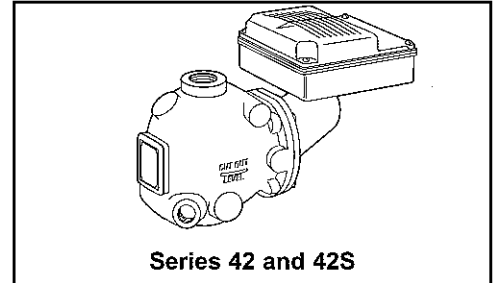




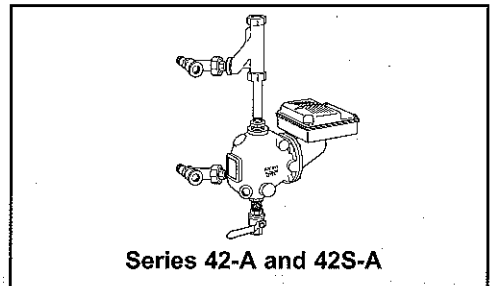
Series 42
(Mercury Switch)

Series 42S
(Snap Switch)

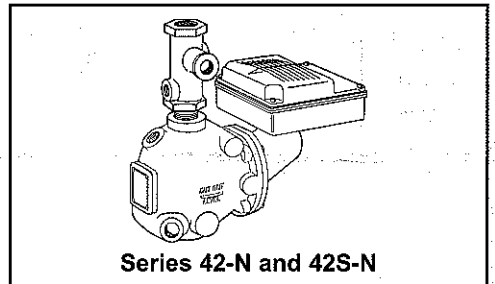
Low Water Cut-Off/Pump Controller
For Steam Boilers



Series 42 and 42S



Series 42-A and 42S-A

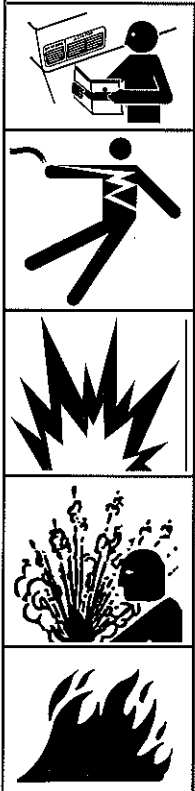


Series 42-N and 42S-N

Typical Applications:

- Pump controller/low water fuel cut-off for steam boilers
- Low water cut-off

⚠ WARNING



- Before using this product read and understand instructions.
 - Save these instructions for future reference
 - 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.
 - 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 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.
 - 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.
 - To prevent serious personal injury from steam blow down, connect a drain pipe to the control opening to avoid exposure to steam discharge.
 - 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.
- Failure to follow this warning could cause property damage, personal injury or death.

OPERATION

Maximum Pressure: 50 psi (3.5 kg/cm²)

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	

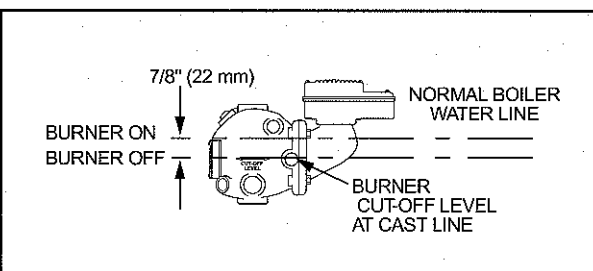
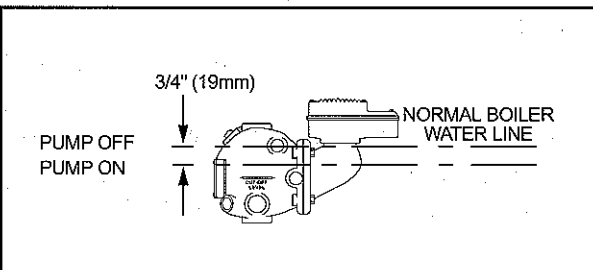
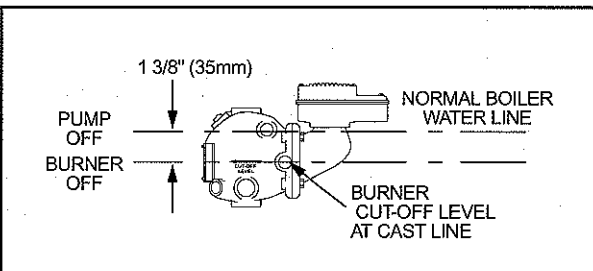
Motor Horsepower	
Voltage	Hp
120 VAC	1/3
240 VAC	1/3

