use only the vent terminals provided or factory authorized terminals for venting this water heater.
The water heater requires its own separate venting system. Do not connect the exhaust vent into an existing vent pipe or chimney.
All of the exhaust venting connections must be leak checked with a soap solution upon initial start-up of the water heater. Any leaks must be repaired before continuing operation of the water heater.
Do not terminate the venting where noise from the exhaust or intake will be objectionable. This includes locations close to or across from windows and doors. Avoid anchoring the vent and intake pipes directly to framed walls, floors, or ceilings unless rubber isolation pipe hangers are used. This prevents any vibrations from being transmitted into the living spaces.
Do not exceed the venting distances or the number of elbows listed in the instruction manual supplied with the water heater. Exceeding the maximum venting distances may cause the water heater to malfunction or cause an unsafe condition.
DO NOT operate this water heater until the venting installation is complete and the piping completed. Failure to complete installation before operation can result in property damage, personal injury, or death.

⚠ WARNING

DO NOT install Centrotherm Innoflue venting components with any other manufacturer's vent components. Centrotherm Innoflue components must be used exclusively throughout the entire venting system from the water heater coupling or vent connection to the outside wall or ceiling near the vent terminal location.

This supplement is intended only for additional information for installing Centrotherm Innoflue single wall venting system and the instruction manual supplied with the water heater must be followed for the detailed information provided for the venting system installation.

Step 1: Thoroughly read and understand the venting section of the Installation and Operating Instruction Manual that was supplied with the water heater before determining the location of the water heater and the vent terminals. Locate the water heater for the shortest practical vent length to the outside. Measure the total venting distance required to reach the outside wall or roof. Determine the diameter of the venting components to use for the length of vent pipe (and combustion air supply for direct vent models) required by referring to the venting tables in the instruction manual for the maximum vent length for each diameter pipe size. Obtain all the necessary venting system components for the installation.

Step 2: Before installation, inspect each vent component for damage making sure the gaskets for each component are fully intact and in undamaged condition. Do not attempt to install or repair damaged components. If a gasket is damaged, these are available from the supplier of Centrotherm Innoflue components. Do not use gaskets from another manufacturer and do not try to repair the gasket.

Step 3: A Centrotherm PVC to Polypropylene adapter (Centrotherm ISAGL part series) must be used to connect into a PVC coupling or tee (Commercial and Residential Power Direct Vent air intake connections), condensate elbow (High Efficiency Commercial Condensing models) or the exhaust outlet adapter for Commercial Power Direct Vent and Residential Power Vented models. To make the insertion of the gasketed fittings into the coupling easier, Centrocerin gasket lubricant is recommended. Centrocerin is a water based lubricant available from your Centrotherm supplier. If Centrocerin is not available, water may be used. DO NOT use any other kind of lubricant which may damage the gaskets.

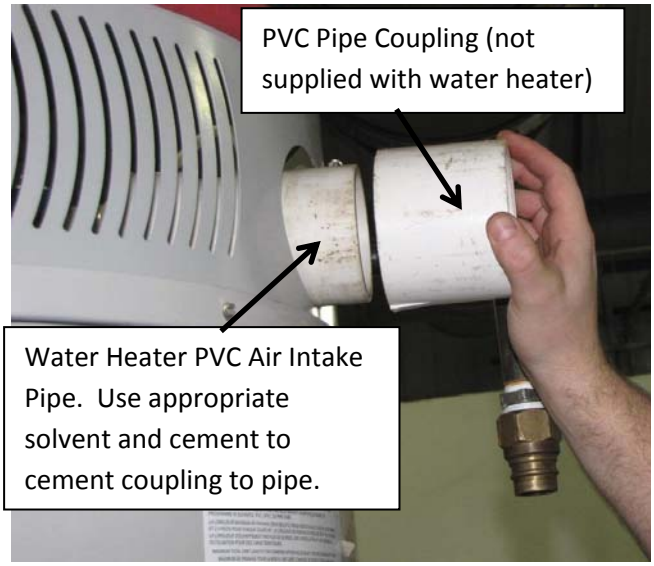
Apply lubricant using your finger to the gasket surface and inside of the coupling and insert the male end of the adapter with the exterior gasket into the coupling, condensate elbow or exhaust outlet adapter connection. If a larger vent diameter size is to be used, use the appropriately sized reducer coupling first on the water heater intake or exhaust vent connection as detailed in the installation manual supplied with the water heater. See the following photos.

⚠ WARNING

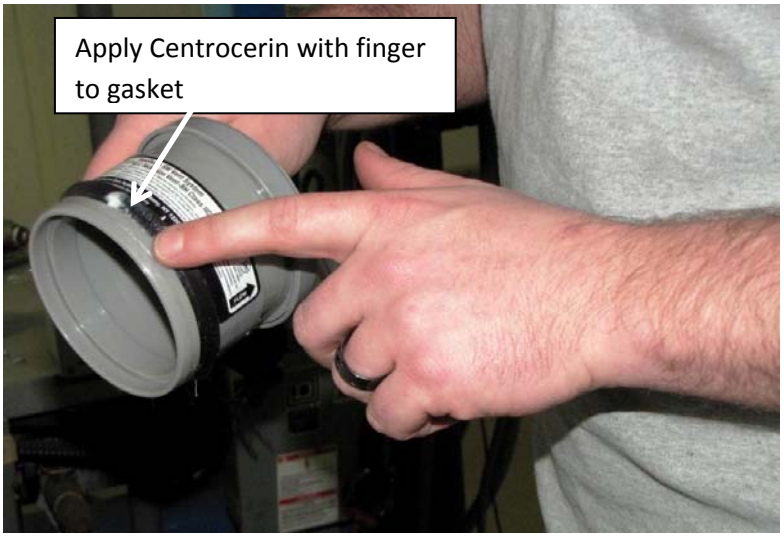
Use only water or Centrocerin lubricant for lubricating the gaskets and pipe ends to allow easy insertion. DO NOT use any other kind of lubricant, since deterioration of the gasket may result, which may allow dangerous flue gases to leak into the room. If the vent pipe needs to be disassembled after the gasket has dried, wet the joint thoroughly to loosen the connection.

High Efficiency Condensing Commercial Models: Use the appropriate primer and cement (refer to venting section of instruction manual with water heater) for cementing a PVC coupling (not supplied with water heater) to the end of the PVC air intake pipe connection. Apply Centrocerin lubricant with your finger to the male gasketed end of the Centrotherm PVC adapter and fully insert into the air intake coupling. Loosen the Centrotherm flue pipe clamp (Centrotherm p/n IAFC03) and install on the end of the PVC coupling so that the 3 clamp hooks secure the PVC adapter to the PVC coupling. See following photos.

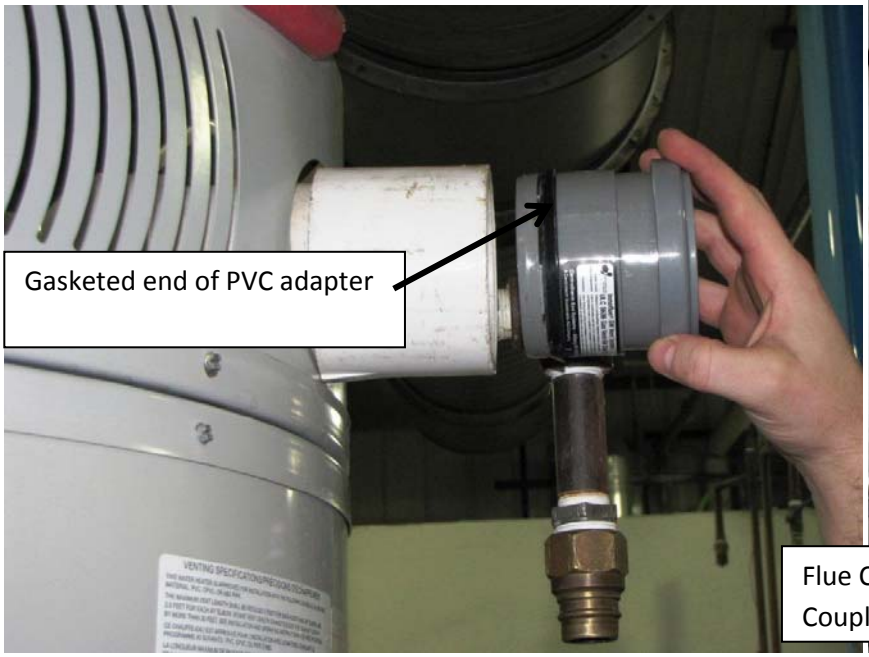
Install PVC pipe coupling over air intake pipe connection and cement to pipe using appropriate solvent and cement.



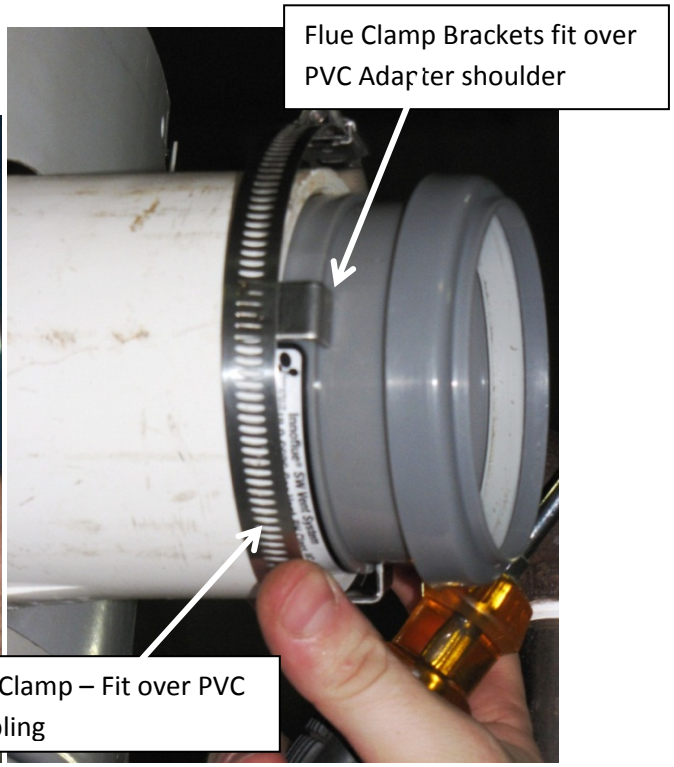
Apply Centrocerin Lubricant to PVC Adapter gasket using finger



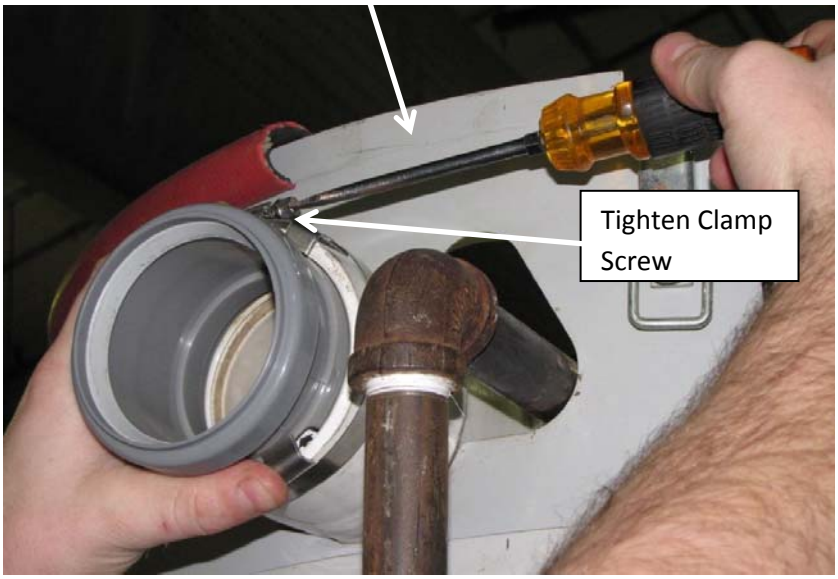
Insert male gasketed end of Centrotherm PVC adapter into PVC pipe coupling.



Install Centrotherm Flue Clamp (IAFC03) over the PVC coupling so that clamp brackets secure the shoulder of PVC adapter fitting.



Tighten clamp screw securely to secure the PVC Adapter to
the cemented PVC coupling. Refer to the instruction manual for appropriate solvent and cement.

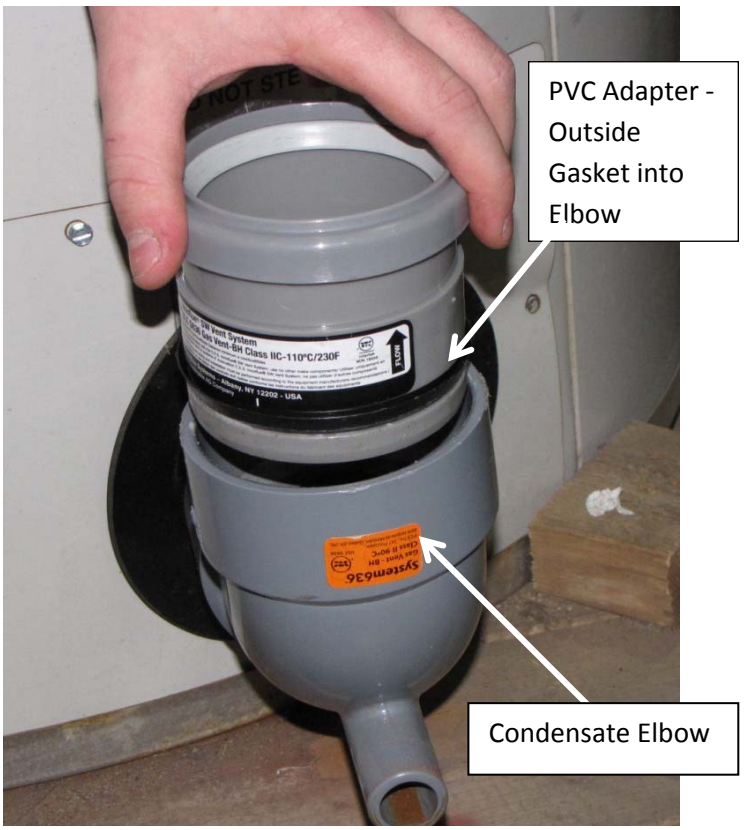


⚠ WARNING

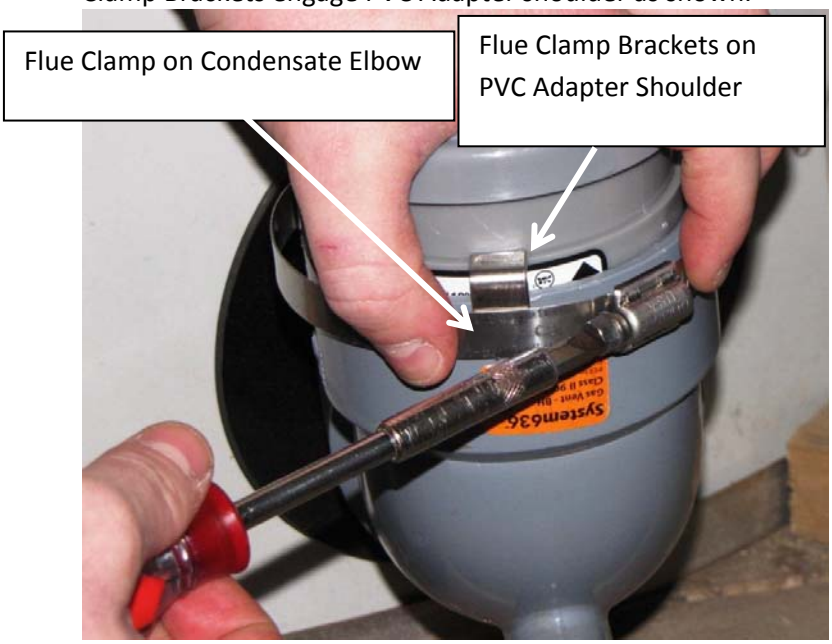
Centrotherm Flue Clamps (p/n: IAFC02, 03, or 04) MUST be properly installed to secure the PVC Vent Adapter. DO NOT operate the vent system without first installing the Flue Clamps.

For High Efficiency Commercial Model series exhaust connection, apply Centrocerin lubricant with finger to outside gasket and insert PVC adapter into the condensate elbow. Insert PVC Adapter fitting into Condensate Elbow as shown.

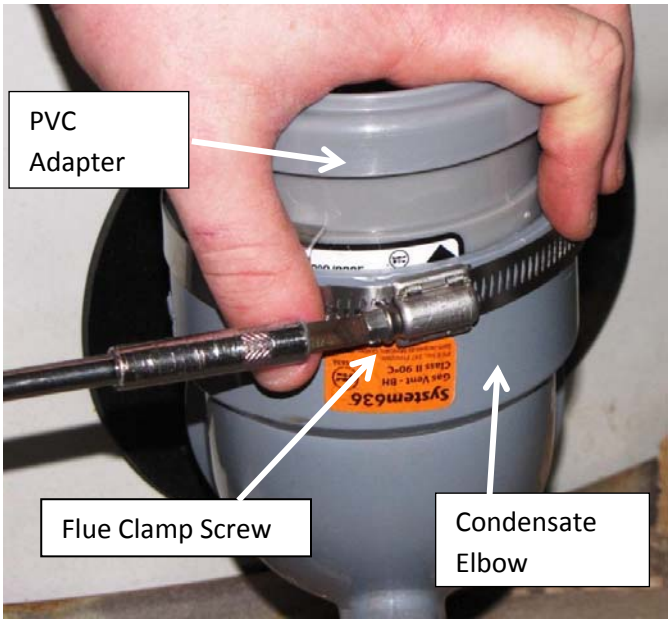




Install Centrotherm Flue Clamp around outside of elbow so that Clamp Brackets engage PVC Adapter shoulder as shown.



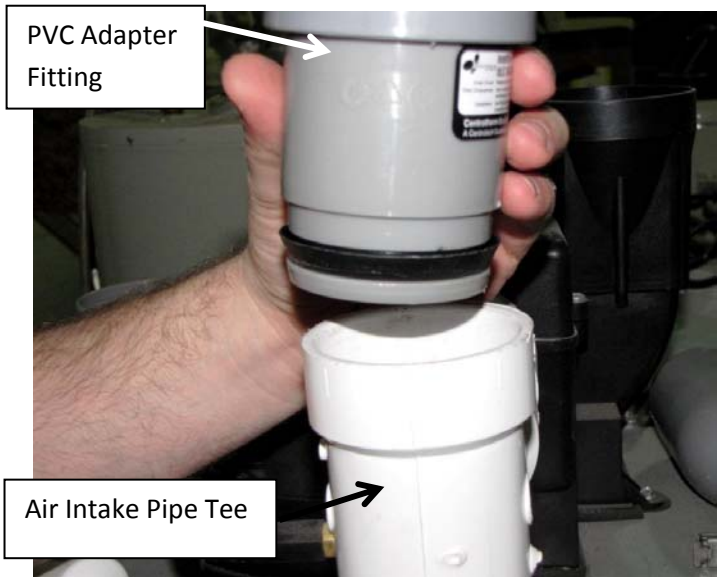
Tighten Flue Clamp Screw to secure PVC Adapter into Condensate Elbow



Commercial and Residential Power Direct Vent Models and Residential Power Vent Models:

For installations of commercial and residential power direct vent models, install the PVC adapter into the air intake pipe tee as shown.

