

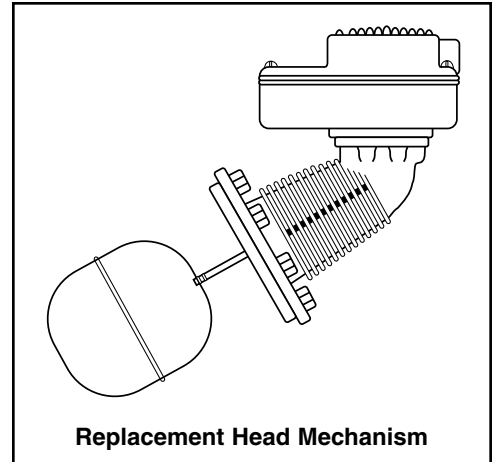


## Replacement Head Mechanism



**Snap Switch**  
**Models:**

- 150S-HD
- 150S-M-HD
- 150S-MD-HD
- 150S-M-MD-HD
- 158S-HD
- 158S-M-HD
- 158S-MD-HD
- 158S-M-MD-HD
- 159S-HD



Replacement head mechanisms can be installed without disturbing existing equalizing connections or disassembly of components, making repair simple and easy.

### **WARNING**

	<ul style="list-style-type: none"> <li>• Before using this product read and understand instructions.</li> <li>• Save these instructions for future reference.</li> </ul>
	<ul style="list-style-type: none"> <li>• All work must be performed by qualified personnel trained in the proper application, installation, and maintenance of plumbing, steam, and electrical equipment and/or systems in accordance with all applicable codes and ordinances.</li> <li>• To prevent serious burns, the boiler must be cooled to 80°F (27°C) and the pressure must be 0 psi (0 bar) before servicing.</li> <li>• To prevent electrical shock, turn off the electrical power before making electrical connections.</li> </ul>
	<ul style="list-style-type: none"> <li>• This low water cut-off must be installed in series with all other limit and operating controls installed on the boiler. After installation, check for proper operation of all of the limit and operating controls, before leaving the site.</li> <li>• We recommend that secondary (redundant) Low Water Cut-Off controls be installed on all steam boilers with heat input greater than 400,000 BTU/hour or operating above 15 psi of steam pressure. At least two controls should be connected in series with the burner control circuit to provide safety redundancy protection should the boiler experience a low water condition. Moreover, at each annual outage, the low water cut-offs should be dismantled, inspected, cleaned, and checked for proper calibration and performance.</li> </ul>
	<ul style="list-style-type: none"> <li>• To prevent serious personal injury from steam blow down, connect a drain pipe to the control opening to avoid exposure to steam discharge.</li> </ul>
	<ul style="list-style-type: none"> <li>• To prevent a fire, do not use this low water cut-off to switch currents over 7.4A, 1/3 Hp at 120 VAC or 3.7A, 1/3 Hp at 240 VAC, unless a starter or relay is used in conjunction with it.</li> </ul> <p>Failure to follow this warning could cause property damage, personal injury or death.</p>

# OPERATION

**Maximum Pressure:** 150 psi (10.5 kg/cm<sup>2</sup>)

## Electrical Ratings

Voltage	Pump Circuit Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	345 VA at 120 or 240 VAC
240 VAC	3.7	22.2	