Settings and Differential Pressures

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

Series 42 and 42S

Pressure	Setting	Approximate Distance Above Cast Line In. (mm)	Differential In. (mm)
50 psi (3.5 kg/cm ²)	Pump Off	1 ³ / ₈ (35)	3/4 (19)
	Pump On	5/8 (16)	
	Burner On	7/8 (22)	7/8 (22)
	Burner Off	0 (0)	



INSTALLATION –

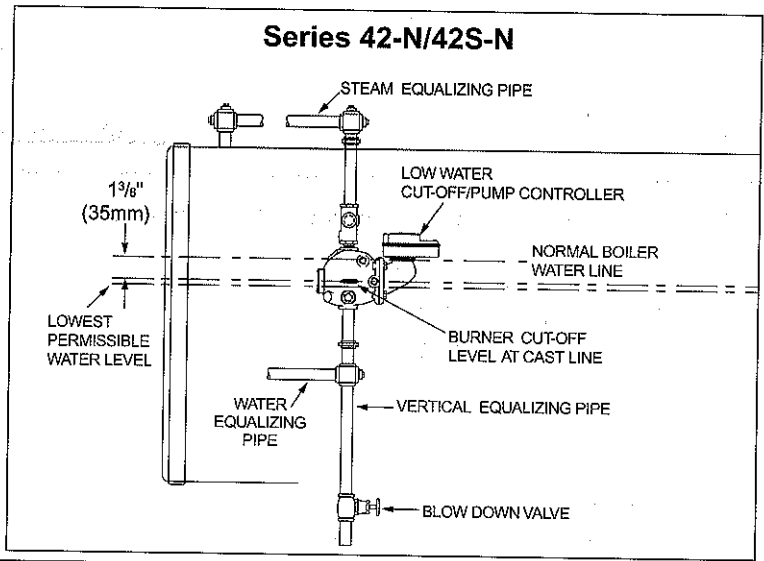
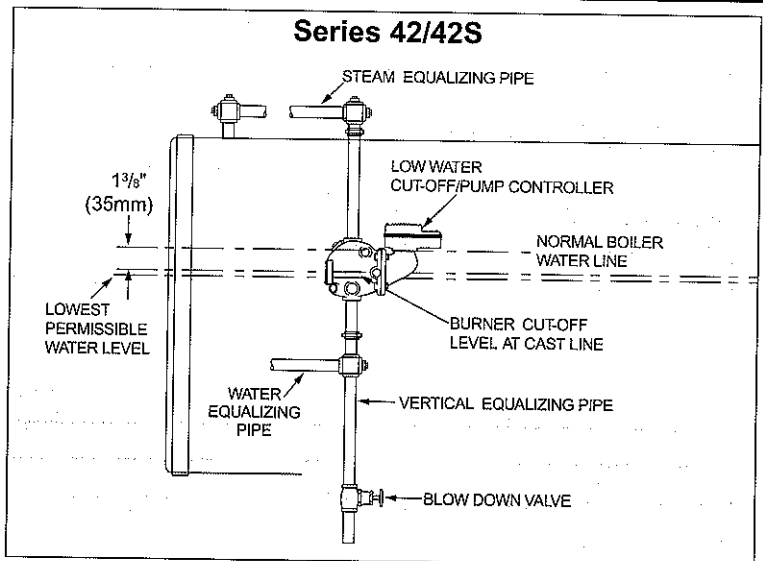
TOOLS NEEDED:

Two (2) pipe wrenches, one (1) flathead screw driver, and pipe sealing compound.

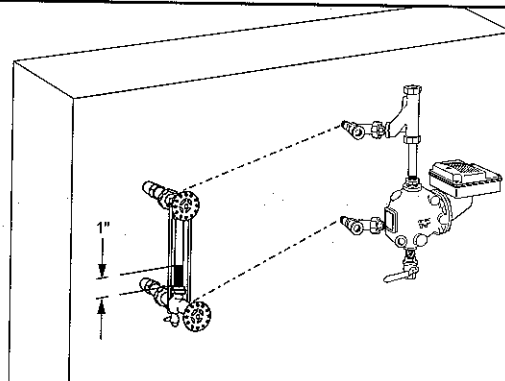
IMPORTANT: Follow the boiler manufacturer's instructions along with all applicable codes and ordinances for piping, blow down valve and water gauge glass requirements.