Install the Flue Clamp over the Air Intake Pipe Tee and tighten Flue Clamp Screw to secure the PVC adapter.

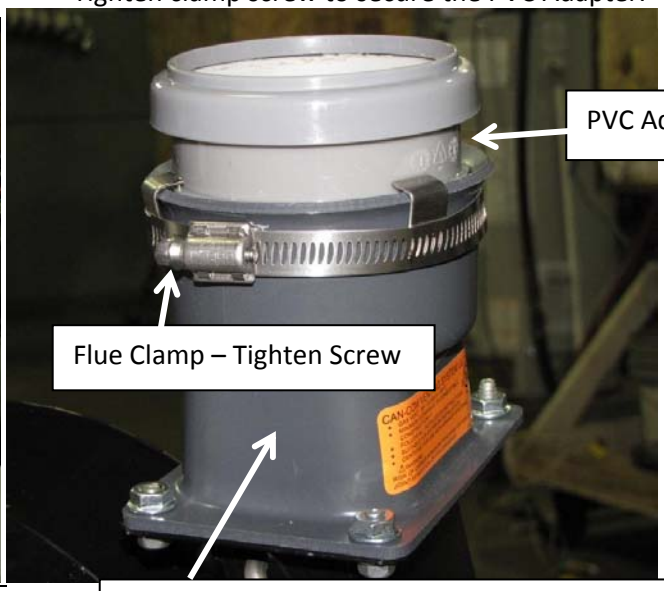




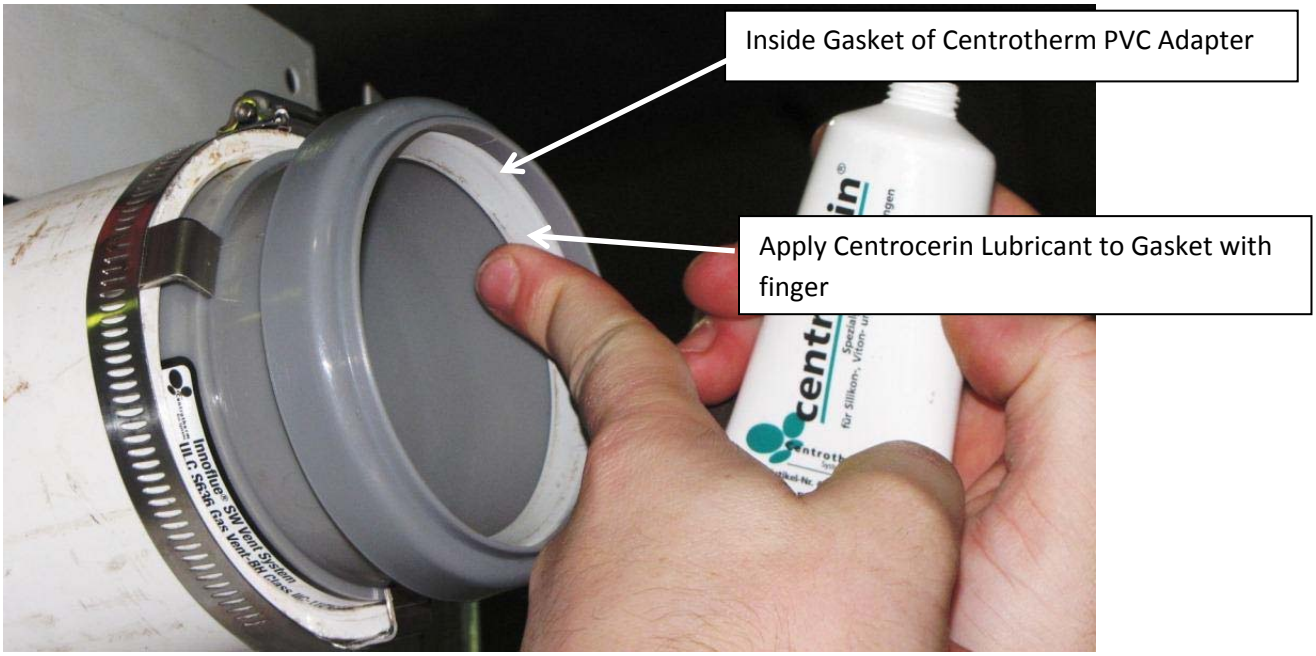
For the exhaust venting for all power vent and power direct vent models, insert the PVC Adapter into the Exhaust Outlet Adapter. On residential models, tighten the clamp to secure the PVC Adapter.



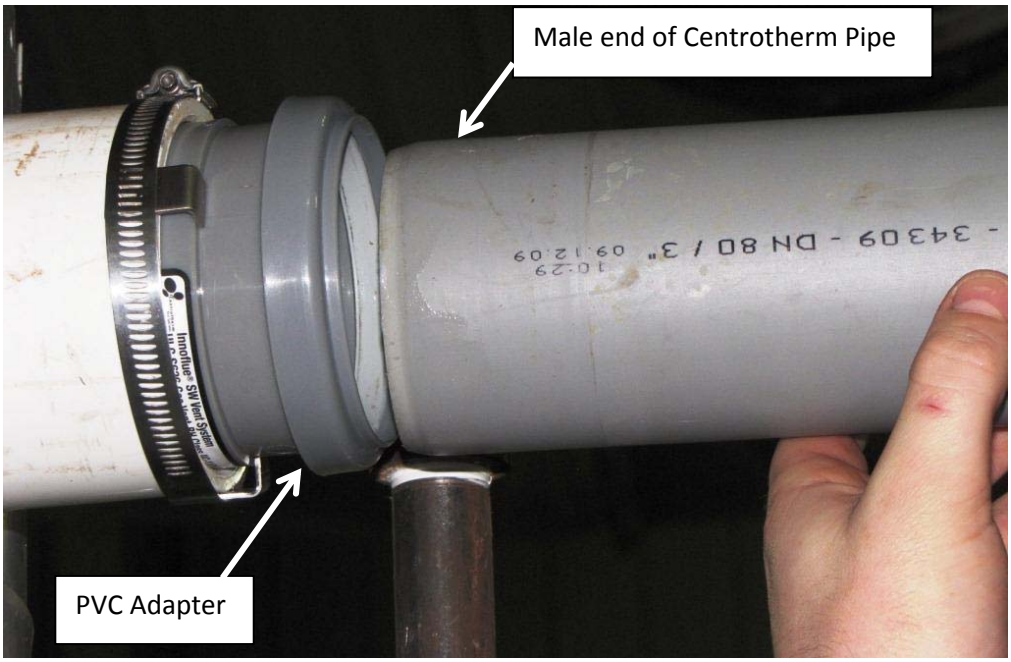
For Commercial Power Direct Vent models, insert PVC Adapter into Exhaust Outlet Adapter.
Install Flue Clamp over Exhaust Outlet Adapter and Tighten clamp screw to secure the PVC Adapter.



Step 4: Lubricate the inside gasket of the PVC adapter and the male end (without gasket) of the elbow or straight section of pipe for running the exhaust or intake pipe from the water heater. Insert the male end of the elbow or straight section into the PVC adapter. Use a twisting motion while pushing the male end of the pipe or elbow into the PVC adapter to fully seat into the gasket. The male end of the pipe or elbow must always point toward the water heater.
Apply Centrocerin lubricant to the inside gasket of the PVC adapter.



Insert the male end of the straight pipe or elbow into the flanged gasketed end of the PVC adapter. Push the pipe or elbow into the adapter using a twisting motion to fully insert the pipe into the gasket inside the adapter.



⚠ WARNING

Make sure pipe sections are fully inserted into the PVC adapter and/or gasketed end of Centrotherm fitting. Insertion depth is no less than 2 inches.

Step 5: Centrotherm supplied support brackets must be used to support the pipe sections. The vent pipe sections **must be** supported a minimum of every 5 feet (1.5 meters) of vertical run or every 3 feet (1 meter) of horizontal run of pipe. Consult local codes for additional requirements. In addition, support brackets must be installed on both sides of elbows used in the venting system.

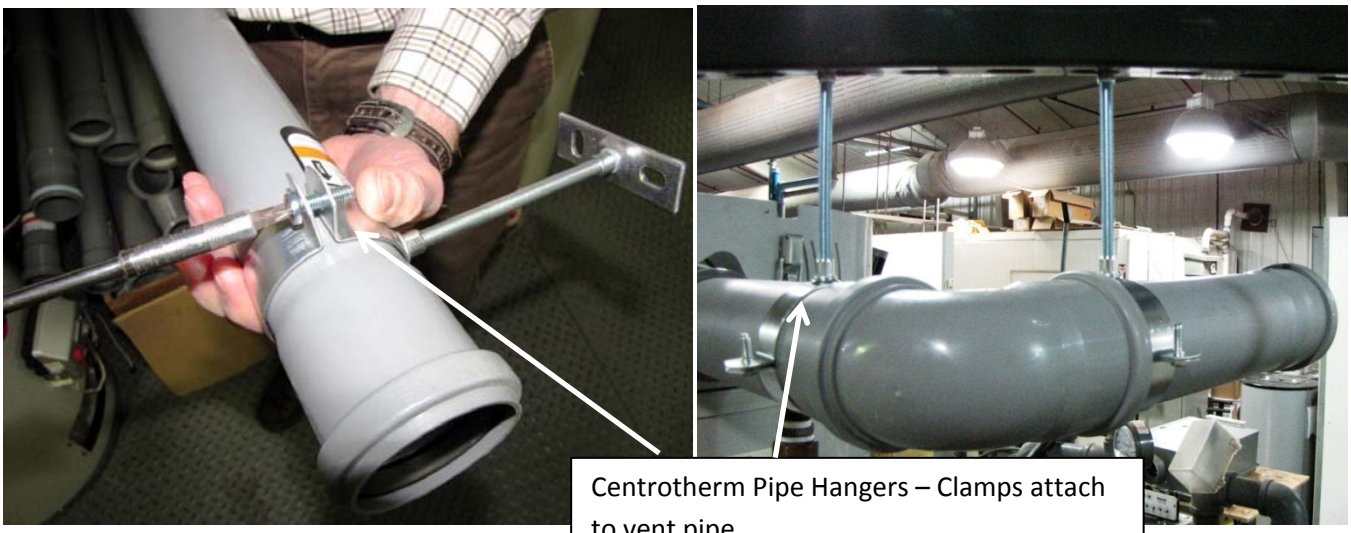
High Efficiency Commercial Condensing Models:

For horizontal sections of flue pipe, the pipe must be installed with a slight upward slope of approximately 5/8 inch per foot (5.6 cm per meter) toward the water heater (as recommended by Centrotherm) to allow condensate to drain into the condensate elbow.

Residential and Commercial Power Direct Vent and Residential Power Vent Models:

To prevent condensate from accumulating in the exhaust blower, install the horizontal vent pipe with a downward slope toward the vent terminal of 5/8 inch per foot (5.6 cm per meter) of horizontal vent pipe. An optional condensate kit is available for residential power vent models or a tee fitting with a condensate drain loop may be used on commercial power direct vent models to prevent condensate accumulation in the blower for long vertical runs of vent pipe. Refer to the venting section of the Installation and Operating Instructions supplied with the water heater.

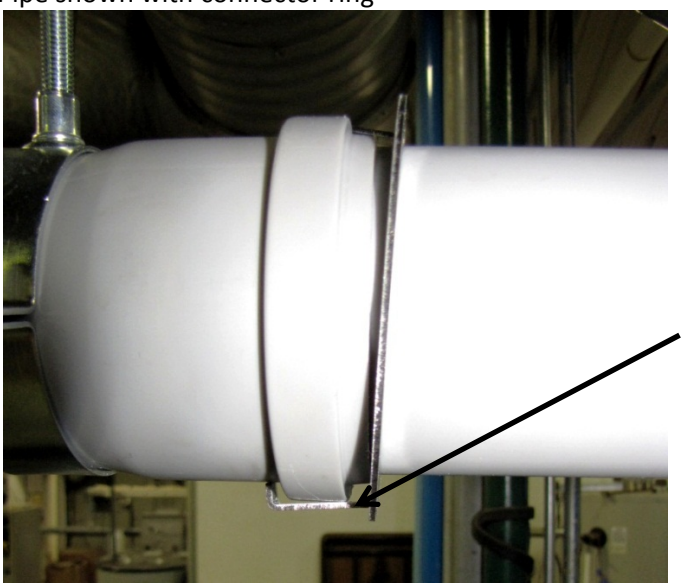
Installing pipe clamp around pipe every 3 feet to support pipe. Install pipe clamps on each side of elbow.



Centrotherm Pipe Hangers – Clamps attach to vent pipe.

Steel joint connector rings (available from Centrotherm supplier) must be used at each pipe joint. The connector rings ensure that the joints do not separate under heavy loads. These connector rings must be used to comply with ULC-S636 requirements. See following photo with the joint connector attached to the pipe sections.

Pipe shown with connector ring



⚠ WARNING

DO NOT operate vent system without properly installing Connector Rings.

Centrotherm Connector Ring. Hooked bracket over bottom joint as shown

Step 6: If any of the straight pipe sections need to be cut, use a hack saw and make a straight cut on the male (ungasketed) end of the pipe. When making the cut, allow for the 2" minimum (51 mm) insertion distance inside the female end of the pipe. Using a razor knife, deburr the edges of the cut pipe to make an approximately 15 degree bevel to avoid any sharp edges that may damage the gasket.

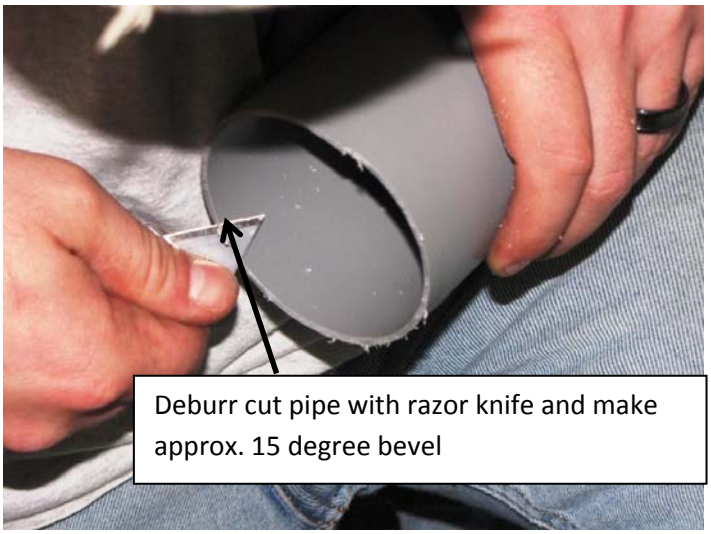
⚠ WARNING

Cut pipe edges must be properly deburred. Damage to the gasket from not deburring the edges of the cut male end may result in the release of dangerous flue products.

Cut end of pipe to length using a hacksaw. Cut male end only and allow for 2” insertion depth into female end of fitting.

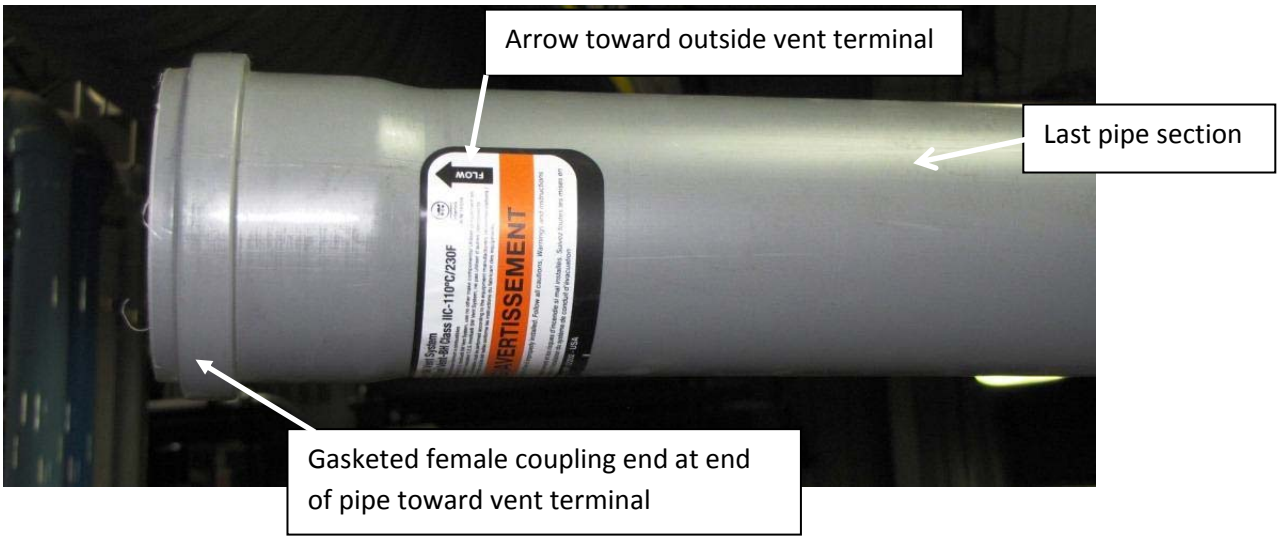
Deburring cut pipe edge with razor knife to create smooth 15° (approx.) bevel to prevent gasket damage.