Alarm Circuit Rating	
Voltage	Amps
120 VAC	1
240 VAC	1/2

Motor Horsepower	
Voltage	Hp
120 VAC	1/3
240 VAC	1/3

**Enclosure rating:** NEMA 1 General Purpose

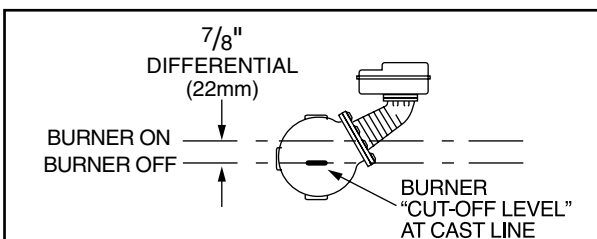
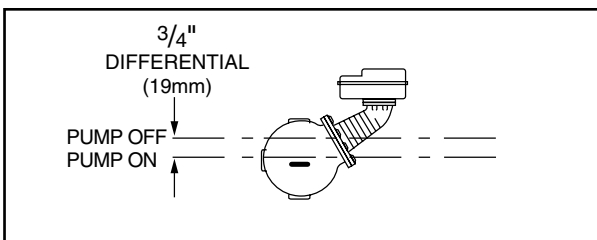
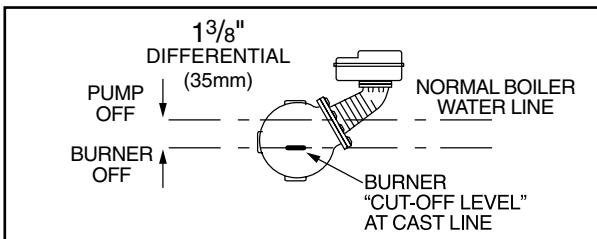
## Settings and Differential Pressures

Values are  $\pm 1/8"$  (3.2mm).

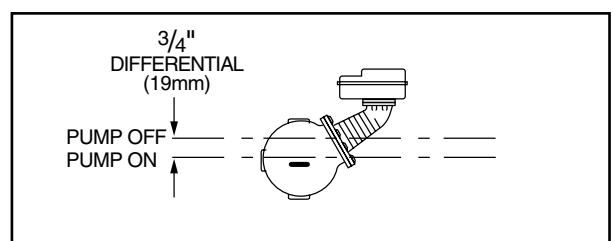
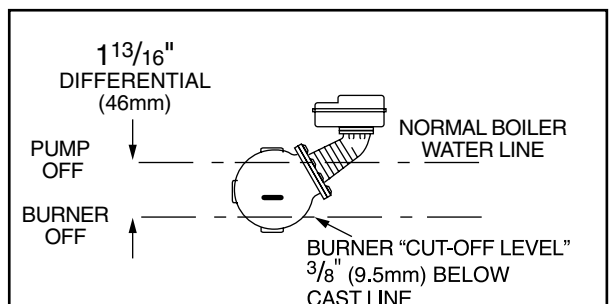
Series 150S and 157S			
Pressure	Setting	Approximate Distance Above Cast Line In. (mm)	Differential In. (mm)
<b>0 psi (0 kg/cm<sup>2</sup>)</b>	Pump Off	15/16 (24)	5/16 (8)
	Pump On	5/8 (16)	
	Burner On	5/8 (16)	3/8 (16)
	Burner Off	1/4 (6.4)	
<b>150 psi (10.5 kg/cm<sup>2</sup>)</b>	Pump Off	13/8 (41)	3/4 (19)
	Pump On	5/8 (16)	
	Burner On	7/8 (22)	7/8 (22)
	Burner Off	0 (0)	

Model 150S-MD and 157S-MD			
Pressure	Setting	Approximate Distance Above Cast Line In. (mm)	Differential In. (mm)
<b>0 psi (0 kg/cm<sup>2</sup>)</b>	Pump Off	15/16 (24)	3/8 (16)
	Pump On	9/16 (14)	
	Burner Off	0 (0)	N/A
<b>150 psi (10.5 kg/cm<sup>2</sup>)</b>	Pump Off	17/16 (37)	3/4 (19)
	Pump On	11/16 (17)	
	Burner Off	- 3/8 (-16)	N/A

