



Series 1575



McDonnell & Miller
Installation & Maintenance
Instructions
MM-286

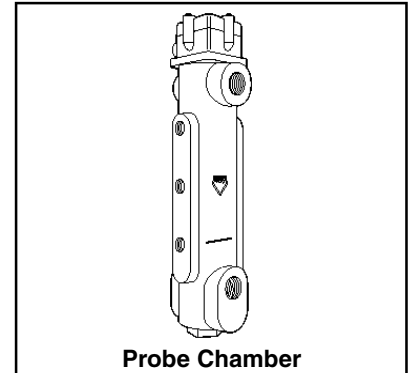
Low Water Cut-Off/Pump Controller

For Steam Boilers and Other Level Control Applications

FEATURES

Probe Chamber:

- Cast Iron Body
- Sight Glass Tappings
- Gage Cock Tappings
- Stainless Steel Probes
- NEMA 4X Electrical Enclosure
- 250 psi Maximum Working Pressure

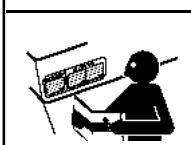


Probe Chamber



Electronic Control Unit

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 16A, 1 Hp at 120 VAC or 8A, 1 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.

Electronic Control Unit

Burner Relay Time Delay

The field-adjustable time delay (DOB) helps to prevent nuisance burner shut-down. The number of seconds water needs to be off the longest probe before the burner will shut down can be set between 0 and 60 seconds.

Redundant Low Water Cut-Off

When the boiler water drops below the middle probe, a 3 minute timing circuit will be activated. If water does not return to the middle probe within three minutes, the burner relay will shut down. The Red LED will flash once every second if this condition occurs.

- Automatic Reset units will automatically reset when the water level is restored to the middle probe.

NOTE: The timing circuit will automatically reset if the water level returns to the middle probe within 3 minutes.

Redundant Pump Off

The pump relay will be activated, turning the pump on after water drops below the middle probe. If the water level is not restored to the top probe within 3 minutes the pump relay will be deactivated, shutting off the pump. After the pump relay is deactivated, normal operation is resumed. Water must again drop off the middle probe to activate the pump relay. There is no LED signal for this occurrence.

Adjustable Pump Differentials

The water level positions for turning the pump on and off and obtaining the needed pump differentials are changed by cutting the length of the middle and shortest probes.

SPECIFICATIONS

Maximum Pressure: 150 psi (10.5 kg/cm²)

ELECTRICAL RATINGS & SWITCH RATINGS					
Supply Voltage	Probe Voltage	Full Load (Amps) NO (NC), VAC	Locked Rotor (Amps) NO (NC), VAC	Pilot Duty (VA) NO (NC), VAC	Motor (HP) NO (NC), VAC
120 VAC 50/60 HZ	5 VAC maximum	16 (5.8), 120	96 (34.8), 120	470 (290), 120	1 (1/4), 120
		8 (2.9), 240	48 (17.4), 240	470 (290), 240	1 (1/4), 240

Burner Delay (DOB): 0 to 60 seconds (Field Adjustable)

Ambient Temp: 120°F Max.

