SERVICE HANDBOOK

# SandBlaster®

## Self Cleaning Commercial Gas Water Heaters with Flue Damper and Electronic Ignition

**MODELS COVERED**

**SBD71 120 Through SBD85 500**

Also includes Parts List

**Part Number STC-072**
**Printed in the U.S.A. - 0106**

state COMMERCIAL
*The Expert's Choice®*

# SBD HANDBOOK

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## SBD SERVICE HANDBOOK INTRODUCTION

This service handbook is designed to aid in servicing and troubleshooting State SBD water heaters in the field. No duplication or reproduction of this book may be made without the express written authorization of the State Water Heater Company.

The following text and illustrations will provide you with a step by step procedure to verify proper installation, operation, and troubleshooting procedures. Additional quick reference data is included to assist you in servicing this product.

The information contained in this handbook is designed to answer common questions encountered in the operation of the SBD product line and is not meant to be all inclusive. If you are experiencing a problem not covered in this handbook, please contact the Technical Information Department at 1-800-365-0577 or your Local State Water Heater Sales Representative for further assistance. This handbook is intended for use by licensed plumbing professionals and reference should be made to the installation manual accompanying the product. This handbook contains supplemental information to the SBD installation and operation manual.

**Qualifications:** 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 testing skills are required.

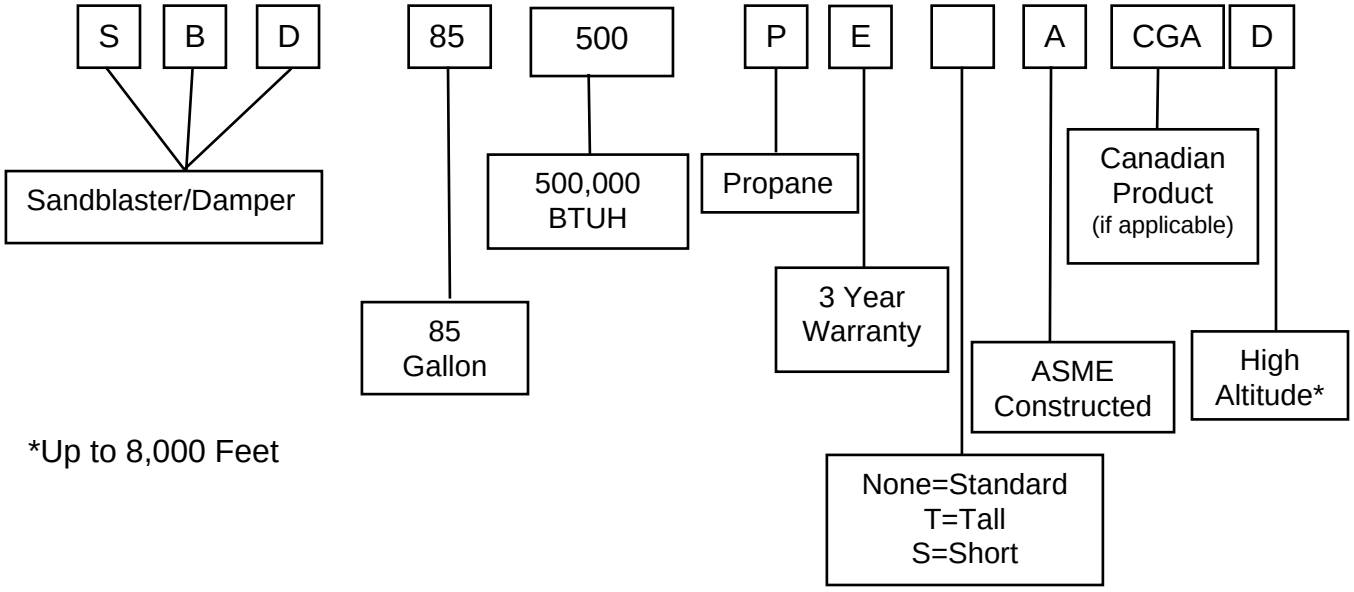
Tools Required:

- Phillips head screwdriver
- standard screwdrivers
- a 3/8 and 7/16 inch open end wrench
- set of marked drill bits
- an electrical multimeter tester capable of measuring continuity
- gas pressure gauge or manometer
- water pressure gauge
- thermometer
- 1/2 inch socket with extension for removal of the clean out cover,
- 1 1/16 inch socket with extension for anode removal.

## CUSTOM COMMERCIAL STORAGE TANK MODEL NUMBER BREAKDOWN

### Model Breakdown

### SBD 85 500 P E A CGA D

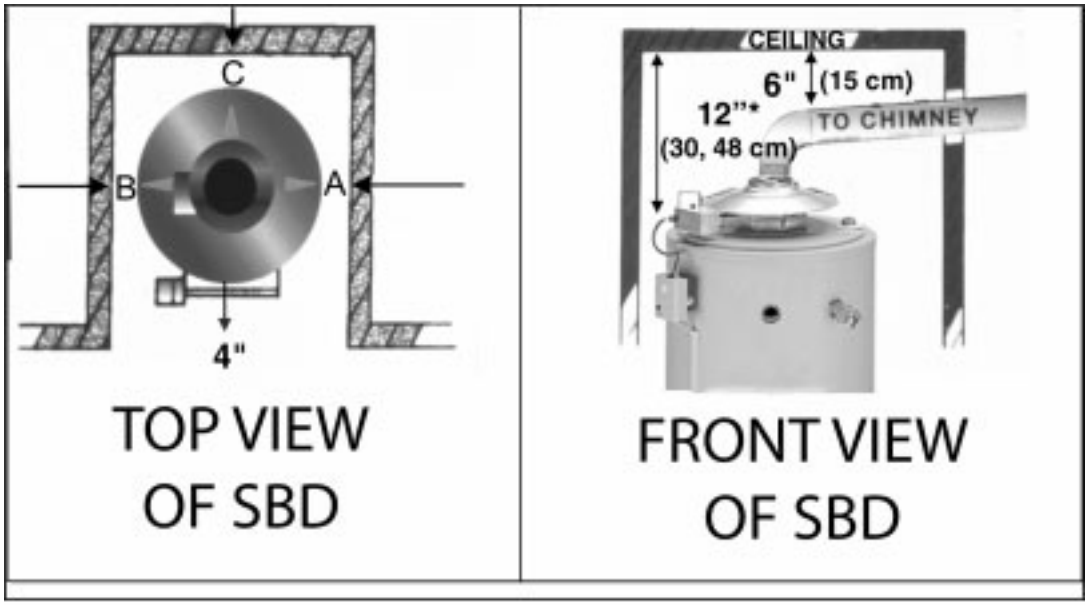



*Up to 8,000 Feet

# INSTALLATION

This portion of the handbook will review some often overlooked installation considerations, taking note of necessary installation requirements for the SBD 71120 through SBD 85500 model heaters. The installation manual covers most of these items in detail.

## CLEARANCES FROM COMBUSTIBLES



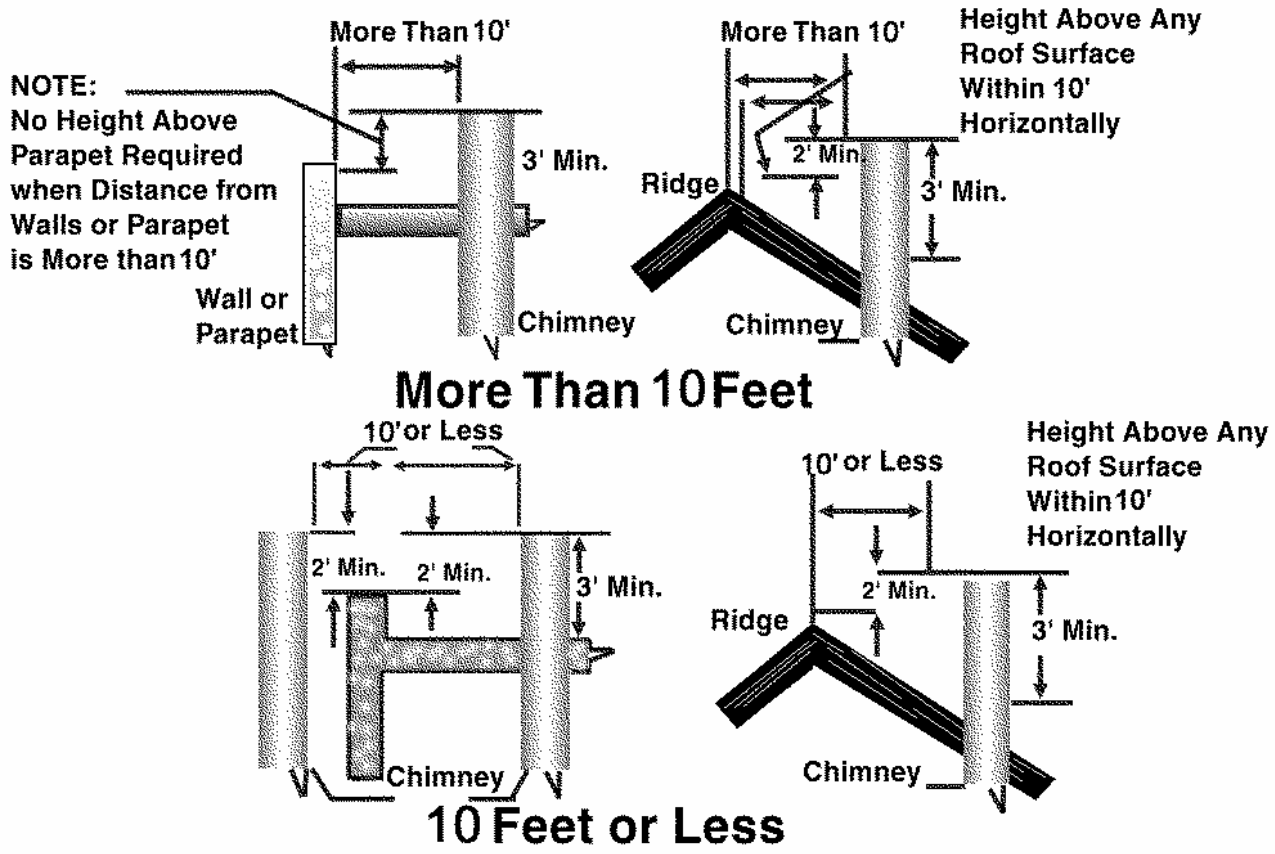

**Clearance to Combustibles Table**

| MODEL | A | B | C |
|---|---|---|---|
| 120 - 200 | 1” (2.54CM) | 1” (2.54CM) | 1” (2.54CM) |
| 250 - 305 | 2” (5.08CM) | 2” (5.08CM) | 2” (5.08CM) |
| 365 - 400 | 3” (7.75CM) | 3” (7.75CM) | 3” (7.75CM) |
| 500 | 5” (12.7CM) | 5” (12.7CM) | 5” (12.7CM) |

A 24 inch clearance for all serviceable parts is recommended. Clearances may vary between SBD models – See instruction manual or the label on the heater, for clearances applicable to your specific model.

*20” (50.8CM) for 500 models.

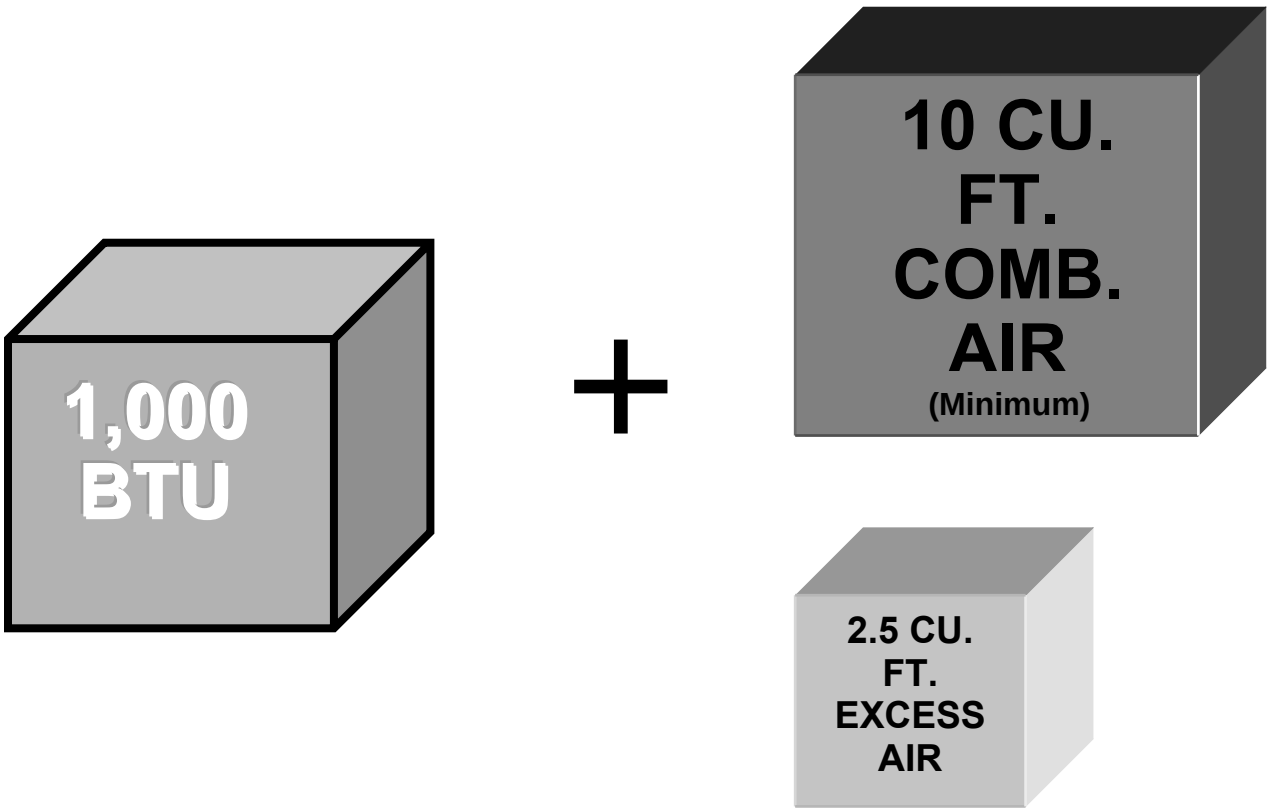
# EXTERIOR CLEARANCE






This illustrates the exterior roof clearances for SBD units with natural draft venting. The vent shall extend at least 3 feet above the highest point where it passes through a roof of a building, and at least 2 feet higher than any portion of a building within a horizontal distance of 10 feet (for vents of 12" in diameter or less). (NFPA 54 ANSI Z 223.1 SEC 7.5.2a). (Sec 7.6.2a may allow reduction to 8 feet with a " Listed vent cap").

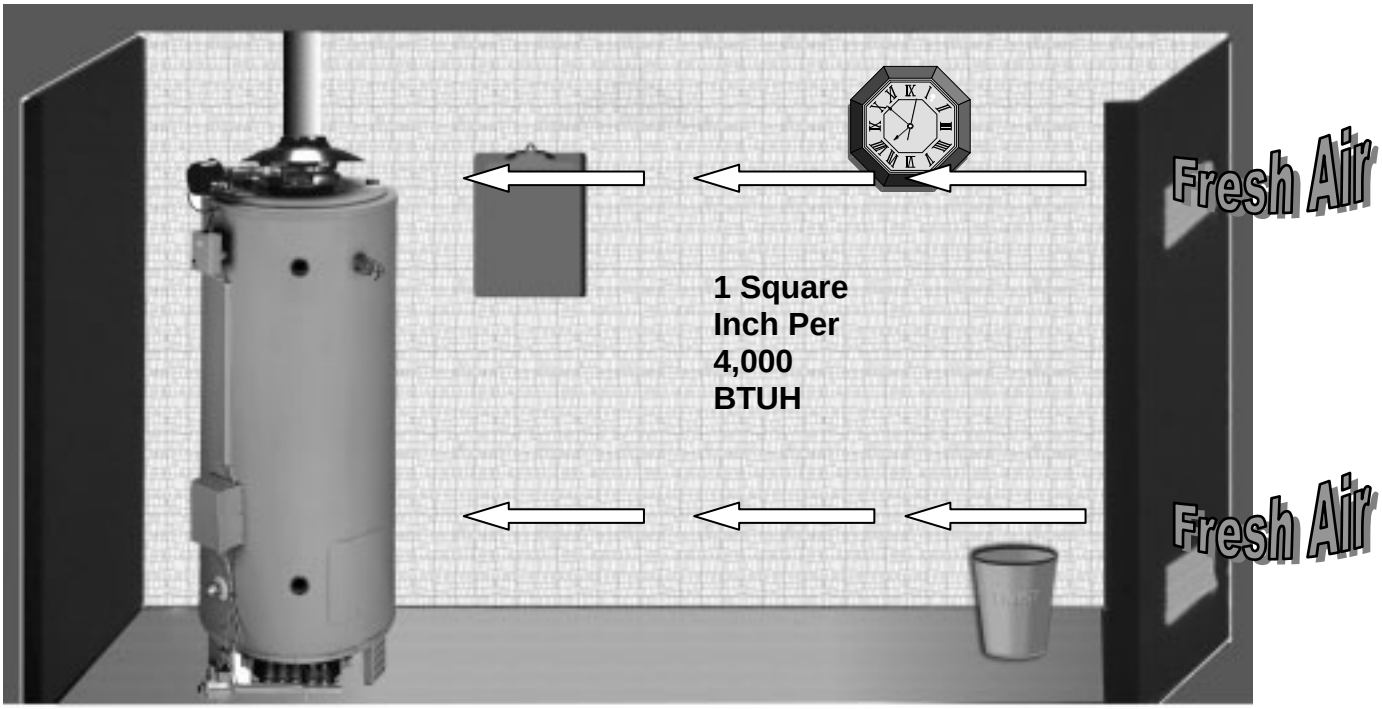
## AIR FOR COMBUSTION
## 10 CUBIC FEET OF AIR PER 1,000 BTU




Stoichiometric or theoretical complete combustion requires 10 cubic feet of air per 1000 BTUH input of the gas input. The National Fuel Gas Code also recommends an additional 2.5 cu.ft. of "excess" air. This 12.5 cu.ft minimum supply air per 1000 BTUH input applies to natural and propane gas models.

The National Fuel Gas Code also specifies minimum make-up air opening sizes for various building installations. (Ref: NFPA 54, ANSI Z223.1, sec 5.3)

# MAKE-UP AIR
## DIRECT COMMUNICATION

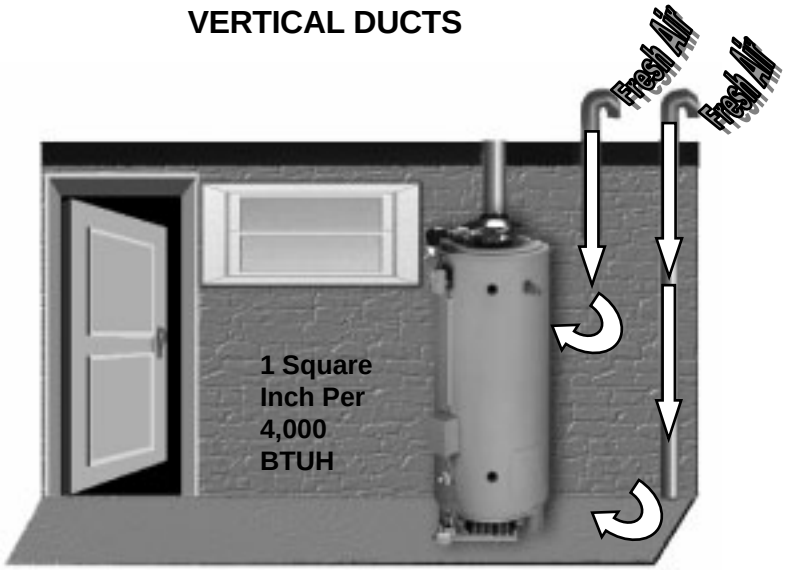



A fresh supply of make-up air for combustion can be supplied to the heater through make-up air ducts which directly communicate with the out of doors. Two openings are required - one within 12 inches of the top of the enclosure and one within twelve inches of the bottom of the enclosure. Each opening shall have a free area of not less than 1 square inch per 4000 BTUH of the total input of all appliances within the enclosure.

The lower opening is primarily providing combustion air. The upper opening is providing vent dilution air and acts as a relief opening for flue gases should the vent become obstructed or a downdraft condition occur. Additionally, when the heater is installed in a confined space and communicating with the outdoor air, one permanent opening, commencing within 12 in. (30 cm) of the top of the enclosure, shall be permitted where the equipment has clearances of at least 1 in. (2.5 cm) from the sides and back and 6 in. (16 cm) from the front of the appliance. The opening shall directly communicate with the outdoors and shall communicate through a vertical or horizontal duct to the outdoors or spaces (crawl or attic) that freely communicate with the outdoors, and shall have a minimum free area of:

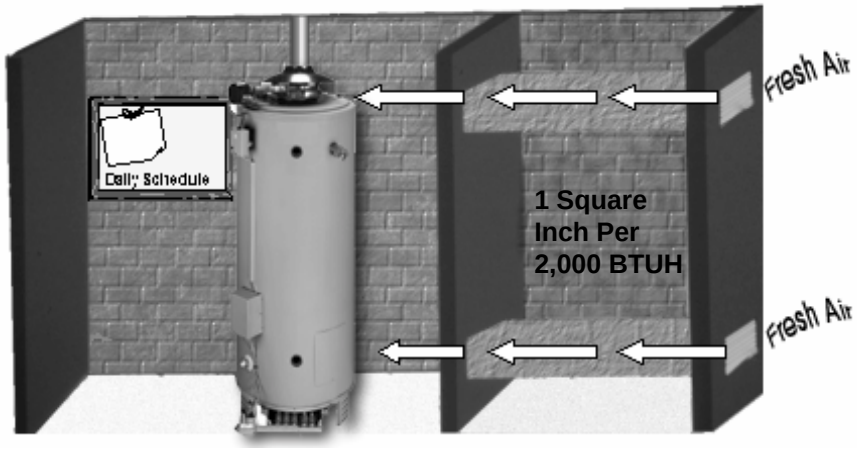
a. 1 sq. in. per 3000 BTU per hr (7 $cm^2$ per kW) of the total input of all equipment located in the enclosure, and
b. Not less than the sum of the areas of all vent connectors in the confined space.

