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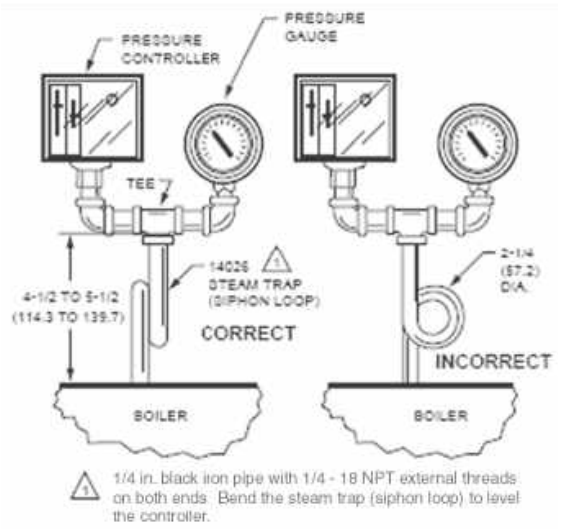
McDonnell Miller Liquid Level Controls

Mercury Switch Update

Boiler Pressure Controllers

Until recently the most commonly used pressure controllerwas a mercury-tube type control. Because of the number of the these controls still in use and because the functionality of the mercury free controls is the same, this article will explain the basic use and setup of the mercury controls.

The pressure controller regulates the operating range of the boiler by starting and stopping the burner on boiler steam pressure demand. The pressure controller is connected to the highest part of the steam side of the boiler and is protected from live steam by a siphon loop.

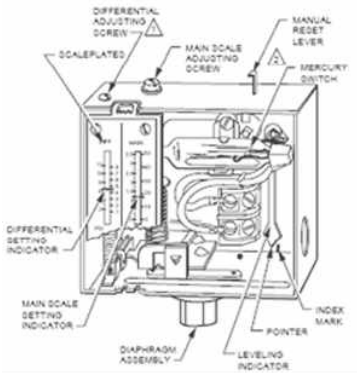


Pressure Controller Installation

The siphon loop forms a water seal, protecting the bellows from distortion or ruptures caused by the high temperature of steam. The mercury-tube pressure controller must be installed using a pigtail siphon and must be maintained in a vertical position for it to function properly.

The pressure controller has two scales. One scale is set at the cut-in (starting) pressure, and the other scale is set at the differential pressure, which controls the cut-out (shut off). When adjusting the scales, cut-in pressure plus differential pressure equals cut-out pressure. When the cut-out pressure is reached in the boiler, the burner will shut down. By adjusting the cut-in and cut-out pressure settings, the operator can obtain any necessary combination to meet the plant's needs. NOTE: Some pressure controllers have a main scale and a differential scale instead of a cut-in and cut-out differential scale. The cut-out pressure is determined by the main scale minus the differential setting.

The modulating pressure controller regulates high and low fire and is connected to the highest part of the steam side of the boiler. A burner must always start in low fire and as a rule of thumb, shut down in low fire. This prevents wasting fuel and reduces the possibility of a flashback (minor furnace explosion) when excess fuel accumulates in the furnace. Maintaining the pressure controller is a matter of checking on a daily basis if the control is maintaining set points and checking the wiring for signs of cracking due to age or heat. Also, in case of the mercury-tube type, check for signs of cracking or discoloration of the mercury tubes.



Typical Honeywell Pressure Controller:

INSIDE THE BOILER

*****Mercury Switch Cross-over Chart Page 4-5*****

McDonnell & Miller Mercury Notice

As some of you may know, ***McDonnell & Miller has made the announcement to discontinue the use of mercury in the controls they manufacture.*** The state of Illinois has passed legislation banning the sale and distribution of products containing mercury effective on July 1, 2007. Since McDonnell & Miller manufactures in Illinois, to be in compliance with the law, they must not sell or ship any mercury products after July 1, 2007.

Key Dates for McDonnell & Miller

April 7, 2007 Stop taking orders for mercury products June 25, 2007 No further shipments of mercury products

Alternatives to Controls Containing Mercury:

McDonnell & Miller offers excellent alternatives for the 150 series controllers. They recommend the mercury free 150S (with snap action switches) or the 150E (electronic conductance probe type) series. For the 42 series, they recommend the 42S series. ***See page 4 for cross reference chart***

McDonnell & Miller 150/157 Troubleshooting Procedures

The McDonnell & Miller 150/157 are similar to each other with the exception of the 157 having an integral water column. These troubleshooting tips should work with all switch type 150 Series controllers. General Recommendation: The nameplate indicates that the controller has a maximum working pressure of 150 psig. Note that the recommended blow-off period is once per day.