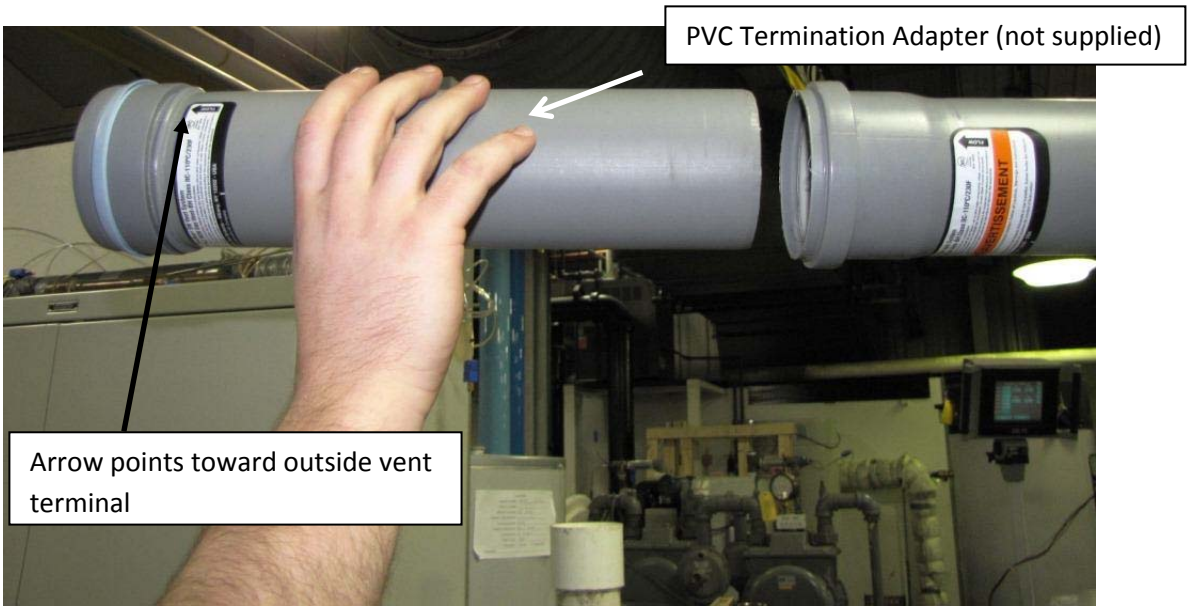


Step 7: Continue installing straight sections of pipe and elbows and support with pipe support clamps as previously shown a minimum of every 36 inches (1 meter). Run the vent pipe near the outside wall or roof to be terminated. A Centrotherm ISTAGL-0202, 0303, or 0404 PVC Termination Adapter (2”, 3” or 4” diameters) must be used to connect the Centrotherm polypropylene vent pipe to PVC pipe first before exiting the wall or roof. The Centrotherm polypropylene to PVC Vent Adapter has a male ungasketed end and a male outside gasket on the other end. The ungasketed end of the Centrotherm PVC Termination Adapter is inserted into the last section of the gasketed end of vent pipe. The arrow on the Centrotherm PVC termination adapter must point toward the vent terminal. Connect the PVC coupling and flue pipe clamp to the gasketed end of the PVC Termination Adapter. Cut the PVC pipe to the length needed to exit the wall or roof. Refer to the installation instruction manual supplied with the water heater for information regarding the location of the vent terminals.

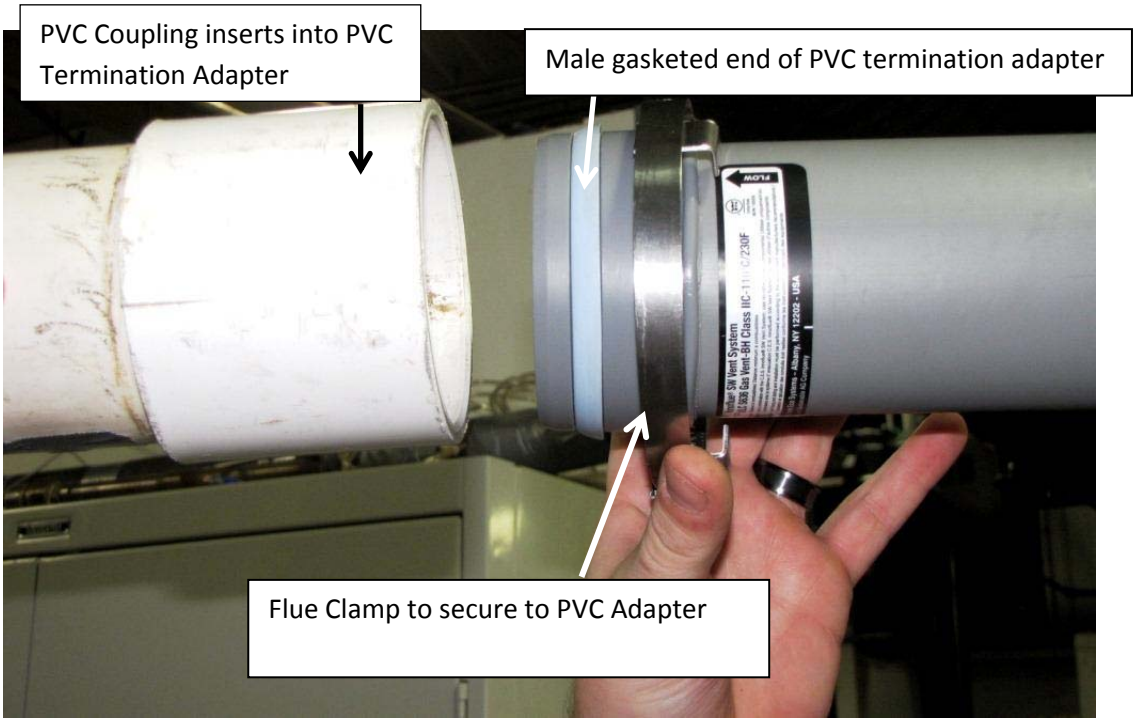
Cut the male end of the last piece of pipe to the length as needed to get near the exiting wall or ceiling of the desired outside vent terminal location. Install this last section of pipe.



Install the appropriate diameter Centrotherm ISTAGL PVC Termination Adapter on the end of the last pipe.



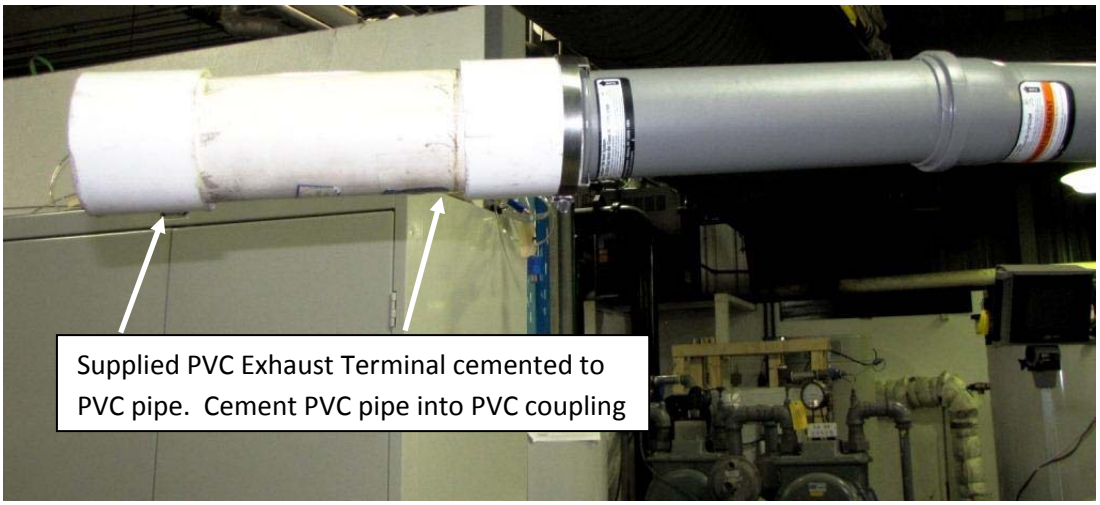
Install a PVC coupling onto the male gasketed end of the Centrotherm PVC Termination Adapter. A reducer coupling may be needed to use the supplied vent terminals if a larger pipe diameter size was used. Cement the straight section of PVC pipe to the PVC pipe coupling. Install the PVC pipe to exit the wall or roof, and then cement the vent terminal onto the PVC or CPVC pipe. Refer to the venting section of the water heater Installation and Operating Instruction manual for the appropriate solvent and cement to use. The exhaust vent terminal for the EF model series is shown. Use the vent terminals supplied with the water heater. See the following photos.



⚠ WARNING

A Centrotherm ISTAGL series PVC Vent Termination Adapter must be used at the end of the last section of polypropylene vent pipe to connect to the PVC pipe coupling. The arrow must point toward the vent terminal. DO NOT USE THE SAME PVC ADAPTER THAT IS USED TO CONNECT TO THE WATER HEATER.

Secure the PVC coupling to the PVC Terminal Adapter with the Centrotherm Flue Pipe Clamp. Cement a short section of PVC pipe into the PVC pipe coupling. Cement the supplied PVC exhaust terminal coupling onto the PVC pipe.



Step 8: After the venting system installation is completed, start the water heater and check all joints for leaks using a soapy water solution. Any leaks found must be repaired. If a gasket is damaged, replacement gaskets may be obtained from the local Centrotherm supplier.

⚠ WARNING

All of the exhaust venting connections must be leak checked with a soap solution upon initial start-up of the water heater. Any leaks must be repaired before continuing operation of the water heater.
Periodically check all venting system connections for leakage. Replace any defective venting components. Refer to the maintenance section of the Installation and Operating Instructions for further details.

SUPPLEMENT – VENTING INSTRUCTIONS FOR INSTALLATION AND OPERATION INSTRUCTION MANUALS FOR THE FOLLOWING PRODUCT TYPES:

HIGH EFFICIENCY CONDENSING COMMERCIAL, COMMERCIAL POWER DIRECT VENT, LIGHT DUTY COMMERCIAL POWER DIRECT VENT, LIGHT DUTY COMMERCIAL POWER VENT, RESIDENTIAL POWER DIRECT VENT, RESIDENTIAL POWER VENT MODEL SERIES, ULTRA LOW NOx RESIDENTIAL POWER DIRECT VENT, ULTRA LOW NOx LIGHT DUTY POWER DIRECT VENT, ULTRA LOW NOx RESIDENTIAL POWER VENT, ULTRA LOW NOx LIGHT DUTY POWER VENT, HIGH PERFORMANCE SERIES POWER VENT, COMBI POWER VENT, SOLAR POWER VENT GAS BACKUP.

INSTALLATION OF DURAVENT POLYPRO® SINGLE WALL POLYPROPYLENE VENTING SYSTEMS

This supplement is for the installation of polypropylene single wall venting system manufactured by M&G DuraVent, Inc. The DuraVent Polypro venting system is a CSA approved alternative to the PVC, ABS, and CPVC venting components for the High Efficiency Condensing Commercial, Commercial Power Direct Vent, Light Duty Commercial Power Direct Vent, Light Duty Commercial Power Vent, Residential Power Direct Vent, Residential Power Vent Model Series, Ultra Low NOx Residential Power Direct Vent, Ultra Low NOx Light Duty Power Direct Vent, Ultra Low NOx Residential Power Vent, Ultra Low NOx Light Duty Power Vent, High Performance Series Power vent, Combi Power Vent, Solar Power Vent Gas Backup Model Series.

The DuraVent venting system components are ULC S636 approved and listed by a recognized agency and may be installed in the U.S. and Canada. All components used must be from the same manufacturer and are designed for use with the above noted products. The DuraVent components may be purchased from plumbing supply distributors. The vent size diameter and maximum vent lengths must be followed as detailed in the Installation and Operating Instruction Manual that was supplied with the water heater. Thoroughly read and understand the venting section of the instruction manual supplied with the water heater before proceeding with the following instructions in this supplement. The vent terminals supplied with the water heater or the factory approved accessory vent terminal kits must be used with this venting system.

⚠ WARNING
The venting system must be properly installed. Failure to properly install the vent system could result in property damage, personal injury, or death.
DO NOT install damaged venting system components. If damage is evident then please contact the supplier where the water heater or venting system components were purchased for replacement parts.
Use only the vent terminals provided or factory authorized terminals for venting this water heater.
The water heater requires its own separate venting system. Do not connect the exhaust vent into an existing vent pipe or chimney.
All of the exhaust venting connections must be leak checked with a soap solution upon initial start-up of the water heater. Any leaks must be repaired before continuing operation of the water heater.
Do not terminate the venting where noise from the exhaust or intake will be objectionable. This includes locations close to or across from windows and doors. Avoid anchoring the vent and intake pipes directly to framed walls, floors, or ceilings unless rubber isolation pipe hangers are used. This prevents any vibrations from being transmitted into the living spaces.
Do not exceed the venting distances or the number of elbows listed in the instruction manual supplied with the water heater. Exceeding the maximum venting distances may cause the water heater to malfunction or cause an unsafe condition.
DO NOT operate this water heater until the venting installation is complete and the piping completed. Failure to complete installation before operation can result in property damage, personal injury, or death.

⚠ WARNING

DO NOT install Duravent Polypro venting components with any other manufacturer's vent components. Duravent components must be used exclusively throughout the entire venting system from the water heater coupling or vent connection to the outside wall or ceiling near the vent terminal location.

This supplement is intended only for additional information for installing Duravent Polypro single wall venting system and the instruction manual supplied with the water heater must be followed for the detailed information provided for the venting system installation.

Step 1: Thoroughly read and understand the venting section of the Installation and Operating Instruction Manual that was supplied with the water heater before determining the location of the water heater and the vent terminals. Locate the water heater for the shortest practical vent length to the outside. Measure the total venting distance required to reach the outside wall or roof. Determine the diameter of the venting components to use for the length of vent pipe (and combustion air supply for direct vent models) required by referring to the venting tables in the instruction manual for the maximum vent length for each diameter pipe size. Obtain all the necessary venting system components for the installation.

Step 2: Before installation, inspect each vent component for damage making sure the gaskets for each component are fully intact and in undamaged condition. Do not attempt to install or repair damaged components. If a gasket is damaged, these are available from the supplier of DuraVent components. Do not use gaskets from another manufacturer and do not try to repair the gasket.

Step 3: A DuraVent PVC to Polypropylene adapter (referred by DuraVent as Appliance Adapters, 2PPS-AD, 3PPS-AD, or 4PPS-AD) must be used to connect into a PVC coupling or tee (Commercial and Residential Power Direct Vent air intake connections), condensate elbow (High Efficiency Commercial Condensing models) or the exhaust outlet adapter for Commercial Power Vent and Residential Power Vent models. To make the insertion of the gasketed fittings into the coupling easier, rotate the joints slightly and use water to lubricate the gaskets. DO NOT use any other kind of lubricant.

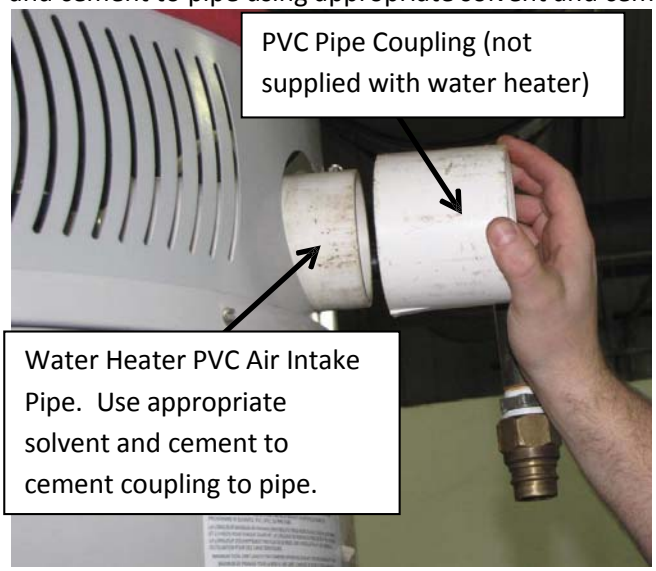
Wet the gasket surface and inside of the coupling using your finger or wet paper towel and insert the male end of the adapter with the exterior gasket into the coupling, condensate elbow or exhaust outlet adapter connection. If a larger vent diameter size is to be used, use the appropriately sized reducer coupling first on the water heater intake or exhaust vent connection as detailed in the installation manual supplied with the water heater. See the following photos.

⚠ WARNING

Use only water for lubricating the gaskets and pipe ends to allow easy insertion. DO NOT use any other kind of lubricant, since deterioration of the gasket may result, which may allow dangerous flue gases to leak into the room. If the vent pipe needs to be disassembled after the gasket has dried, wet the joint thoroughly to loosen the connection.

High Efficiency Condensing Commercial Models: Use the appropriate primer and cement (refer to venting section of instruction manual with water heater) for cementing a PVC coupling (not supplied with water heater) to the end of the PVC air intake pipe connection. Using your finger, wet with water the male gasketed end of the DuraVent PVC to PolyPro adapter and fully insert into the air intake coupling. Loosen the DuraVent adapter connector clamp (PPS-PAC) and install over the PVC coupling. See following photos.

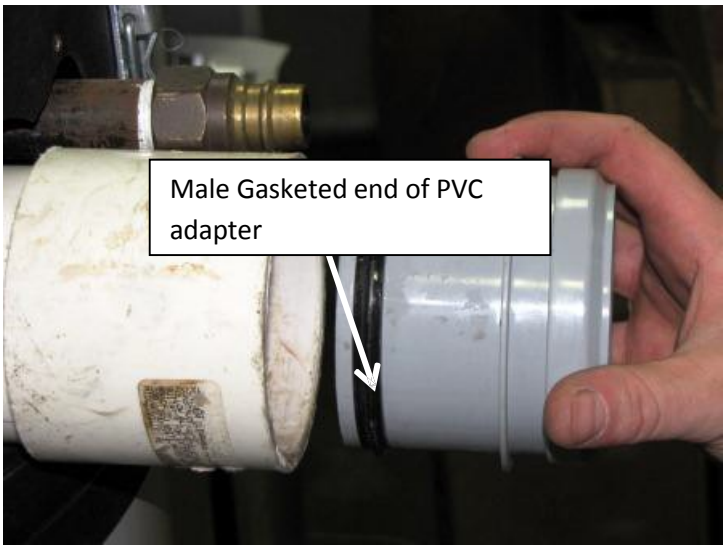
Install PVC pipe coupling over air intake pipe connection and cement to pipe using appropriate solvent and cement.



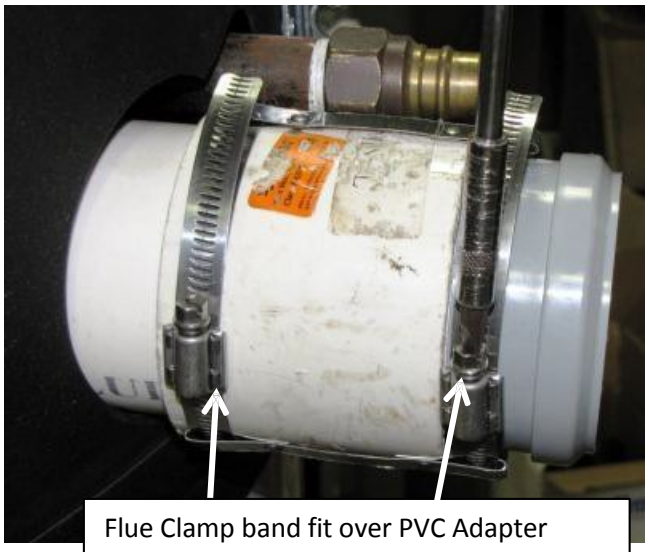
Wet gaskets of DuraVent PVC Adapter using finger.



Insert male gasketed end of DuraVent PVC adapter into PVC pipe coupling.