## MAKE-UP AIR
### VERTICAL DUCTS



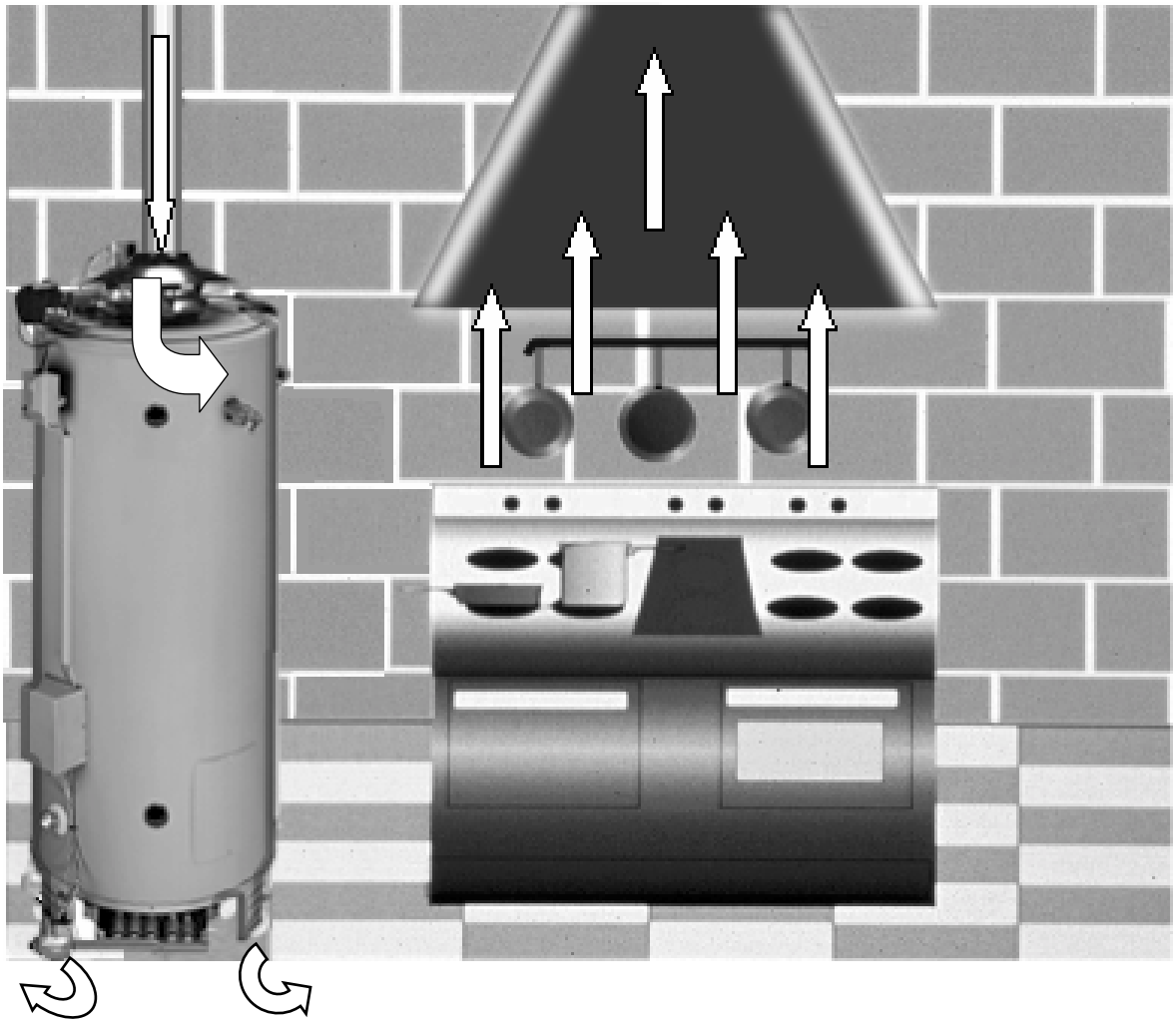

Often it is more practical to install vertical make-up air ducts to the out doors. Again, two openings are required - one within 12 inches of the top of the enclosure and one within twelve inches of the bottom of the enclosure. Each opening shall have a free area of not less than 1 square inch per 4000 BTUH of the total input of all appliances within the enclosure.

## MAKE-UP AIR
### HORIZONTAL DUCTS



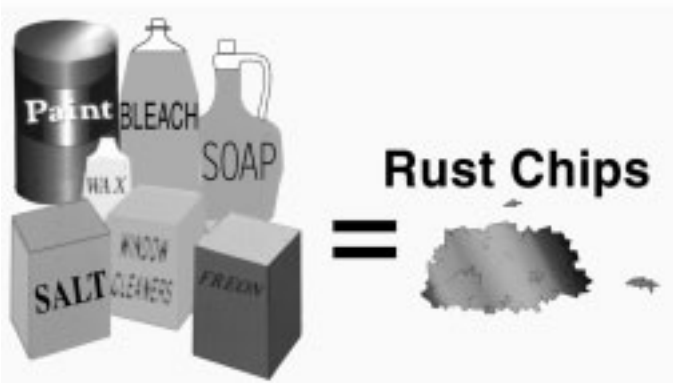

When the heater is installed in an interior room with no roof access for vertical ducts, horizontal make-up air ducts should be installed. When using horizontal ducts, two openings are required - one within 12 inches of the top of the enclosure and one within twelve inches of the bottom of the enclosure. Each opening shall have a free area of not less than 1 square inch per 2000 BTUH of the total input of all appliances within the enclosure.

# INSUFFICIENT MAKE-UP AIR
## BACKDRAFT



Insufficient make-up air is a major cause of combustion problems. One common example is in a restaurant installation where exhaust vent equipment was not considered in sizing make-up air requirements. This may result in air being backdrafted by the restaurant exhaust equipment through the heater causing flue gas spillage, flame roll out, improper combustion, inconsistent pilot operation, and/or erratic heater shut down.

## CONTAMINATED AIR

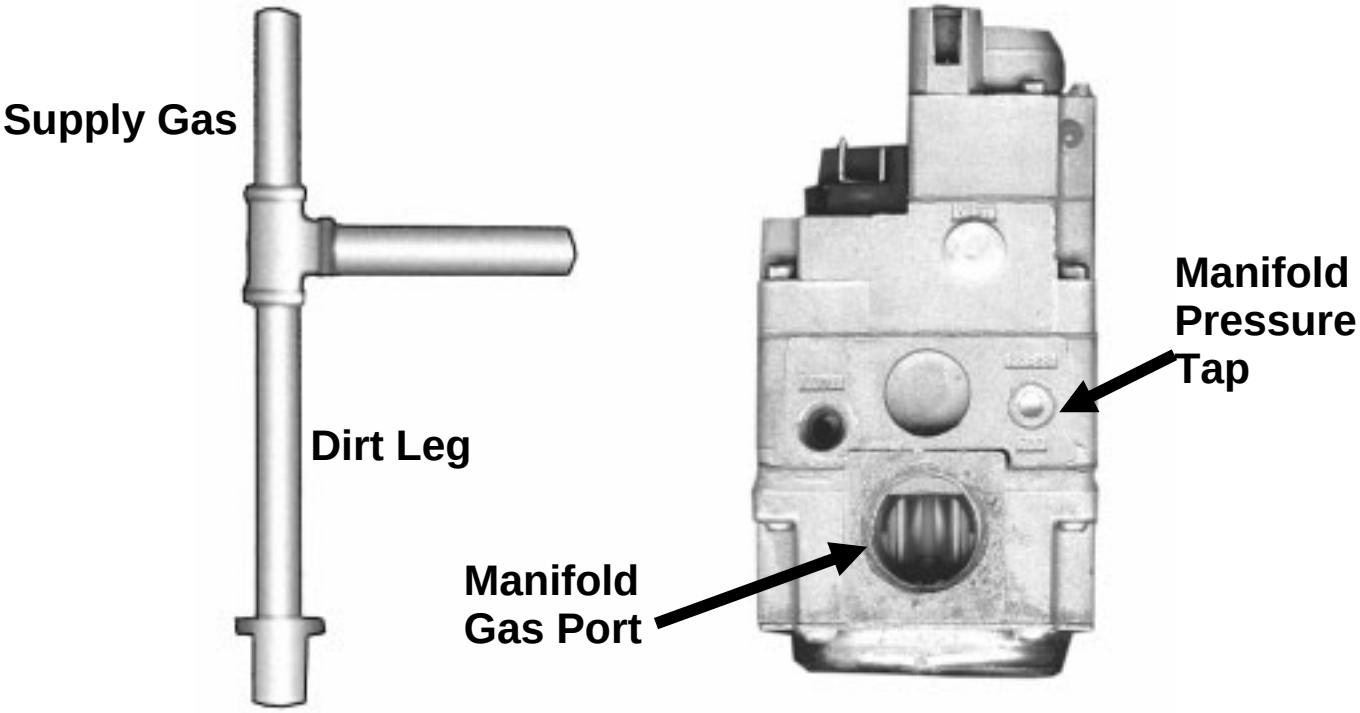



Along with adequate make-up air, the quality of the air is important. Contaminants in combustion air can lead to premature heater failure. Vapors from bleaches, soaps, waxes, salts, etc. are drawn into the combustion chamber with the make-up air and, once fired, mix with water vapor in the gases to form extremely corrosive hydrochloric or hydrofluoric acid and other corrosive byproducts.

## AIR FOR COMBUSTION
## Flammable Items


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

## GAS PRESSURE REQUIREMENTS



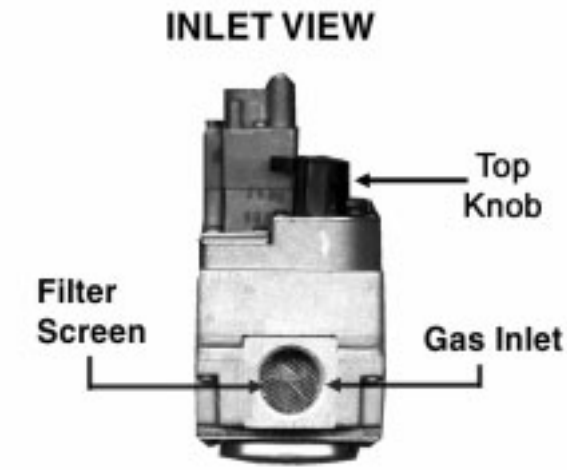

| | Natural Gas | Propane Gas |
|---|---|---|
| Maximum Supply Pressure | 10.5" W.C. | 13.8" W.C. |
| Minimum Supply Pressure | 5.0" W.C. | 11" W.C. |
| Manifold Pressure | 4.0 " W.C. | 10" W.C. |

The supply gas pressure is normally measured at the dirt leg or at the gas pressure tapping on the gas supply shutoff valve. This reading must be measured with 'flowing' gas.

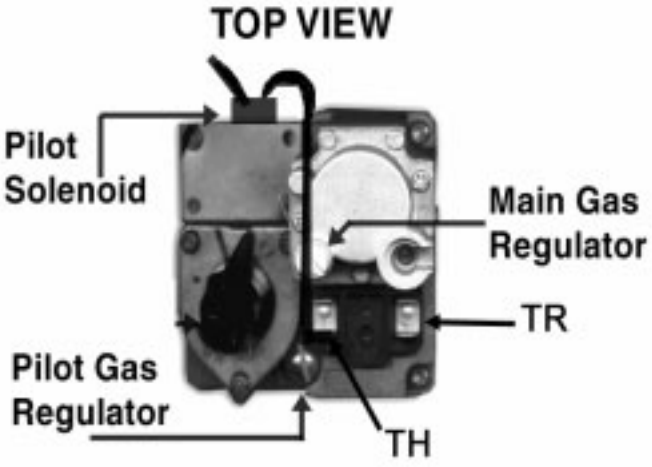
The manifold gas pressure is measured at the manifold pressure tap of the gas valve when the gas is flowing.

# SBD GAS VALVE

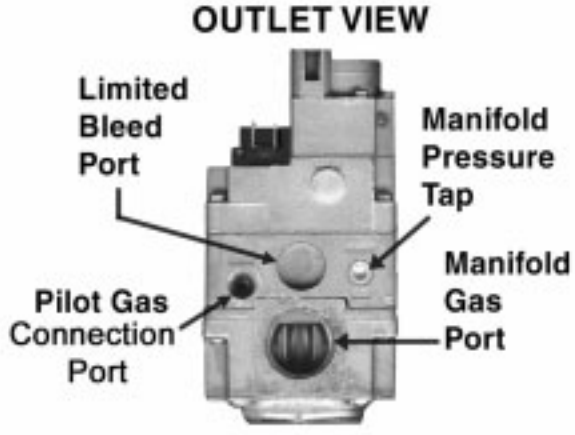
The gas valves used on all SBD water heaters are 24 volt AC combination step opening gas valves. They incorporate the pilot valve, main valve, and gas pressure regulators into one body. The inlet view of the valve features a filter screen and the top knob. The top knob is a manual on/off gas control for both the pilot and main gas valves. When the top knob is placed on the black mark, gas is supplied only to the pilot valve.




On the top view, we see the pilot solenoid and pilot and main gas regulators. The top view also displays the "TH and "TR" terminals. The pilot gas regulator is found under its cover screw. It is factory preset at 3.5" W.C. but can be adjusted from 2.5 to 5 inches water column. The main gas regulator is found under its cover screw. It is factory preset to 3.5 inches W.C. and adjusts gas pressure output from 2.5 to 5 inches water column. The two electrical terminals are marked TH and TR. The TH terminal is the common between the pilot valve solenoid coil and the main valve solenoid coil. The other wire emerging from the pilot solenoid connects to the pilot valve electrical output on the IID (terminal PV). The TR terminal connects directly to the main valve electrical output from the IID module (terminal MV).




On the outlet view of the gas valve, we see the pilot gas connection port, manifold gas connection port, a limited bleed vent port, the manifold gas and pressure tap.
*See step 18 for SBD-500 gas valve illustration*



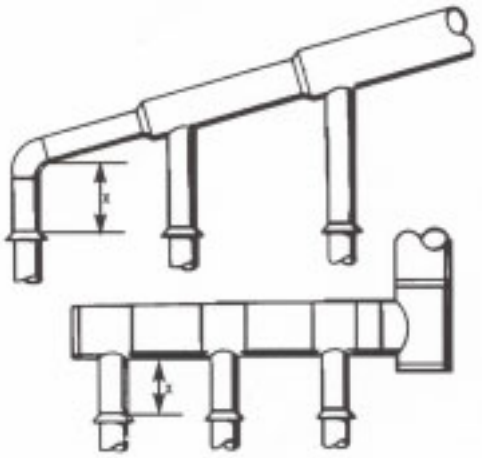
# VENTING
## Atmospheric, Single, and Multiple Heaters

All SBD water heaters are classified by ANSI as category I (non-condensing, negative pressure venting) appliances. They are approved for type B vent.

For larger applications, SBD water heaters can be common vented together either in a tapered manifold or constant size manifold. (Follow National Fuel Gas Code requirements for sizing and installation.)

## Combined Vents

When vents are combined, the area of the combined vent should be equal to area of the largest single vent, plus 50% of area of all others joining.



EXAMPLE: To combine two 6” vents with an 8” vent, the area of a combined vent should be one half area of two 6 inch vents (14 + 14) plus area of 8 inch vent (50) or 78 sq. inches. Referring to chart, 78 sq. inches require 10” diameter vent.

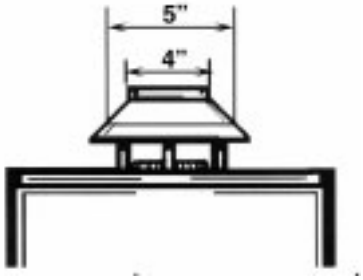
| Vent Size | Area in Square Inches | Vent Size | Area in Square Inches |
|---|---|---|---|
| 5" | 20 | 10" | 79 |
| 6" | 28 | 12" | 113 |
| 7" | 38 | 14" | 154 |
| 8" | 50 | 16" | 201 |
| 9" | 64 | 18" | 254 |

## Nine Rules for Good Vents

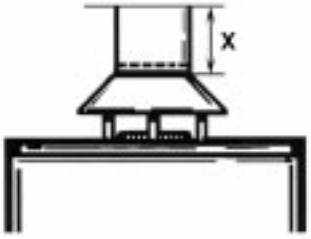
1. The vent pipe should ALWAYS be the same size as the outlet of the draft diverter or factory supplied vent reducer.
    - Model SBD 120 are supplied with a 6” to 5” reducer.
    - Models SBD 250, 251 and 275 are supplied with a 8” to 6” reducer.

## Nine Rules for Good Vents (continued)

2. The diameter of a vent pipe should NEVER be reduced, no matter what the circumstances.

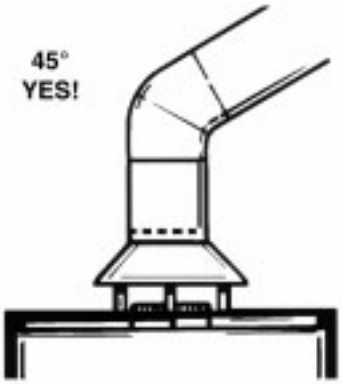


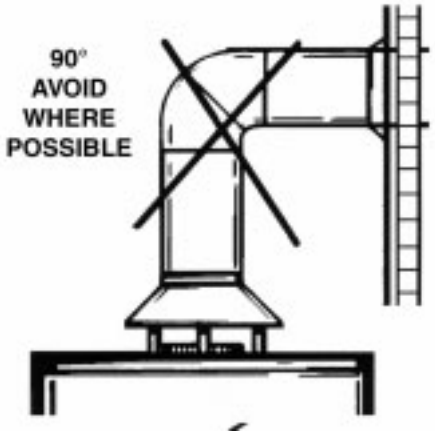

3. In some cases it may be necessary to run a vent larger than the draft diverter outlet.



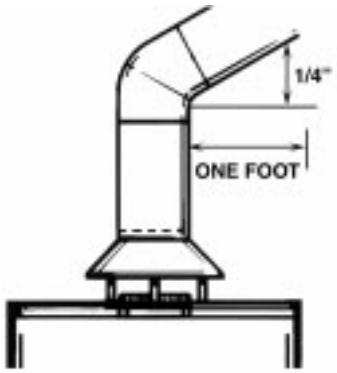

4. Take the maximum vertical rise possible immediately above the draft diverter.

5.

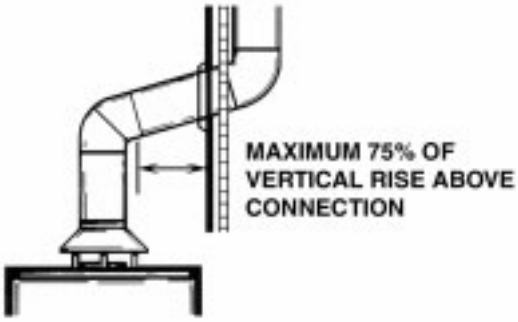


## Nine Rules for Good Vents (continued)

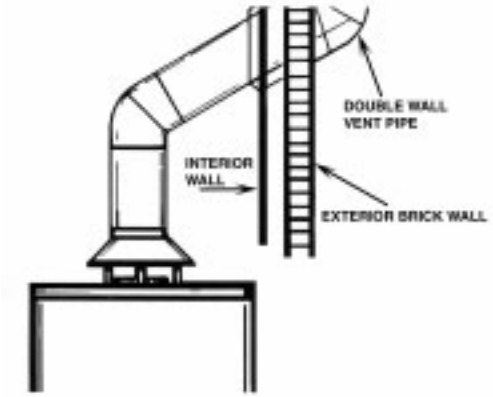



6. Horizontal pipe should be sloped upward at a minimum of ¼" per foot.

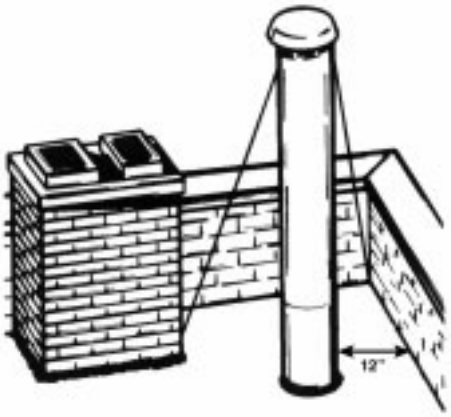



7. Horizontal elements should be limited to 75% of the vertical rise of the vent above the connection.

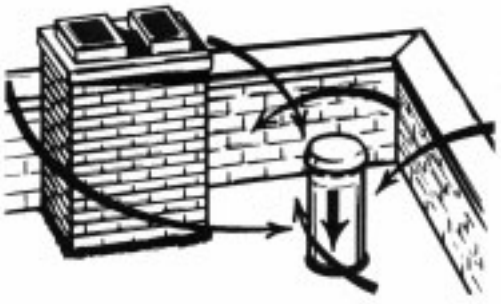
8. Flue gases must be kept hot for proper venting.