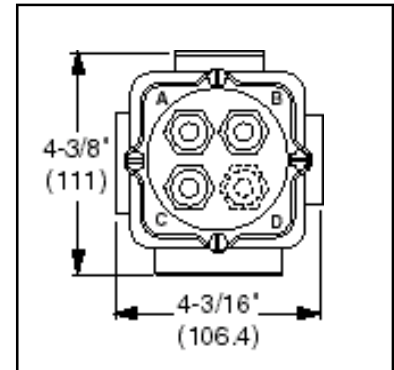
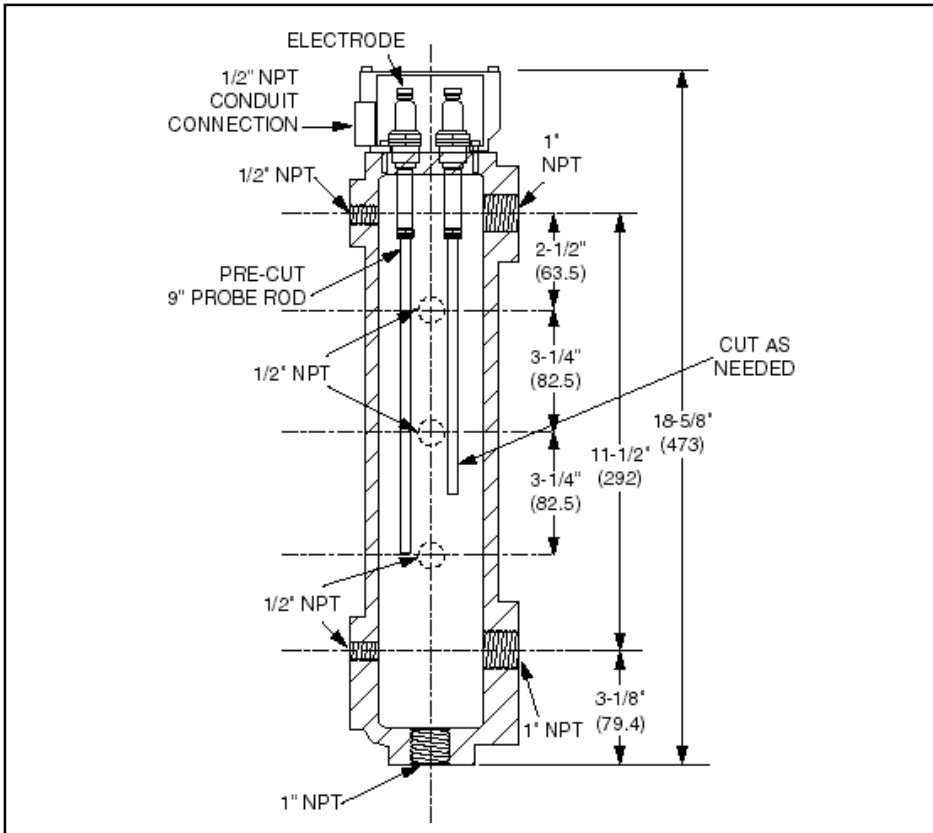
NOTE: The circuit board is protected with a sensor which will shut down the unit if the temperature at the board exceeds 176°F (80°C). The board will reset when the temperature at the board drops below 167°F (75°C).

Maximum System Water Temperature: 406°F (208°C)

Maximum System Water Pressure: 250 psi (17.6 kg/cm²)

Maximum System Steam Pressure: 250 psi (17.6 kg/cm²)

All probes in the Series 1575 units are sent from the factory pre-cut to 9" length (229mm). Any of the probes can be used as the low water cut-off level probe. The 9" length positions the probe at the low water cut-off cast-in line on the chamber body. The remaining probes can be 'cut to length' using a metal cutting saw to achieve desired pump control (pump on/pump off) and pump differential levels. Approximately 1 inch of the metal probe rod should be exposed below the Teflon® coating.



SPECIFICATIONS (cont.)

SWITCH SETTINGS:

When the water level in the boiler drops below the middle probe, the circuit is broken which will activate the pump relay, turning the pump on. When the water level rises above the shortest probe, the circuit is made and the pump relay is deactivated, turning the pump off.

When the water level in the boiler drops below the longest probe, the circuit is broken which will deactivate the burner relay, turning the burner off. When the water level is restored to the middle probe, the burner relay will be activated (burner on) for auto reset controls only.

STEP 1 - Installation

TOOLS NEEDED:

One (1) pipe wrench, one (1) flathead screwdriver and/or 11/32" nut driver, one (1) metal-cutting saw, one (1) 9/16" socket or wrench and pipe sealing compound.

- Mount **Control Box** in a suitable location near the boiler's main electrical panel.

NOTE

Boiler sight glass must be visible from location of Control Box and must be within 25 feet of Control Box.

- Install electrical conduit between electrical enclosure of the **Probe Chamber** and **Control Box**.