### 150 psi (10.5 kg/cm<sup>2</sup>) Levels



### 150 psi (10.5 kg/cm<sup>2</sup>) Levels



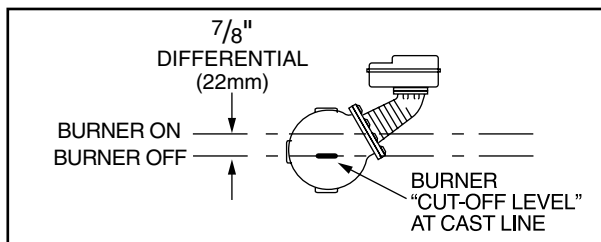
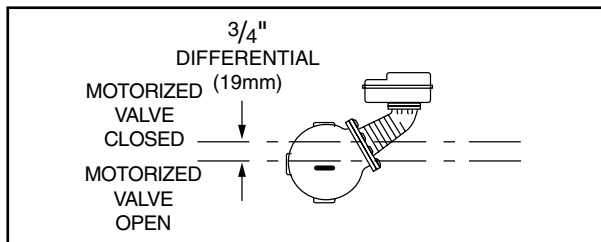
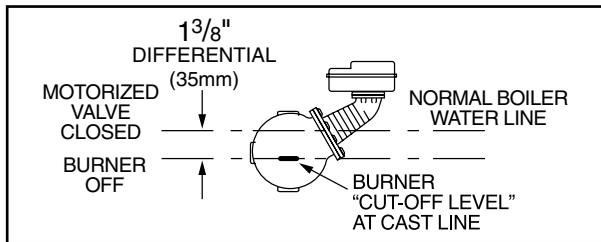
## Settings and Differential Pressures (continued)

Values are  $\pm 1/8"$  (3.2mm).

### Model 158S

Pressure	Setting	Approximate Distance Above Cast Line In. (mm)	Differential In. (mm)
<b>0 psi (0 kg/cm<sup>2</sup>)</b>	Motorized Valve Closed	15/16 (24)	5/16 (8)
	Motorized Valve Open	5/8 (16)	
	Burner On	5/8 (16)	3/8 (16)
	Burner Off	1/4 (6.4)	
<b>150 psi (10.5 kg/cm<sup>2</sup>)</b>	Motorized Valve Closed	1 3/8 (41)	3/4 (19)
	Motorized Valve Open	5/8 (16)	
	Burner On	7/8 (22)	7/8 (22)
	Burner Off	0 (0)	

### 150 psi (10.5 kg/cm<sup>2</sup>) Levels

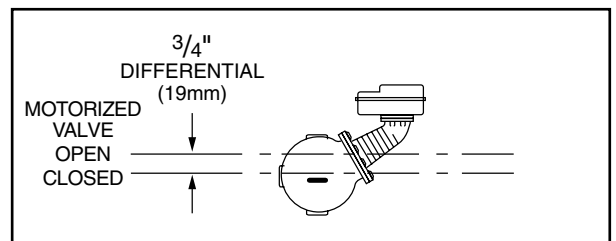
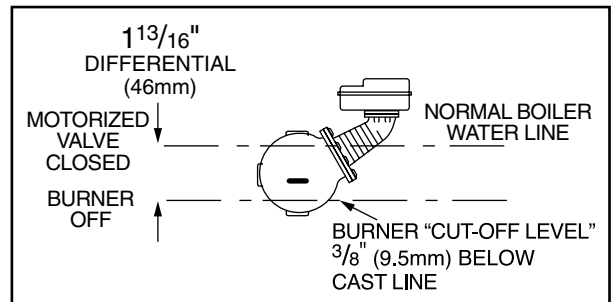


NOTE: Due to the slower operation of some motorized valves, complete valve opening or closing will occur at slightly different levels than indicated above.

### Model 158S-MD

Pressure	Setting	Approximate Distance Above Cast Line In. (mm)	Differential In. (mm)
<b>0 psi (0 kg/cm<sup>2</sup>)</b>	Pump Off	15/16 (24)	3/8 (16)
	Pump On	9/16 (14)	
	Burner Off	0 (0)	N/A
<b>150 psi (10.5 kg/cm<sup>2</sup>)</b>	Pump Off	1 7/16 (37)	3/4 (19)
	Pump On	11/16 (17)	
	Burner Off	- 3/8 (-16)	N/A

### 150 psi (10.5 kg/cm<sup>2</sup>) Levels



NOTE: Due to the slower operation of some motorized valves, complete valve opening or closing will occur at slightly different levels than indicated above.