STEP 1 - Determine the Elevation at Which the Low Water Cut-Off/Pump Controller Must be Installed

The 42/42S and 42-N/42S-N controls are installed so that the horizontal cast line on the body is $1\frac{3}{8}$ " (35mm) below the boiler's normal water level, but not lower than the lowest, safe permissible water level, as determined by the boiler manufacturer.

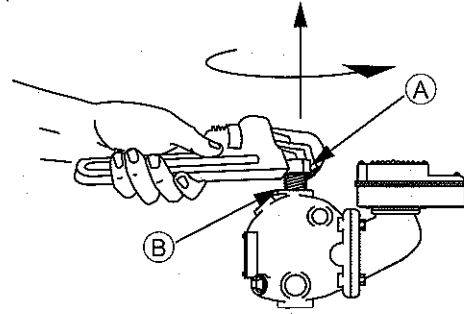


The 42-A/42S-A controls are installed in boiler's gauge glass tapings. The horizontal cast line should be approximately 1" (25 mm) above the bottom of the glass. Verify that this level is not below the lowest, safe permissible water level, as determined by the boiler manufacturer.



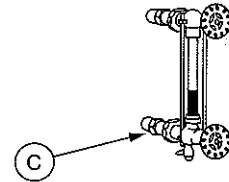
STEP 2 - Installation

- a. Using a pipe wrench, unscrew shipping block (A) from upper 1" NPT tapping (B) of the control body.

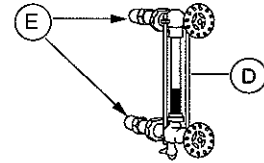


For 42-A/42S-A Control

- a. Drain the water in the boiler until the level falls below the lower gauge glass connection (C). Allow the boiler to cool to 80°F (27 °C) and allow the pressure to release to 0 psi (0 bar).



- b. Remove the water glass (D) and gauge glass connections (E) from the boiler.



- c. Determine the position of the black 'Y' casting (H).

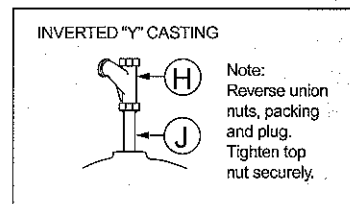
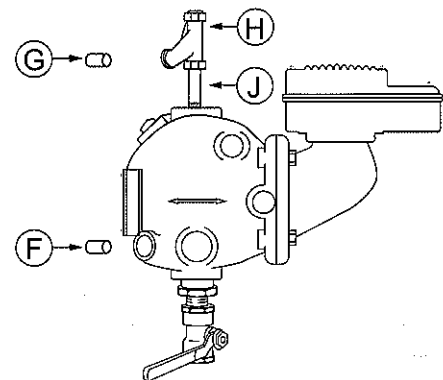
If gauge glass tapings (F) and (G) are less than 10 5/8" (270 mm) apart, install the black 'Y' casting (H) as depicted in the diagram to the top right.

OR

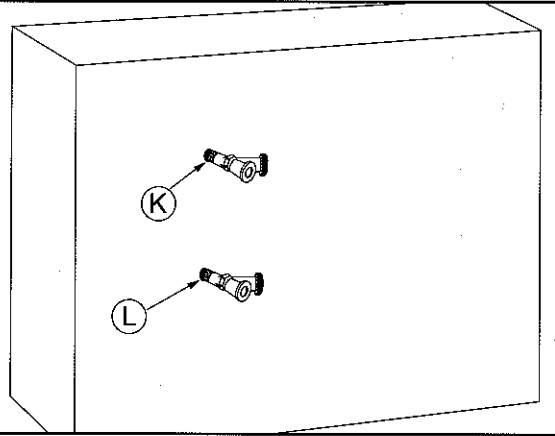
If gauge glass tapings (F) and (G) are greater than 10 5/8" (270 mm) apart, invert the black 'Y' casting (H) as depicted in the diagram to the bottom right.