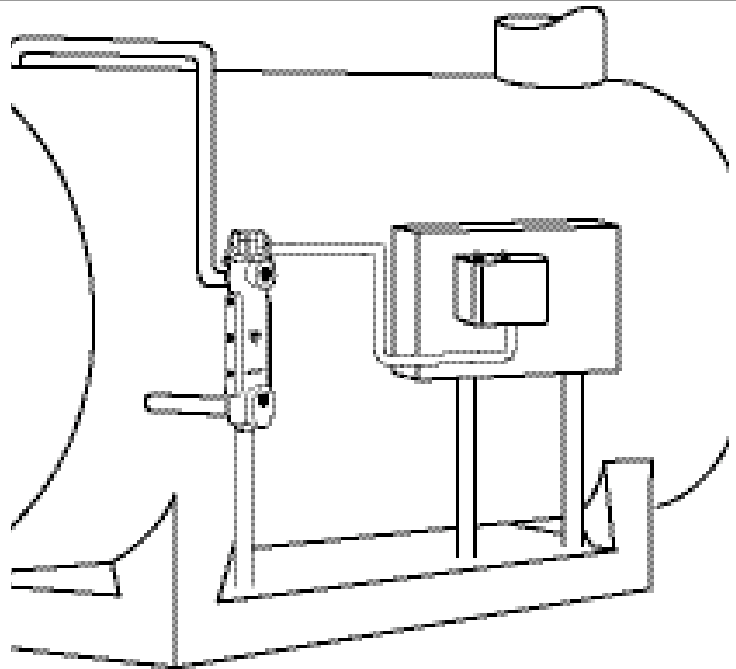
NOTE

Wire must be 18 AWG stranded with glass braided silicone jacket (UL 3071) suitable for high temperature (200°C) service.

NOTE

Refer to and follow local codes and standards when selecting conduit and electrical fittings. Wires from Electrical Enclosure of the Probe Chamber to Control Box must be in their own conduit. If they are run in conduit with other wires, there may be interference that can affect the performance of the control.

- Pull four (4) wires through conduit.

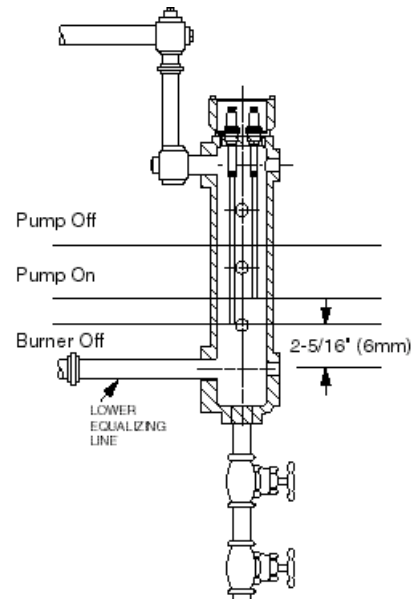


Chamber

If the control will be the primary low water fuel cut-off, size the steam (top) and water (bottom) equalizing pipe lengths to the chamber so that the cut-off level mark is 1½" (38mm) below the boiler's normal water level, but not lower than the lowest safe permissible water level, as determined by the boiler manufacturer.

OR

If the control will be the secondary low water fuel cut-off, size the steam (top) and water (bottom) equalizing pipe lengths to the chamber so that the cut-off level mark is at or above the lowest safe permissible water level, as determined by the boiler manufacturer.



Probes and Electrical Connections

- Each probe is made up of an electrode and a probe rod. Each probe rod must be cut to an appropriate point of operation.
- **A 9" rod will be positioned at the low water cut-off level.** Cut other rods for the pump operating probes to the desired length.
- After cutting, secure the probe rod to the electrode and lock the thread using the jamnut in the electrode sleeve. Insert the probe into the chamber and tighten by hand. Then torque to **22-25 ft/lbs (30-34 N/m).**

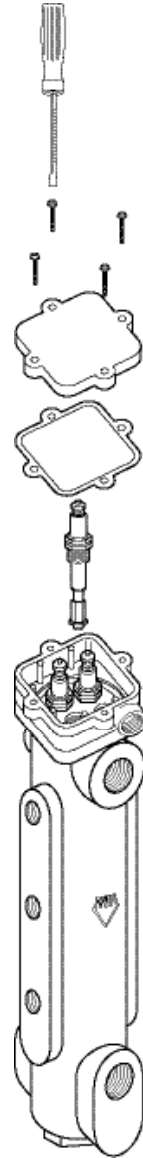
IMPORTANT: Do not use Teflon® tape or hardening type thread sealant. Use of pipe dope or hi-temp boiler grease is recommended.

- Refer to and follow all local codes and standards.
- Secure the electrical enclosure to the chamber with gasket between. Note that the electrical connection opening can be orientated in any of 4 positions. Tighten screws to 30 - 35 in/lbs (3.4-4.0 N/m).
- Probe wire and conduit connections should be made following accepted electrical practices.