Troubleshooting

1. Should the complaint involve leaking from the bellows base gasket surface, use ¼"-20 Allen set screw wrench and check screws for tightness. Check to see if the screws are loose and that there are no signs of tampering. It is necessary to remove the switch cover from the switch enclosure to make this inspection.
2. If signs of leaking are visible at the bottom of the bellows base clamp die casting, check tightness of ¼"-20 Allen head screw at this point. Check if they are loose and no evidence of tampering.
3. The complaint may involve a leaking bellows. Observe signs of bellows leakage. Determine if there are fatigue fractures or corrosion pinholes. If there are signs of leakage at the top of the bellows, check the Allen head screw at the top of the bellows.
4. If the complaint is improper functioning of the mercury switches, remove the head assembly from the float chamber. This will permit visual inspection for sediment from the float chamber or a loaded (waterlogged) float. If the float chamber is clean and the float is in good condition, the switches should be checked.
5. The 150 controller has two separate mercury switches. The pump switch is single pole, single throw and has terminals 1 and 2. The low water cut-off and alarm switch is single pole, double throw. Terminal 5 is common, terminal 4 is alarm circuit and terminal 6 is burner circuit. To check switch operation, connect OHM meter to terminals 1 and 2. Hold head assembly dead level and raise the float to the high position. The circuit should open. Dropping the float should make the circuit, indicating "pump on". Move the OHM meter clips to terminals 5 and 6. This is the burner circuit. It should be "off" at the low float position and "make" as the float is raised, remaining closed all the way up to the "pump off" float position. Move the clip from terminal 6 and place it on terminal 4. This is the alarm circuit and should be "off" at the high float position and "made" at the lower float position which interrupted the burner circuit. If the 150M and 157M manual reset models are being tested, the float must be raised and the manual

continued on next page

McDonnell & Miller 150/157 Troubleshooting Procedures *continued*

reset mechanism activated to put the mercury switch into the "on" position.

6. If the switches do not perform as just described, closely inspect the mercury switches. Excessive electrical loads or a crack in the glass will result in the mercury being discolored or stretched out in a string-like fashion. Excessive electrical loads can result from incorrect wiring or attempting to operate equipment drawing more amperage than the rated switch capacity.

General Troubleshooting Hints for McDonnell & Miller

Electrical (Check for these problems):

1. Short circuit to low water cut-off
2. Open circuit to pump
3. Improper wiring to control or to system
4. Fuse burn out to pump
5. Motor overload out on pump
6. Burner motor relay stuck open or closed
7. Pump motor relay stuck open or closed
8. Fuel valve stuck in open position
9. Fused contacts in control circuit
10. Loose electrical connections
11. Fusing or breaking of switch contacts:

- **a)** Burner motor having greater power requirements than shown on motor nameplate
- **b)** Motor having a dead spot may stall or heat up, causing overload of switch
- **c)** Grounding of wire in control circuit (insulation breakage or dampness)
- **d)** Switch submerged in water
- **e)** Lightning striking electrical service to building, causing overload condition
- **f)** Overload circuit in building resulting in low voltage condition, which causes too heavy of amperage draw and switch burnout
- **g)** Other limiting devices like pressure controls, relays, thermostats, etc. may short circuit, overloading all switches in line

Mechanical (Check for these problems):

1. Improper piping of installation

- **a)** Faulty installation of complete job
- **b)** Improper installation of control
  Lower equalizing line too low
  Upper equalizing line in steam flow
  Lower equalizing line to rear
  Incorrect location of control
- **c)** Plugging of piping
  Upper or lower equalizing plugged with sediment, dirt, lime, rags, etc.
  Feed water line plugged or restricted
  Strainer plugged or restricted
- **d)** Valves incorrectly "on" or "off"
  Equalizing or feed lines "off"
  Main water supply turned "off"

continued on next page

General Troubleshooting Hints for McDonnell & Miller

Mechanical (Check for these problems): ***continued***

2. Sediment holding float in the "up" position
3. Float collapses due to excessive pressure or water hammer
4. Chemical action on components
5. Dirt or foreign objects in switching mechanism
6. Incorrect application of control
7. Seat of water feeder scratched or nicked by sediment, etc.
8. Tampering of control by operating personnel
9. Improper sizing of controls

Antunes Controls Air Proving Switches

- **Differential**
- **Vacuum**
- **Pressure**

Antunes Controls Air Proving Switches are designed to provide excellent repeatability and dependable, trouble free operation.