Install DuraVent Adapter Connector Clamp (PPS-PAC) over the PVC coupling so that clamp brackets secure the shoulder of PVC adapter fitting. Tighten clamp screws securely.



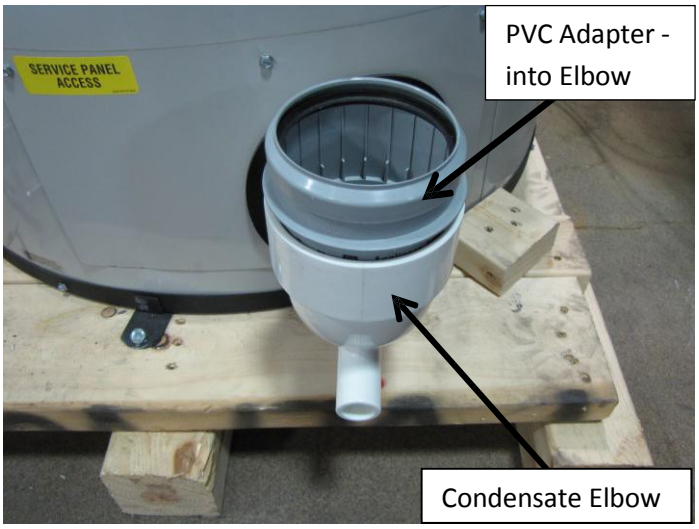
⚠ WARNING

DuraVent Adapter Connector Clamps (p/n: PPS-PAC) MUST be properly installed to secure the PVC Vent Adapter. DO NOT operate the vent system without first installing the Flue Adapter Connector Clamps.

For High Efficiency Commercial Model series exhaust connection, wet outside gasket with finger and insert PVC adapter into the condensate elbow. Insert DuraVent PVC Adapter fitting into Condensate Elbow as shown.



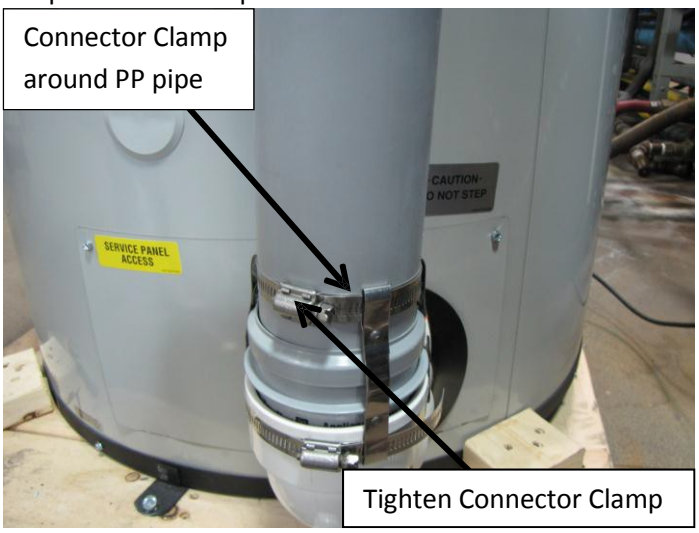
Wet gasket with water using finger of PVC Adapter



Install DuraVent Connector Clamp around outside of Condensate Elbow as shown.



Tighten Connector Clamp Screw to secure PVC Adapter and Adapter and Vent Pipe into condensate Elbow.



Commercial and Residential Power Direct Vent / Power Vent Models:

For installation of commercial and residential power vent models, install the male end of the PVC to PolypPro adapter into the air intake pipe tee as shown.	Install the adapter connector clamp over the PVC adapter. Then install the elbow or vent pipe section into the PVC adapter. Tighten the clamp bands of the adapter connector to the air intake tee and pipe elbow or straight pipe section to secure vent pipe to the water heater air intake tee as shown below.

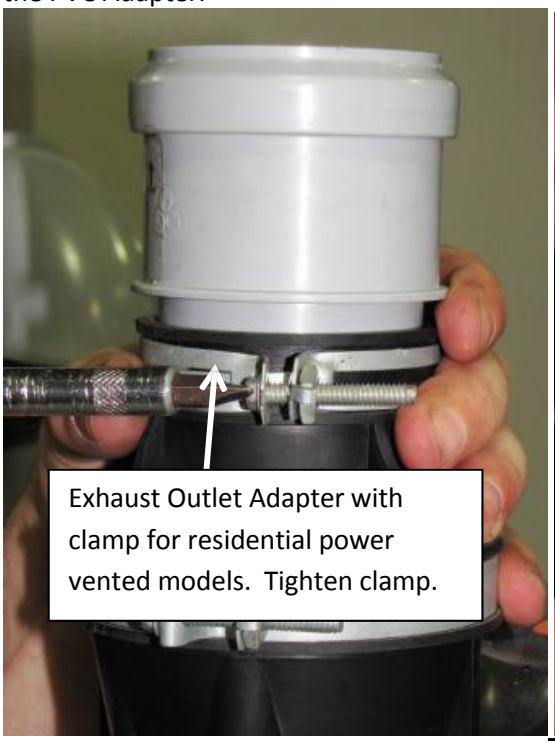
PVC Adapter Fitting





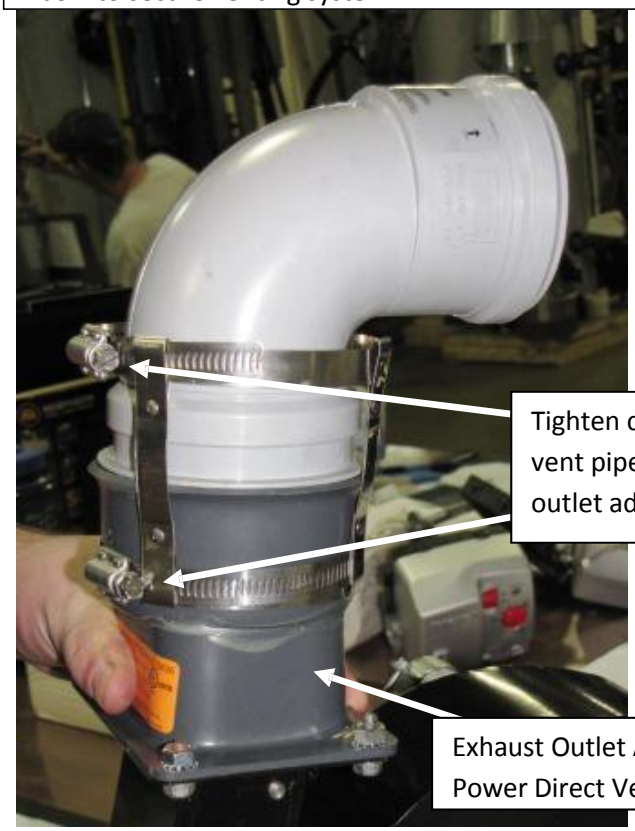
For the exhaust venting for all power vent and power direct vent models, insert the PVC Adapter into the Exhaust Outlet Adapter. On residential models, tighten the clamp to secure the PVC Adapter.

For Commercial Power Direct Vent models, insert PVC Adapter into Exhaust Outlet Adapter.



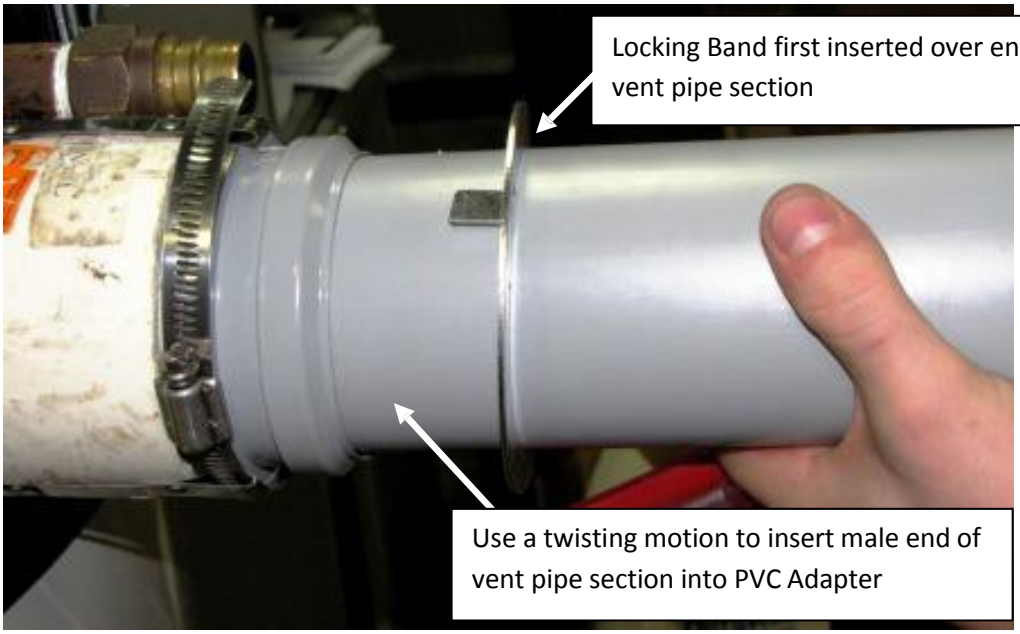


Install the Adapter Connector Clamp over the PVC adapter and install the elbow or next section of straight pipe into the PVC adapter. Then tighten the clamp bands of the Adapter Connector around the Exhaust Outlet Adapter and Elbow to secure venting system.

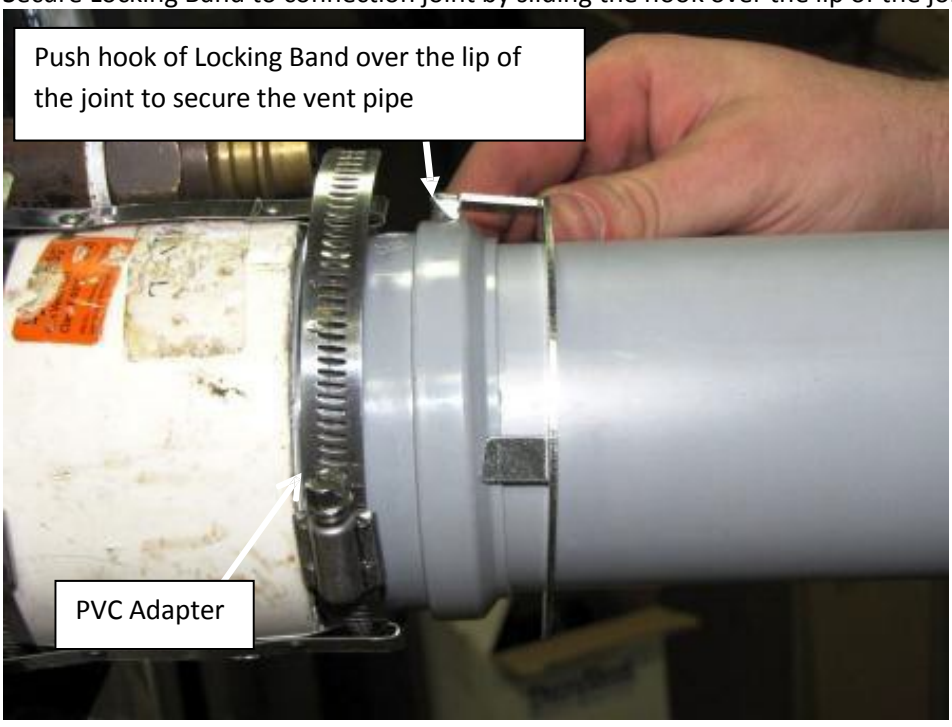


Step 4: Using a finger or paper towel, wet with water the inside gasket of the PVC adapter and the male end (without gasket) of the elbow or straight section of pipe for running the exhaust or intake pipe from the water heater.

Steel joint Locking Bands (available from DuraVent supplier) must be used at each pipe joint. The connector rings ensure that the joints do not separate under heavy loads. These connector rings must be used to comply with ULC-S636 requirements. See following photo with the joint connector attached to the pipe sections.
Insert a Locking Band over the male end of the vent pipe section with the hook and leg facing the joint. Insert the male end of the elbow or straight section into the PVC adapter. Use a twisting motion while pushing the male end of the pipe or elbow into the PVC adapter to fully seat into the gasket. The male end of the pipe or elbow must always point toward the water heater.



Secure Locking Band to connection joint by sliding the hook over the lip of the joint as shown below.



⚠ WARNING

DO NOT operate vent system without properly installing Locking Bands.

⚠ WARNING

Make sure pipe sections are fully inserted into the PVC adapter and/or gasketed end of DuraVent fitting. Insertion depth is no less than 2 inches.

Step 5: DuraVent supplied support brackets must be used to support the pipe sections. The vent pipe sections **must be** supported a minimum of every 10 feet (3 meters) of vertical run or on every horizontal pipe section. Consult local codes for additional requirements.

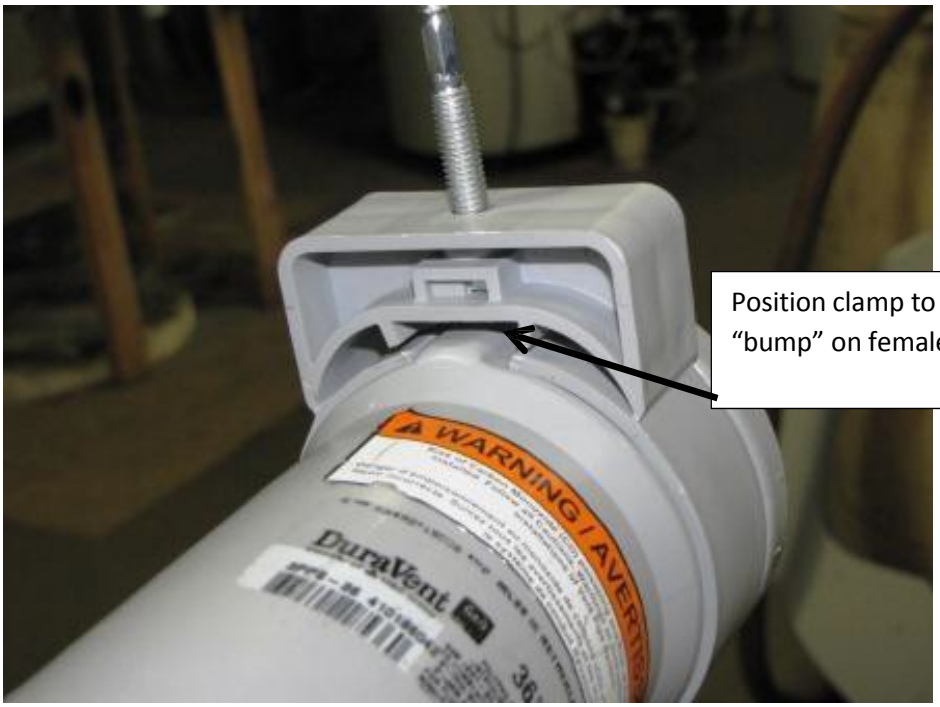
DuraVent supplies two types of approved clamps available for hanging the vent pipe. The Polypropylene snap style clamp can be attached at either the male or female end of the pipe. Determine the location for the anchor bolt mounting to the wall or framing member. Mount the anchor bolt supplied with the clamp. Align the encapsulated nut of the clamp with the anchor bolt and rotate the body of clamp with the nut onto the threads of the anchor bolt. With the vent pipe in place, the clamp is then snapped together by closing the clamp around the vent pipe body or female end of the pipe.

The metal Wall Strap type clamp can only be mounted on the body of the vent pipe. Open the metal clamp to fit around the body of the vent pipe and slide into the desired location to secure to the wall or ceiling. Secure to the wall or structural member by using (2) 1 ½" #8 wood screws or equivalent (not supplied with clamp). Secure the clamp around the vent pipe by tightening the nuts and bolts of the clamp.

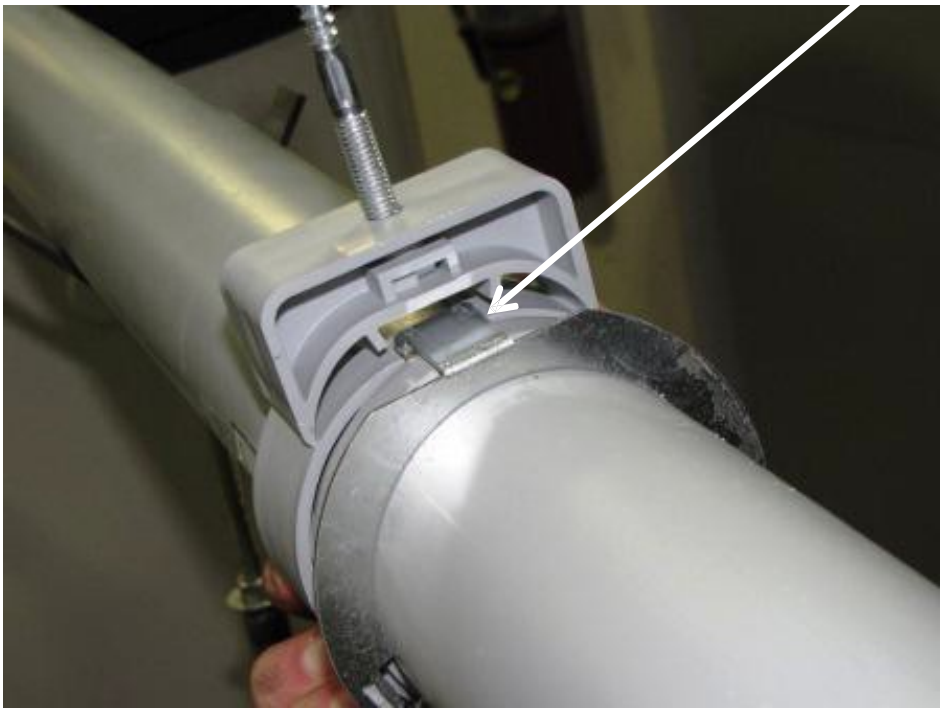




Plastic Clamp also fits over Female Flange of DuraVent Vent Pipe Sections



Plastic Clamp opening allows room for Locking Bands to hook over flared female joint



Tighten Metal Clamp around body of vent pipe.