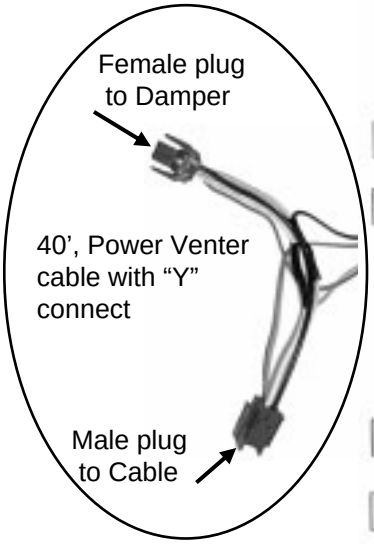

The vent pipe should be extended to meet local codes

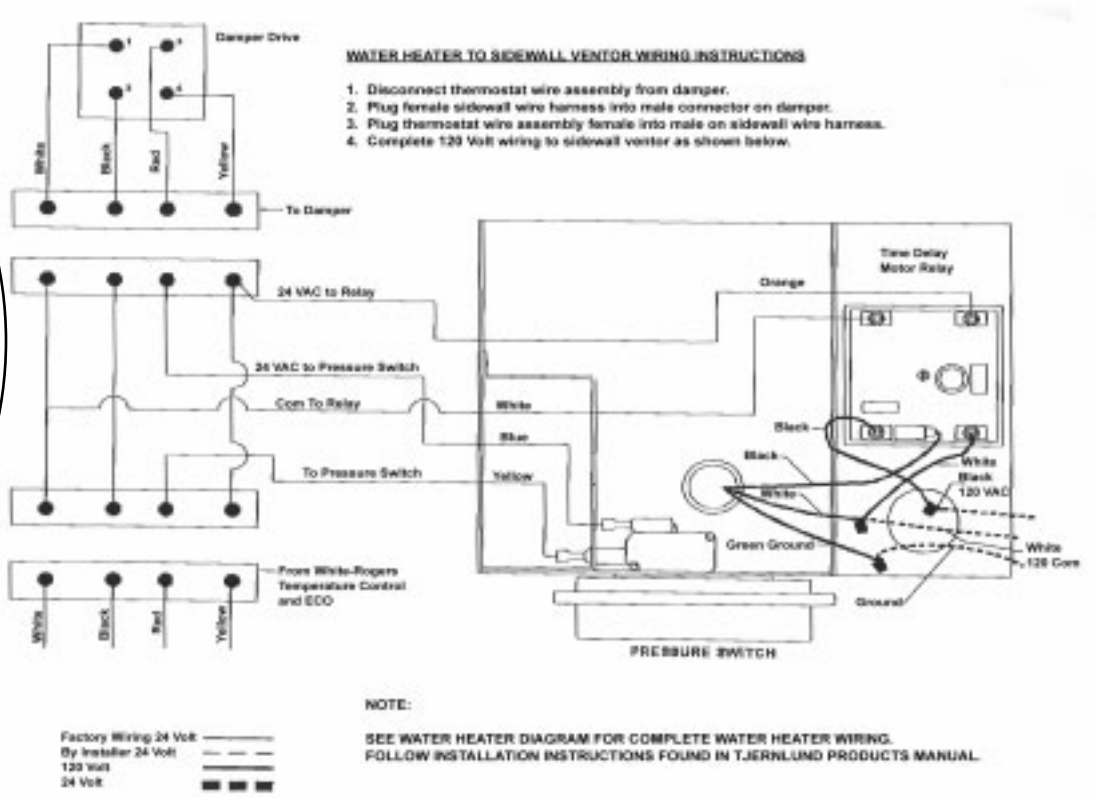



9. Obstructions can cause down drafts.



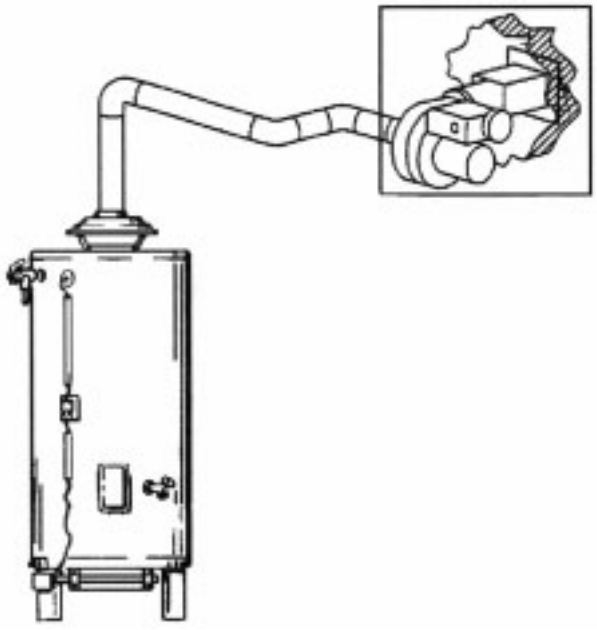
# POWER VENT KITS FOR SIDEWALL VENTING



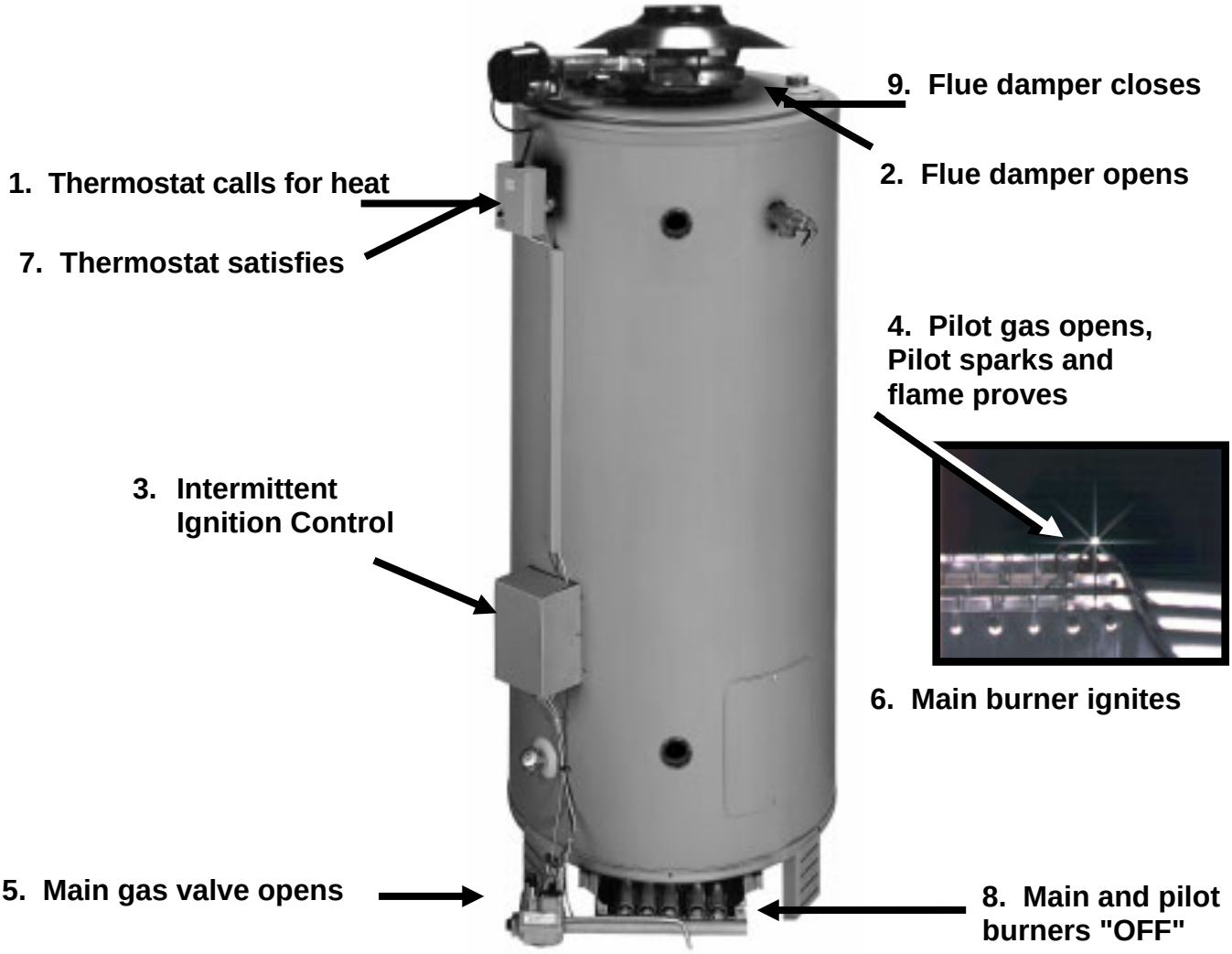




| Water Heater Models | Part Number |
|---|---|
| SBD-120-200 | 193933-0 |
| SBD-250-500 | 193933-1 |

SBD water heaters can be used with power vent kits for sidewall venting. State offers power vent kits for use on installations with a maximum of 100 equivalent feet of vent piping. The power vent kits also use type B vent materials. When power venting, specific exterior clearances must be maintained, as outlined in the National Fuel Gas Code. (NFPA 54, ANSI A223.1, sec 7.8)



# SBD SEQUENCE OF OPERATION

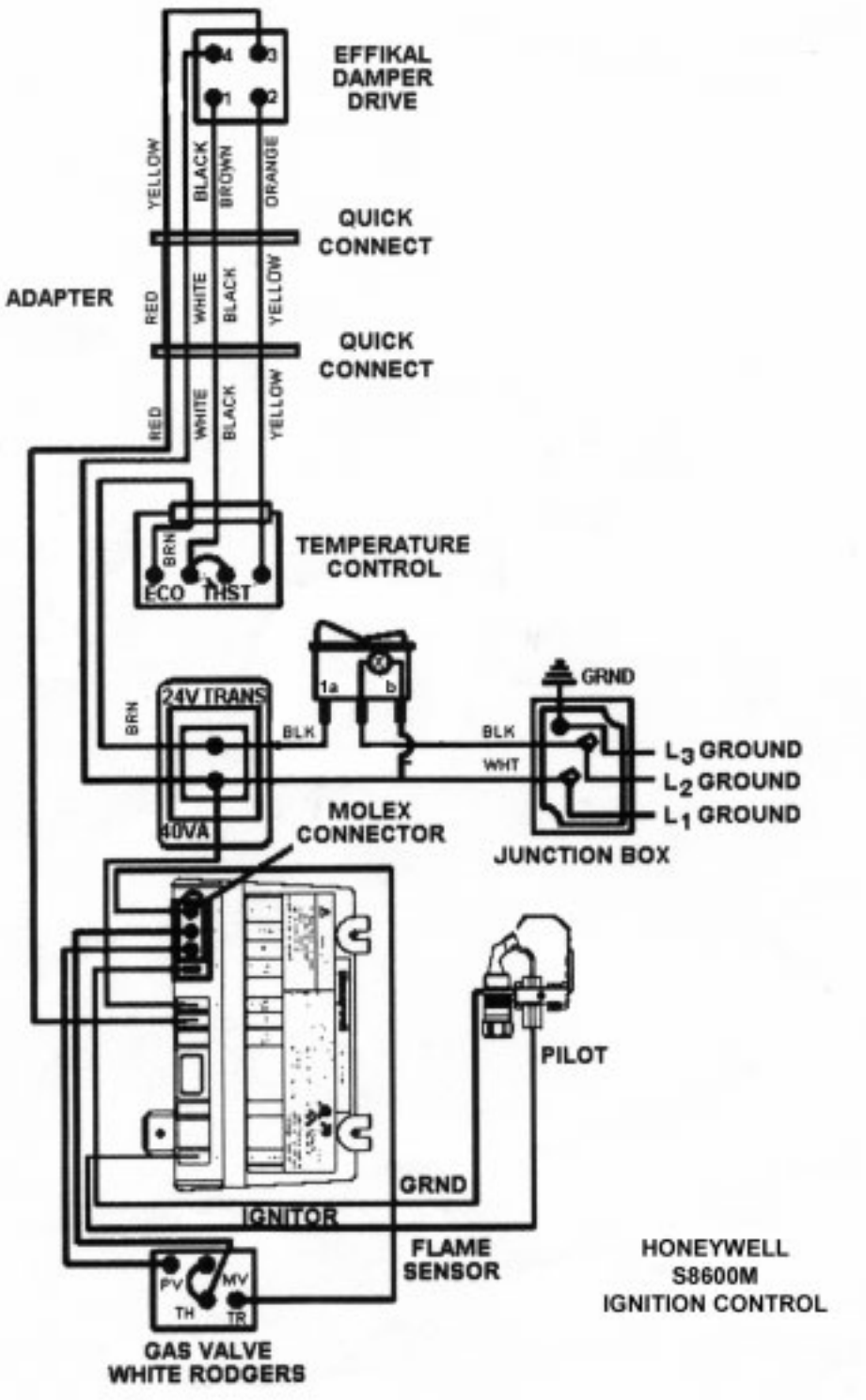



## SEQUENCE OF OPERATION

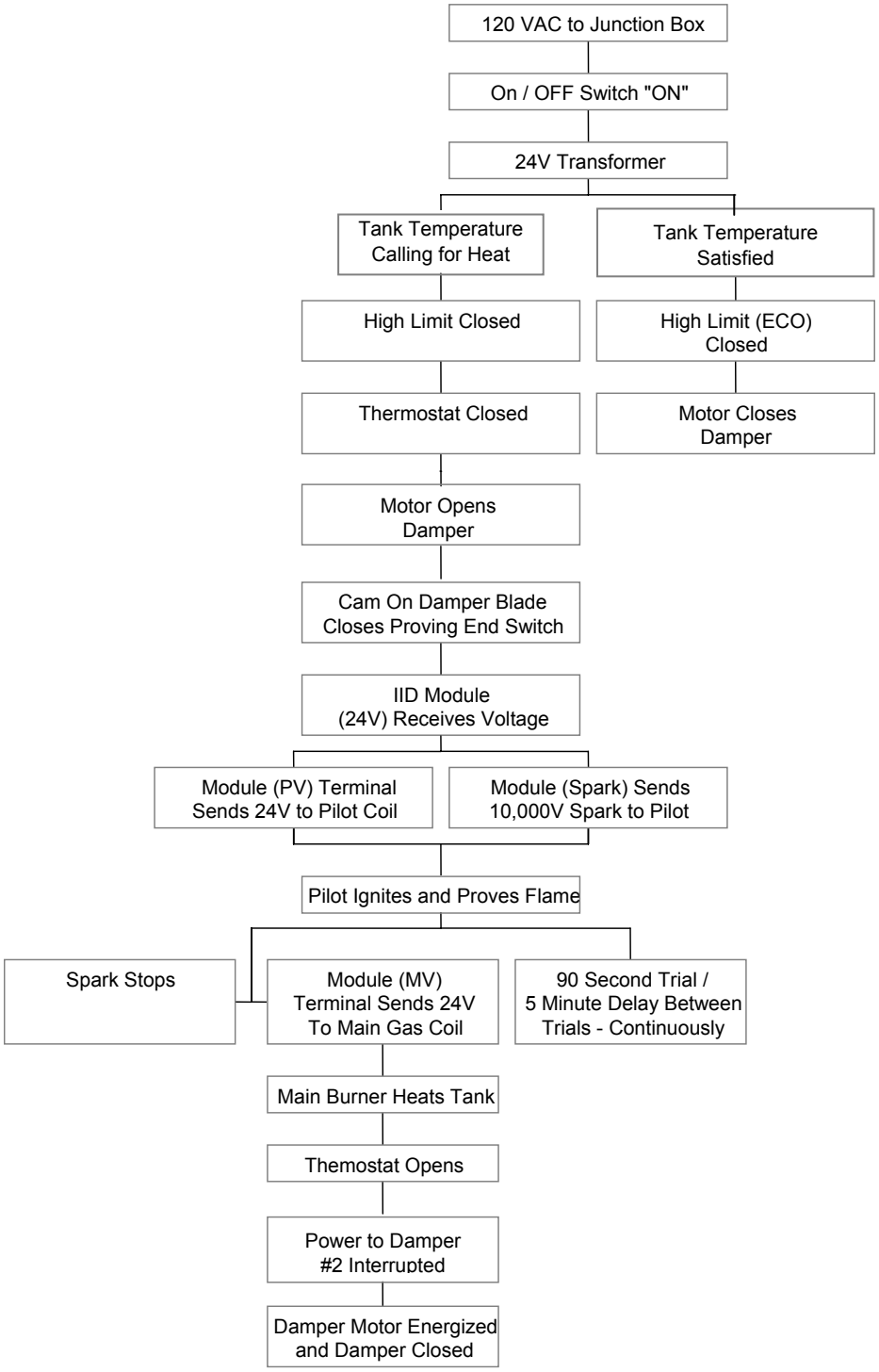
To understand SBD tank type water heaters, an examination of their sequence of operation is necessary.

When the thermostat calls for heat, the relay in the draft hood assembly activates the flue damper motor. The damper opens and power flows to the IID (Intermittent Ignition Device). This activates the IID module to open the pilot valve and begin sparking at the pilot burner assembly. Once the pilot flame is established and confirmed back to the IID, the sparking is stopped and the main gas valve is opened, allowing gas flow to the main burner. When the thermostat satisfies, main and pilot gas is shut off. Damper is returned to closed position.

# SBD ELECTRICAL SEQUENCE
## 100 – 109 Series



# SBD ELECTRICAL SEQUENCE OF OPERATION
## 115/60/12A



# TROUBLESHOOTING SBD WATER HEATERS

To troubleshoot a SBD water heater check that:

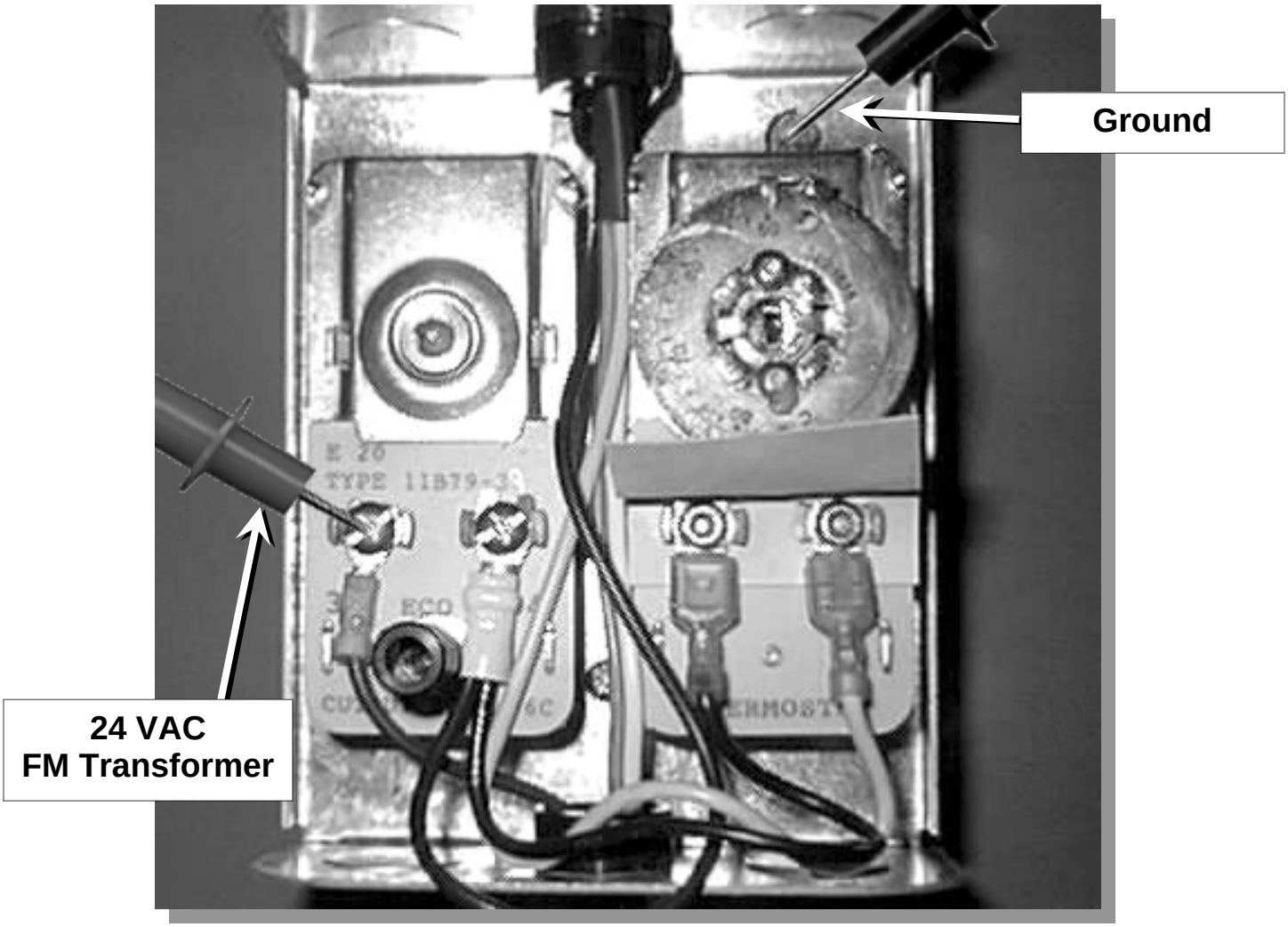
- 120 VAC is supplied to the heater
- the tank is full of water
- gas is supplied to the unit

| STEP 1 | TEST THE TRANSFORMER |
|---|---|


**STEP 1 - TO TEST THE TRANSFORMER** - Using a multimeter, test for 24 VAC between the secondary transformer terminals.

| IF | THEN |
|---|---|
| The meter does not read 24 VAC: | • Check that the 120 VAC is supplied from the On/Off Switch – if not, replace switch.<br>• Check that the 120 VAC is supplied from transformer. |
| The meter reads 24 VAC: | • Go to step 2. |

## STEP 2 HIGH LIMIT, LEFT TERMINAL TEST

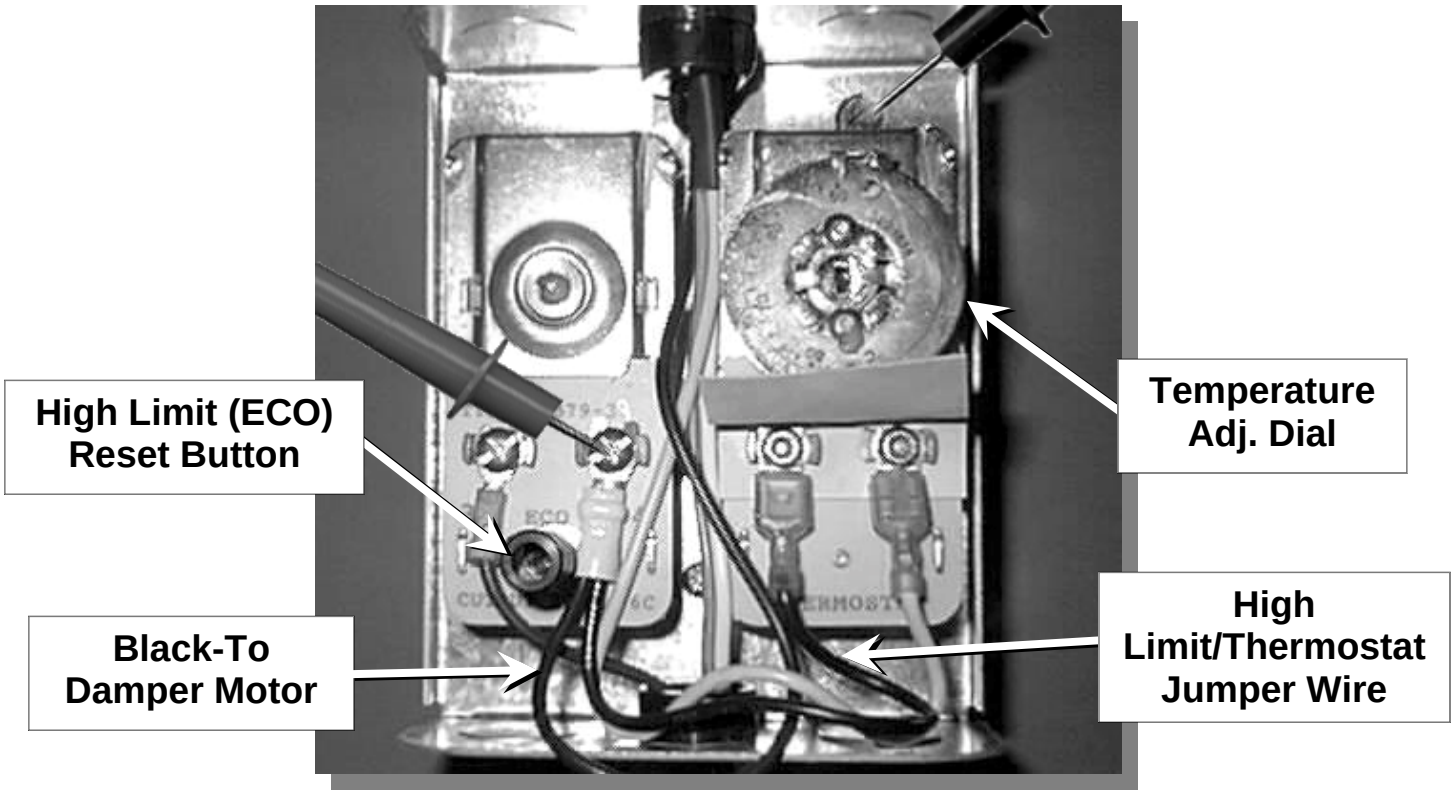



**STEP 2. HIGH LIMIT, LEFT TERMINAL TEST.** Test for 24 VAC between the left high limit terminal and ground.

| IF | THEN |
|---|---|
| The meter does not read 24 VAC: | • Check wiring between transformer and high limit. |
| The meter reads 24 VAC: | • Go to Step 3. |

***Note: The high limit (Energy Cut Off) opens if the tank water temperature exceeds 205 degrees. The control is resettable (manually) when the tank water temperature drops below 185 degrees.***

## STEP 3 TEST HIGH LIMIT RIGHT TERMINAL




**STEP 3. TO TEST HIGH LIMIT RIGHT TERMINAL**. Ensure that the jumper wire between the high limit and thermostat is connected, and the damper motor power line is connected. Test for 24 VAC between the high limit right terminal and ground.