OR

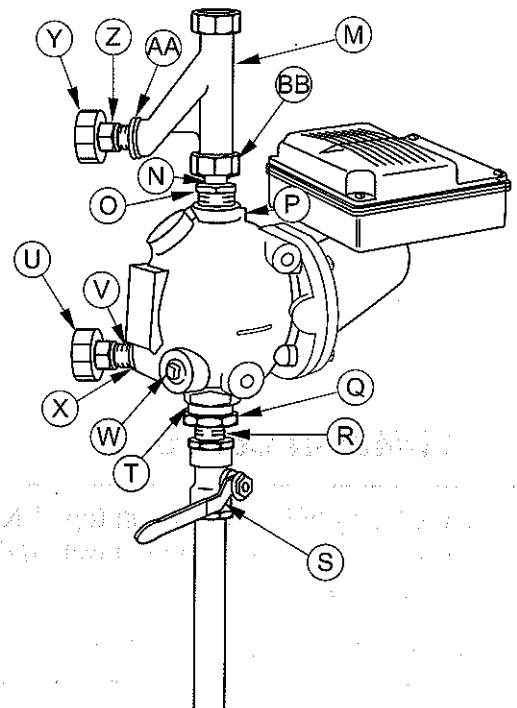
If gauge glass tapings (F) and (G) are greater than 14" (356 mm) apart, invert the black 'Y' casting (H) as depicted in the diagram to the bottom right and install a longer brass nipple (J).



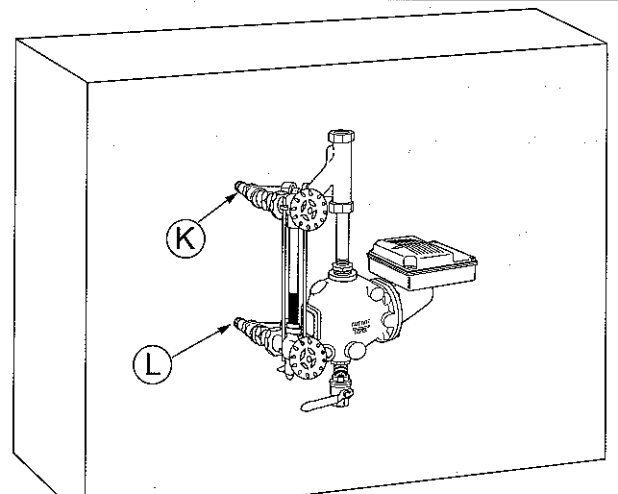
- d. • Install upper 'Y' fitting (K) into upper 1/2" NPT gauge glass tapping on boiler.
- Install lower 'Y' fitting (L) into 1/2" NPT gauge glass tapping on boiler.



- e. • Screw reducer bushing (O) and nipple (N) into top 1" NPT tapping (P).
- Screw reducer bushing (Q), nipple (R) and blow-off valve (S) into bottom 1" NPT tapping (T).
- Screw lower union tailpiece (V) with nut (U) into either 1/2" NPT lower tapping (W, X). Screw 1/2" NPT pipe plug into unused lower tapping.
- Screw upper union tailpiece (Z) with nut (Y) into 'Y' casting (M) 1/2" NPT tapping (AA).
- Slide 'Y' casting (M) and compression nut (BB) over nipple (N).
- Connect upper and lower union nuts (U, Y) to 'Y' fittings (K, L) installed in boiler gauge glass tapings.
Note: 'Y' fitting (M) will have to be moved up or down nipple (N) to mate union halves.
- Tighten compression nut (BB).

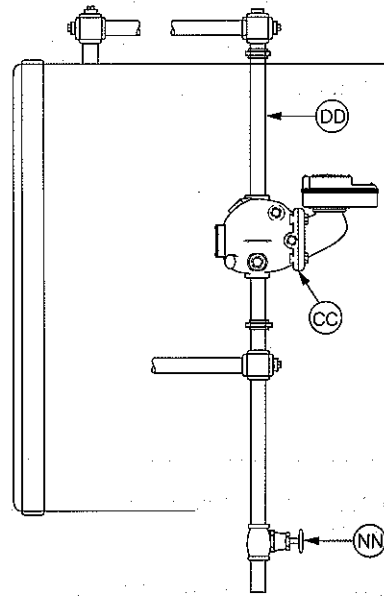


- f. Reinstall gauge glass and trim to 'Y' fittings (K, L).
Note: Make sure gauge glass valves are fully open.