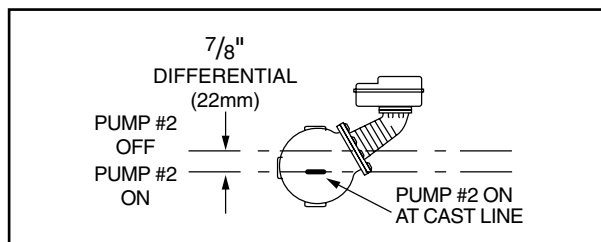
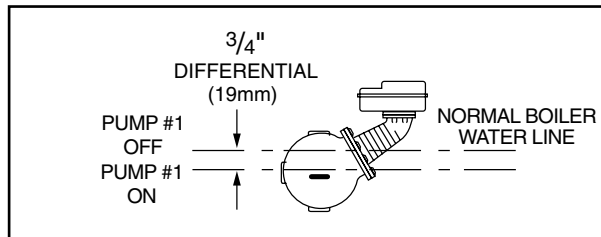
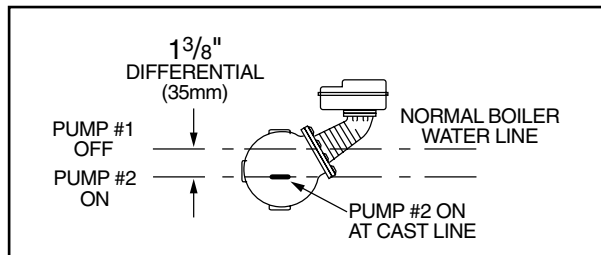
## Settings and Differential Pressures (continued)

Values are  $\pm 1/8"$  (3.2mm).

### Model 159S

Pressure	Setting	Approximate Distance Above Cast Line In. (mm)	Differential In. (mm)
<b>0 psi</b> <b>(0 kg/cm<sup>2</sup>)</b>	Pump #1 Off	$15/16$ (24)	$5/16$ (8)
	Pump #1 On	$5/8$ (16)	
	Pump #2 Off	$5/8$ (16)	$3/8$ (16)
	Pump #2 On	$1/4$ (6.4)	
<b>150 psi</b> <b>(10.5 kg/cm<sup>2</sup>)</b>	Pump #1 Off	$13/8$ (41)	$3/4$ (19)
	Pump #1 On	$5/8$ (16)	
	Pump #2 Off	$7/8$ (22)	$7/8$ (22)
	Pump #2 On	0 (0)	

### 150 psi (10.5 kg/cm<sup>2</sup>) Levels



# INSTALLATION

## TOOLS NEEDED:

One (1) pipe wrench, one (1) flathead screwdriver, one (1) scraper, and one (1) 9/16" socket or wrench.

## STEP 1 - Preparation

### WARNING

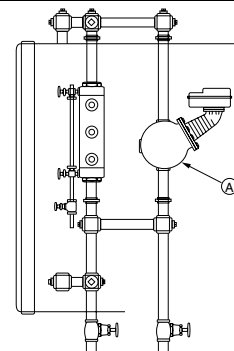


- To prevent serious burns, the boiler must be cooled to 80°F (27°C) and the pressure must be 0 psi (0 bar) before servicing.

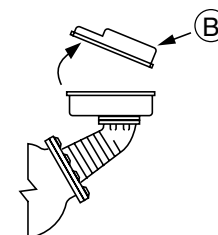


- To prevent electrical shock, turn off the electrical power before disconnecting or making electrical connections. Failure to follow this warning could cause property damage, personal injury or death.

- a. Drain water in the boiler to a level which is below the float chamber (A). Allow the boiler to cool to 80°F (27°C) and release the boiler pressure to 0 psi (0 bar).



- b. Using a flathead screwdriver, remove the junction box cover (B). Disconnect, mark, and remove the supply wires and conduit connections.