Metal clamp fastens to wall with wood screws



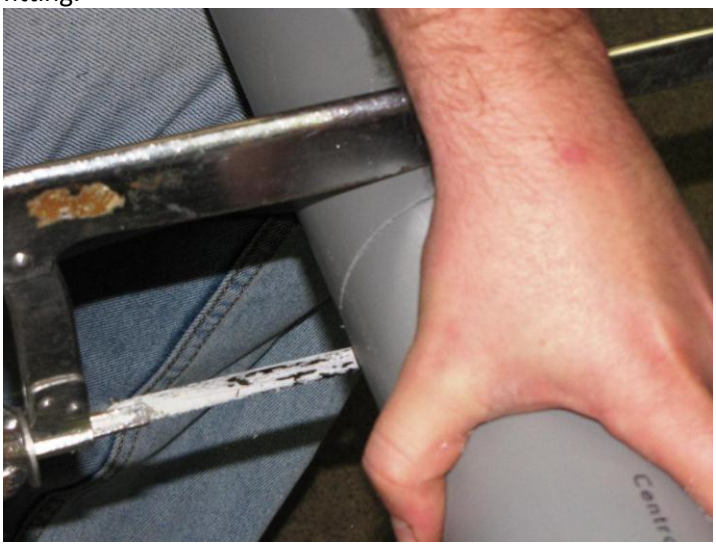
High Efficiency Commercial Condensing Models:
For horizontal sections of flue pipe, the pipe must be installed with a slight upward slope of approximately ¼ inch per foot (20 mm per meter) toward the water heater to allow condensate to drain into the condensate elbow.
Residential and Commercial Power Direct Vent / Power Vent Models:
To prevent condensate from accumulating in the exhaust blower, install the horizontal vent pipe with a downward slope toward the vent terminal of ¼ inch per foot (20 mm per meter) of horizontal vent pipe. An optional condensate kit is available for residential power vent models or a tee fitting with a condensate drain loop may be used on commercial power direct vent models to prevent condensate accumulation in the blower for long vertical runs of vent pipe. Refer to the venting section of the Installation and Operating Instructions supplied with the water heater.

Step 6: If any of the straight pipe sections need to be cut, use a hack saw and make a straight cut on the male (ungasketed) end of the pipe. When making the cut, allow for the 2" minimum (51 mm) insertion distance inside the female end of the pipe. Make sure the cuts are made square and use a razor knife to deburr the edges of the cut pipe to avoid any sharp edges that may damage the gasket.
DuraVent has adjustable vent pipe sections available, which allow 4.5 inches (114 mm) of adjustment to the length.

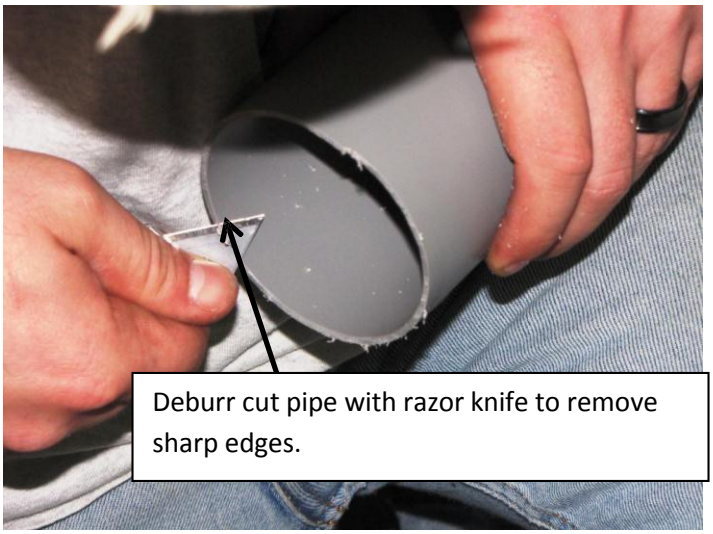
⚠ WARNING

Cut pipe edges must be properly deburred. Damage to the gasket from not deburring the edges of the cut male end may result in the release of dangerous flue products.

Cut end of pipe to length using a hacksaw. Cut male end only and allow for 2” insertion depth into female end of fitting.



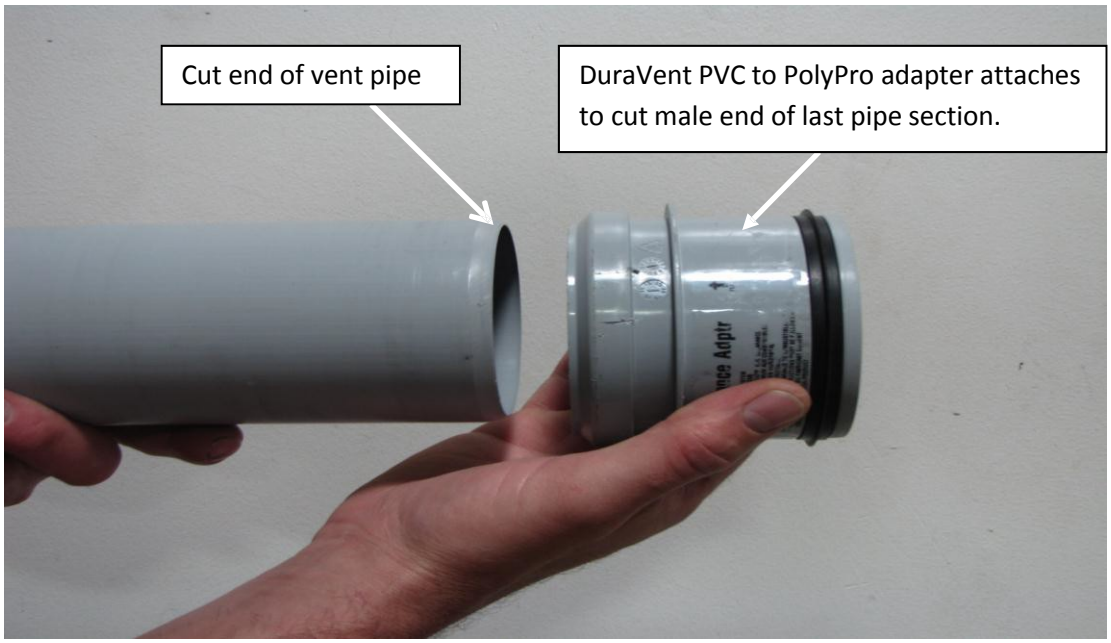
Deburring cut pipe edge with razor knife to remove sharp edges to prevent gasket damage.



Step 7: Continue installing straight sections of pipe and elbows and support with pipe support clamps as previously shown on every horizontal pipe section or at least every 10 feet (3 meters) for vertical runs. Run the vent pipe near the outside wall or roof to be terminated. A DuraVent PVC to PolyPro Adapter (2”, 3” or 4” diameters) must be used to connect the DuraVent polypropylene vent pipe to PVC pipe first before exiting the wall or roof. The female flared end (inside gasket) of the last DuraVent pipe section must be cut off at the proper length needed. Connect the female end of the PVC Adpater into the end of the last pipe. Connect the PVC coupling over the male gasketed end of the PVC Termination Adapter. Secure the PVC pipe coupling to the DuraVent PVC adapter with the Adapter Connector Clamp and detailed previously. Cut the PVC pipe to the length needed to exit the wall or roof. Refer to the installation instruction manual supplied with the water heater for information regarding the location of the vent terminals.

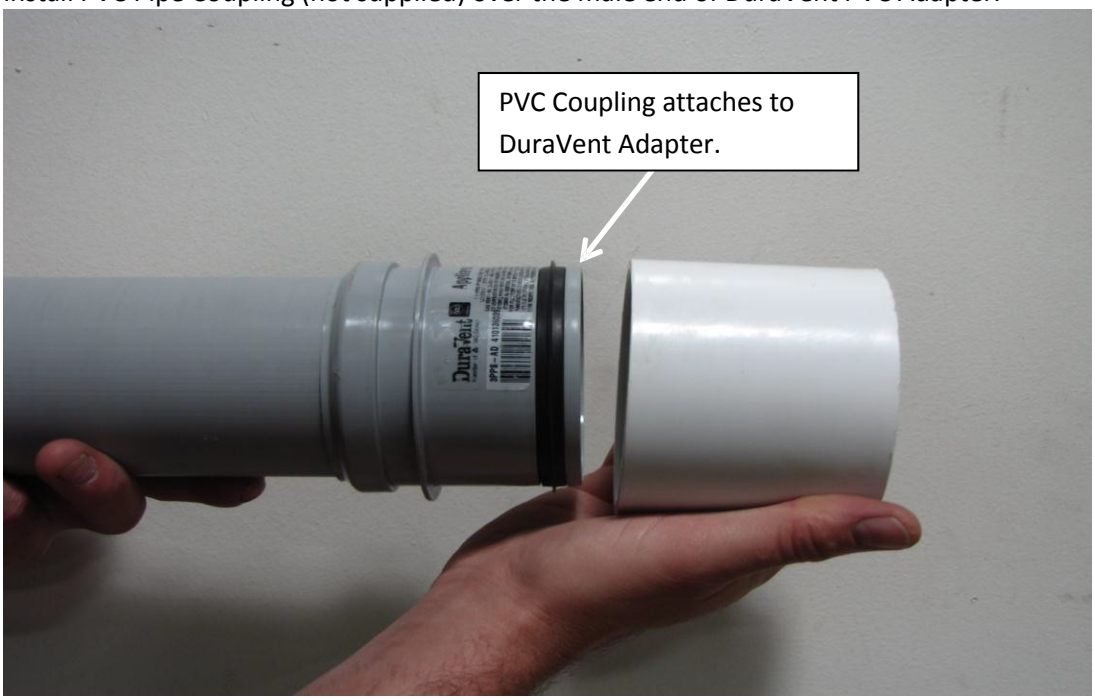
Cut the male end of the last piece of pipe to the length as needed to get near the exiting wall or ceiling of the desired outside vent terminal location. Install this last section of pipe.

Install the appropriate diameter DuraVent PVC Adapter on the end of the last pipe.

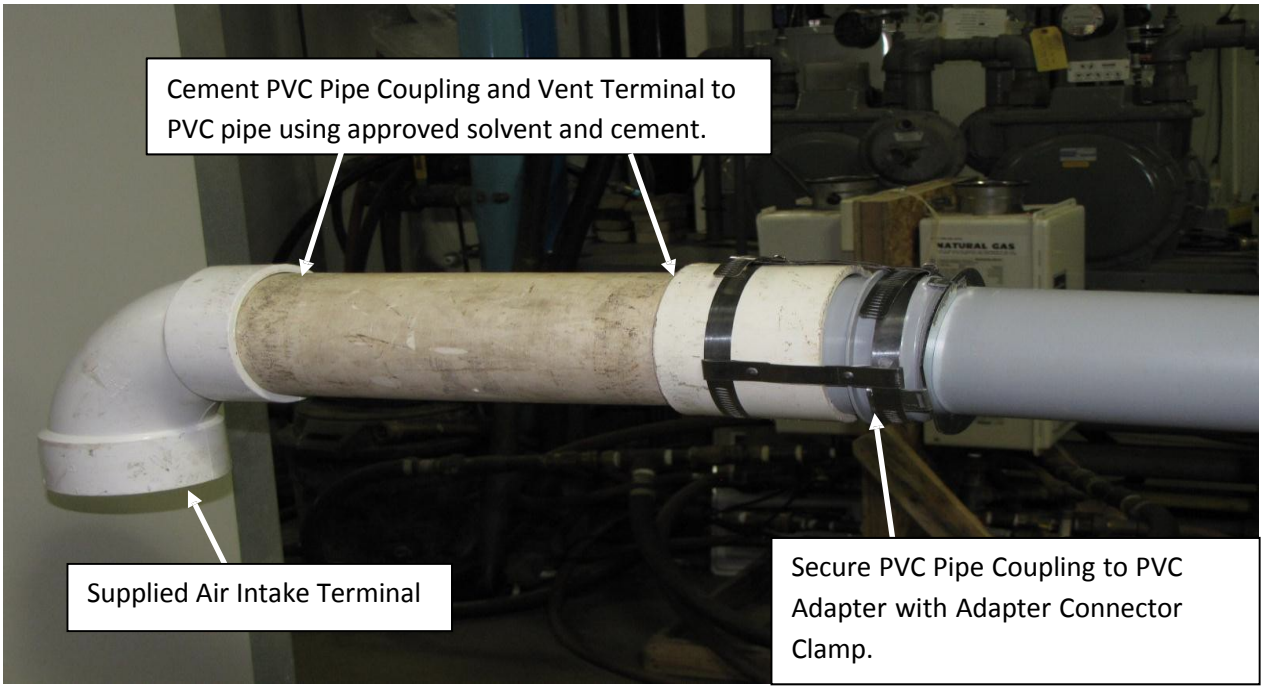


Install a PVC coupling onto the male gasketed end of the DuraVent PVC Adapter. A reducer coupling may be needed to use the supplied vent terminals if a larger pipe diameter size was used. Cement the straight section of PVC pipe to the PVC pipe coupling. Install the PVC pipe to exit the wall or roof, and then cement the vent terminal onto the PVC or CPVC pipe. Refer to the venting section of the water heater Installation and Operating Instruction manual for the appropriate solvent and cement to use. The exhaust vent terminal for the EF model series is shown. Use the vent terminals supplied with the water heater. See the following photos.

Install PVC Pipe Coupling (not supplied) over the male end of DuraVent PVC Adapter.



Secure the PVC coupling to the PVC Terminal Adapter with the DuraVent Flue Pipe Clamp. Cement a short section of PVC pipe into the PVC pipe coupling. Cement the supplied PVC exhaust terminal coupling onto the PVC pipe.



Step 8: After the venting system installation is completed, start the water heater and check all joints for leaks using a soapy water solution. Any leaks found must be repaired. If a gasket is damaged, replacement gaskets may be obtained from the local DuraVent supplier.

⚠ WARNING

All of the exhaust venting connections must be leak checked with a soap solution upon initial start-up of the water heater. Any leaks must be repaired before continuing operation of the water heater.
Periodically check all venting system connections for leakage. Replace any defective venting components. Refer to the maintenance section of the Installation and Operating Instructions for further details.

BRADFORD WHITE®
WATER HEATERS

RESIDENTIAL AND COMMERCIAL GAS REPLACEMENT PARTS LIST

Ultra High Efficiency Models With Direct Spark Ignition

EFR160T120*(EN,SX)
EF(60,100)T(125-300)(E*N)(*X)(A)2
(Serial Number GB13006174 and After)



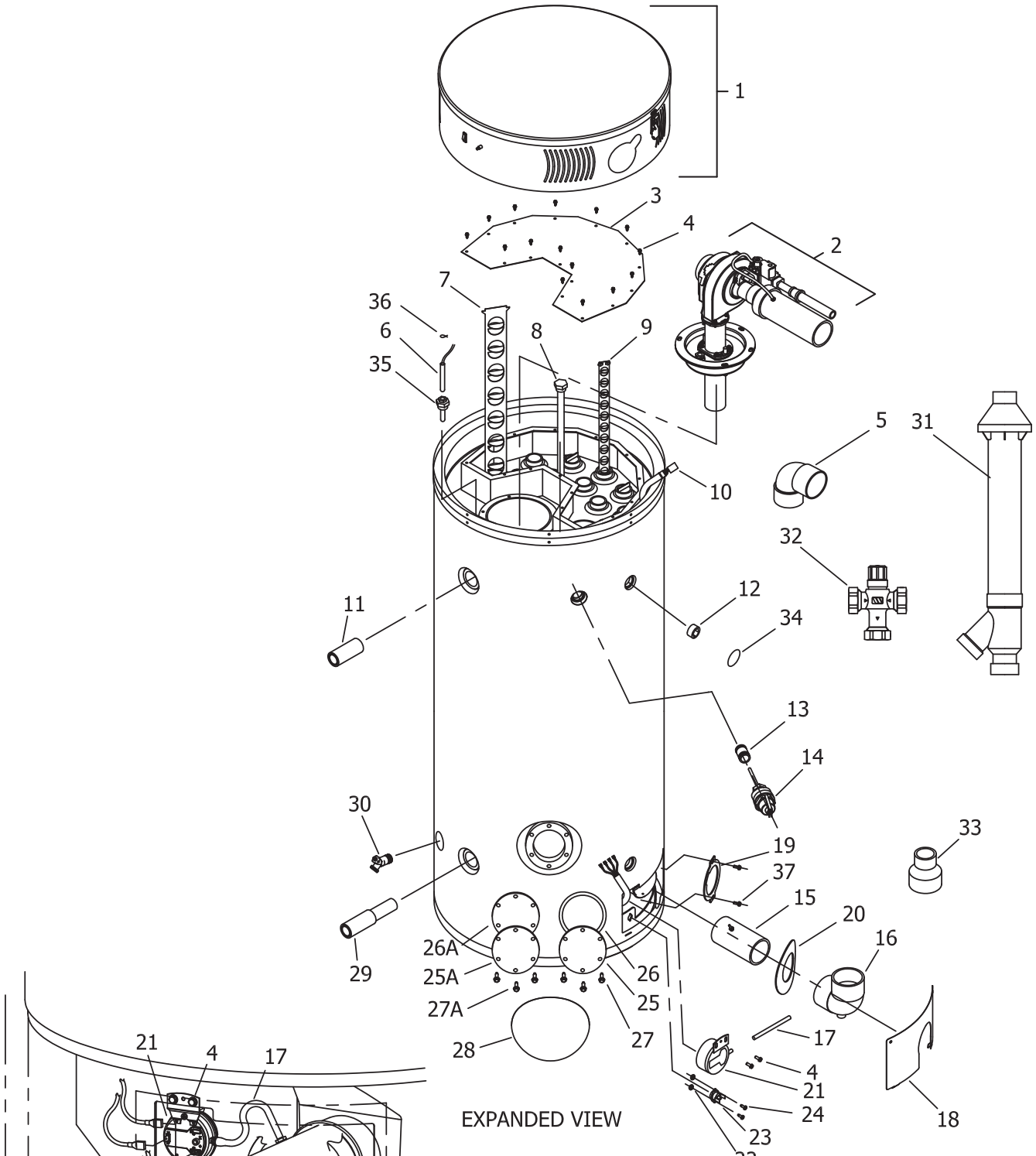
Includes Hydrojet® Total Performance System

Effective: July, 2016
ECO 7971

NOTE: BOTH MODEL AND SERIAL NUMBERS ARE REQUIRED FOR ORDERING REPLACEMENT PARTS

Dimensions and specifications subject to change without notice.