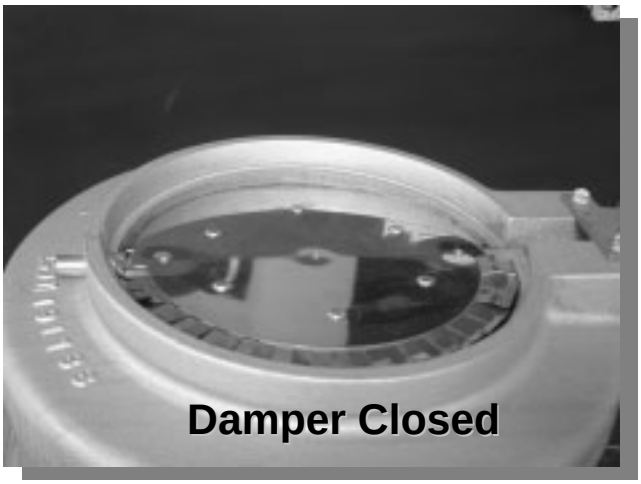
| IF | THEN |
|---|---|
| The meter does not read 24 VAC: | • Push the reset button and redo the test (storage water temperature below 185 degrees). |
| The meter reads 24 VAC: | • Go to step 4. |

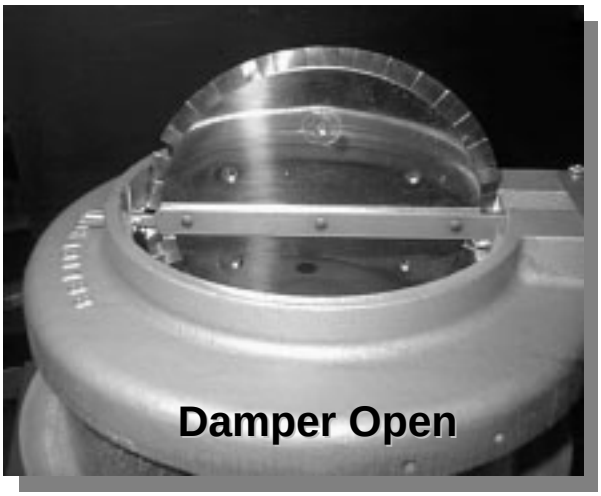
**After Push in Reset - 24 VAC is now present**

| Reasons For Resetting | | |
|---|---|---|
| **Condition** | **Cause** | **Solution** |
| High limit open | Never set on initial installation | Push high limit button |
| Excessive water temperature | Faulty thermostat | Replace dual control |
| Heater shut down before reaching thermostat setting | Faulty high limit | Replace dual control |

***Note: The right terminal of the high limit has a jumper wire connected to the left terminal of the thermostat. There is also a black wire connecting to the damper motor assembly. This black wire supplies power to the motor to close the damper during periods of standby.***

## STEP 4 INSPECT THE DAMPER




**STEP 4. INSPECT THE DAMPER.** Lower the thermostat setting so the unit will not be calling for heat, then inspect the damper.

| IF | THEN |
|---|---|
| If the damper is open: | • Go to step 5. |
| If the damper is closed: | • Go to step 7. |

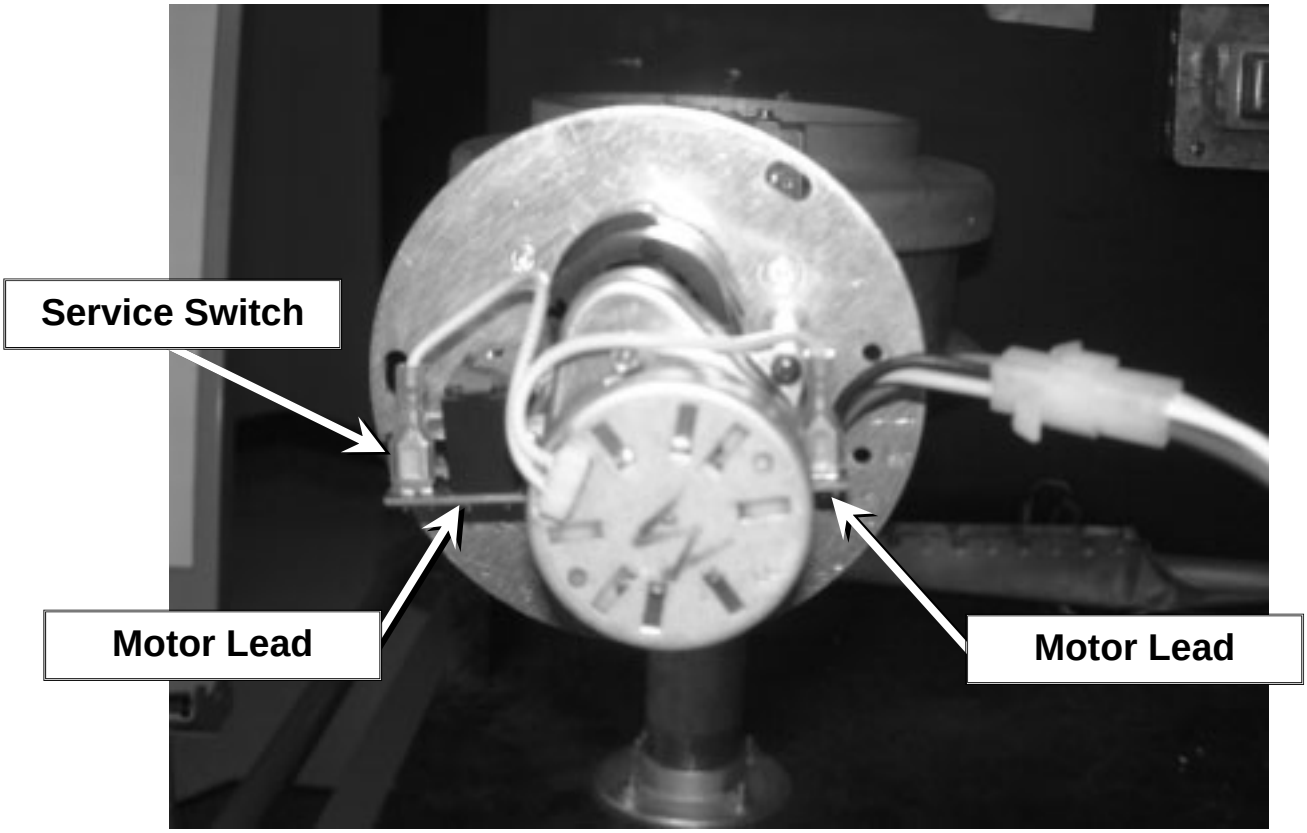
***Note: If the water temperature in the tank is below 120 degrees F, temporarily disconnect the jumper wire between the high limit and thermostat to simulate a satisfied thermostat.***

## STEP 5 CHECK THE PC BOARD


**STEP 5. CHECK THE PC BOARD.** Test for 24 VAC between the black PC board wire connection and ground.

| IF | THEN |
|---|---|
| 24 VAC is not present: | • Check the black wire connections between PC Board and high limit. |
| 24 VAC is present: | • Go to step 6. |

## STEP 6 — PC BOARD MOTOR TEST



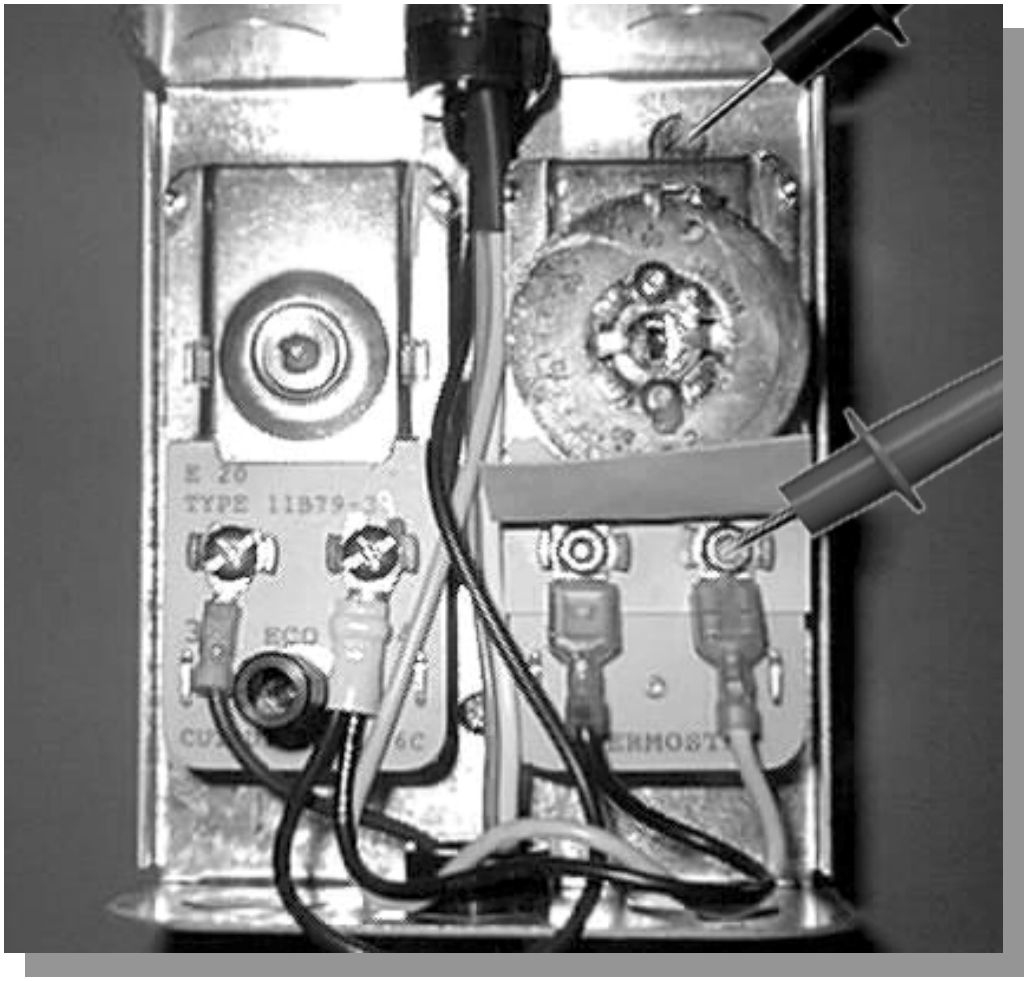

**STEP 6. PC BOARD/MOTOR TEST.** Check for 24 VAC between the two motor lead terminals of the PC board. Disconnect the wires for this test.

| IF | THEN |
|---|---|
| 24 VAC is not present: | • Replace the Damper Drive (part # 194484) and go to step 7. The board and relay are one piece. Regardless of which part is defective, both parts should be changed. |
| Voltage is present: | • This verifies that the motor is receiving power but not closing the damper.<br>• Replace the Damper Drive and go to step 7. |

***Note: The service switch may be used to bypass the damper, while waiting for a replacement part.***

**WARNING -** In the event of damper motor failure, verify that the damper is in the "open" position before utilizing the service switch

| STEP 7 | THERMOSTAT TEST |
|---|---|



**STEP 7. THERMOSTAT TEST.** Set the thermostat to call for heat. Using your multimeter, test for 24 VAC between right terminal and ground.

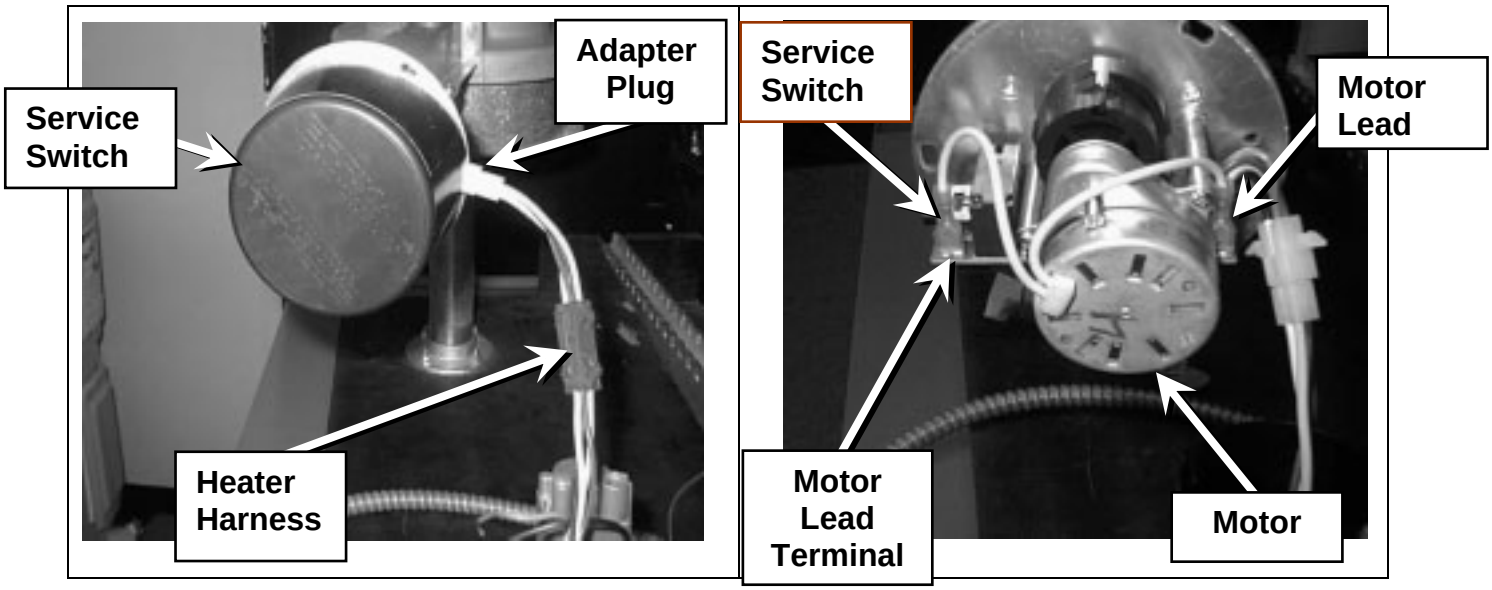
| IF | THEN |
|---|---|
| The meter does not read 24 VAC and the jumper wire between the high limit and the thermostat is in place: | • Replace the thermostat |
| The meter reads 24 VAC: | • Go to step 8. |

***Note: If the high limit to thermostat jumper wire was disconnected earlier to simulate a satisfied thermostat, reconnect the jumper to the terminals.***

***Note: A yellow wire from this thermostat terminal connects to the damper PC board.***

## EFFIKAL DAMPER

The wiring colors from the damper PC Board are different colors than the wires on the heater wiring harness. The male/female plugs to connect the damper board to the heater harness join in only one way.

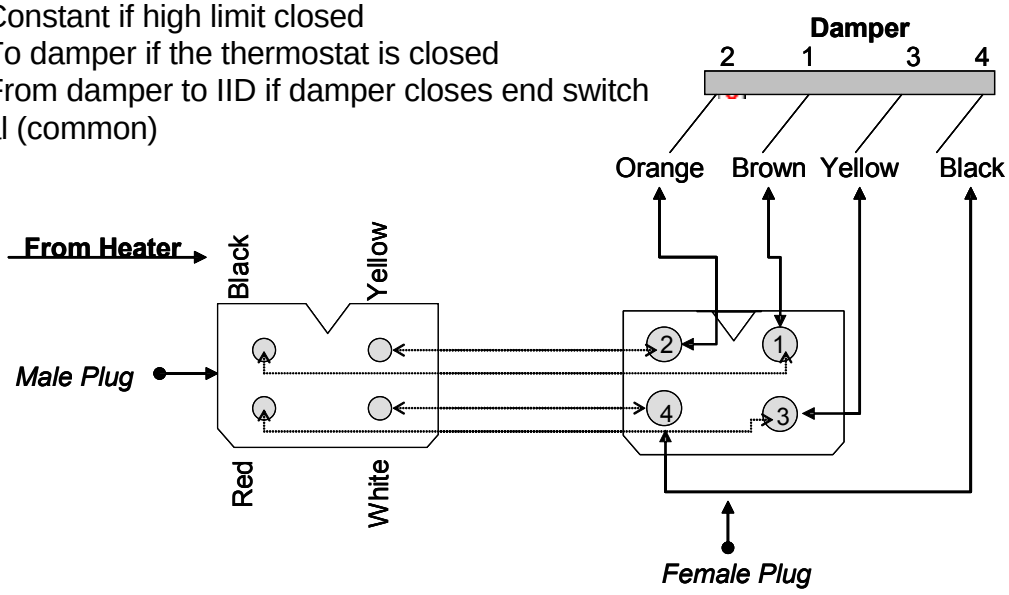



Effikal Control Cover (Photo of kit mounting) Effikal Style

Adapter not necessary on production 110,111 Series

The heater harness wires still serve the same function:

Black – 24V Constant if high limit closed
Yellow – 24V To damper if the thermostat is closed
Red – 24V From damper to IID if damper closes end switch
White – Neutral (common)



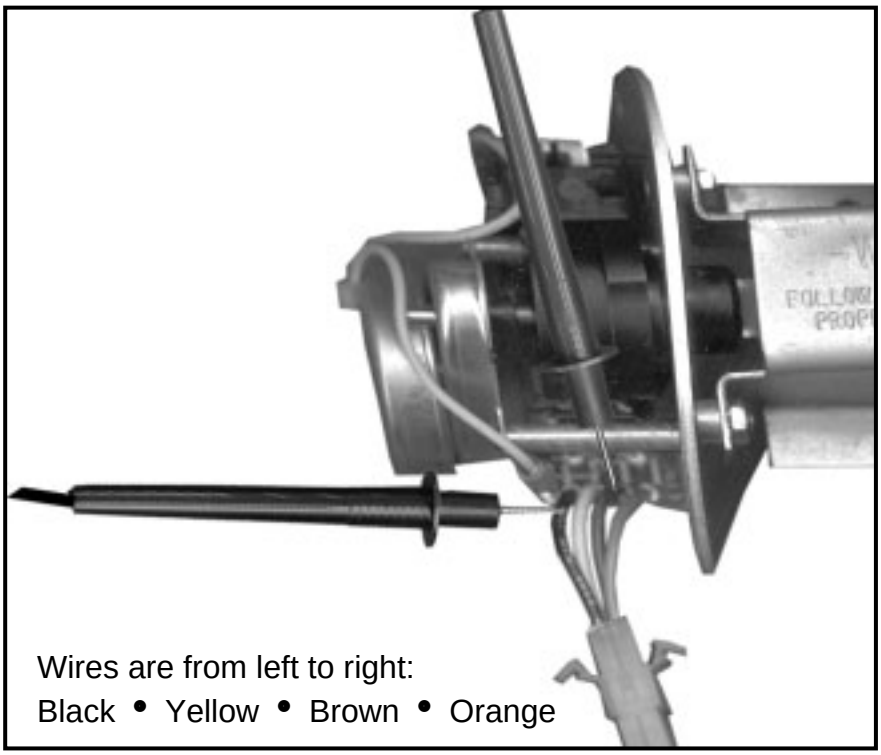
## HARNESS CHART

| Heater Harness | Function | Damper Harness |
|---|---|---|
| Black | 24V Hot | 1-Brown |
| Yellow | 24V from Thermostat | 2-Orange |
| Red | 24V from damper | 3-Yellow |
| White | 24V common | 4-Black |