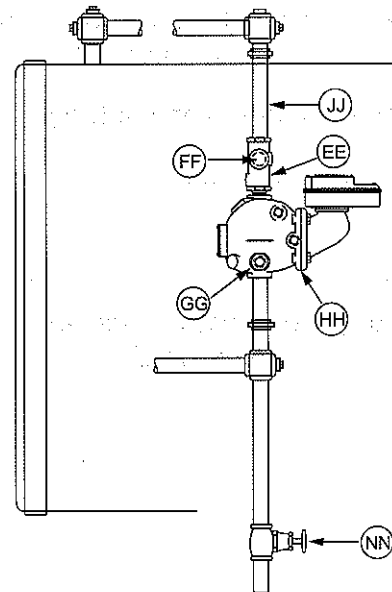
For 42/42S Control

- a. Mount and pipe control (CC) on vertical equalizing pipes (DD) at the required elevation as determined in Step 1.
- b. Install a full ported ball valve (NN) directly below the lower cross of the water (lower) equalizing line.



For 42-N/42S-N Control

- a. Install fitting (EE) provided in top 1" NPT tapping. Orient 1/2" NPT tapping (FF) with 1/2" tapping on control (GG).
- b. Mount and pipe control (HH) on vertical equalizing pipes (JJ) at the required elevation as determined in Step 1.
- c. Install gauge glass and other trim such as pressure gauges or pressure controls following manufacturer's instructions. **Note:** These items are not provided and must be purchased separately.
- d. Install pipe plugs in all unused tappings on control body and fittings.
- e. Install a full ported ball valve (NN) directly below the lower cross of the water (lower) equalizing line.



STEP 3 - Electrical Wiring

WARNING



- 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.

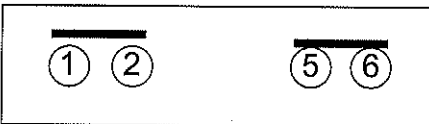


- Modification of the switch assembly before or after installation could cause damage to the boiler and/or boiler system.

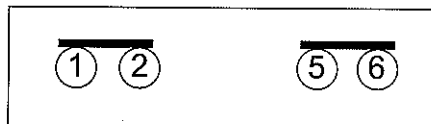
Failure to follow this warning could cause electrical shock, an explosion and/or a fire, which could result in property damage, personal injury or death.

Switch Operation

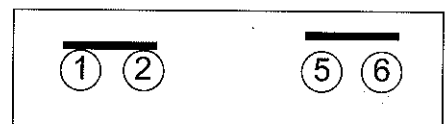
Boiler feed pump off,
burner on.



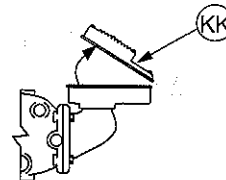
Boiler feed pump on,
burner on.



Boiler feed pump on,
burner off.



- a. Using a flathead screwdriver, remove the junction box cover (KK).

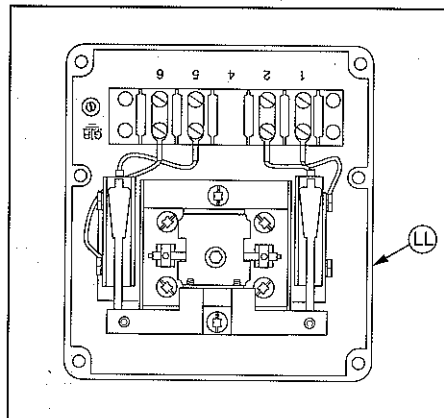


- b. Following the appropriate wiring diagram, (refer to page 8) based on your application requirements, and using BX armored cable or Thinwall electrical metal tubing connector fittings, make electrical connections to the junction box (LL).

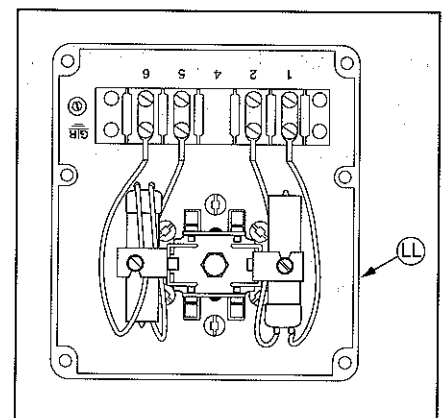
Note: Follow local codes and standards when selecting the types of electrical fittings and conduit to connect to control.