Parts Book #238-48204-00E



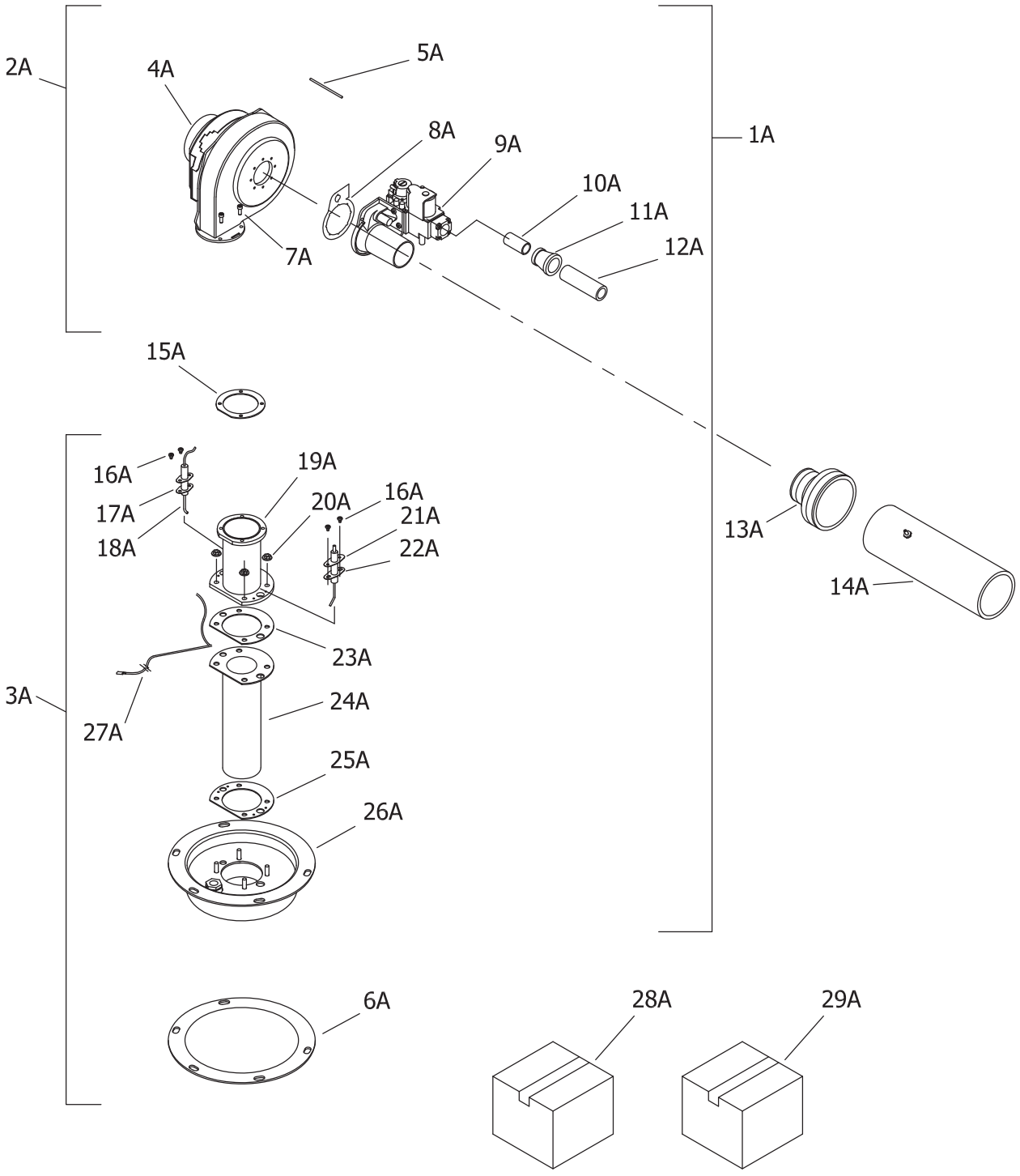
BRADFORD WHITE® WATER HEATERS

Item	Description	Model EFR160T120*(EN,SX)	Model EF100T150(E)*(N,X)(A)2	Model EF100T199(E)*(N,X)(A)2	Model EF100T250(E)*(N,X)(A)2
1	Combustion Surround Assembly	See Page 10	See Page 10	See Page 10	See Page 10
2	Combustion System Assembly	See Page 6	See Page 6	See Page 6	See Page 6
3	Collector Cover Second Pass	239-43454-00	239-43454-00	239-43454-00	239-43454-00
4	Screw 10-16 x 3/4	239-44444-00	239-44444-00	239-44444-00	239-44444-00
5	Elbow-Vent Terminal (2 Req'd)	239-39831-00	---	---	---
	Elbow-Vent Terminal	---	239-40579-00	239-40579-00	239-40579-00
	Coupling-Vent Terminal	---	239-46740-00	239-46740-00	239-46740-00
6	Temperature Sensor	239-46553-02	239-46553-02	239-46553-02	239-46553-02
7	Baffle 4" Flue (2 Req'd)	243-43304-00	---	243-43304-00	243-43304-00
8	Anode Rod (Magnesium) (4 Req'd)	224-47782-13	224-47782-08	224-47782-08	224-47782-08
	Anode Rod (Aluminum) (4 Req'd)	224-38508-06	224-38508-01	224-38508-01	224-38508-01
	Anode Rod (A420 Aluminum) (4 Req'd)#	224-49559-04	224-49559-04	224-49559-04	224-49559-04
9	Baffle 2" Flue (8 Req'd)	239-45659-00	239-45658-00	239-45658-00	239-45658-00
10	Wire Harness-Service Panel	239-43358-02	239-43358-01	239-43358-01	239-43358-01
11	Nipple Hot Water Outlet Plastisert (Front Connect)	229-32762-18	229-40913-07	229-40913-07	229-40913-07
12	Pipe Plug 1" NPT	239-02048-00	239-02048-00	239-02048-00	239-02048-00
13	Nipple Plastisert T & P	229-32762-02	229-32762-02	229-32762-02	229-80982-00
14	T&P Relief Valve	230-30246-00	230-30246-00	230-30246-00	230-33630-04
15	Exhaust Vent Pipe	239-45971-00	239-45971-00	239-45971-00	239-45971-00
16	Condensate Elbow	239-43211-00	239-43211-00	239-43211-00	239-43211-00
17	Silicone Tubing 3/16" I.D.	239-41718-00	239-41718-00	239-41718-00	239-41718-00
18	Outer Door Service Panel	239-48134-00	243-44668-00	243-44668-00	243-44668-00
19	Bracket Exhaust Support	239-44667-00	239-44667-00	239-44667-00	239-44667-00
20	Escutcheon-Exhaust Pipe (EF Series)	239-43997-00	239-43997-00	239-43997-00	239-43997-00
21	Exhaust Pressure Switch	239-46037-01	239-46037-01	239-46037-01	239-46037-01
22	Keps Nut (2 Req'd)	239-81844-00	239-81844-00	239-81844-00	239-81844-00
23	Hi-Limit Switch	239-43238-02	239-43238-02	239-43238-02	239-43238-02
24	Screw 6-32 x 3/8 (2 Req'd)	239-81843-00	239-81843-00	239-81843-00	239-81843-00
25	Cleanout Cover	205-18428-00	205-18428-00	205-18428-00	205-18428-00
25A	Cleanout Cover (ASME)	---	205-32941-00	205-32941-00	205-32941-00
26	Cleanout Gasket	205-18427-00	205-18427-00	205-18427-00	205-18427-00
26A	Cleanout Gasket (ASME)	---	205-32942-00	205-32942-00	205-32942-00
27	Screw 5/16 - 18 x 1/2	239-82166-00	239-82166-00	239-82166-00	239-82166-00
27A	Screw 5/16 - 18 x 1/2 (ASME) (6 Req'd)	---	239-32970-00	239-32970-00	239-32970-00
28	Clean Out Access Cover	239-20299-00-17	243-20299-00	243-20299-00	243-20299-00
29	Inlet Tube Hydrojet (Front Connect)	229-48076-01	229-44375-00	229-44375-00	229-44375-00
30	Drain Valve Brass (No Handle)	265-42351-02	265-42351-02	265-42351-02	265-42351-02
31	Coaxial Vent Pipe with Terminal (Optional)	239-44069-02	239-44069-01	239-44069-01	239-44069-01
32	ASSE Approved Mixing Valve (Optional)	239-43740-02	239-43740-02	239-43740-02	239-43740-02
33	Reducer 3" x 2"	239-48199-00	---	---	---
34	Hole Closure	239-31547-02	239-31547-02	239-31547-02	239-31547-02
35	Sensor Well	233-46558-01	233-46558-01	233-46558-01	233-46558-01
36	Clip Thermostat	233-45242-00	233-45242-00	233-45242-00	233-45242-00
37	Screw 1/4-20 x 5/8 Hex Washer (2 Req'd.)	239-42637-00	239-42637-00	239-42637-00	239-42637-00

* Applies to all warranties

A420 Anode may need to be cut to length

BRADFORD WHITE® WATER HEATERS



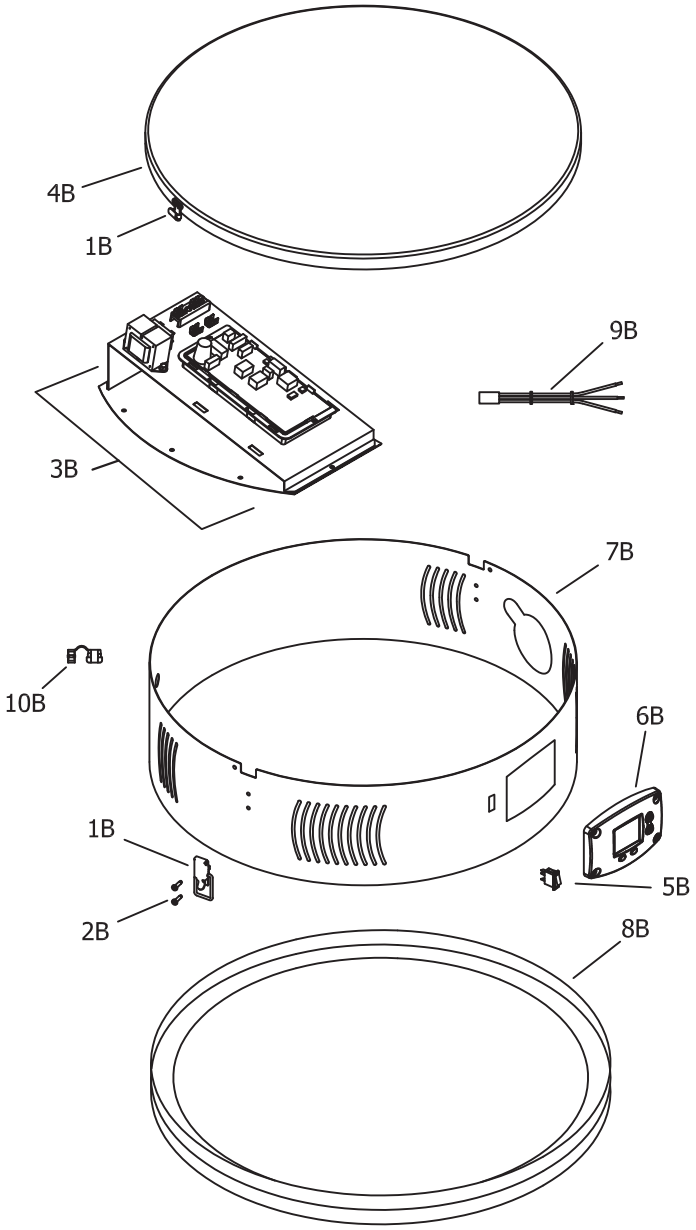
BRADFORD WHITE® WATER HEATERS

Item	Description	Model EFR160T120*(EN,SX)	Model EF100T150(E)*(N,X)(A)2	Model EF100T199(E)*(N,X)(A)2	Model EF100T250(E)*(N,X)(A)2
1A	Combustion System Assembly (Nat).	243-48073-01	243-48073-05	243-48073-07	243-48073-09
	Combustion System Assembly (LP).	243-48073-02	243-48073-06	243-48073-08	243-48073-10
2A	Blower and Gas Valve Assembly (Nat).	243-46009-01	243-46009-03	243-46010-01	243-46010-03
	Blower and Gas Valve Assembly (LP).	243-46009-02	243-46009-04	243-46010-02	243-46010-04
3A	Burner Assembly EF	265-46023-00	265-46023-00	265-46023-00	265-46024-00
4A	Blower	265-51225-00	265-51225-00	265-48922-00	265-48922-00
5A	Hose Tubing 3/16" I.D.	239-41718-00	239-41718-00	239-41718-00	239-41718-00
6A	Burner Mounting Insert Gasket**	239-43197-00	239-43197-00	239-43197-00	239-43197-00
7A	Screw 10-32 x 3/4 SHCS (4 Reqd)	239-43273-00	239-43273-00	239-43273-00	239-43273-00
8A	Gasket Venturi to blower	239-44654-00	239-44654-00	239-44654-00	239-44654-00
9A	Gas Valve Assembly (Nat.)	243-46007-01	243-46007-02	243-46007-02	243-46007-03
	Gas Valve Assembly (LP).	243-46008-01	243-46008-02	243-46008-02	243-46008-03
10A	Nipple 1/2 NPT X 3"	239-37047-00	239-37047-00	239-37047-00	239-37047-00
11A	Reducer 3/4 x 1/2 NPT	239-04474-00	239-04474-00	239-04474-00	239-04474-00
12A	Nipple 3/4 NPT x 7"	239-43373-00	239-43373-00	239-43373-00	239-43373-00
13A	2" x 3" Dia. Flex Reducer	239-40902-00	239-40902-00	239-40902-00	239-40902-00
14A	Inlet Tube (PVC)	239-43364-01	239-43364-01	239-43364-01	239-43364-01
15A	Gasket Blower Transition	239-43241-00	239-43241-00	239-43241-00	239-43241-00
16A	Screw 8-32 x 1/4 RHCR (4 Req'd)	239-43272-00	239-43272-00	239-43272-00	239-43272-00
17A	Flame Sensor Gasket	239-43371-00	239-43371-00	239-43371-00	239-43371-00
18A	Flame Sensor W/ Gasket	265-43232-00	265-43232-00	265-43232-00	265-43232-00
19A	Blower Transition Weldment	239-43201-00	239-43201-00	239-43201-00	239-43201-00
20A	Nut Hex Washer (4 Req'd)	239-43297-00	239-43297-00	239-43297-00	239-43297-00
21A	Spark Rod (w/ Gasket)	265-46481-00	265-46481-00	265-46481-00	265-46481-00
22A	Spark Rod Gasket	239-43370-00	239-43370-00	239-43370-00	239-43370-00
23A	Burner Mounting Gasket	239-43246-00	239-43246-00	239-43246-00	239-43246-00
24A	Burner Tube Kit (w/ gasket)	265-45624-00	265-45624-00	265-45624-00	265-46019-00
25A	Burner Mounting Gasket	239-43246-00	239-43246-00	239-43246-00	239-43246-00
26A	Burner Mounting Insert	239-43167-00	239-43167-00	239-43167-00	239-43167-00
27A	Ground Wire Assembly 24" Green	239-51994-00	239-51994-00	239-51994-00	239-51994-00
28A	Gas Regulator Kit (optional)	243-45517-00	243-45517-00	243-45517-00	243-45517-00
29A	LP to Natural Gas Conversion Kit	265-46391-01	265-46391-02	265-46391-02	265-46391-03

* Applies to all warranties

** Included with Item 3A

BRADFORD WHITE® WATER HEATERS

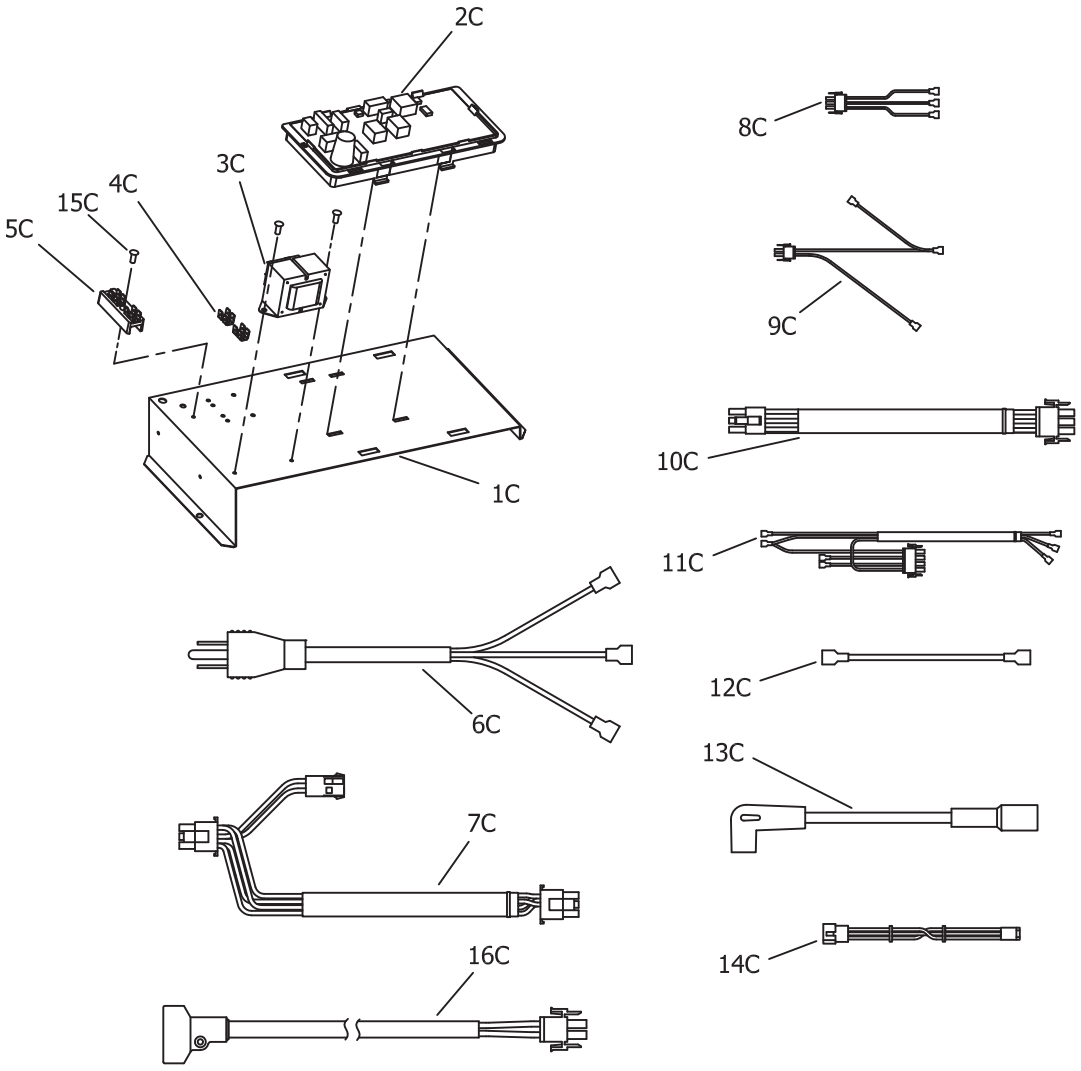


BRADFORD WHITE
WATER HEATERS

Item	Description	Model EFR160T120*(EN,SX)	Model EF100T150(E)*(N,X)(A)2	Model EF100T199(E)*(N,X)(A)2	Model EF100T250(E)*(N,X)(A)2
1B	Keeper Latch & Catch	239-43239-00	239-43239-00	239-43239-00	239-43239-00
2B	Screw 8-32 x 1/2 RHCR (2 Req'd)	239-41715-00	239-41715-00	239-41715-00	239-41715-00
3B	Ignition Control Assembly	243-47149-01 (see page 8)	243-47149-01 (see page 8)	243-47149-01 (see page 8)	243-47149-01 (see page 8)
4B	Surround Head-EF Comm.	243-45823-02	243-45823-02	243-45823-02	243-45823-02
5B	Main Power Switch	239-43234-00	239-43234-00	239-43234-00	239-43234-00
6B	Control Display-Honeywell Integrated Control	265-46557-00	265-46557-00	265-46557-00	265-46557-00
7B	Ring Combustion Surround	239-47305-02	239-47305-02	239-47305-02	239-47305-02
8B	Combustion Surround Base	239-43710-02	239-43710-02	239-43710-02	239-43710-02
9B	Integrated Control Display Harness	239-46617-00	239-46617-00	239-46617-00	239-46617-00
10B	Strain Relief Bushing (Power Cord)	239-80372-00	239-80372-00	239-80372-00	239-80372-00