NOTE

Wire must be 18 AWG stranded with glass braided silicone jacket (UL 3071) suitable for high temperature (200°C) service.

- Install electrical cover enclosure after making all connections and after control has been tested for proper operation. Tighten screws to 30 - 35 in/lbs (3.4-4.0 N/m).



Connect wires between **Control Box** and **Probes** as follows.

Probes	Control
Shortest/Blue	Shortest/Blue
Middle/Yellow	Middle/Yellow
Longest/Red	Longest/Red
Chamber Ground	Chassis Ground

(Attach to an electrical enclosure/mounting screw)

NOTE

Wire connections at Probes (1/4" Ring Terminal) and Control Panel (22-18 1/4" Female Spade) must be made with connectors suitable for high temperature (200°C) service.

STEP 2 - 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.
- Boiler manufacturer schematics should always be followed. In the event that the boiler manufacturer's schematic does not exist, or is not available from the boiler manufacturer, refer to the schematics provided in this document.



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.

Cover Removal and Installation Procedure

- To remove cover, use a flathead screwdriver to loosen screws and remove the cover (K).
- To reconnect cover, slide over brackets and tighten screws using a flathead screwdriver.

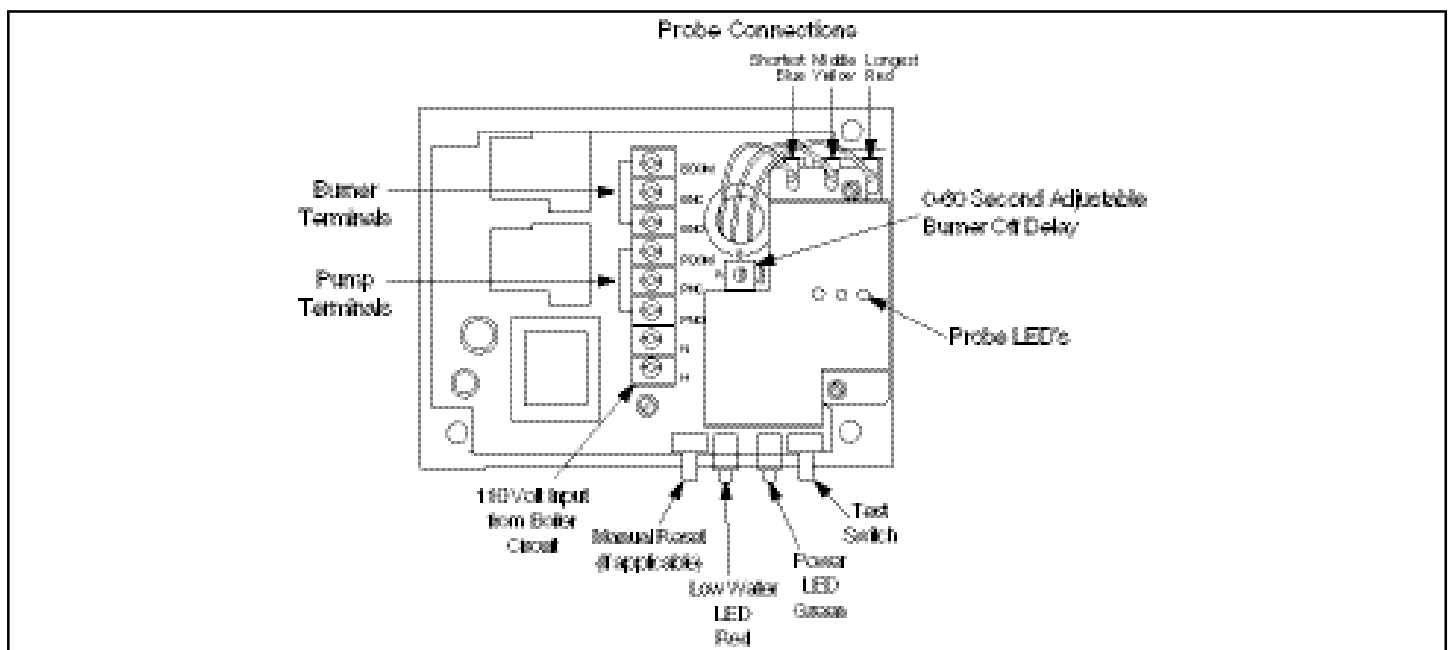


- Following the appropriate wiring diagram (refer to page 7) based on your application requirements, and using BX armored cable or Thinwall electrical metal tubing connector fittings, make electrical connections to the junction box (L).