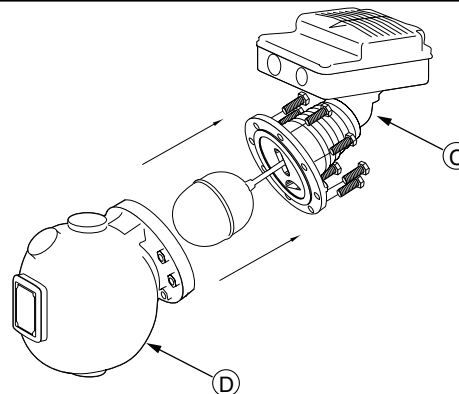


### CAUTION

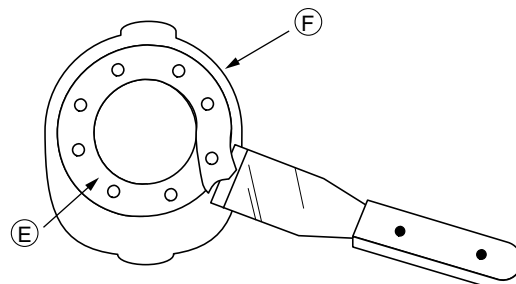
There may be more than one source of power to the boiler.



- c. Remove the existing head mechanism (C) from the body (D).

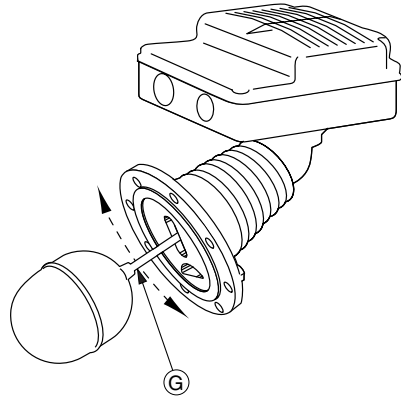


- d. Using a scraper, remove the old gasket (E). Clean all debris from the float chamber. The gasket sealing surface (F) must be smooth and clean.

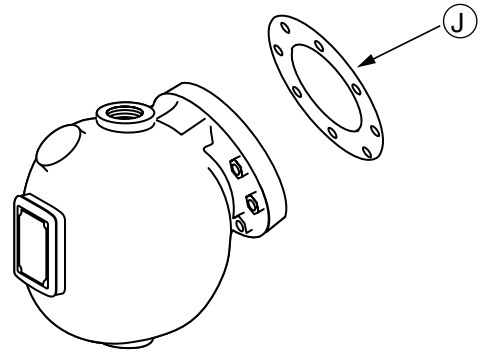


## STEP 2 - Installing the Replacement Head Mechanism

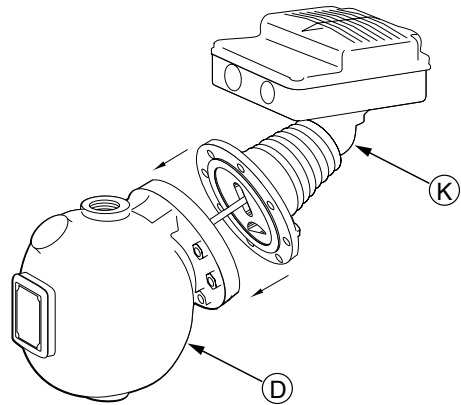
- a. Carefully remove the new replacement head mechanism from the carton. Handle it carefully to prevent damage to the float rod (G).



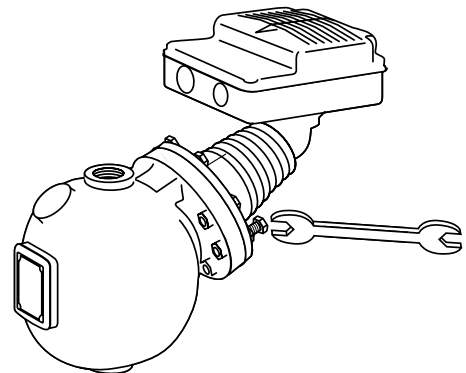
- b. Align the bolt holes of the new head gasket (J) on the sealing surface of the control body.