## NORMAL OPERATION

**Condition:**

- Heater on standby
- Damper closed
- High Limit closed




| STEP 8 | TEST FOR 24VAC BETWEEN BLACK (COMMON) AND BROWN |
|---|---|

### STEP 8. TEST FOR 24VAC BETWEEN BLACK (COMMON) AND BROWN

| IF | THEN |
|---|---|
| 24VAC is present | Continue to Step 8A. |
| 24VAC is not present | See Troubleshooting Step 9A |

## NORMAL OPERATION (continued)

**Condition:**
- Thermostat closed, damper in process of opening

### STEP 8A TEST FOR 24VAC BETWEEN BLACK AND ORANGE

| IF | THEN |
|---|---|
| 24VAC is present | Continue to Step 8B. |
| 24VAC is not present | See Troubleshooting Step 9B. |

**Condition:**
- Thermostat closed, damper fully open

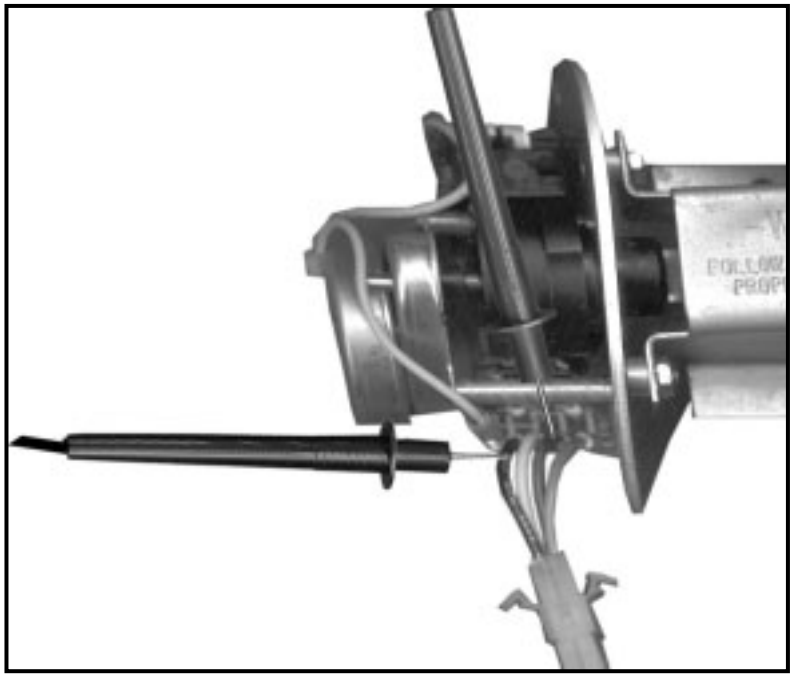
### STEP 8B TEST FOR 24VAC BETWEEN BLACK AND YELLOW

| IF | THEN |
|---|---|
| 24VAC is present | Continue to Step 10A. |
| 24VAC is not present | See Troubleshooting Step 9B. |

# TROUBLESHOOTING THE EFFIKAL DAMPER

**Condition:**
Thermostat closed, damper closed

Wires are from left to right:
Black • Yellow • Brown • Orange

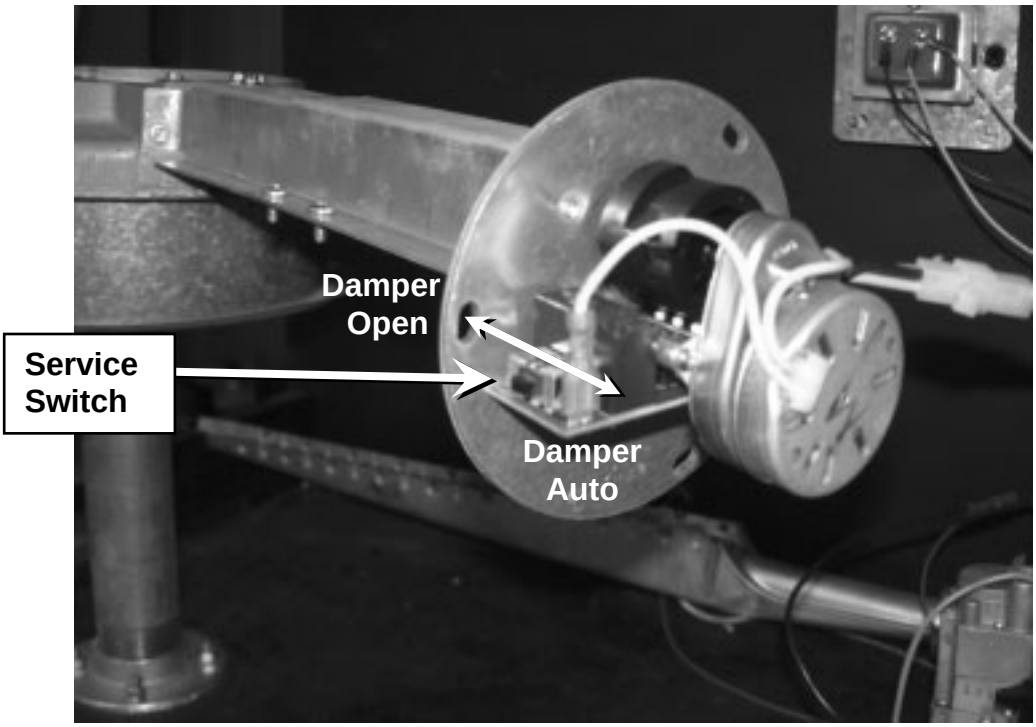


| STEP 9A | TEST BETWEEN BLACK (COMMON) AND BROWN ON THE DAMPER BOARD |
|---|---|

| IF | THEN |
|---|---|
| 24VAC is present | This is correct |
| 24VAC is not present | • See Steps 1 thru 4<br>Check the harness plugs connecting heater and damper for looseness or damage. |

## TROUBLESHOOTING THE EFFIKAL DAMPER (continued)

**Condition:**
Thermostat closed, damper open.




| STEP 9B | A1 IS CORRECT, CHECK SERVICE SWITCH POSITION |
|---|---|

| IF | THEN |
|---|---|
| Switch is incorrect position | Replace damper board/motor assembly. |
| Switch is not in correct position | • Adjust switch<br>• Cycle thermostat to verify that damper operation is correct. |

## TROUBLESHOOTING THE EFFIKAL DAMPER (continued)

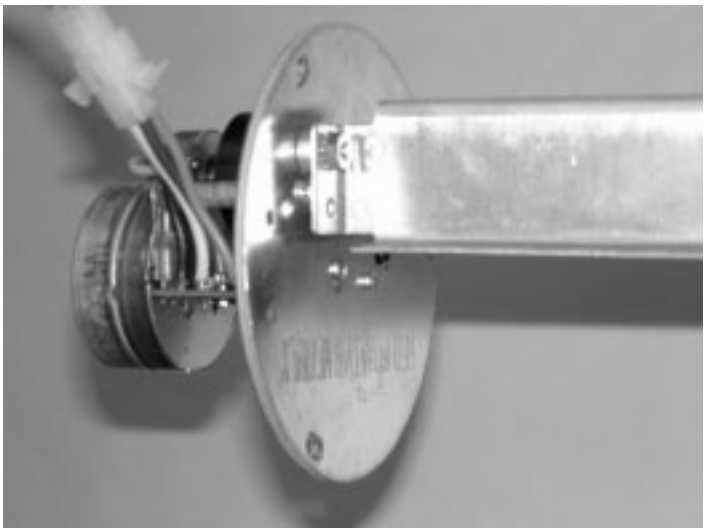
**Condition:**
Thermostat closed, damper is open fully

| STEP 10A | TEST FOR 24VAC BETWEEN BLACK AND YELLOW |
|---|---|

| IF | THEN |
|---|---|
| 24VAC is present | This is correct – continue to Step 11 |
| 24VAC is not present | • See Step 9B.<br>• Check the harness plug connecting.<br>• Check that cam on shaft rotates with shaft.<br>• Replace the damper board.<br>• Ensure that cam is secure against end switch. |

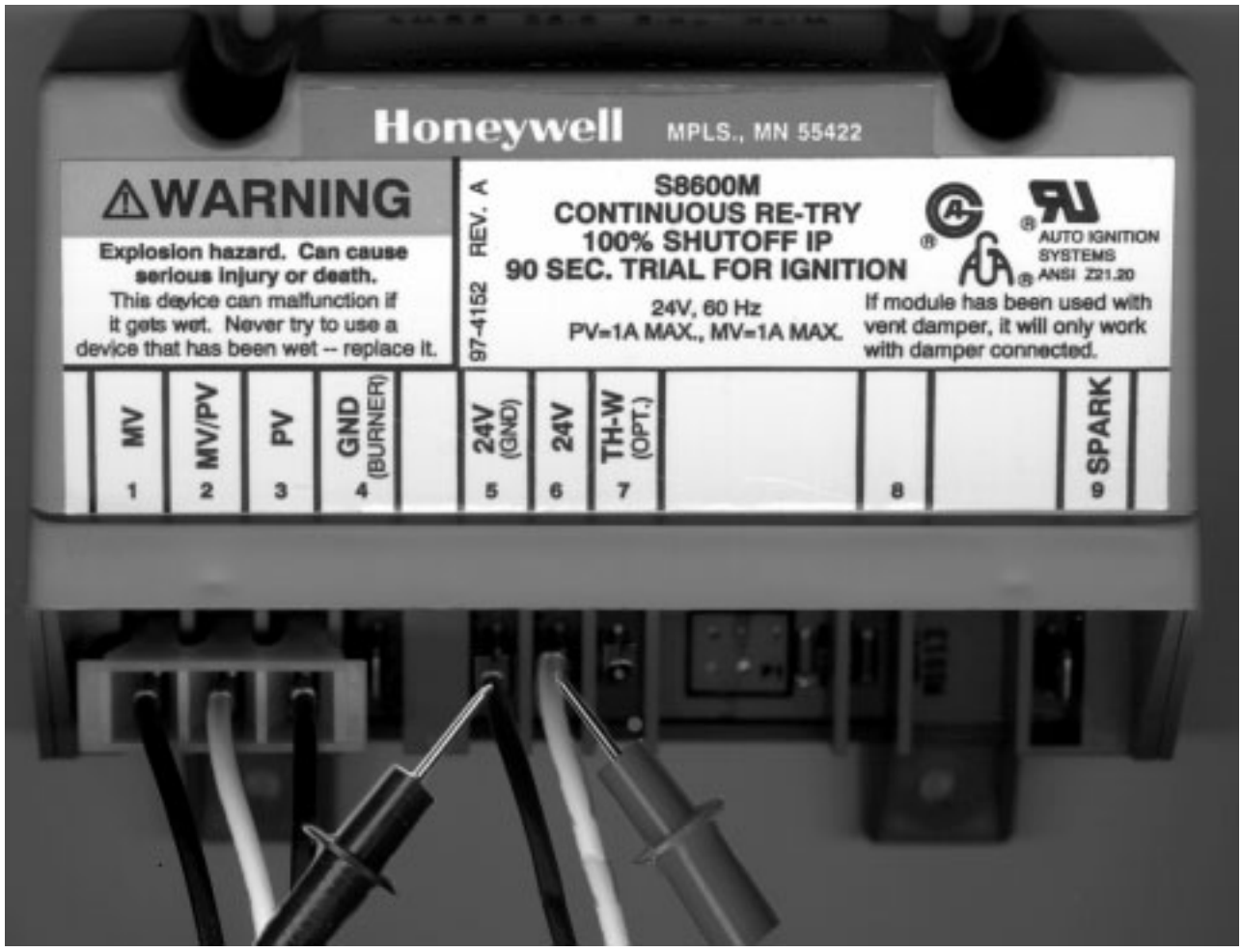
**Condition:**
Damper rotates continuously

| STEP 10B | ADJUST END SWITCH TO CAM CONTACT |
|---|---|



| IF | THEN |
|---|---|
| Damper stops in proper position | 24 VAC should be open on a call for heat and close during standby/ |
| Damper does not stop in proper position | • Replace damper assembly. |

| STEP 11 | WIRE HARNESS TEST |
|---|---|

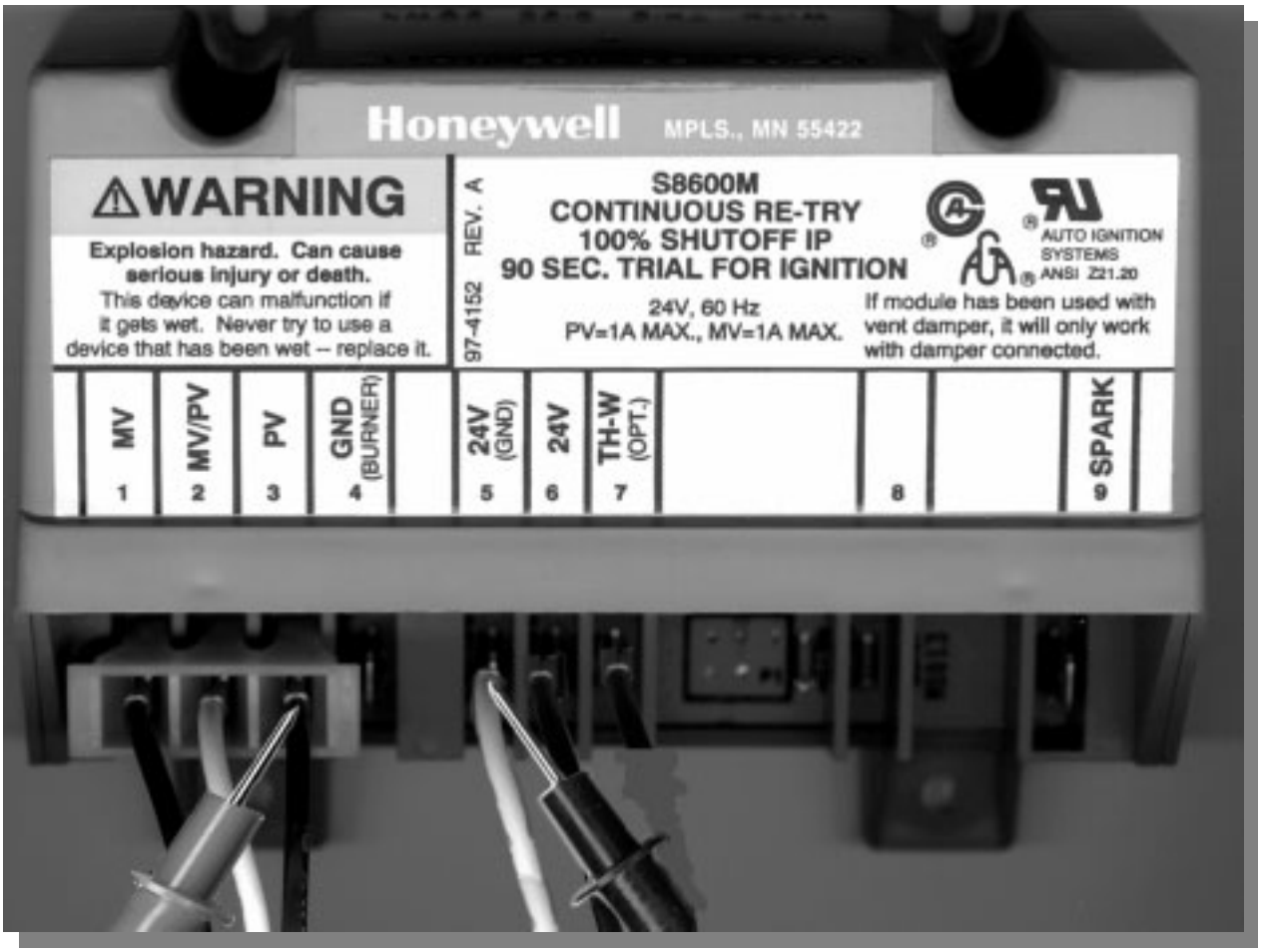



**STEP 11. WIRE HARNESS TEST.** Test for 24 VAC between terminal 24V on the IID module, and 24V GND.

| IF | THEN |
|---|---|
| 24 VAC is not present: | • Check the wiring harness. |
| 24 VAC is present: | • Go to step 12. |

***Note: This test may be easier to conduct by removing the red wire from the IID terminal. Test for 24 VAC between the red wire and ground. Reconnect the red wire to the 24V terminal after the test.***

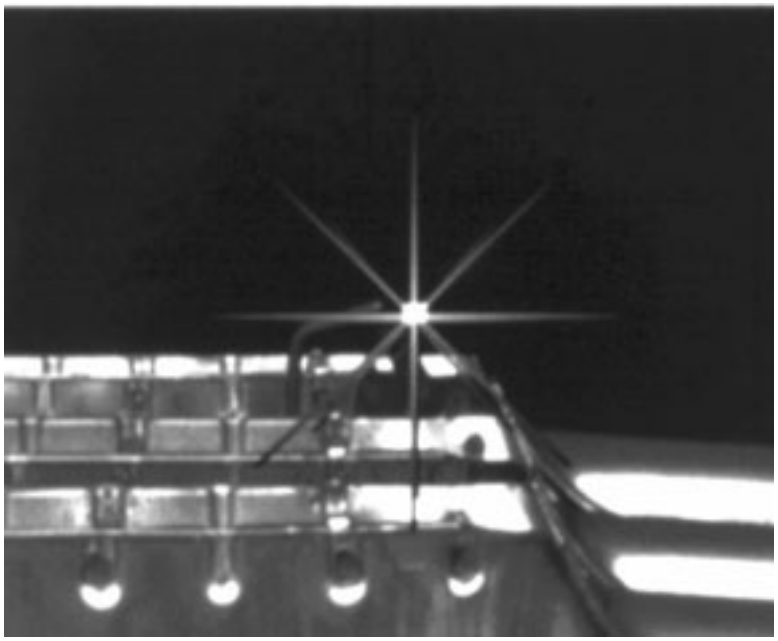
| STEP 12 | IID MODULE TEST |
|---|---|




**STEP 12. IID MODULE TEST (Power to the Pilot Valve).** Using a multimeter, test for 24 VAC between terminal PV and 24V (GND) on the IID during the 90 second trial for ignition.

| IF | THEN |
|---|---|
| The meter does not read 24 VAC and the IID module is not between ignition trials: | • Replace the module. |
| The meter does read 24 VAC: | • Go to step 13 |

| STEP 13 | PILOT SPARK TEST |
|---|---|



**STEP 13. PILOT SPARK TEST.** Visually check for spark at the pilot assembly.
Note: The pilot burner mounts on the left side of the main burner.

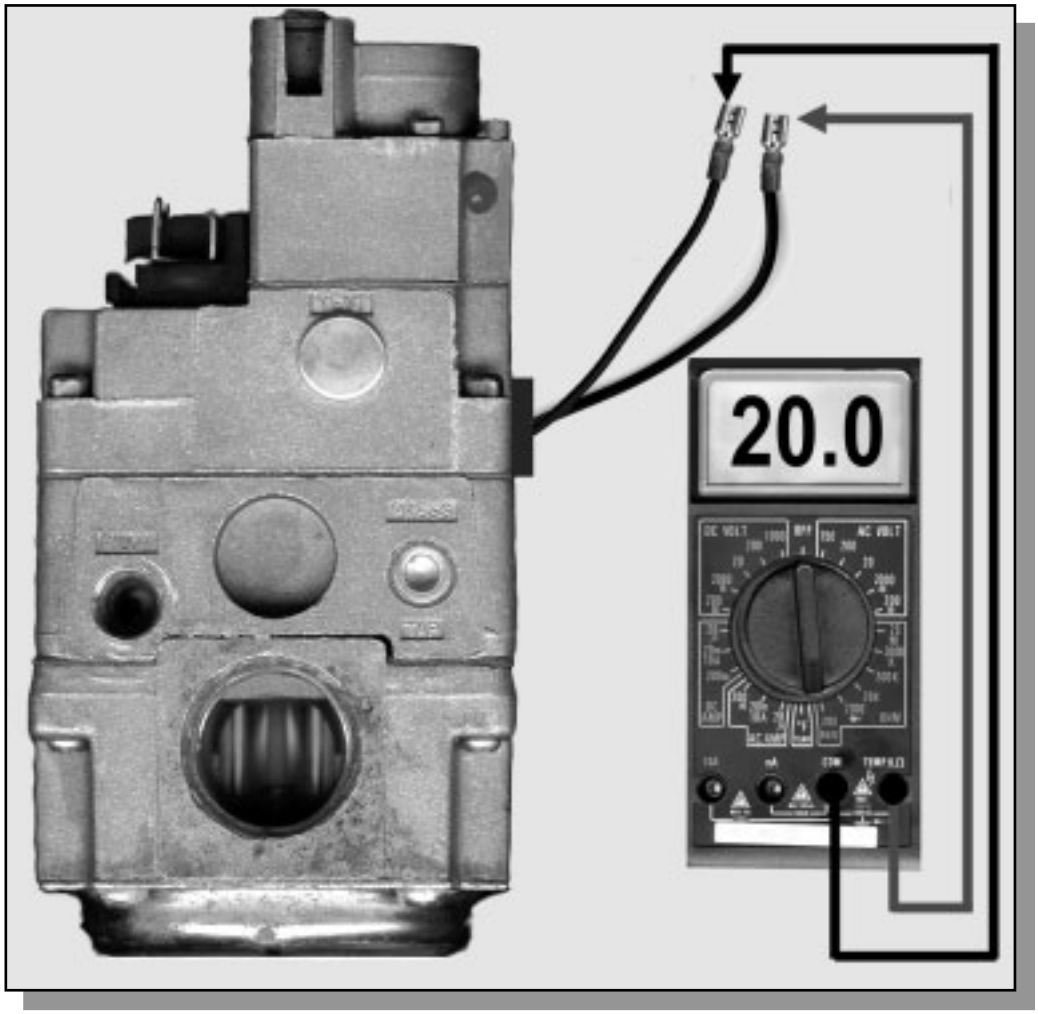
| IF | THEN |
|---|---|
| The igniter is not sparking: | Check for:<br>• A 7/64" spark gap<br>• Spark cable continuity<br>• Ground cable continuity |
| Sparking is present: | • Go to step 14. |