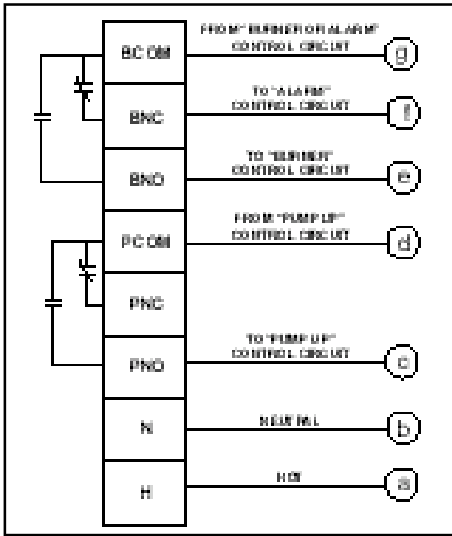
IMPORTANT: There must be a minimum space of 1/2" (13mm) between connector fittings and electrical live metal parts.

Circuit Board Layout

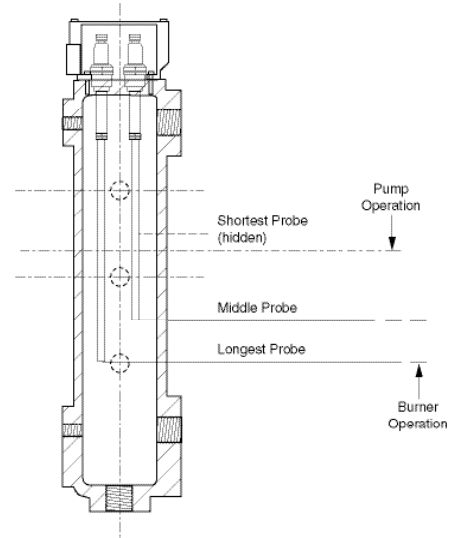


WIRING DIAGRAMS

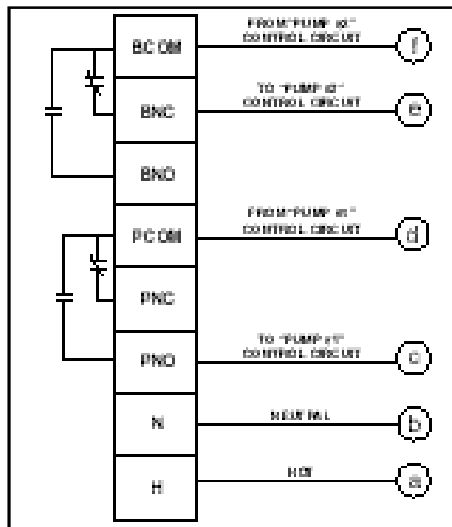
Low Water Cut-Off, Alarm and Pump Up Control



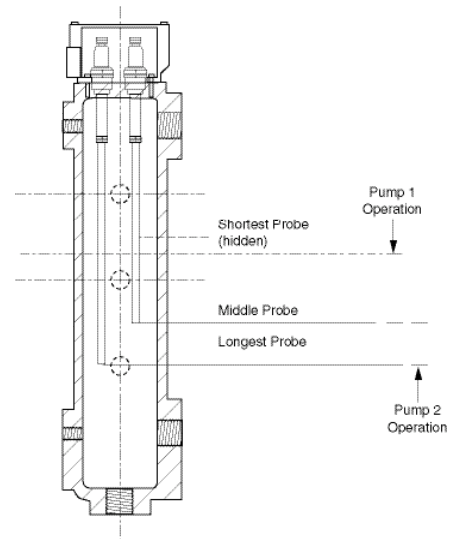
- Connect wire “a” from power supply to terminal “H”.
- Connect wire “b” from neutral supply to terminal “N”.
- Connect wire “c” from pump control circuit to terminal “PNO”.
- Connect wire “d” from pump control circuit to terminal “PCOM”.
- Connect wire “e” from burner control circuit to terminal “BNO”.
- Connect wire “f” from alarm control circuit to terminal “BNC”.
- Connect wire “g” from burner or alarm control circuit to terminal “BCOM”.