- c. Install the new replacement head (K) on the body (D) by guiding the float into the control body and aligning the bolt holes.



- d. Using a wrench, insert the eight (8) bolts and tighten them to approximately 14-20 ft•lb (19-27 N•m) in an alternating star pattern.



## STEP 3 - Electrical Wiring

### WARNING



- To prevent a fire, do not use this product to switch currents over 7.4A, 1/3 Hp at 120 VAC or 3.7A, 1/3 Hp at 240 VAC, unless a starter or relay is used in conjunction with it.
- To prevent electrical shock, turn off the electrical power before making electrical connections.
- This low water cut-off must be installed in series with all other limit and operating controls installed on the boiler. After installation, check for proper operation of all of the limit and operating controls, before leaving the site.



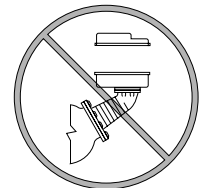
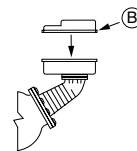
- Modification of the switch assembly before or after installation could cause damage to the boiler and/or boiler system.  
Failure to follow this warning could cause electrical shock, an explosion and/or a fire, which could result in property damage, personal injury or death.

- a. Reconnect conduit and wires which were disconnected prior to head removal.

**IMPORTANT:** There must be a minimum space of 1/2" (13mm) between connector fittings and electrical live metal parts.

- b. Re-attach the junction box cover (B).

**Note:**  
Cover must be installed correctly as shown



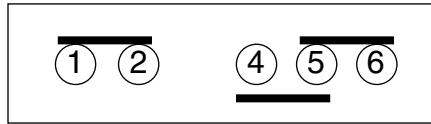
## Switch Operation

### For all Models except 158S and 159S

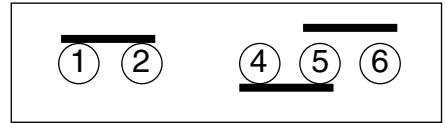
Boiler feed pump off,  
burner on, alarm off.



Boiler feed pump on,  
burner on, alarm off.

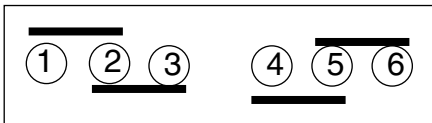


Boiler feed pump on,  
burner off, alarm on.

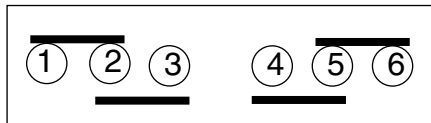


### For Model 158S

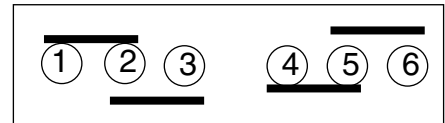
Motorized valve closed,  
burner on, alarm off.



Motorized valve open,  
burner on, alarm off.



Motorized valve open,  
burner off, alarm on.



### For Model 159S

Pump #1 off,  
pump #2 off.



Pump #1 on,  
pump #2 off.



Pump #1 on,  
pump #2 on.



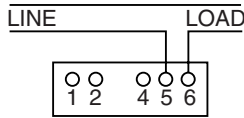


# WIRING DIAGRAMS

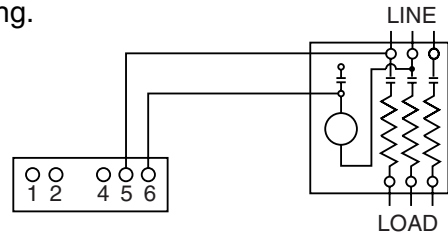
For Motorized Valves, refer to the valve manufacturer's wiring instructions.

## Low Water Cut-Off Only

1. Main Line Switch - For burner circuits within the switch's electrical rating.
2. Pilot Switch - To holding coil of a starter when the burner circuit exceeds the switch's electrical rating.