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

**Snap Switches
(Series 42S)**



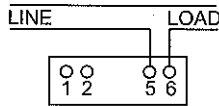
**Mercury Switches
(Series 42)**



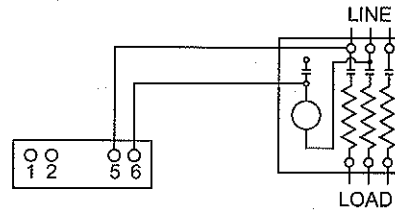
WIRING DIAGRAMS

Low Water Cut-Off Only

1. Main Line Switch - For burner circuits within the switch's electrical rating.



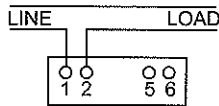
2. Pilot Switch - To holding coil of a starter when the burner circuit exceeds the switch's electrical rating.



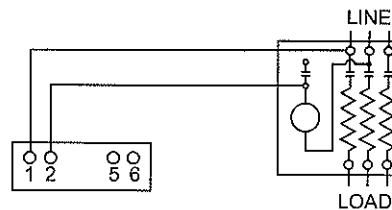
OR

Pump Control Only

1. Main Line Switch - For pump motors within the switch's electrical rating.



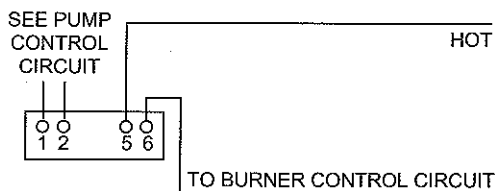
2. Pilot Switch - To holding coil of a starter when the pump circuit exceeds the switch's electrical rating.



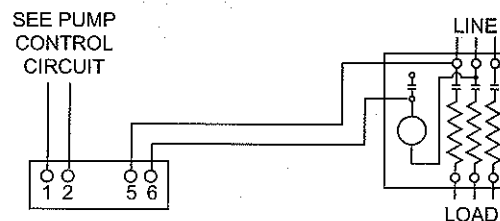
OR

Combination Pump Control, Low Water Cut-Off and Alarm

1. Main Line Switch - For burner circuits within the switch's electrical rating.

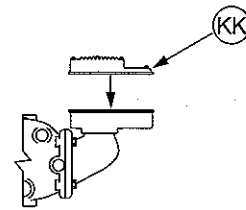


2. Pilot Switch - To holding coil of a starter when the burner circuit exceeds the switch's electrical rating.



OR

c. Re-attach the junction box cover (KK).



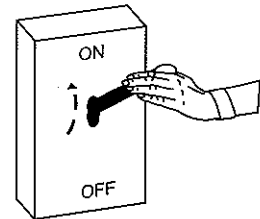
STEP 4 - Testing

This control is factory calibrated for specific applications. The following testing procedure is only meant to serve as a verification of proper operating sequence.

Dimensions provided are typical for a boiler not being fired and/or not at pressure. Actual operating ranges are shown on page 2 in the "Operation" section.

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. With the boiler empty the pump should go on and the burner must remain off.



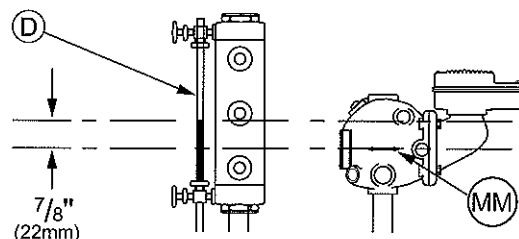
WARNING



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

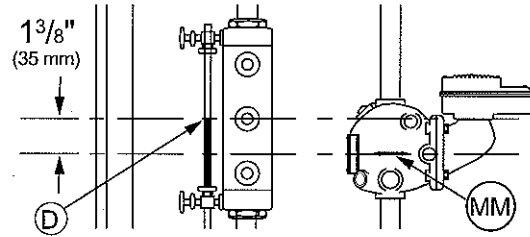
Failure to follow this warning could cause an explosion or fire and result in property damage, personal injury or death.

b. The boiler should begin to fill with water. Watch the gauge glass (D) until the water level reaches approximately $\frac{7}{8}$ " (22mm) above the horizontal cast line (MM) on the low water cut-off. When the water level reaches approximately $\frac{7}{8}$ " (22mm) the burner should come on.



IMPORTANT: If water does not start filling the boiler, immediately turn off the the boiler and make the necessary corrections.