Features:

- Sensitive diaphragm
- Single pole, double throw snap action electrical switch
- Visible ON-OFF indicator in compact die-cast aluminum housing
- Spring adjustable switches - dual scales calibrated in millimeters and inches of water column
- Five range scales – from .07" W.C. to a maximum of 35" W.C.
- Set point indication
- Rugged die cast aluminum construction

Call Power Plus International for spring range scales or more information on the Antunes JD-2 Air Proving Switches.

Replacement Cross Reference for Mercury Switches

Old Mercury Controls*	Mercury Free Controls
150 (171700)	150S (171702) or 150E (171600)
150M (172700)	150S-M (172702) or 150E-M (171610)
150-HD (173300)	150S-HD (173003) or 150E-HD (171640)
150-M-HD (173200)	150S-M-HD (173203) or 150E-M-HD (171650)
157 (173500)	157S (173502) or 157E (171620)
42 (129300)	42S (129302)
42-HD(129500)	42S-HD (129502)

Note: The mercury switches in these products MUST be removed and recycled in accordance with Local, State, and Federal Regulations.

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Honeywell Mercury Free Cross Reference Chart

Many states throughout the United States have declared war on mercury controls as an environmental hazard. In the December 2006 issue of Boiling Point we included the cross reference information on McDonnell and Miller controls. In this issue we will focus on Honeywell pressure controls.

OS#	Mercury Free Repl.	Comments on Replacement
L404A1354	L404F1060	Max. pressure 25 psi (not 50 psi)
L404A1370	L404F1078	Differential starts at 6 psi (not 4 psi)
L404A1396	L404F1102	Differential starts at 10 psi (not 8 psi)
L404A1404	L404F1094	Differential starts at 20 psi (not 15 psi)
L404A1586	L404F1060	Max. pressure 25 psi (not 50 psi)
L404A1594	L404F1078	Differential starts at 6 psi (not 4 psi)
L404A1602	L404F1102	Differential starts at 10 psi (not 8 psi)
L404A1610	L404F1094	Differential starts at 20 psi (not 15 psi)
L404A1636	L404F1060	Differential starts at 2 psi (not 1 psi)
L404B1296	L404F1409	Max. pressure 25 psi (not 50 psi)
L404B1304	L404F1409	Max. pressure 25 psi (not 50 psi)
L404B1320	L404F1375	Differential starts at 6 psi (not 4 psi)
L404B1346	L404F1383	Differential starts at 10 psi (not 8 psi)
L404B1353	L404F1391	Differential starts at 20 psi (not 15 psi)
L404B1361	L404F1409	Differential starts at 2 psi (not 1 psi)
L404B1536	L404F1409	Max. pressure 25 psi (not 50 psi)
L404B1544	L404F1375	Differential starts at 6 psi (not 4 psi)
L404B1569	L404F1391	Differential starts at 20 psi (not 15 psi)
L404B1577	L404F1409	Differential starts at 2 psi (not 1 psi)
L404C1113	L4079B1058	
L404C1139	L4079B1066	
L404C1147	L4079B1033	
L404C1154	L4079B1058	
L404C1162	L4079B1041	
L404T1022	L404T1055	Differential starts at 6 psi (not 4 psi)
L404T1030	L404T1063	Differential starts at 10 psi (not 8 psi)
L404V1046	L404V1087	Differential starts at 10 psi (not 8 psi)
L404V1053	L404V1095	Differential starts at 6 psi (not 4 psi)
L404W1037	L4079W1000	
L604A1169	L404F1060	
L604A1177	L404F1078	Differential starts at 6 psi (not 4 psi)
L604A1185	L404F1102	Differential starts at 10 psi (not 8 psi)
L604A1193	L404F1094	Differential starts at 20 psi (not 15 psi)