* Applies to all warranties

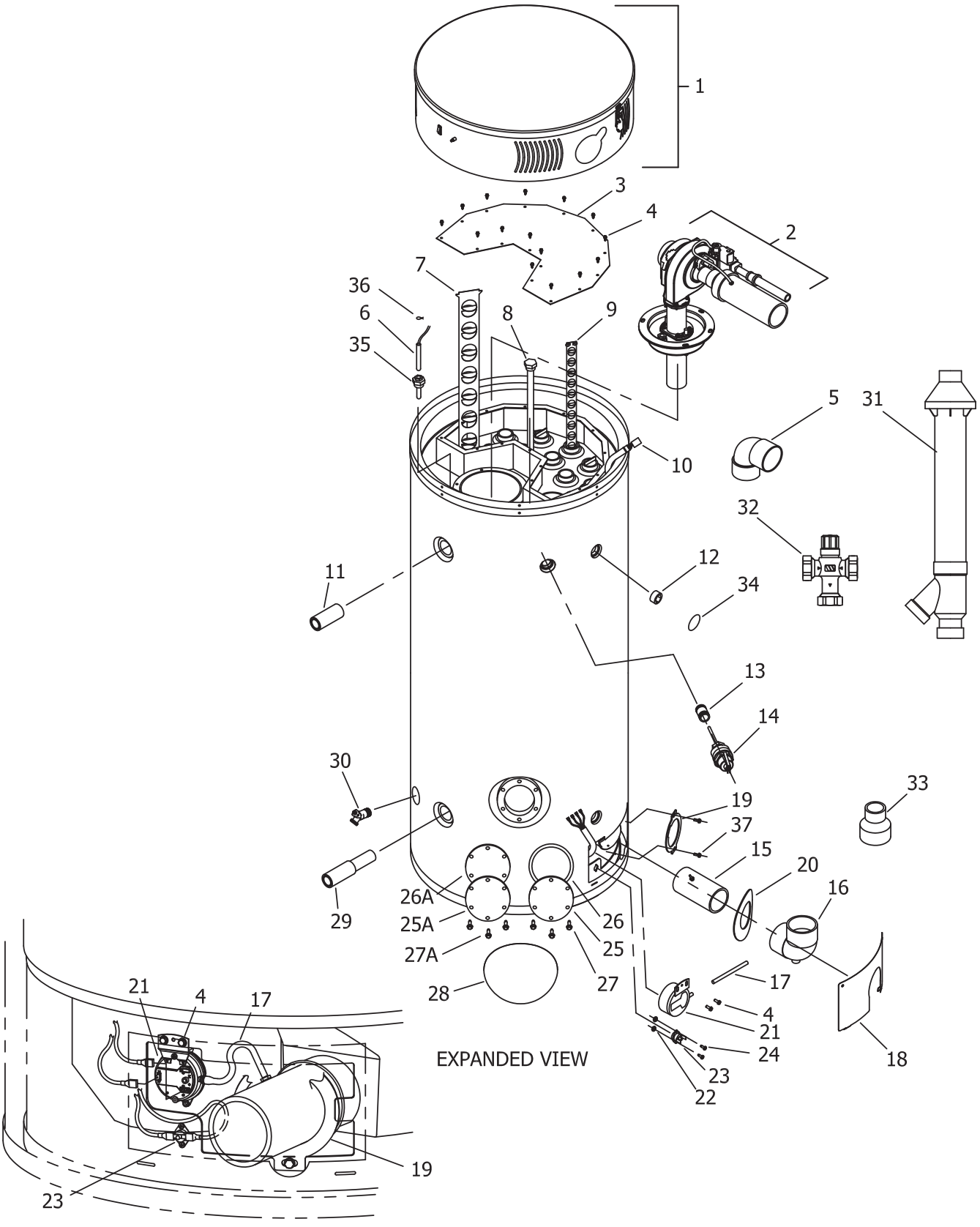
BRADFORD WHITE® WATER HEATERS



BRADFORD WHITE
WATER HEATERS

Item	Description	Model EFR160T120*(EN,SX)	Model EF100T150(E)*(N,X)(A)2	Model EF100T199(E)*(N,X)(A)2	Model EF100T250(E)*(N,X)(A)2
1C	Control Panel	239-48060-00	239-48060-00	239-48060-00	239-48060-00
2C	Integrated Control Board	233-46954-00	233-46954-00	233-46954-00	233-46954-00
3C	Transformer	233-44072-01	233-44072-01	233-44072-01	233-44072-01
4C	Ground Lug	239-80112-00	239-80112-00	239-80112-00	239-80112-00
5C	Terminal Strip	239-80373-00	239-80373-00	239-80373-00	239-80373-00
6C	Power Cord	239-44466-00	239-44466-00	239-44466-00	239-44466-00
7C	Control Harness	239-46863-00	239-46863-00	239-46863-00	239-46863-00
8C	Primary Harness	239-46531-00	239-46531-00	239-46531-00	239-46531-00
9C	Secondary Harness	239-46530-00	239-46530-00	239-46530-00	239-46530-00
10C	Blower Harness	239-46865-00	239-46865-00	239-46865-00	239-46865-00
11C	Power Switch Harness	239-46864-00	239-46864-00	239-46864-00	239-46864-00
12C	Sensor Wire 19" Black	239-38951-65	239-38951-65	239-38951-65	239-38951-65
13C	High Voltage Spark Cable	239-46861-00	239-46861-00	239-46861-00	239-46861-00
14C	Integrated Control Board Display Harness	239-46944-00	239-46944-00	239-46944-00	239-46944-00
15C	Screw-#8-18 x 1/2 PHCR (3 Req'd)	239-43736-00	239-43736-00	239-43736-00	239-43736-00
16C	Rectifier Harness EF	239-43571-00	239-43571-00	239-43571-00	239-43571-00

* Applies to all warranties



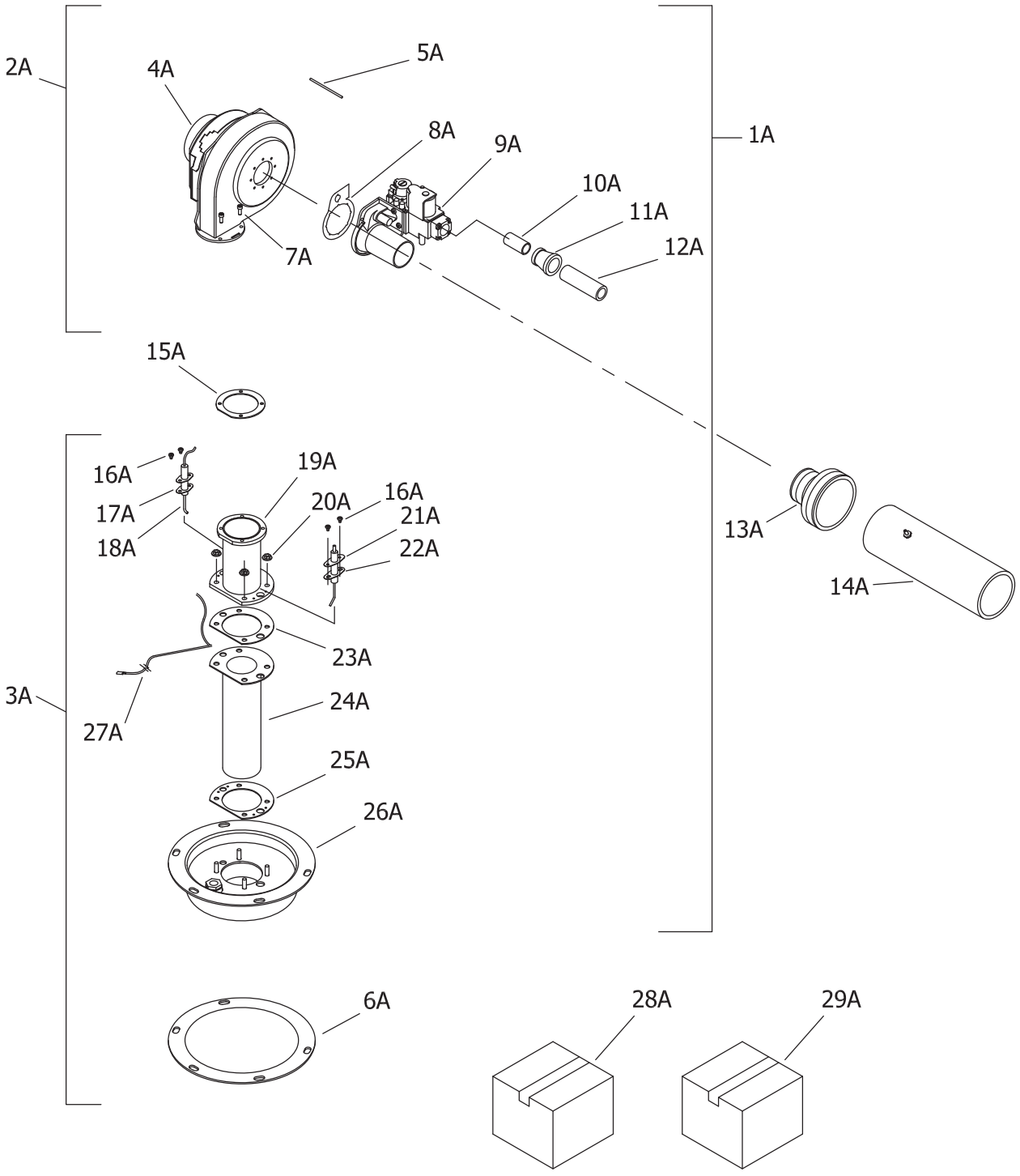
BRADFORD WHITE
WATER HEATERS

Item	Description	Model EF100T300(E)*(N,X)(A)2	Model EF60T125(E)*(N,X)(A)2	Model EF60T150(E)*(N,X)(A)2	Model EF60T199(E)*(N,X)(A)2
1	Combustion Surround Assembly	See Page 12	See Page 12	See Page 12	See Page 12
2	Combustion System Assembly	See Page 8	See Page 8	See Page 8	See Page 8
3	Collector Cover Second Pass	239-43454-00	239-43454-00	239-43454-00	239-43454-00
4	Screw 10-16 x 3/4	239-44444-00	239-44444-00	239-44444-00	239-44444-00
5	Elbow-Vent Terminal (2 Req'd)	---	---	---	---
	Elbow-Vent Terminal	239-40579-00	239-40579-00	239-40579-00	239-40579-00
	Coupling-Vent Terminal	239-46740-00	239-46740-00	239-46740-00	239-46740-00
6	Temperature Sensor	239-46553-02	239-46553-02	239-46553-02	239-46553-02
7	Baffle 4" Flue (2 Req'd)	243-43304-00	243-43304-00	243-43304-00	243-43304-00
8	Anode Rod (Magnesium) (4 Req'd)	224-47782-08	224-47782-13	224-47782-13	224-47782-13
	Anode Rod (Aluminum) (4 Req'd)	224-38508-01	224-38508-06	224-38508-06	224-38508-06
	Anode Rod (A420 Aluminum) (4 Req'd)#	224-49559-04	224-49559-04	224-49559-04	224-49559-04
9	Baffle 2" Flue (8 Req'd)	239-45658-00	239-45659-00	239-45659-00	239-45659-00
10	Wire Harness-Service Panel	239-43358-01	239-43358-02	239-43358-02	239-43358-02
11	Nipple Hot Water Outlet Plastisert (Front Connect)	229-40913-07	229-40913-07	229-40913-07	229-40913-07
12	Pipe Plug 1" NPT	239-02048-00	239-02048-00	239-02048-00	239-02048-00
13	Nipple Plastisert T & P	229-80982-00	229-32762-02	229-32762-02	229-32762-02
14	T&P Relief Valve	230-33630-04	230-30246-00	230-30246-00	230-30246-00
15	Exhaust Vent Pipe	239-45971-00	239-45971-00	239-45971-00	239-45971-00
16	Condensate Elbow	239-43211-00	239-43211-00	239-43211-00	239-43211-00
17	Silicone Tubing 3/16" I.D.	239-41718-00	239-41718-00	239-41718-00	239-41718-00
18	Outer Door Service Panel	243-44668-00	243-44668-00	243-44668-00	243-44668-00
19	Bracket Exhaust Support	239-44667-00	239-44667-00	239-44667-00	239-44667-00
20	Escutcheon-Exhaust Pipe (EF Series)	239-43997-00	239-43997-00	239-43997-00	239-43997-00
21	Exhaust Pressure Switch	239-46037-01	239-46037-01	239-46037-01	239-46037-01
22	Keps Nut (2 Req'd)	239-81844-00	239-81844-00	239-81844-00	239-81844-00
23	Hi-Limit Switch	239-43238-02	239-43238-02	239-43238-02	239-43238-02
24	Screw 6-32 x 3/8 (2 Req'd)	239-81843-00	239-81843-00	239-81843-00	239-81843-00
25	Cleanout Cover	205-18428-00	205-18428-00	205-18428-00	205-18428-00
25A	Cleanout Cover (ASME)	205-32941-00	205-32941-00	205-32941-00	205-32941-00
26	Cleanout Gasket	205-18427-00	205-18427-00	205-18427-00	205-18427-00
26A	Cleanout Gasket (ASME)	205-32942-00	205-32942-00	205-32942-00	205-32942-00
27	Screw 5/16 - 18 x 1/2	239-82166-00	239-82166-00	239-82166-00	239-82166-00
27A	Screw 5/16 - 18 x 1/2 (ASME) (6 Req'd)	239-32970-00	239-32970-00	239-32970-00	239-32970-00
28	Clean Out Access Cover	243-20299-00	243-20299-00	243-20299-00	243-20299-00
29	Inlet Tube Hydrojet (Front Connect)	229-44375-00	229-44375-00	229-44375-00	229-44375-00
30	Drain Valve Brass (No Handle)	265-42351-02	265-42351-02	265-42351-02	265-42351-02
31	Coaxial Vent Pipe with Terminal (Optional)	239-44069-01	239-44069-01	239-44069-01	239-44069-01
32	ASSE Approved Mixing Valve (Optional)	239-43740-02	239-43740-02	239-43740-02	239-43740-02
33	Reducer 3" x 2"	---	---	---	---
34	Hole Closure	239-31547-02	239-31547-02	239-31547-02	239-31547-02
35	Sensor Well	233-46558-01	233-46558-01	233-46558-01	233-46558-01
36	Clip Thermostat	233-45242-00	233-45242-00	233-45242-00	233-45242-00
37	Screw 1/4-20 x 5/8 Hex Washer (2 Req'd.)	239-42637-00	239-42637-00	239-42637-00	239-42637-00