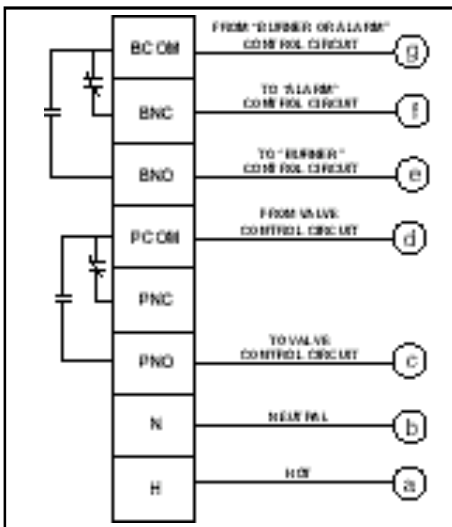
Dual Pump Control



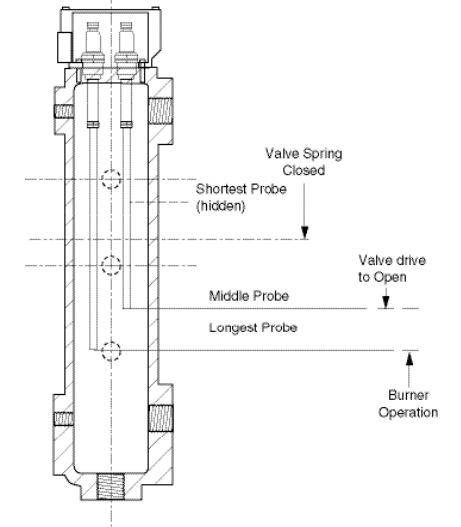
- Connect wire “a” from power supply to terminal “H”.
- Connect wire “b” from neutral supply to terminal “N”.
- Connect wire “c” from pump #1 control circuit to terminal “PNO”.
- Connect wire “d” from pump #1 control circuit to terminal “PCOM”.
- Connect wire “e” from pump #2 control circuit to terminal “BNC”.
- Connect wire “f” from pump #2 control circuit to terminal “BCOM”.



Motorized Valve and Low Water Cut-Off



- Connect wire “a” from power supply to terminal “H”.
- Connect wire “b” from neutral supply to terminal “N”.
- Connect wire “c” from valve control circuit to terminal “PNO”.
- Connect wire “d” from valve control circuit to terminal “PCOM”.
- Connect wire “e” from burner control circuit to terminal “BNO”.
- Connect wire “f” from alarm control circuit to terminal “BNC”.
- Connect wire “g” from burner or alarm control circuit to terminal “BCOM”.



STEP 3 - Testing

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

Exterior Lights

- **Green light on:** Unit has power
- **Red light on:** Boiler water dropped below the longest probe for longer than the adjustable time delay setting. The burner has shut down.
- **Red light flashing every second:** Boiler water was below the middle probe for more than three minutes and the burner has shut down.
 - **Auto reset units** will automatically reset when the boiler water returns to the middle probe.
- **Red light and green light flashing alternately every 1/2 second.** Probes are out of sequence. Unit has shut down. Unit will automatically reset when condition has cleared or been corrected.
- **Red light and green light flashing simultaneously every 1/2 second:** The PCB is too hot and the unit has shut down. The unit will automatically restart when the PCB has cooled sufficiently.
- When using the "TEST" button, the green light will flash once per second during the time delay interval. The time delay setting can be determined by counting the number of flashes.

Interior Lights

Green Light – Shows status of shortest probe

Yellow Light – Shows status of middle probe

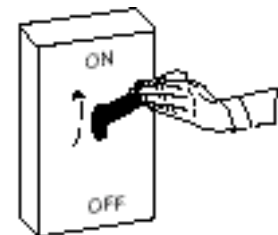
Red Light – Shows status of longest probe

- If the light is on, the probe is in water and probe resistance is well below the threshold.
- If the light is flashing every 1/2 second, the probe is in water, but probe resistance is near (just below) the threshold.
- If the light is flashing every 2 seconds, the probe is out of water, but probe resistance is near (just above) the threshold.
- If the light is off, the probe is out of water and probe resistance is well above the threshold.