- c. Continue watching the gauge glass (D) to see that the water continues to rise to approximately $1\frac{3}{8}$ " (35mm) above the horizontal cast line (MM). The pump should shut off.



d.

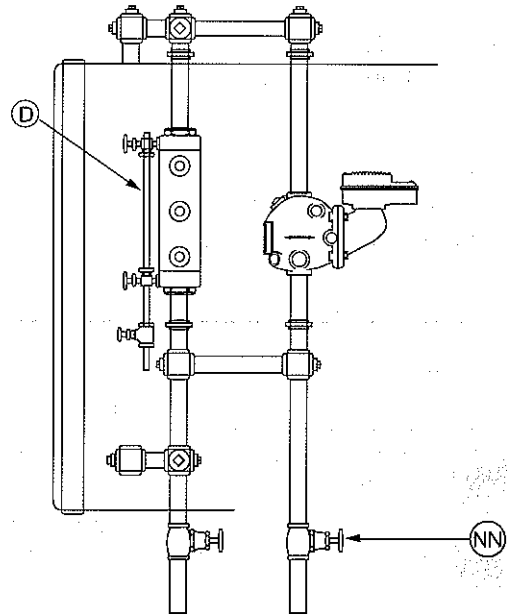
⚠ CAUTION



To prevent serious personal injury from steam and hot water during blow-down, connect piping to the discharge side of the blow-down valve to avoid exposure to steam discharge.

Failure to follow this caution could cause personal injury.

When the water level is at its normal level and the burner is on, **slowly** open the blow down valve (NN) until it is fully open. Watch the gauge glass (D) to see that the water level drops. Close the valve after verifying that the pump comes on and the burner shuts off. If this does not occur, immediately shut-off the boiler and correct the problem and retest.



INSTALLATION COMPLETE

MAINTENANCE

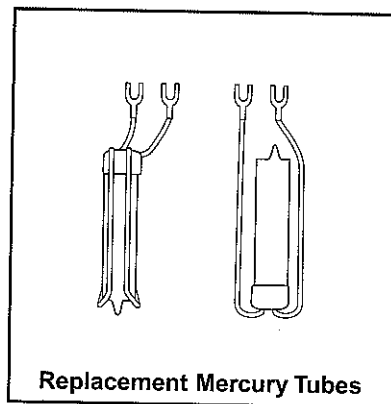
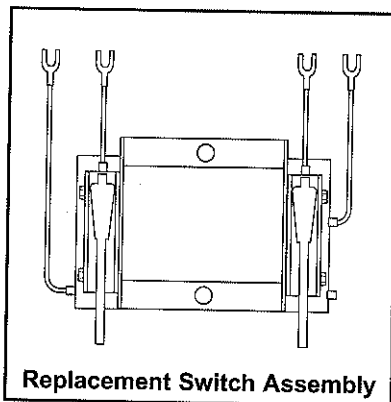
SCHEDULE:

- 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 unusual water or system conditions, including dirt and minerals and/or local codes.

- **Disassemble and inspect the low water cut-off/pump controller annually. Replace if it is worn, corroded, or if components no longer operate properly.**
- **Inspect the float chamber and equalizing piping annually. Remove all sediment and debris.**
- **Replace head mechanism every 5 years.**
More frequent replacement may be required when severe conditions exist such as rapid switch cycling, surging water levels, and use of water treatment chemicals.
- **We recommend head mechanism replacement when the switch(es) no longer operate properly.**
If you choose to replace the switch(es), order the proper McDonnell & Miller replacement switch or switch assembly and follow the Repair Procedure provided.



PROCEDURE:

CAUTION



To prevent serious personal injury from steam and hot water during blow down, connect piping to the discharge side of the blow down valve to avoid exposure to steam discharge.

Failure to follow this caution could cause personal injury.

1. Blow down the low water cut-off when the water level is at its normal level and the burner is on. **Slowly** open the blow down valve until it is fully open and observe the water level fall in the gauge glass. Close the valve after verifying that the pump contacts have closed and the burner shuts off. If this does not happen, immediately shut off the boiler and correct the problem.

CAUTION

Snap switches must be replaced as an assembly.

McDonnell & Miller



ITT Industries
Engineered for life

3500 N. Spaulding Avenue
Chicago, Illinois 60618
tel: 773 267-1600
fax: 773 267-0991
www.mcdonnellmiller.com

©2005 ITT Industries Inc.
Printed in U.S.A. 2-05 246736