**Power To Module May Be Interrupted To Reset .**

**Trial for Ignition**

| | *90 sec.* | *5 min.* | *90 sec.* | *5 min.* | *90 sec.* | |
|---|---|---|---|---|---|---|
| ***Call for heat*** | ***Sparking*** | ***No Sparking*** | ***Sparking*** | ***No Sparking*** | ***Sparking*** | ***Continuous Trial Sequence*** |

## STEP 14A — PILOT VALVE - OHM TEST

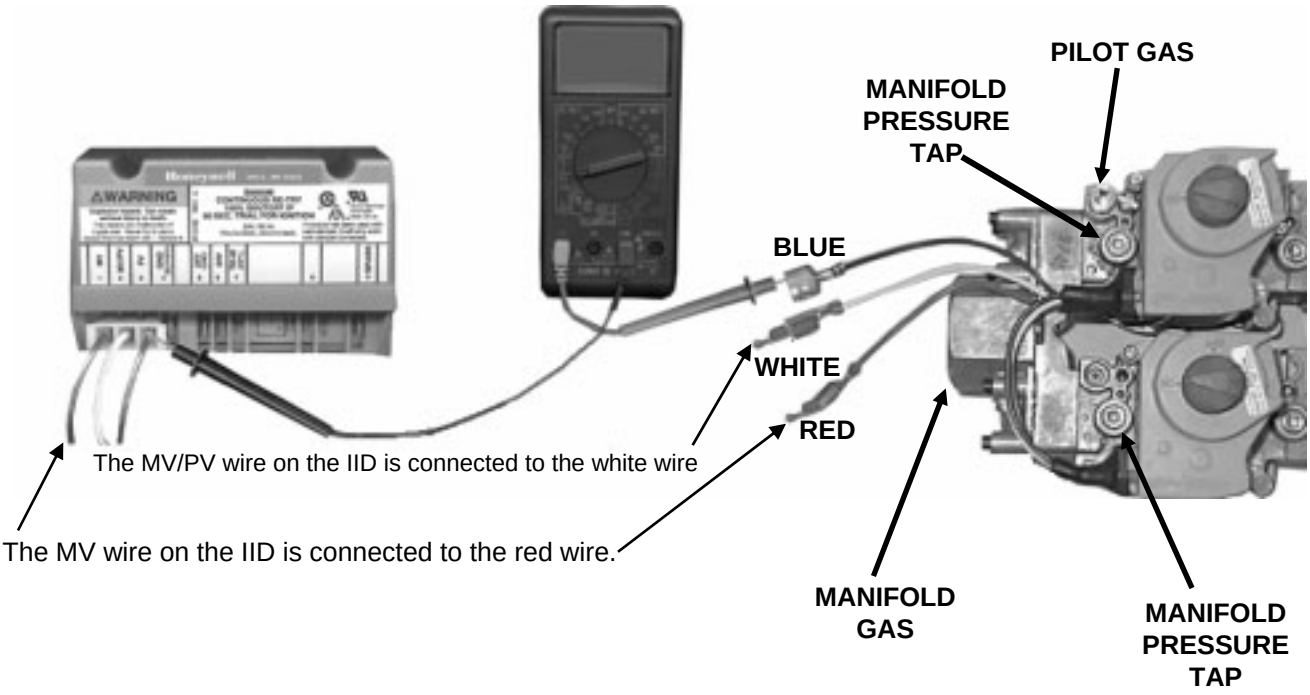



***SBD 120 – 400 GAS VALVE***

**STEP 14A. PILOT VALVE - OHM TEST.** If pilot assembly is sparking but no pilot flame is established, disconnect the pilot valve solenoid leads. Using a multimeter, (set to read ohms) test for 20* ohms resistance +/- 5 through the solenoid coil.

| IF | THEN |
|---|---|
| The meter dose not read 20 ohms plus or minus 5: | • Replace gas valve |
| The meter does read 20 ohms plus or minus 5: | • Gas valve should work. Also check that pilot gas is present and pilot tube or orifice are not blocked |

## STEP 14B PILOT VALVE TEST – SBD 500 ONLY




**STEP 14B. PILOT VALVE TEST – SBD 500 ONLY.** Testing the two coils of the Honeywell VR8404P 5004 gas valve used on the model SBD 500 only. Because of built in diodes, it is difficult to test for ohms resistance through these coils. The following is a DC amperage check of the main and pilot coils.

Condition:

- Tank calls for heat
- PV terminal of module has 24 Vac
- No Pilot flame

Test Procedure:

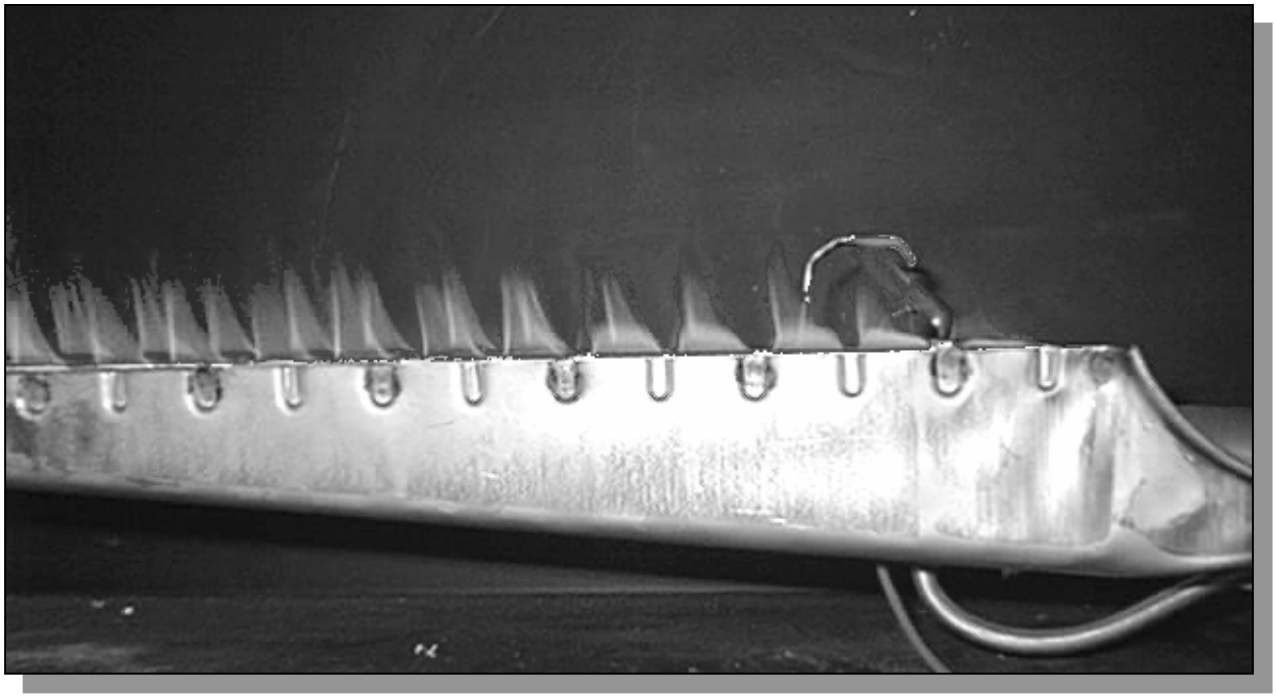
- Turn off power to heater
- Meter set to test for DC amperage (on meters, the black wire is in the "com" port, the red wire is in the "10A" port, the dial is set to 20M/10A in the DC AMP test area).
- Blue "PV" wire is disconnected from the ignition PV terminal.
- Install meter in series between gas valve and ignition module – 10A wire to blue gas valve lead, common wire to PV module terminal.
- Turn power on to heater, after module receives 24V

Test DC Amperage through Pilot coil of gas valve

| IF | THEN |
|---|---|
| .75 to .85 DCA is not present: | • Replace the gas valve |
| .75 to .85 DCA is present | • Pilot should work if gas (not air) is present to pilot |

Power off, reattach blue gas valve wire to PV terminal of module.

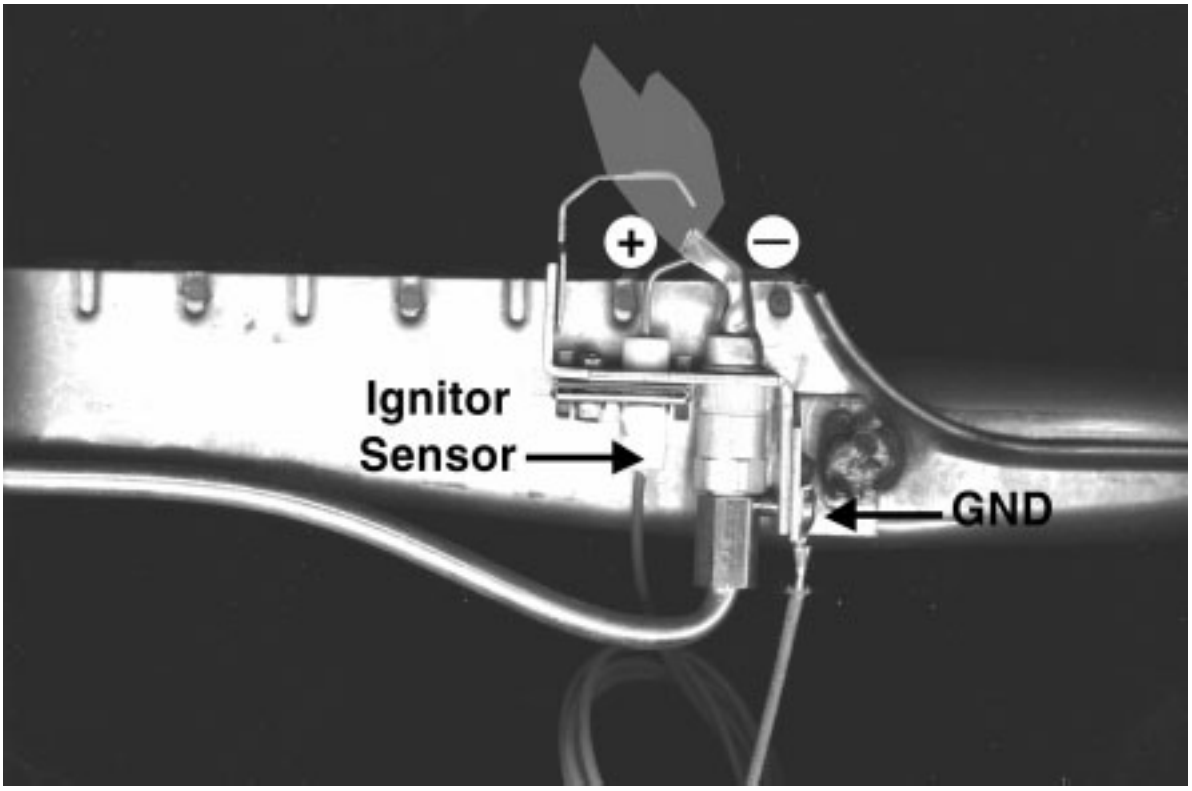
| STEP 15 | MAIN BURNER TEST |
|---|---|



**STEP 15. MAIN BURNER TEST.** Visually check for main burner.

| IF | THEN |
|---|---|
| The main burner ignites: | • Sequence is complete |
| The main burner does not ignite | • Go to step 16 |

| STEP 16 | FLAME RECTIFICATION |
|---|---|



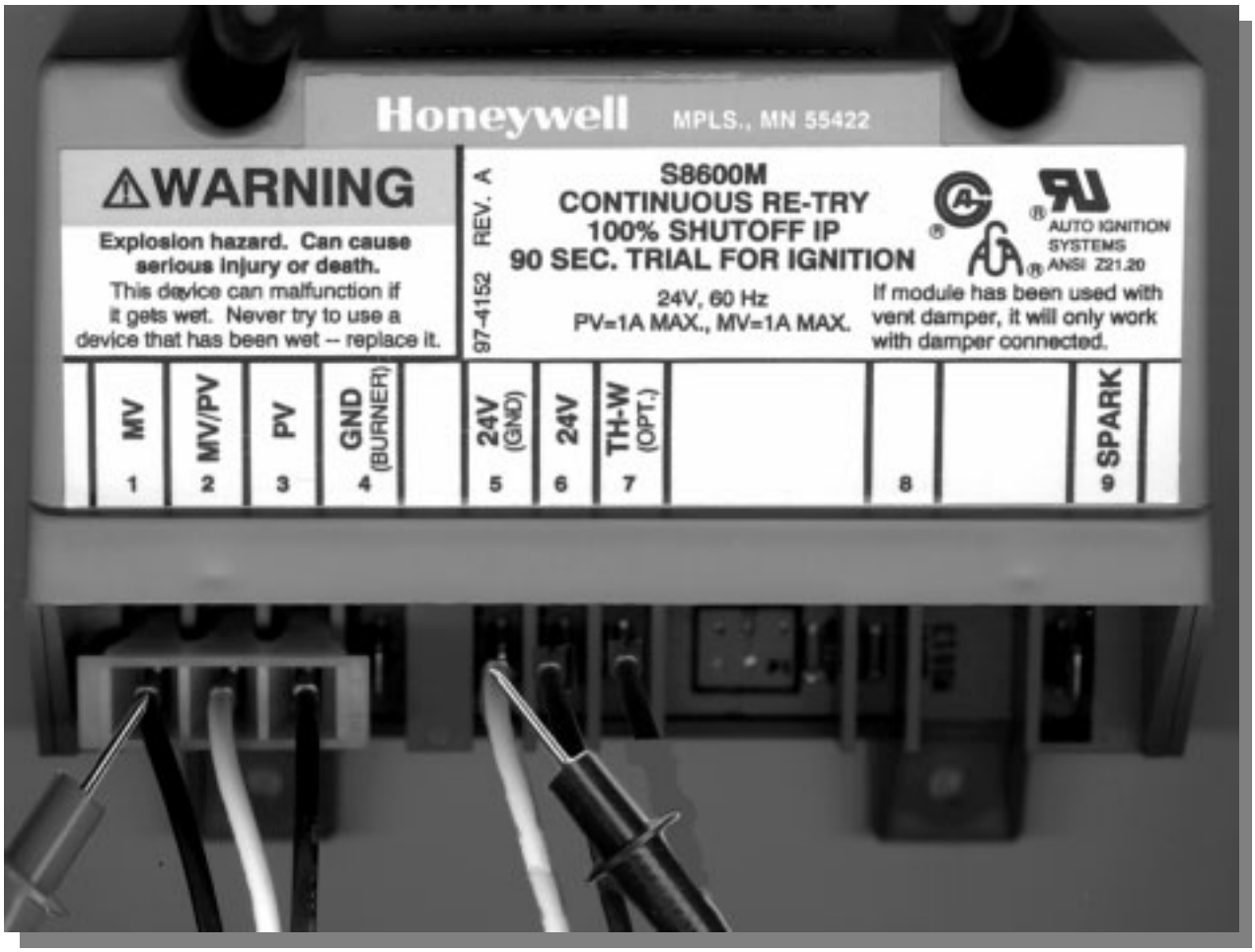

## STEP 16. FLAME RECTIFICATION

*Note: Flame rectification means that an alternating current (AC) signal is changed to a direct current (DC) signal. The pilot flame is the 'switch' which connects the pilot hood to the igniter and ground. If the pilot hood and igniter sensor had the same surface area, the flame 'switch' would conduct an AC signal. Because the pilot surface is greater than the igniter surface, the signal becomes a DC current that the module can interpret. The pilot hood must be properly grounded and the pilot flame must remain in contact with both surfaces for the flame proving signal to remain constant.*
*If the signal is broken for just 8 tenths of a second, the heater will cycle off.*
***Sparking at the pilot will continue if an insufficient signal is received by the module.***

*Sparking at the pilot will stop almost immediately after the ignition module senses the pilot flame.*

| IF | THEN |
|---|---|
| Sparking continues after pilot is established: | • Check wire connections<br>• Check flame contact between hood and lighter<br>• Clean pilot burner surfaces<br>• Replace pilot assembly |
| Sparking stops: | • Go to step 17. |

| STEP 17 | IID MODULE TEST |
|---|---|

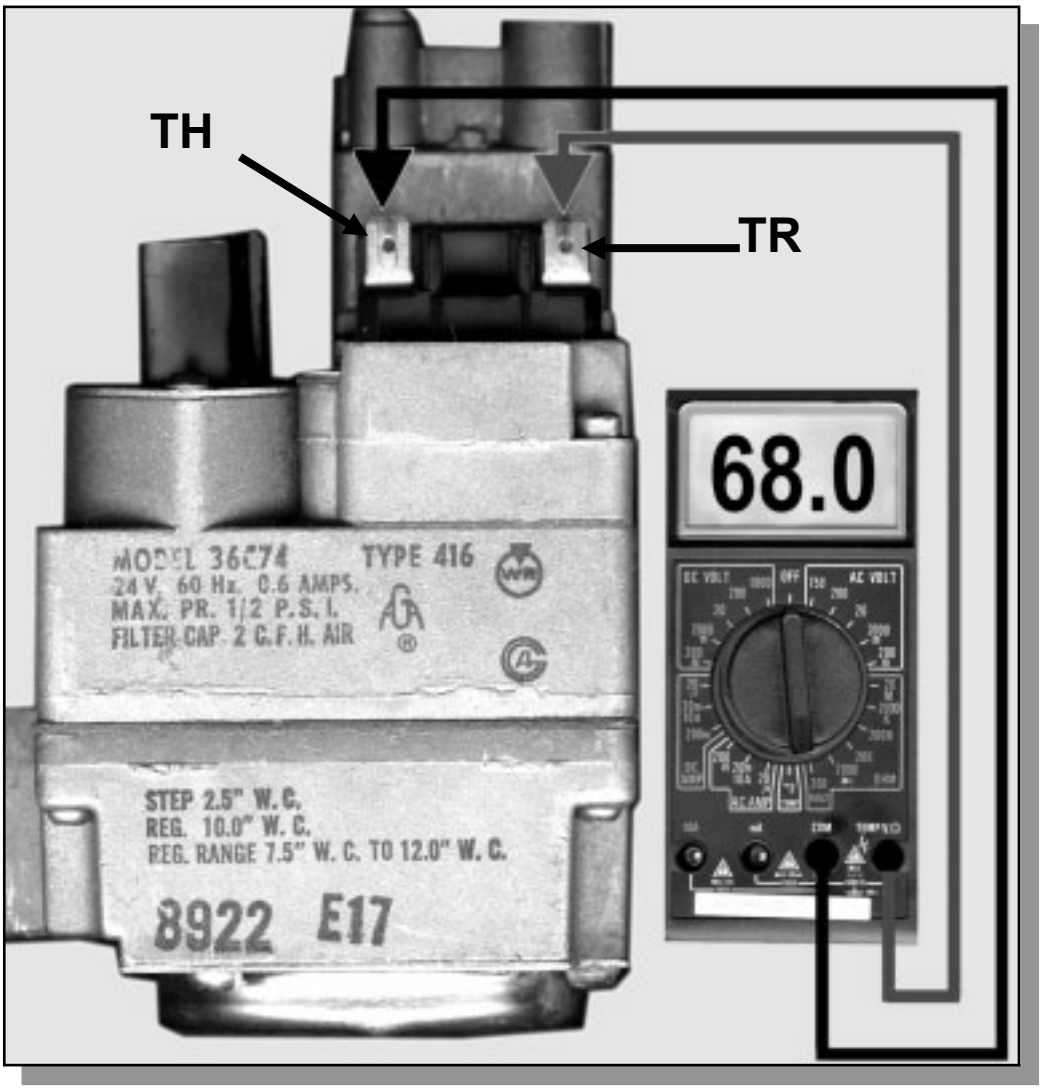



**Pilot is lit - Sparking has stopped.**

**STEP 17. IID MODULE TEST (Power to the Main Valve).** Using a multimeter, test for 24 VAC between terminal MV on the IID and 24V (GND).

| IF | THEN |
|---|---|
| 24 VAC is not present: | • Replace the IID module. Conduct Step 18 before applying power to replacement module. |
| 24 VAC is present: | • Go to step 18. |

| STEP 18A | MAIN GAS VALVE CHECK |
|---|---|

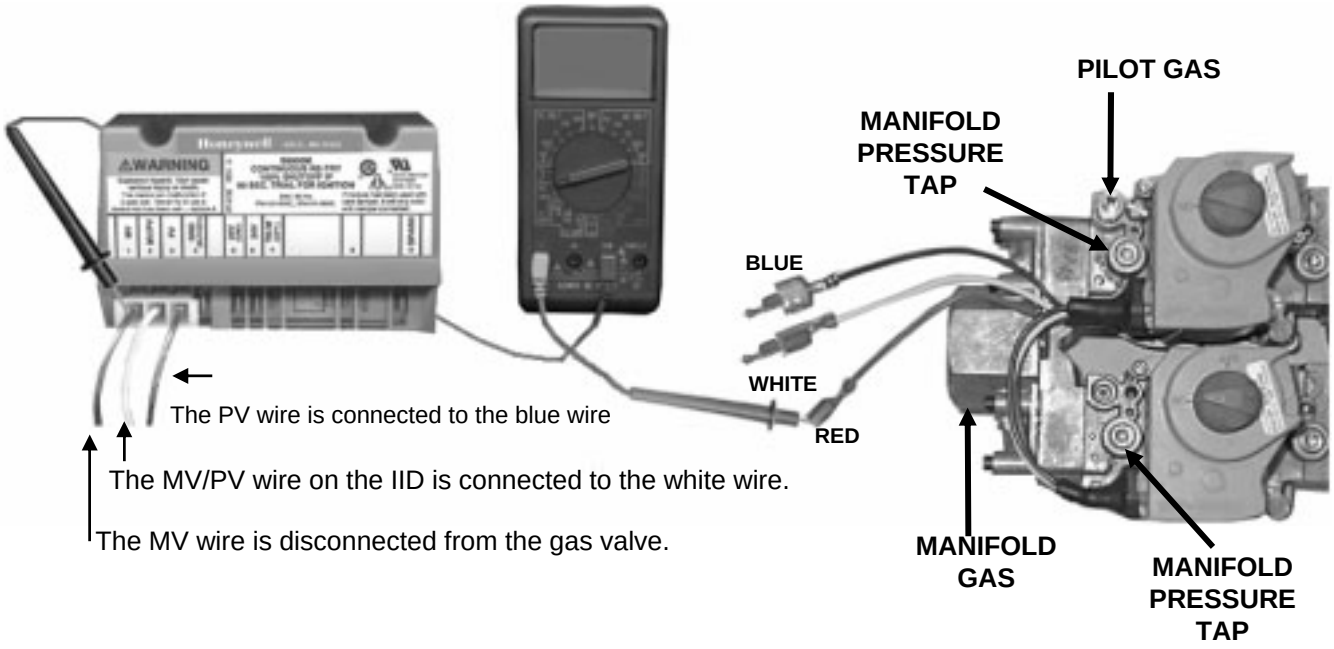



***SBD 120 – 400 GAS VALVE***

**STEP 18A. MAIN GAS VALVE CHECK.** Disconnect wires from gas valve TH and TR terminals. Using a multimeter, test for 68 ohms plus or minus 5 between TH and TR on the main valve coil.

| IF | THEN |
|---|---|
| The meter reads 'O' or infinity | • Replace the gas valve |
| The meter reads 68* ohms plus or minus 5 | • The main burner will ignite |

## STEP 18B MAIN GAS VALVE COIL CHECK




**STEP 18B. MAIN GAS VALVE COIL CHECK – SBD 500 ONLY**

Condition:

- Pilot lights
- Sparking stops
- No main burner ignition

Test Procedure:

- Power off
- Disconnect red, main valve wire from module MV terminal
- Meter set to test for DC amperage
- 10A wire to red gas valve wire, COM wire to MV terminal of ignition module
- Turn power on to heater
- After pilot lights and sparking stops

| IF: | THEN: |
|---|---|
| .25 to .35 DC Amps is not present | • Replace the gas valve |
| .25 to .35DCA is present | • Main burner gas should ignite. |

Be certain to correct you meter wire connections and setting before performing further tests.