Procedure

Turn on power to the boiler and pump circuits. With the boiler empty, the control will be activated (Green LED On) and the pump should turn on. The burner should stay off (Red LED On).

NOTE: If Green and Red LED's flash alternately, the probes are out of sequence, indicating they are not working correctly. Turn off power and check probe wires for proper connection.



WARNING



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



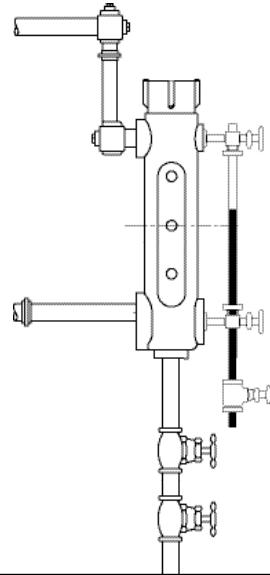
Failure to follow this warning could cause an explosion or fire and result in property damage, personal injury or death.

The boiler should begin to fill with water.

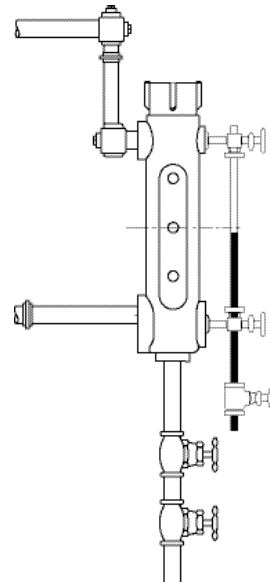
NOTE: If water does not start filling the boiler, immediately turn off the boiler and make the necessary corrections.

For Automatic Reset Models:

When the water level reaches the level of the middle probe, the burner circuit should be activated and the Red LED should turn off. (Pump #2 should turn off with Dual Pump Applications).



When the water level rises to the level of the top probe, the pump relay will be de-activated. Depending on the application, this will either turn off the pump or close a valve.



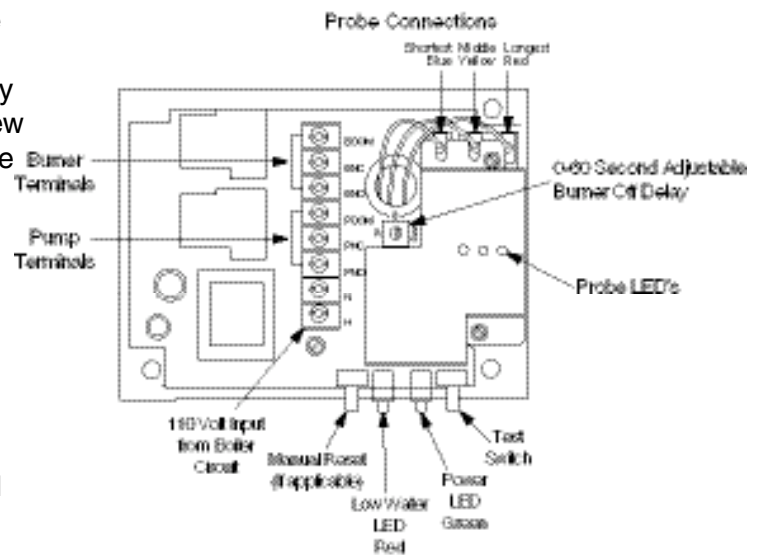
Adjusting Burner Delay (DOB)

The number of seconds that water must be off the shortest probe before the burner will turn off is adjustable from 0 to 60 seconds. The unit is factory set at 0 seconds. To adjust, turn the adjusting screw clockwise using a small flatblade screwdriver to the delay time desired.

NOTE

If the time delay on the primary control set is too long, the manual reset secondary LWCO may turn off the boiler before the primary control turns off the boiler. If this occurs, shorten the time delay by turning the adjustment screw counter-clockwise from the new setting.

Follow the blowdown procedure found on page 11 to verify operation.



INSTALLATION COMPLETE

Troubleshooting

Green LED does not turn on.

- There may be no power to the unit. Check wiring connected to 'H' and 'N' terminals on circuit board. Verify that the control is being powered when the boiler power is turned on.

Red & Green LEDs flash alternately every 1/2 second.