OR



## Pump Control Only

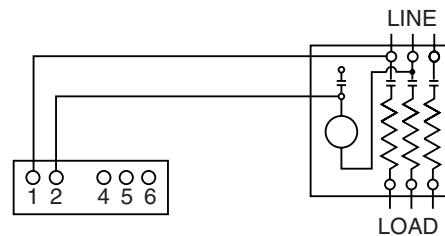
1. Install a starter or relay in pump control circuit, as shown, to prevent damage to snap switch and help insure proper switch/control operation. Failure to do so may shorten the life of the switch when actual amperage exceeds switch rating.
2. Connect wires from holding coil of pump starter or relay to terminals 1 and 2 as shown.

### NOTE

**For Model 159S, use terminals 5 and 6 from starter or relay for pump #2.**

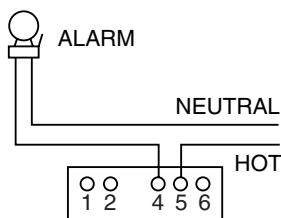
### NOTE

**To help insure most effective operation, balance boiler feed pump(s) to deliver required water feed rate to match boiler steaming requirements.**

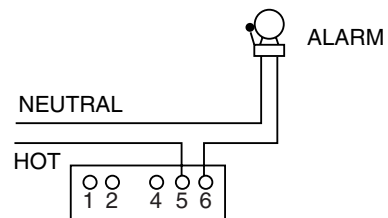


## Alarm Circuit Only

1. Low Water Alarm
2. High Water Alarm

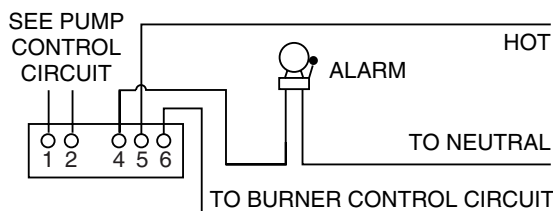


OR

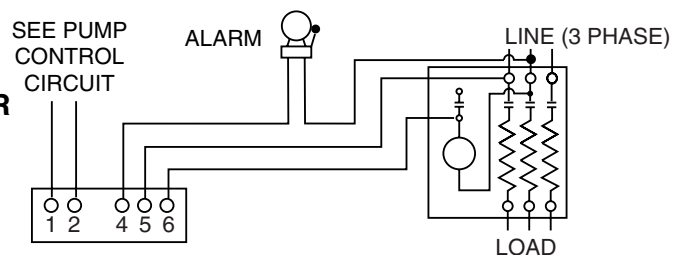


## Combination Pump Control, Low Water Cut-Off and Alarm

1. Main Line Switch - For burner circuits within the switch's electrical rating.
2. Pilot Switch - To holding coil of a starter when the burner circuit exceeds the switch's electrical rating.



OR



## STEP 4 - Testing

This control is factory calibrated for specific level settings as shown on pages 2-4 in the "Operation" section.

The following testing procedure is only meant to serve as a verification of proper operating sequence.

**IMPORTANT:** Follow the boiler manufacturer's start-up and operating instructions along with all applicable codes and ordinances.

- a. Turn on the electric power to the boiler. The pump should go on and the burner must remain off.

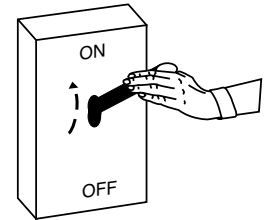
### WARNING



If the burner comes on, immediately turn the boiler off and make the necessary corrections.



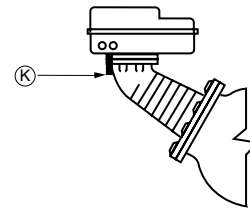
Failure to follow this warning could cause an explosion or fire and result in property damage, personal injury or death.



- b. The boiler should begin to fill with water. As the water level rises in the sight glass, the burner should turn on and then the pump should turn off at appropriate levels. For manual reset models, press the reset button (K) when the water reaches appropriate level. If the burner does not turn on or pump turn off at appropriate levels, immediately turn off the boiler and make necessary corrections.