* Applies to all warranties

A420 Anode may need to be cut to length

BRADFORD WHITE® WATER HEATERS



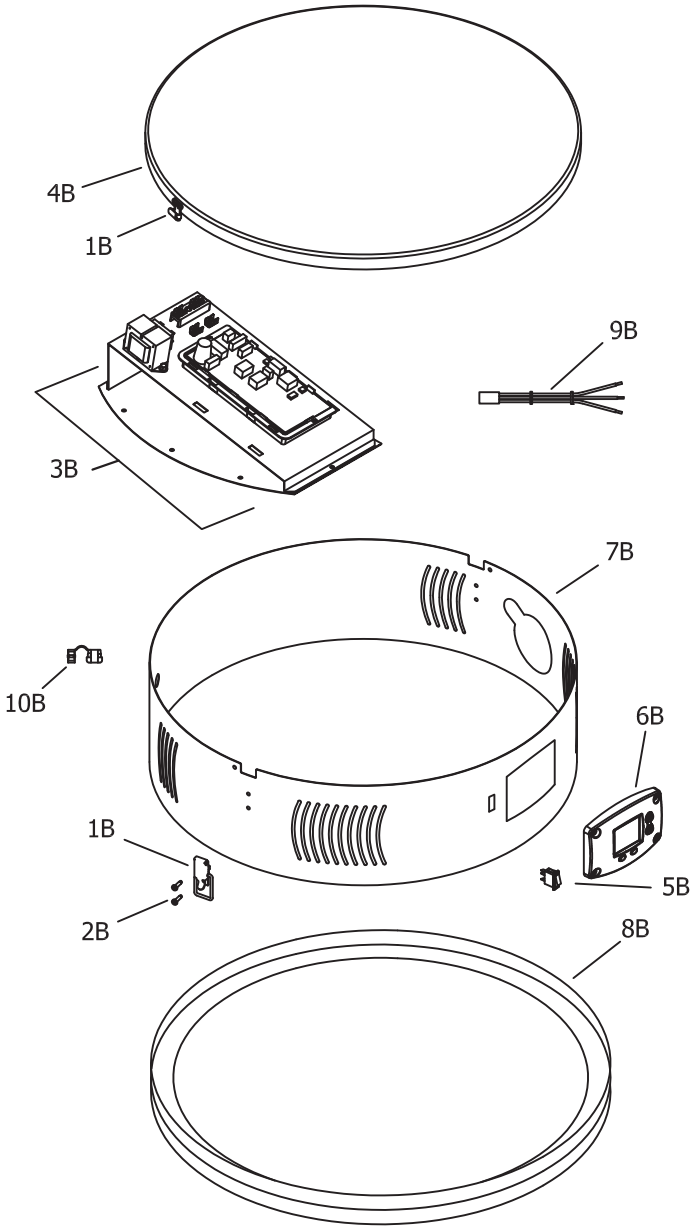
BRADFORD WHITE® WATER HEATERS

Item	Description	Model EF100T300(E)*(N,X)(A)2	Model EF60T125(E)*(N,X)(A)2	Model EF60T150(E)*(N,X)(A)2	Model EF60T199(E)*(N,X)(A)2
1A	Combustion System Assembly (Nat).	243-48073-11	243-48073-03	243-48073-05	243-48073-07
	Combustion System Assembly (LP).	243-48073-12	243-48073-04	243-48073-06	243-48073-08
2A	Blower and Gas Valve Assembly (Nat).	243-46010-05	243-46009-01	243-46009-03	243-46010-01
	Blower and Gas Valve Assembly (LP).	243-46010-06	243-46009-02	243-46009-04	243-46010-02
3A	Burner Assembly EF	265-46024-00	265-46023-00	265-46023-00	265-46023-00
4A	Blower	265-48922-00	265-51225-00	265-51225-00	265-48922-00
5A	Hose Tubing 3/16" I.D.	239-41718-00	239-41718-00	239-41718-00	239-41718-00
6A	Burner Mounting Insert Gasket**	239-43197-00	239-43197-00	239-43197-00	239-43197-00
7A	Screw 10-32 x 3/4 SHCS (4 Reqd)	239-43273-00	239-43273-00	239-43273-00	239-43273-00
8A	Gasket Venturi to blower	239-44654-00	239-44654-00	239-44654-00	239-44654-00
9A	Gas Valve Assembly (Nat.)	243-46007-04	243-46007-01	243-46007-02	243-46007-02
	Gas Valve Assembly (LP).	243-46008-04	243-46008-01	243-46008-02	243-46008-02
10A	Nipple 1/2 NPT X 3"	239-37047-00	239-37047-00	239-37047-00	239-37047-00
11A	Reducer 3/4 x 1/2 NPT	239-04474-00	239-04474-00	239-04474-00	239-04474-00
12A	Nipple 3/4 NPT x 7"	239-43373-00	239-43373-00	239-43373-00	239-43373-00
13A	2" x 3" Dia. Flex Reducer	239-40902-00	239-40902-00	239-40902-00	239-40902-00
14A	Inlet Tube (PVC)	239-43364-01	239-43364-01	239-43364-01	239-43364-01
15A	Gasket Blower Transition	239-43241-00	239-43241-00	239-43241-00	239-43241-00
16A	Screw 8-32 x 1/4 RHCR (4 Req'd)	239-43272-00	239-43272-00	239-43272-00	239-43272-00
17A	Flame Sensor Gasket	239-43371-00	239-43371-00	239-43371-00	239-43371-00
18A	Flame Sensor W/ Gasket	265-43232-00	265-43232-00	265-43232-00	265-43232-00
19A	Blower Transition Weldment	239-43201-00	239-43201-00	239-43201-00	239-43201-00
20A	Nut Hex Washer (4 Req'd)	239-43297-00	239-43297-00	239-43297-00	239-43297-00
21A	Spark Rod (w/ Gasket)	265-46481-00	265-46481-00	265-46481-00	265-46481-00
22A	Spark Rod Gasket	239-43370-00	239-43370-00	239-43370-00	239-43370-00
23A	Burner Mounting Gasket	239-43246-00	239-43246-00	239-43246-00	239-43246-00
24A	Burner Tube Kit (w/ gasket)	265-46019-00	265-45624-00	265-45624-00	265-45624-00
25A	Burner Mounting Gasket	239-43246-00	239-43246-00	239-43246-00	239-43246-00
26A	Burner Mounting Insert	239-43167-00	239-43167-00	239-43167-00	239-43167-00
27A	Ground Wire Assembly 24" Green	239-51994-00	239-51994-00	239-51994-00	239-51994-00
28A	Gas Regulator Kit (optional)	243-45517-00	243-45517-00	243-45517-00	243-45517-00
29A	LP to Natural Gas Conversion Kit	265-46391-04	265-46391-01	265-46391-02	265-46391-02

* Applies to all warranties

** Included with Item 3A

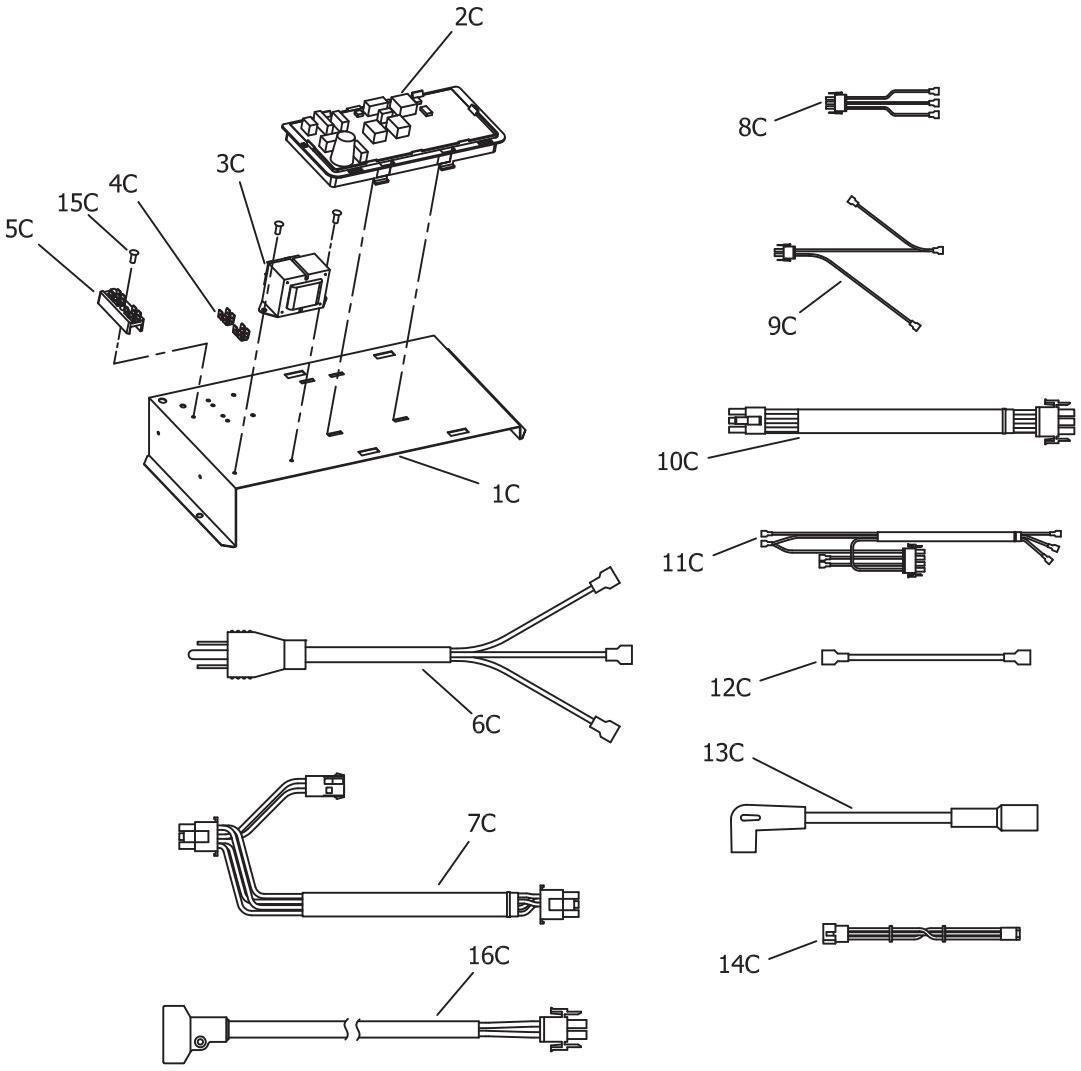
BRADFORD WHITE® WATER HEATERS



BRADFORD WHITE
WATER HEATERS

Item	Description	Model EF100T300(E)*(N,X)(A)2	Model EF60T125(E)*(N,X)(A)2	Model EF60T150(E)*(N,X)(A)2	Model EF60T199(E)*(N,X)(A)2
1B	Keeper Latch & Catch	239-43239-00	239-43239-00	239-43239-00	239-43239-00
2B	Screw 8-32 x 1/2 RHCR (2 Req'd)	239-41715-00	239-41715-00	239-41715-00	239-41715-00
3B	Ignition Control Assembly	243-47149-01 (see page 16)	243-47149-01 (see page 16)	243-47149-01 (see page 16)	243-47149-01 (see page 16)
4B	Surround Head-EF Comm.	243-45823-02	243-45823-02	243-45823-02	243-45823-02
5B	Main Power Switch	239-43234-00	239-43234-00	239-43234-00	239-43234-00
6B	Control Display-Honeywell Integrated Control	265-46557-00	265-46557-00	265-46557-00	265-46557-00
7B	Ring Combustion Surround	239-47305-02	239-47305-02	239-47305-02	239-47305-02
8B	Combustion Surround Base	239-43710-02	239-43710-02	239-43710-02	239-43710-02
9B	Integrated Control Display Harness	239-46617-00	239-46617-00	239-46617-00	239-46617-00
10B	Strain Relief Bushing (Power Cord)	239-80372-00	239-80372-00	239-80372-00	239-80372-00

* Applies to all warranties



BRADFORD WHITE
WATER HEATERS

Item	Description	Model EF100T300(E)*(N,X)(A)2	Model EF60T125(E)*(N,X)(A)2	Model EF60T150(E)*(N,X)(A)2	Model EF60T199(E)*(N,X)(A)2
1C	Control Panel	239-48060-00	239-48060-00	239-48060-00	239-48060-00
2C	Integrated Control Board	233-46954-00	233-46954-00	233-46954-00	233-46954-00
3C	Transformer	233-44072-01	233-44072-01	233-44072-01	233-44072-01
4C	Ground Lug	239-80112-00	239-80112-00	239-80112-00	239-80112-00
5C	Terminal Strip	239-80373-00	239-80373-00	239-80373-00	239-80373-00
6C	Power Cord	239-44466-00	239-44466-00	239-44466-00	239-44466-00
7C	Control Harness	239-46863-00	239-46863-00	239-46863-00	239-46863-00
8C	Primary Harness	239-46531-00	239-46531-00	239-46531-00	239-46531-00
9C	Secondary Harness	239-46530-00	239-46530-00	239-46530-00	239-46530-00
10C	Blower Harness	239-46865-00	239-46865-00	239-46865-00	239-46865-00
11C	Power Switch Harness	239-46864-00	239-46864-00	239-46864-00	239-46864-00
12C	Sensor Wire 19" Black	239-38951-65	239-38951-65	239-38951-65	239-38951-65
13C	High Voltage Spark Cable	239-46861-00	239-46861-00	239-46861-00	239-46861-00
14C	Integrated Control Board Display Harness	239-46944-00	239-46944-00	239-46944-00	239-46944-00
15C	Screw-#8-18 x 1/2 PHCR (3 Req'd)	239-43736-00	239-43736-00	239-43736-00	239-43736-00
16C	Rectifier Harness EF	239-43571-00	239-43571-00	239-43571-00	239-43571-00

* Applies to all warranties

BRADFORD WHITE®

WATER HEATERS

Ambler, PA

For U.S. and Canada field service,
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***

BRADFORD WHITE™

WATER HEATERS

Halton Hills, Ontario, Canada

Sales & Technical Support/**866-690-0961**
905-203-0600

*Fax/**905-636-0666***

Email
parts@bradfordwhite.com
techserv@bradfordwhite.com

www.bradfordwhite.com

Service Manual Supplement – Quick Service Guide

EF Series Direct Spark - ICON HD

Error Code	Definition	Service Action	Possible Parts Needed
4	Low flame sense signal	Check micro amps	1) Flame sensor 2) Control board
6	Flame sensed out of normal sequence	Verify if flame is present Inspect flame sensor/wire	1) Control board 2) Flame sensor
23	Flame detected before ignition	Verify if flame is present Verify blower turns off Inspect flame sensor/wire	1) Control board 2) Flame sensor
24	Flame detected after heating cycle	Verify if flame is present Verify blower turns off Is gas valve powered by 24V? Inspect flame sensor/wire	1) Control board 2) Flame sensor
29	Pressure switch failed to close	Verify if pressure switch is open Check for condensation blockage Check for vent restriction	1) Pressure switch 2) Control board
32	Temp sensor fault	Measure resistance of temp sensor	1) Temp sensor 2) Control board
57	Spark rod shorted to ground	Check spark rod	1) Spark rod
58	Power supply problem (line voltage)	Verify proper supply voltage, grounding/polarity	1) None
59	Line voltage too low or high	Verify dedicated circuit is being used	1) Transformer
61	DC voltage unstable	Verify transformer output is 22-27 Vac	1) Control board 2) Transformer
62	Ignition failure	Verify ignition sequence Clean spark rod Clean flame sensor	1) Burner 2) Spark rod 3) Control board
63	Ignition failure	Verify ignition sequence Clean spark rod Clean flame sensor	1) Burner 2) Spark rod 3) Control board
64	Electronics failure	Verify all electrical connections Check wire connections/ground	1) Control board 2) Display 3) Spark rod
65	High water temperature (200F)	Measure resistance of temp sensor	1) Temp sensor

NOTE: No display check primary/secondary voltage
Check all wire connections **Check inlet and manifold gas pressure**
Check vent restrictions **Check for grounding connections**

BRADFORD WHITE CORPORATION

LIMITED COMMERCIAL WATER HEATER WARRANTY

WHAT DOES THIS LIMITED WARRANTY COVER?

This limited warranty covers both the glass-lined tank and component parts for leakage or other malfunction caused by defects in materials and/or workmanship. It extends to the first buyer and to any subsequent owner(s) as long as the water heater remains installed at its original place of installation.

WHAT DOES THIS LIMITED WARRANTY NOT COVER?*

1. This limited warranty does not cover leakage or other malfunctions caused by:
   a) Defective installation, and specifically, any installation which is made:
      i) in violation of applicable state or local plumbing, housing or building codes, or
      ii) without a certified American Gas Association, ASME, or comparable combination temperature and pressure relief valve, or
      iii) contrary to the written instructions furnished with the unit.
   b) Adverse local conditions, and specifically, sediment or lime precipitate in the tank or corrosive elements in the atmosphere.
   c) Misuse, and specifically, operations, and maintenance contrary to the written instructions furnished with the unit, removal of anode(s), disconnection, alteration or addition of non-approved components or apparatus, operation with fuels or at settings other than those set forth on the rating plate, or accidental or other exterior damage.
2. This warranty also does not cover:
   a) Production of noise, taste, odors, discoloration or rusty water.
   b) Incidental property damage, loss of use, inconvenience or other incidental or consequential costs.
   c) Costs associated with the replacement and/or repair of the unit, including:
      i) any freight, shipping or delivery charges
      ii) any removal, installation or re-installation charges
      iii) any material, and/or permits required for installation, re-installation or repair
      iv) charges to return the defective water heater and/or component part to the manufacturer.

WHAT IS THE PERIOD OF COVERAGE?

This limited warranty runs from date of installation (or without proof of installation, from three (3) months after the date of manufacture) for the period specified on the following chart. To determine length of coverage, check model number listed on the rating plate of appliance against this chart.

MODEL NUMBER PREFIX	LIMITED TANK** WARRANTY	LIMITED PARTS** WARRANTY
D, H, V, LD, DB, PDV, F-I, L-I-6, M,M-I, M-II, EF, LH-I, LV-I, TW, DH, SW, CDW, PDX, P, E, U, (U)LG, LE, LC, CEHD, CEA	1, 3, 5 or 6 YRS	1 YEAR
M3ST, BST, NH, NV	5 YRS	1 YEAR
No Letter Prefix	1,3 or 5 YRS	1 YEAR

NOTE: The duration of the tank warranty will be found in the model number.
i.e.; D80T1991N has a 1 Year tank warranty;
D80T1993N has a 3 Year tank warranty;
LG250H3N has a 3 Year tank warranty;
LG250H5N has a 5 Year tank warranty.
**All replacement water heaters and parts carry the balance of the original warranty, i.e. if an original three (3) year tank warranted water heater develops a leak due to defects in materials/workmanship after only two (2) years, the replacement unit is warranted for only the balance remaining from the original three (3) year warranty, or one (1) year in this example.

WHAT IS THE DURATION OF THE IMPLIED WARRANTY?

ANY IMPLIED WARRANTIES, INCLUDING THE WARRANTY OF MERCHANTABILITY IMPOSED ON THE SALE OF THE WATER HEATER UNDER THE LAWS OF THE STATE OF SALE ARE LIMITED IN DURATION TO ONE YEAR FROM DATE OF ORIGINAL INSTALLATION.

HOW DOES STATE LAW RELATE TO THE WARRANTY?

Some states do not allow:
1. Limitations on how long an implied warranty lasts.
2. Limitations on incidental or consequential damages.

Therefore, the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

***Restrictions are not applicable to implied warranties in California. See "Special State Provisions" on reverse side.**

P/N 238-36612-00Z (07/19)

LIMITED COMMERCIAL WATER HEATER WARRANTY (CONTINUED)

WHAT WILL WE DO TO CORRECT PROBLEMS?

If a defect occurs within the warranty period, we will:

1. Provide a replacement water heater of our manufacture, (or at our option) repair any unit which develops a leak in the steel tank within the tank warranty period. To obtain a replacement, you must forward the rating plate from the defective unit to us. If government regulations require the replacement water heater to have features not found in the defective water heater, you will be required to pay the difference in price represented by those government required features.
2. Provide a replacement part (or at our option repair) any part which fails to function within the parts warranty period. To obtain a replacement, you must forward the defective part to us. If government regulations require the replacement part to have features not found in the defective part, you will be required to pay the difference in price represented by those government required features.

We do reserve the right to verify any claims of defect by inspection.

WHAT WILL WE NOT DO?

We will not:

1. Repair or replace any water heater, or part, subject to conditions outlined in “What Does This Limited Warranty Not Cover?”
2. Reimburse any costs associated with repair and/or replacement.
3. Replace and/or repair any water heater without complete model/serial number.
4. Replace any water heater without prior receipt of actual rating plate from appliance.

HOW DO YOU GET WARRANTY ASSISTANCE?

Upon discovering a defect or problem, you should:

1. Contact either the installer or dealer, or
2. Contact us--

   BRADFORD WHITE CORPORATION
   WARRANTY SUPPORT GROUP
   200 LAFAYETTE STREET
   MIDDLEVILLE, MI 49333
   (800) 531-2111

WHAT SHOULD YOU DO TO KEEP THE WARRANTY IN EFFECT?

To facilitate warranty assistance, you should:

1. Follow all instructions enclosed with the product.
2. Retain all bills of sale or receipts for proof of installation, etc.
3. Contact your installer, dealer or our Warranty Department as soon as any problem or defect is noticed.
4. When necessary, allow us, or our chosen representative, to inspect the unit.
5. For your reference, fill in the Model and Serial Number found on the units Rating Plate:

Model Number _____

Serial Number _____

Date of Installation _____

SPECIAL STATE PROVISIONS

For water heaters installed in California or Oregon, Paragraphs 2(c) (i) (iv) of the paragraph “WHAT DOES THIS WARRANTY NOT COVER?” does not apply.

All other terms and conditions of this warranty apply as stated.

PLEASE RETAIN THIS WARRANTY IN A SAFE LOCATION FOR FUTURE REFERENCE.

P/N 238-36612-00Z (07/19)