- The probes are out of sequence. Check probe wires and connections.

Red & Green LEDs flash simultaneously every 1/2 second.

- The temperature at the circuit board is higher than 170°F. Removing the control box cover may cool the control enough for it to operate. If the control works with the cover removed, the control box should then be mounted remotely.

Pump does not turn off when water level is above shortest probe.

- The probes may be fouled with dirt, scale or rust. Remove head assembly to inspect probes.
- The wiring connections for the pump may not be connected properly. Check wiring at terminals.

Pump does not turn on when water level is below the middle probe.

- The probes may be fouled with dirt, scale or rust. Remove and inspect probes.
- The wiring connections for the pump may not be connected properly. Check wiring at terminals.

Burner does not turn off when water level is below longest probe.

- The probes may be fouled with dirt, scale or rust. Remove and inspect probes.
- The wiring connections for the burner may not be connected properly. Check wiring at terminals.
- Make sure the time delay is not causing delay of burner off.

The 1575 control does not turn off the burner before the secondary (manual reset LWCO) turns off the burner.

- The burner off time delay (DOB) may be set for too long of a delay.

During operation, the burner does not turn off when the water level is below the longest probe.

- The burner off time delay (DOB) may be set for too long of a delay.
- The boiler water may be priming or foaming. Clean boiler water and/or consult with chemical treatment specialist.

During operation, the burner turns off even when the pump has turned on or the motorized valve has opened.

- Pump capacity may not be sufficient or there may be restrictions in the feedwater piping. Check pump capacity and piping.
- The motorized valve stroke-to-open time may be too long. Check valve motor timing.

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.

Disassemble and inspect annually.

- **Inspect the probe chamber and equalizing piping annually.** Remove all sediment and debris from chamber and/or equalizing piping.
- **Inspect and clean probes.** Use a non-abrasive cloth to clean probes. Replace probes if probes are worn, corroded or have excessive coating of scale or rust that can not be easily cleaned off.

NOTE

The probes may need to be inspected and cleaned more frequently on systems where there is the potential of coating build-up on the probes. 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 probes 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.

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 listing or regulating agencies.

BLOW DOWN PROCEDURE:

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.

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 may 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.

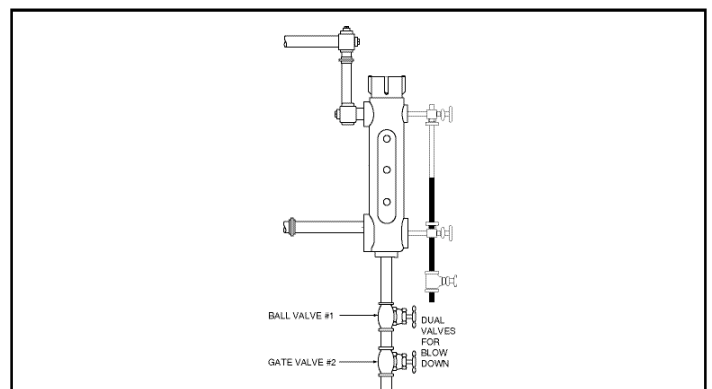
Blow down the low water cut-off when the water level is at its normal level (pump/valve off) and the burner is on.

- Open the upper “Positive Shut-off Ball Valve” (#1).
- Slowly open lower “Throttling Gate Valve” (#2).
- With both valves open, the water level will drop in the sight glass.
- When the water falls below the level of the middle probe, the pump or valve should turn **ON**.
- When the water falls below the level of the longest probe, the burner should turn **OFF**. **NOTE:** The Red LED will turn **ON** to indicate low water condition.
- Slowly close the lower “Throttling Gate Valve” (#2).
- The water level should begin to rise and the burner should turn **ON** (Red LED turns off) when the level is at the middle probe. The pump or valve should turn **OFF** when the water level rises above the shortest probe position.

NOTE

If this sequence of actions does not occur, as described, immediately close all valves, turn off the boiler and correct the problem. To correct the problem, inspection/cleaning of all probes may be required.

- Close the upper valve “Positive Shut-off Ball Valve” (#1).
- Observe that the water level returns to its normal level before leaving the site.



ITT
8200 N. Austin Ave.
Morton Grove, IL 60053
tel: 847-966-3700
fax: 847-966-9052
www.mcdonnellmiller.com



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