# GENERAL SERVICE CHART

| CONDITION | CAUSE | SOLUTION |
|---|---|---|
| DAMPER OPENS NO POWER TO IID MODULE | . DAMPER NOT FULLY OPEN | .EFFIKAL – REPLACE DAMPER CONTROL ASSEMBLY<br>. REPLACE DAMPER |
| | . DEFECTIVE PROTECTOR SWITCH | . REPLACE PC BOARD |
| PILOT LIGHTS, SPARKS CONTINUOUSLY | PILOT FLAME NOT PROVING | SEE FLAME RECTIFICATION - STEP 16 |
| HEATER WILL NOT IGNITE | NOT PROVING PILOT FLAME EXISTANCE | INTERRUPT 120 VAC POWER<br>. CHECK GROUND WIRE ATTACHMENT<br>. CLEAN OR REPLACE PILOT ASSEMBLY |
| | PILOT GAS NOT COMPLETELY INTERRUPTED AT END OF HEATING CYCLE | . CHECK SUPPLY GAS PRESSURE<br>. REPLACE GAS VALVE |
| WEEPING TEMPERATURE AND PRESSURE RELIEF VALVE | . THERMAL EXPANSION | ADD THERMAL EXPANSION TANK |
| | . FAULTY VALVE | REPLACE RELIEF VALVE |
| LARGE VOLUME WATER RELIEF FROM T&P VALVE | . EXCESSIVE WATER TEMPERATURE | . CHECK WIRING<br>. REPLACE DUAL CONTROLLER |
| | . FAULTY RELIEF VALVE | REPLACE RELIEF VALVE |
| PREMATURE TANK LEAKAGE | CONDENSATION | . INCREASE STORED WATER TEMPERATURE AND CONFIRM PROPERLY SIZED APPLICATION |
| | CONTAMINATED AIR | . REMOVE CONTAMINANTS.<br>. SUPPLY CLEAN COMBUSTION AIR. |
| | WATER HAMMER | . ADD WATER HAMMER ARRESTOR.<br>. REDUCE WATER PRESSURE.<br>. REMOVE UNNECESSARY CHECK VALVES. |
| | THERMAL EXPANSION | ADD THERMAL EXPANSION TANK. |
| | DEPLETED ANODES | SCHEDULE ANODE CHECKS - REPLACE AS NEEDED. |
| DAMPER WILL NOT OPEN | BINDING SHAFT | SUPPORT VENTING |
| | DAMPER MOTOR | EFFIKAL-REPLACE DAMPER CONTROL ASSEMBLY |
| NO SPARK AT PILOT - DAMPER FULLY OPEN | DAMPER ASSEMBLY | SEE STEP 10A<br>Services Switch may bypass problem until replacement part is received. (EFFIKAL – REPLACE DAMPER CONTROL ASSEMBLY |
| | IID MODULE | REPLACE IID STEP 12 |
| | SPARK CABLE | REPLACE CABLE STEP 13 |

# GENERAL QUESTIONS AND ANSWERS

**Q. What is unique about the Canadian – SBC-CGA – models vs. U.S. SBD models?**

A. The Canadian models have different dimensions to meet Canadian code requirements.

**Q: How much electrical power is required for a SBD water heater?**

A: The SBD models draw approximately .7 Amps at 120VAC.

**Q: The units require "leg kits" to meet National Sanitation Foundation standards.**

**Q: When should SBDs be delimed? NOTE: The "Hydrocannon" should eliminate or greatly reduce the lime build up rate from the water heater.**

Many variables affect the liming up process including:

**water temperature** - The amount of lime precipitation during the same period of time will be nearly 2 times greater if water is stored at 140 degrees F than at 120 degrees F. A 180 degree setting will precipitate lime about seven times as fast as a 140 degree F setting.

**volume of water** - The more gallons flowing through the SBD, the more exposure to accumulation.

**hardness** – The harder the water the higher the possibility of lime build up. 1 to 3.5 grains per gallon is "soft", 3.5 to 7 grains per gallon is "moderate", 7 to 10.5 grains per gallon is "hard" and 10.5 + grains per gallon is "very hard". (An aspirin is about 5 grains. One grain is equal to 17.1 parts per million.)

A: Deliming should be done when a slight rumbling or popping sound is detected when the main burners are on.

**Q: What effect will lime build-up have on the SBD water heater?**

A: One eighth inch of scale build-up may reduce efficiency as much as 22%; a 1/4 inch build-up, as much as 38%.

A: Less efficient heat transfer means more bottom head expansion/contraction stress and premature leakage.

A: Heavy build-up on the bottom head and bottom portion of the flue pipes leads to more heat transfer at the top of the flues. This can lead to stacking or erratic thermostat operation.

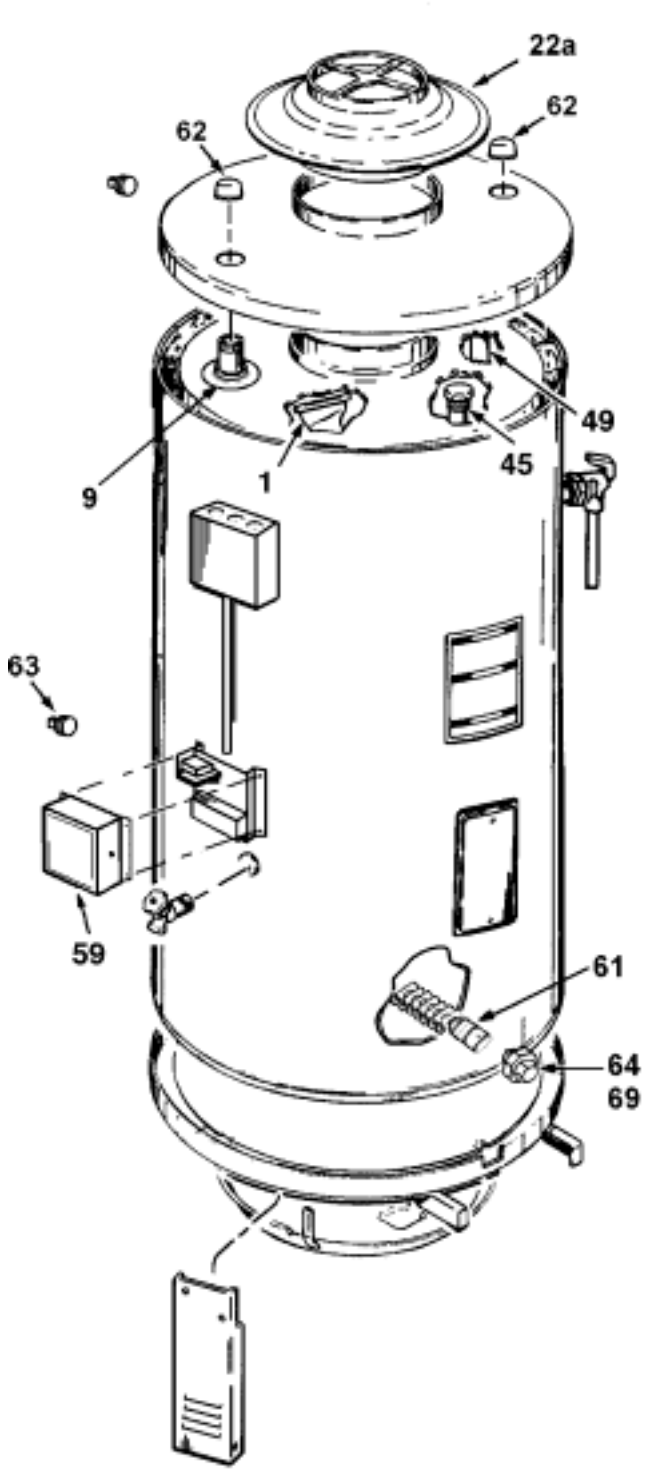
A: The "Hydrocannon" greatly reduces the possibility of lime build-up.

**Q: Anode rods provide additional protection against corrosion. When should these be replaced?**

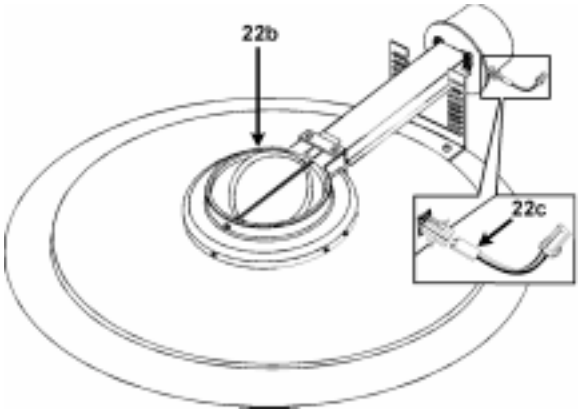
A: When large gouges or pits appear in the anodes, replace them. It is recommended that these be inspected every 6 months.

# SBD MODELS 120 THRU 500A
# SERIES 110-111

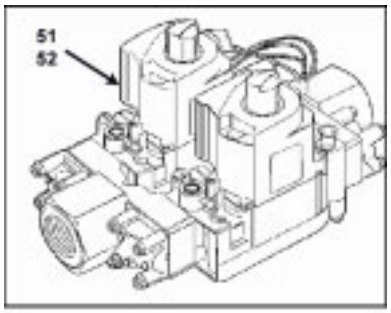
**PARTIAL REPLACEMENT PARTS LIST**
**MODELS SBD 120 THRU 500A: STANDARD AND ASME (A)**
**SERIES 110/111**



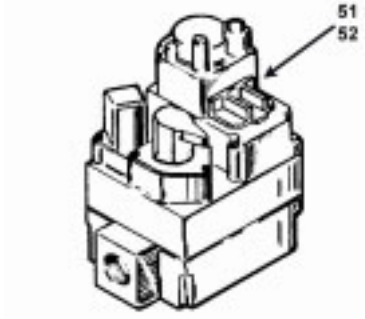

**EFFIKAL DAMPER DRIVE ASSEMBLY**



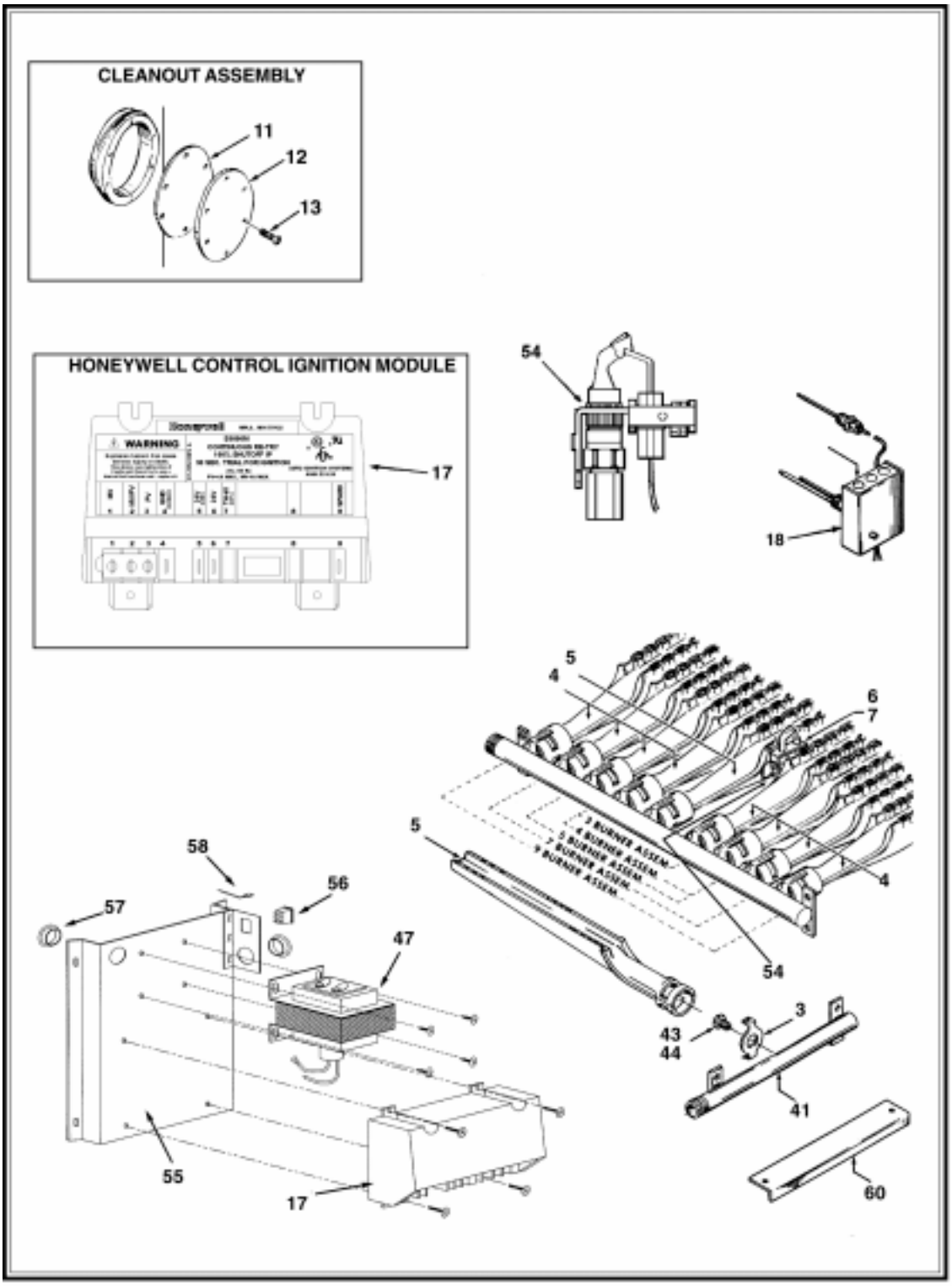

**GAS VALVES**
**HONEYWELL VALVE SBD 500A**




**WHITE RODGERS VALVE SBC 120 – 400A**



# SBD MODELS 120 THRU 500A (continued)
# SERIES 110-111



# SBD MODELS 120 THRU 500A (continued)
# SERIES 110-111

| ITEM | PARTS | SBD71120NE | SBD81154NE | SBD81180NE | SBD100199NET | SBD100199NE |
|---|---|---|---|---|---|---|
| 1 | Flue Baffle | 193595 | 192199-3 | 193795-1 | 193696 | 193696 |
| 3 | Main Burner Orifice Bracket | 98044(3) | 98044(3) | 98044(5) | 98044(5) | 98044(5) |
| 4 | Main Burner | 98047 | 98047 | 98047 | 98047 | 98047 |
| 5 | Main Burner w/Pilot Bracket | 193873-1 | 193873-1 | 193873-1 | 193873-1 | 193873-1 |
| 6 | Pilot Burner, Natural | 193314-4 | 193314-4 | 193314-4 | 193314-4 | 193314-4 |
| 7 | Pilot Burner, LP | 193314-3 | 193314-3 | 193314-3 | 193314-3 | 193314-3 |
| **CLEANOUT ASSEMBLY** | | | | | | |
| 11 | Gasket | 99038 | 99038 | 99038 | 99038 | 99038 |
| 12 | Pressure Plate | 99037 | 99037 | 99037 | 99037 | 99037 |
| 13 | Screws, Self Tapping | 69852 | 69852 | 69852 | 69852 | 69852 |
| 17 | Control, Ignition Module | 193325 | 193325 | 193325 | 193325 | 193325 |
| 18 | Control, Dual w/ECO | 192828 | 192828 | 192828 | 192828 | 192828 |
| 19 | Cover, Cleanout | 181260 | 181260 | 181260 | 181260 | 181260 |
| 22a | Drafthood | 193596 | 193596-1 | 191790 | 191790 | 191790 |
| 22b | Damper Drive Assembly | 194484 | 194484 | 194484 | 194484 | 194484 |
| 22c | Harness Adapter | 194459 | 194459 | 194459 | 194459 | 194459 |
| **LABELS** | | | | | | |
| 41 | Manifold | 76244 | 76244 | 76244-2 | 76244-2 | 76244-2 |
| 42 | Instruction Manual | 195121 | 195121 | 195121 | 195121 | 195121 |
| 43 | Main Burner Orifice, Natural | 76243-32 | 76243-30 | 76243-35 | 76243-32 | 76243-32 |
| 44 | Main Burner Orifice, LP | 76243-49 | 76243-46 | 76243-51 | 76243-49 | 76243-49 |
| 45 | Anode Rod | 43817-38 | 43817-38 | 43817-38 | 43817-42 | 43817-42 |
| 47 | Transformer | 193444 | 193444 | 193444 | 193444 | 193444 |
| 48 | Pilot Tubing | 1417-60 | 1417-60 | 1417-60 | 1417-60 | 1417-60 |
| 49 | Inlet Tube | 193729 | 192626 | 193729 | 192626 | 192626 |
| 51 | Gas Valve Natural | 192827 | 192827 | 192827 | 192827 | 192827 |
| 52 | Gas Valve LP | 192827-1 | 192827-1 | 192827-1 | 192827-1 | 192827-1 |
| 55 | Switch Panel/Mounting Plate | 193448 | 193448 | 193448 | 193448 | 193448 |
| 56 | Off/On Switch | 193243 | 193243 | 193243 | 193243 | 193243 |
| 57 | Bushing | 193404 | 193404 | 193404 | 193404 | 193404 |
| 58 | Jumper Wire | 193476 | 193476 | 193476 | 193476 | 193476 |
| 59 | Control Box Panel | 193447 | 193447 | 193447 | 193447 | 193447 |
| 60 | Cover - Burner | 98185 | 98185 | 98185-2 | 98185-2 | 98185-2 |
| 61 | Hydro-Cannon | 195100 | 195100 | 195098 | 195098 | 195098 |
| 62 | (1 1/2”) galvanized pipe cap | 193940 | 193940 | 193940 | 193940 | 193940 |
| 63 | (1 1/2”) galvanized pipe plug | 194623 | 194623 | 194623 | 194623 | 194623 |
| 64 | (1 1/2”) galvanized pipe union | 194127 | 194127 | 194127 | 194127 | 194127 |

# SBD MODELS 120 THRU 500A (continued)
# SERIES 110-111

| ITEM | PARTS | SBD81190NE | SBD100199NES/A | SBD100250NE/A | SBD65251NE/A | SBD100275NE/ |
|---|---|---|---|---|---|---|
| 1 | Flue Baffle | 193795-1 | 193889 | 193595 | 193595 | 193945 |
| 3 | Main Burner Orifice Bracket | 98044(5) | 98044(5) | 098044(5) | 098044(7) | 098044(5) |
| 4 | Main Burner | 98047 | 98047 | 98047 | 98047 | 98047 |
| 5 | Main Burner w/Pilot Bracket | 193873-1 | 193873-1 | 193873-1 | 193873-1 | 193873-1 |
| 6 | Pilot Burner, Natural | 193314-4 | 193314-4 | 193314-4 | 193314-4 | 193314-4 |
| 7 | Pilot Burner, LP | 193314-3 | 193314-3 | 193314-3 | 193314-3 | 193314-3 |
| **CLEANOUT ASSEMBLY** | | | | | | |
| 11 | Gasket | 99038 | 99038 | 99038 | 99038 | 99038 |
| 12 | Pressure Plate | 99037 | 99037 | 99037 | 99037 | 99037 |
| 13 | Screws, Self Tapping | 69852 | 69852 | 69852 | 69852 | 69852 |
| 17 | Control, Ignition Module | 193325 | 193325 | 193325 | 193325 | 193325 |
| 18 | Control, Dual w/ECO | 192828 | 192828 | 192828 | 192828 | 192828 |
| 19 | Cover, Cleanout | 181260 | 181260 | 181260 | 181260 | 181260 |
| 22a | Drafthood | 191790 | 191790 | 193891 | 193891 | 193891 |
| 22b | Damper Drive Assembly | 194484 | 194484 | 194484 | 194484 | 194484 |
| 22c | Harness Adapter | 194459 | 194459 | 194459 | 194459 | 194459 |
| **LABELS** | | | | | | |
| 41 | Manifold | 76244-2 | 76244-2 | 76244-2 | 76244-3 | 76244-2 |
| 42 | Instruction Manual | 195121 | 195121 | 195121 | 195121 | 195121 |
| 43 | Main Burner Orifice, Natural | 76243-32 | 76243-32 | 76243-30 | 76243-33 | 76243-29 |
| 44 | Main Burner Orifice, LP | 76243-49 | 76243-48 | 76243-45 | 76243-51 | 76243-44 |
| 45 | Anode Rod | 43817-38 | 180618-42 | 180618-42 | 43817-38 | 180618-42 |
| 47 | Transformer | 193444 | 193444 | 193444 | 193444 | 193444 |
| 48 | Pilot Tubing | 193729 | 1417-60 | 1417-60 | 1417-60 | 1417-60 |
| 49 | Inlet Tube | 193729 | 193729 | 192626 | NA | 192626 |
| 51 | Gas Valve Natural | 192827 | 192827 | 192827 | 192827 | 192827 |
| 52 | Gas Valve LP | 192827-1 | 192827-1 | 192827-1 | 192827-1 | 192827-1 |
| 55 | Switch Panel/Mounting Plate | 193448 | 193448 | 193448 | 193448 | 193448 |
| 56 | Off/On Switch | 193243 | 193243 | 193243 | 193243 | 193243 |
| 57 | Bushing | 193404 | 193404 | 193404 | 193404 | 193404 |
| 58 | Jumper Wire | 193476 | 193476 | 193476 | 193476 | 193476 |
| 59 | Control Box Panel | 193447 | 193447 | 193447 | 193447 | 193447 |
| 60 | Cover - Burner | 98185-2 | 98185-2 | 98185-2 | 98185-3 | 98185-2 |
| 61 | Hydro-Cannon | 195100 | 195100 | 195098 | 195102 | 195098 |
| 62 | (1 1/2") galvanized pipe cap | 193940 | 193940 | 193940 | NA | 193940 |
| 63 | (1 1/2") galvanized pipe plug | 194623 | NA | NA | 194623 | NA |
| 64 | (1 1/2") galvanized pipe union | 194127 | NA | NA | 194127 | NA |