### Location of Manual Reset Button

#### Snap Switch Models



### CAUTION



To prevent serious personal injury from steam pipe blow down, connect a drain pipe to the control opening to avoid exposure to steam discharge.

Failure to follow this caution could cause personal injury.

- c. Blow down the control when the water in the boiler is at its normal level and the burner is on. Follow Blow Down Procedure found in Maintenance Section on page 11 of these instructions.

**INSTALLATION COMPLETE**

# MAINTENANCE

## SCHEDULE:

Blow down control as follows when boiler is in operation.

- Daily if operating pressure is above 15 psi.
- Weekly if operating pressure is below 15 psi.

**NOTE**

More frequent blow-down may be necessary due to dirty boiler water and/or local codes.

- **Remove head assembly and inspect water side components annually.** Replace head assembly if any of the internal components are worn, corroded or damaged or if control no longer operates properly.
- **Inspect the float chamber and equalizing piping annually.** Remove all sediment and debris.

**NOTE**

The control may need to be inspected and cleaned more frequently on systems where there is the potential of excessive scale or sludge build-up. This includes systems:

- With high raw water make-up
- With no condensate return
- With untreated boiler water
- Where significant changes have been made to the boiler-water chemical treatment process
- With oil in the boiler water

### Replace head mechanism every 5 years.

More frequent replacement may be required when severe conditions exist.

### Replacement parts are available from your local authorized McDonnell & Miller Distributor.

The use of parts or components other than those manufactured by McDonnell & Miller will void all warranties and may affect the units compliance with listings or regulating agencies.

# BLOW DOWN PROCEDURE:

<b>CAUTION</b>	
	<p>To prevent serious personal injury from steam pipe blow down, connect a drain pipe to the control opening to avoid exposure to steam discharge.</p> <p>Failure to follow this caution could cause personal injury.</p>

When blowing down a control at pressure, the blow down valves should be opened slowly. The piping needs to be warmed up and stagnant water in the drain piping needs to be pushed out. Suddenly opening a blow down valve causes steam to condense, which can create water hammer. Damage to components can occur when water hammer occurs due to improper blow down piping. For these reasons, McDonnell & Miller recommends a dual valve blow-down system for each control.

Blow down the control when the water in the boiler is at its normal level and the burner is on.

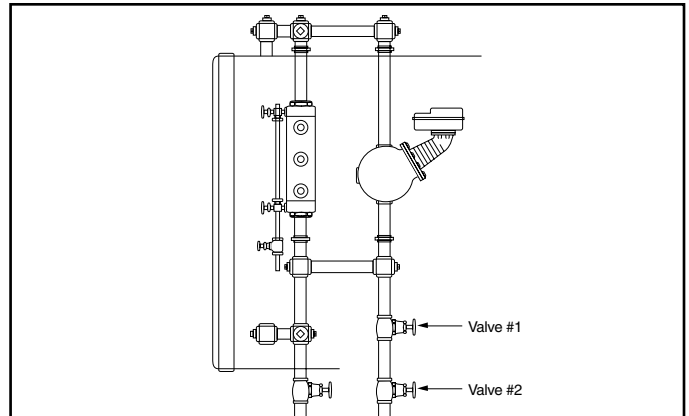
**NOTE:** Refer to page 2 for switch operating points.

- Open upper valve (#1)
- Slowly open the lower valve (#2)
- Water in the sight glass should lower.
- As the water in the sight glass lowers, the pump should turn on.
- As the water continues to lower in the sight glass, the burner should turn off.
- Slowly close the lower valve (#2).
- Close the upper valve (#1)
- The water level in the sight glass should rise, first turning on the burner and then turning off the pump.

**NOTE:** On manual reset models, the reset button will need to be pressed after the water level has been restored before the burner will operate.

**NOTE**

If this sequence of operation does not occur as described, immediately close all the valves, turn off the boiler and correct the problem. Inspection/cleaning of the float mechanism may be required to determine why the control was not working properly. Retest the control after the problem has been identified and corrected.



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