# SBD MODELS 120 THRU 500A (continued)
# SERIES 110-111

| ITEM | PARTS DESCRIPTION | SBD65305NE/A | SBD85365NE/A | SBD100400NE/A | SBD85500NE |
|---|---|---|---|---|---|
| 1 | Flue Baffle | 193595 | 193696 | 193995 | 193995 |
| 3 | Main Burner Orifice Bracket | 098044(7) | 098044(9) | 098044(9) | 098044(9) |
| 4 | Main Burner | 192322 | 98047 | 192322 | 192322 |
| 5 | Main Burner w/Pilot Bracket | 193873 | 193873-1 | 193873 | 193873 |
| 6 | Pilot Burner, Natural | 193314-4 | 193314-4 | 193314-4 | 193314-4 |
| 7 | Pilot Burner, LP | 193314-3 | 193314-3 | 193314-3 | 193314-3 |
| **CLEANOUT ASSEMBLY** | | | | | |
| 11 | Gasket | 99038 | 99038 | 99038 | 99038 |
| 12 | Pressure Plate | 99037 | 99037 | 99037 | 99037 |
| 13 | Screws, Self Tapping | 69852 | 69852 | 69852 | 69852 |
| 17 | Control, Ignition Module | 193325 | 193325 | 193325 | 193325 |
| 18 | Control, Dual w/ECO | 192828 | 192828 | 192828 | 192828 |
| 19 | Cover, Cleanout | 181260 | 181260 | 181260 | 181260 |
| 22a | Drafthood | 193891 | 193891 | 193891 | 193891 |
| 22b | Damper Drive Assembly | 194484 | 194484 | 194484 | 194484 |
| 22c | Harness Adapter | 194459 | 194459 | 194459 | 194459 |
| **LABELS** | | | | | |
| 41 | Manifold | 76244-3 | 76244-4 | 76244-4 | 76244-4 |
| 42 | Instruction Manual | 195121 | 195121 | 195121 | 195121 |
| 43 | Main Burner Orifice, NAT | 76243-37 | 76243-32 | 76243-31 | 76243-28 |
| 44 | Main Burner Orifice, LP | 76243-48 | 76243-49 | 76243-48 | 76243-44 |
| 45 | Anode Rod | 43817-38 | 180618-42 | 180618-42 | 180618-42 |
| 47 | Transformer | 193444 | 193444 | 193444 | 193444 |
| 48 | Pilot Tubing | 1417-60 | 1417-60 | 1417-60 | 1417-60 |
| 49 | Inlet Tube | NA | 192626 | 192626 | 192626 |
| 51 | Gas Valve Natural | 192827-2 | 192827-2 | 192827-2 | 193366-0 |
| 52 | Gas Valve LP | 192827-3 | 192827-3 | 192827-3 | 193366-1 |
| 55 | Switch Panel/Mounting Plate | 193448 | 193448 | 193448 | 193448 |
| 56 | Off/On Switch | 193243 | 193243 | 193243 | 193243 |
| 57 | Bushing | 193404 | 193404 | 193404 | 193404 |
| 58 | Jumper Wire | 193476 | 193476 | 193476 | 193476 |
| 59 | Control Box Panel | 193447 | 193447 | 193447 | 193447 |
| 60 | Cover - Burner | 98185-3 | 98185-4 | 98185-4 | 194111 |
| 61 | Hydro-Cannon | 195102 | 195098 | 195098 | 195098 |
| 62 | (1 1/2”) galvanized pipe cap | NA | 193940 | 193940 | NA |
| 63 | (1 1/2”) galvanized pipe plug | 194623-3 | 194623-3 | NA | 194623-3 |
| 64 | (1 1/2”) galvanized pipe union | 194127 | 194127 | NA | 194127 |

# SBD MODELS 120 THRU 500A (continued)
# SERIES 110-111

| ITEM | PARTS DESCRIPTION | CGA SBD71120NE | CGA SBD81154NE | CGA SBD76180NE | CGA SBD85199NE | CGA SBD76190I |
|---|---|---|---|---|---|---|
| 1 | Flue Baffle | 193595 | 192199-3 | 193795-0 | 193696 | 193795-0 |
| 3 | Main Burner Orifice Bracket | 98044(3) | 98044(3) | 98044(5) | 98044(5) | 98044(5) |
| 4 | Main Burner | 98047 | 98047 | 98047 | 98047 | 98047 |
| 5 | Main Burner w/Pilot Bracket | 193873-1 | 193873-1 | 193873-1 | 193873-1 | 193873-1 |
| 6 | Pilot Burner, Natural | 193314-4 | 193314-4 | 193314-4 | 193314-4 | 193314-4 |
| 7 | Pilot Burner, LP | 193314-3 | 193314-3 | 193314-3 | 193314-3 | 193314-3 |
| **CLEANOUT ASSEMBLY** | | | | | | |
| 11 | Gasket | 99038 | 99038 | 99038 | 99038 | 99038 |
| 12 | Pressure Plate | 99037 | 99037 | 99037 | 99037 | 99037 |
| 13 | Screws, Self Tapping | 69852 | 69852 | 69852 | 69852 | 69852 |
| 17 | Control, Ignition Module | 193325 | 193325 | 193325 | 193325 | 193325 |
| 18 | Control, Dual w/ECO | 192828 | 192828 | 192828 | 192828 | 192828 |
| 19 | Cover, Cleanout | 181260 | 181260 | 181260 | 181260 | 181260 |
| 22a | Drafthood | 193596 | 193596-1 | 193596-1 | 193596-1 | 193596-1 |
| 22b | Damper Drive Assembly | 194484 | 194484 | 194484 | 194484 | 194484 |
| 22c | Harness Adapter | 194459 | 194459 | 194459 | 194459 | 194459 |
| **LABELS** | | | | | | |
| 41 | Manifold | 76244-0 | 76244-0 | 76244-2 | 76244-2 | 76244-2 |
| 42 | Instruction Manual | 195121-1 | 195121-1 | 195121-1 | 195121-1 | 195121-1 |
| 43 | Main Burner Orifice, Natural | 76243-32 | 76243-30 | 76243-35 | 76243-32 | 76243-32 |
| 44 | Main Burner Orifice, LP | 76243-49 | 76243-46 | 76243-51 | 76243-49 | 76243-49 |
| 45 | Anode Rod | 43817-38 | 43817-38 | 43817-38 | 43817-42 | 43817-38 |
| 47 | Transformer | 193444 | 193444 | 193444 | 193444 | 193444 |
| 48 | Pilot Tubing | 1417-60 | 1417-60 | 1417-60 | 1417-60 | 1417-60 |
| 49 | Inlet Tube | 193729 | 192626 | 193729 | 192626 | 193729 |
| 51 | Gas Valve Natural | 192827 | 192827 | 192827 | 192827 | 192827 |
| 52 | Gas Valve LP | 192827-1 | 192827-1 | 192827-1 | 192827-1 | 192827-1 |
| 55 | Switch Panel/Mounting Plate | 193448 | 193448 | 193448 | 193448 | 193448 |
| 56 | Off/On Switch | 193243 | 193243 | 193243 | 193243 | 193243 |
| 57 | Bushing | 193404 | 193404 | 193404 | 193404 | 193404 |
| 58 | Jumper Wire | 193476 | 193476 | 193476 | 193476 | 193476 |
| 59 | Control Box Panel | 193447 | 193447 | 193447 | 193447 | 193447 |
| 60 | Cover - Burner | 98185 | 98185 | 98185-2 | 98185-2 | 98185-2 |
| 61 | Hydro-Cannon | 195100 | 195100 | 195098 | 195098 | 195098 |
| 62 | (1 1/2") galvanized pipe cap | 193940 | 193940 | 193940 | 193940 | 193940 |
| 63 | (1 1/2") galvanized pipe plug | 194623 | 194623 | 194623 | 194623 | 194623 |
| 64 | (1 1/2") galvanized pipe union | 194127 | 194127 | 194127 | 194127 | 194127 |

# SBD MODELS 120 THRU 500A (continued)
# SERIES 110-111

| ITEM | PARTS DESCRIPTION | CGA SBD100199NES/A | CGA SBD100250NE/A | CGA SBD65251NE/A | CGA SBD100275NE/A | CGA SBD65305N |
|---|---|---|---|---|---|---|
| 1 | Flue Baffle | 193889 | 193595 | 193595 | 193945 | 193595 |
| 3 | Main Burner Orifice Bracket | 98044(5) | 98044(5) | 98044(7) | 98044(5) | 98044(7) |
| 4 | Main Burner | 98047 | 98047 | 98047 | 98047 | 192322 |
| 5 | Main Burner w/Pilot Bracket | 193873-1 | 193873-1 | 193873-1 | 193873-1 | 193873 |
| 6 | Pilot Burner, Natural | 193314-4 | 193314-4 | 193314-4 | 193314-4 | 193314-4 |
| 7 | Pilot Burner, LP | 193314-3 | 193314-3 | 193314-3 | 193314-3 | 193314-3 |
| **CLEANOUT ASSEMBLY** | | | | | | |
| 11 | Gasket | 99038 | 99038 | 99038 | 99038 | 99038 |
| 12 | Pressure Plate | 99037 | 99037 | 99037 | 99037 | 99037 |
| 13 | Screws, Self Tapping | 69852 | 69852 | 69852 | 69852 | 69852 |
| 17 | Control, Ignition Module | 193325 | 193325 | 193325 | 193325 | 193325 |
| 18 | Control, Dual w/ECO | 192828 | 192828 | 192828 | 192828 | 192828 |
| 19 | Cover, Cleanout | 181260 | 181260 | 181260 | 181260 | 181260 |
| 22a | Drafthood | 191790 | 193891 | 193891 | 193891 | 193891 |
| 22b | Damper Drive Assembly | 194484 | 194484 | 194484 | 194484 | 194484 |
| 22c | Harness Adapter | 194459 | 194459 | 194459 | 194459 | 194459 |
| **LABELS** | | | | | | |
| 41 | Manifold | 76244 | 76244 | 76244-2 | 76244-2 | 76244-2 |
| 42 | Instruction Manual | 195121-1 | 195121-1 | 195121-1 | 195121-1 | 195121-1 |
| 43 | Main Burner Orifice, Natural | 76243-32 | 76243-30 | 76243-35 | 76243-32 | 76243-32 |
| 44 | Main Burner Orifice, LP | 76243-48 | 76243-46 | 76243-51 | 76243-49 | 76243-49 |
| 45 | Anode Rod | 180618-42 | 43817-38 | 43817-38 | 43817-42 | 43817-38 |
| 47 | Transformer | 193444 | 193444 | 193444 | 193444 | 193444 |
| 48 | Pilot Tubing | 1417-60 | 1417-60 | 1417-60 | 1417-60 | 1417-60 |
| 49 | Inlet Tube | 193729 | 192626 | 193729 | 192626 | 193729 |
| 51 | Gas Valve Natural | 192827 | 192827 | 192827 | 192827 | 192827 |
| 52 | Gas Valve LP | 192827-1 | 192827-1 | 192827-1 | 192827-1 | 192827-1 |
| 55 | Switch Panel/Mounting Plate | 193448 | 193448 | 193448 | 193448 | 193448 |
| 56 | Off/On Switch | 193243 | 193243 | 193243 | 193243 | 193243 |
| 57 | Bushing | 193404 | 193404 | 193404 | 193404 | 193404 |
| 58 | Jumper Wire | 193476 | 193476 | 193476 | 193476 | 193476 |
| 59 | Control Box Panel | 193447 | 193447 | 193447 | 193447 | 193447 |
| 60 | Cover - Burner | 98185-2 | 98185-2 | 98185-2 | 98185-2 | 98185-2 |
| 61 | Hydro-Cannon | 195100 | 195198 | 195102 | 195098 | 195102 |
| 62 | (1 1/2") galvanized pipe cap | 193940 | 193940 | NA | 193940 | NA |
| 63 | (1 1/2") galvanized pipe plug | NA | NA | 194623-3 | NA | 194623-3 |
| 64 | (1 1/2") galvanized pipe union | NA | NA | 194127 | NA | 194127 |

# SBD MODELS 120 THRU 500A (continued)
# SERIES 110-111

| ITEM | PARTS DESCRIPTION | CGA SBD85365NE/A | CGA SBD100400NE/A | CGA SBD85500NE/A |
|---|---|---|---|---|
| 1 | Flue Baffle | 193945 | 193995 | 193995 |
| 3 | Main Burner Orifice Bracket | 098044(9) | 098044(9) | 098044(9) |
| 4 | Main Burner | 98047 | 192322 | 98047 |
| 5 | Main Burner w/Pilot Bracket | 193873-1 | 193873-1 | 193873-1 |
| 6 | Pilot Burner, Natural | 193314-4 | 193314-4 | 193314-4 |
| 7 | Pilot Burner, LP | 193314-3 | 193314-3 | 193314-3 |
| **CLEANOUT ASSEMBLY** | | | | |
| 11 | Gasket | 99038 | 99038 | 99038 |
| 12 | Pressure Plate | 99037 | 99037 | 99037 |
| 13 | Screws, Self Tapping | 69852 | 69852 | 69852 |
| 17 | Control, Ignition Module | 193325 | 193325 | 193325 |
| 18 | Control, Dual w/ECO | 192828 | 192828 | 192828 |
| 19 | Cover, Cleanout | 181260 | 181260 | 181260 |
| 22a | Drafthood | 193891 | 193891 | 193891 |
| 22b | Damper Drive Assembly | 194484 | 194484 | 194484 |
| 22c | Harness Adapter | 194459 | 194459 | 194459 |
| **LABELS** | | | | |
| 41 | Manifold | 76244-4 | 76244-4 | 76244-4 |
| 42 | Instruction Manual | 194027 | 194027 | 194027 |
| 43 | Main Burner Orifice, Natural | 76243-32 | 76243-31 | 76243-29 |
| 44 | Main Burner Orifice, LP | 76243-49 | 76243-48 | 76243-44 |
| 45 | Anode Rod | 180618-42 | 180618-42 | 180618-42 |
| 47 | Transformer | 193444 | 193444 | 193444 |
| 48 | Pilot Tubing | 1417-60 | 1417-60 | 1417-60 |
| 49 | Inlet Tube | 192626 | 192626 | 192626 |
| 51 | Gas Valve Natural | 192827-2 | 192827-2 | 193366 |
| 52 | Gas Valve LP | 192827-3 | 192827-3 | 193366-1 |
| 55 | Switch Panel/Mounting Plate | 193448 | 193448 | 193448 |
| 56 | Off/On Switch | 193243 | 193243 | 193243 |
| 57 | Bushing | 193404 | 193404 | 193404 |
| 58 | Jumper Wire | 193476 | 193476 | 193476 |
| 59 | Control Box Panel | 193447 | 193447 | 193447 |
| 60 | Cover - Burner | 98185-2 | 98185-2 | 98185-2 |
| 61 | Hydro-Cannon | 195102 | 105098 | 195098 |
| 62 | (1 1/2”) galvanized pipe cap | 193940 | 193940 | NA |
| 63 | (1 1/2”) galvanized pipe plug | 194623 | NA | 194623 |
| 64 | (1 1/2”) galvanized pipe union | 194127 | NA | 194127 |

# COMPONENT PART INFORMATION

| | NAME | SPECIFICATIONS | STATE PART NUMBERS |
|---|---|---|---|
| DUAL CONTROLLER | THERMOSTAT | 120-180$^{O}$ RANGE, $\pm$ 4$^{O}$, 5$^{O}$ DIFFERENTIAL, LIQUID FILLED, ANTI-STACKING | # 192828 |
| | HIGH LIMIT (ECO) | OPENS - 205$^{O}$ FIXED, MANUAL RESET BELOW 185$^{O}$ | |
| GAS VALVE | NATURAL GAS | SBD 120-400;24VAC, 60hz, .6A,.7" to 3.5" W.C., STEP OPEN | # 192827-2 |
| | | SBD 500; 24VAC, 60hz, Dual Gas Valve, STEP OPEN | # 193366-0 |
| | PROPANE GAS | SBD 120-400; 2.5 – 10" W.C. STEP OPEN | # 192827-3 |
| | | SBD 500; 24VAC, 60hz, Dual Gas Valve, STEP OPEN | # 193366-1 |
| INTERMITENT IGNITION DEVICE CONTROL | NATURAL GAS AND PROPANE GAS | 24 VAC, 50-60 HZ, .1A; .7 MICROAMP SIGNAL CONTINUOUS RETRIAL | 193325 |
| DAMPER | COMPLETE ASSEMBLY | | SEE PARTS LIST |
| | MOTOR | 24 VAC, 60 HZ, 120 RPM, 5 WATT (NOT 110, 111 SERIES) | #6521 |
| | P.C. BOARD W/RELAY | Service Switch (NOT 110, 111 SERIES) | #6522 |
| TRANSFORMER | | 120 V PRIMARY, 24 VAC SECONDARY, 40 VA, 50-60 HZ, CLASS 2 "B" | #193444 |

# SBD SERVICE CHECKLIST

**(This service checklist may be photo copied to assist with SBD service call.)**

This checklist is intended to aid the Service Agent in determining that the State SBD Water Heater has been properly installed and is operating correctly. Because the circumstances of each installation may vary greatly, it is not intended to be an all-inclusive list of the problems that the Service Agent may encounter. Any item checked "no" on this list should be thoroughly investigated and corrective action taken, if required.

SERVICE AGENT _____ INSTALLATION DATE _____
MODEL NUMBER _____ SERVICE DATE _____
SERIAL NUMBER _____ LOCATION ADDRESS _____
_____
_____

GAS TYPE - CHECK ONE

NATURAL _____ PHONE( )_____-_____
PROPANE

I. Check Clearances (circle answer)
A. Are exterior clearances adequate? yes no
B. Are interior clearances adequate? yes no

Comments:

II. Check Makeup Air Requirements
A. Is the quantity of make-up air adequate per the National Fuel Gas Code? yes no

Comments:

B. Is the quality of make-up air adequate? yes no

Comments:

III. Gas Pressure (fill in blank)
A. Supply gas pressure _____ inches of W.C.
B. Manifold gas pressure (main burner) _____ inches of W.C.

Comments:

IV. Venting (check)
A. Properly sized per the National Fuel Gas Code? yes no
B. Does the installation have mechanically assisted venting? yes no

If so, is it operational? yes no

Comments:

V. WATER PIPING

| | | |
|---|---|---|
| Is the system properly sized? | yes | no |
| Is the system properly installed? | yes | no |
| Are there any water leaks? | yes | no |
| Does the installation have a recirculating system? | yes | no |
| If so, is it operational? | yes | no |

VI. PROPER SEQUENCE OF OPERATION

| | | |
|---|---|---|
| During standby does damper close on standby? | yes | no |
| During standby is pilot flame off? | yes | no |
| On a call for heat does thermostat close? | yes | no |
| On a call for heat does damper open completely? | yes | no |
| Does sparking begin at pilot? | yes | no |
| Is pilot flame established? | yes | no |
| If so, does sparking stop? | yes | no |
| Does main burner ignite? | yes | no |
| Does the thermostat satisfy? | yes | no |
| Does damper close? | yes | no |

Comments:

VII. SAFETY

A. Gas

| | | |
|---|---|---|
| Does pilot flame prove before main burner ignites? | yes | no |
| Does damper blade fully open before ignition sequence occurs? | yes | no |
| Is burner cover plate in place? | yes | no |
| Is burner floor shield in place? | yes | no |
| Does IID lockout occur after 30 sec. trial for ignition? (Propane models only) | yes | no |

B. Water Temperature

| | | |
|---|---|---|
| Is the thermostat adjusted to the lowest acceptable temperature? | yes | no |
| Does the installation have a mixing valve? | yes | no |
| If so, is it operational? | yes | no |
| What is the outlet temperature of the mixing valve? _____ | | |
| Is a properly rated temperature and pressure relief valve installed? | yes | no |

C. Electrical

| | | |
|---|---|---|
| Is the 120 VAC electrical power supply properly wired? | yes | no |
| Are all the SBD control covers in place? | yes | no |
| Is the 120 VAC electrical power supply properly fused? | yes | no |

D. Flammables

| | | |
|---|---|---|
| Are flammable materials located in the area of the water heater? | yes | no |
| Are flammable vapors located in the area of the water heater? | yes | no |

***(This service checklist may be photo copied to assist with SBD service call.)***

# COMMENTS

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Prepared by the State Water Heaters Training Department.
For additional technical information call 800-365-0577.

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