Lattner Boiler Company

Horizontal Electric Boilers

OPERATIONS MANUAL

Lattner Boiler Company
1411 9th St. SW
Cedar Rapids, IA 52404
T: (800) 345-1527
F: (319) 366-0770
E: info@lattner.com
www.lattnerboiler.com

Lattner Boiler Company

START-UP FORM FOR LATTNER HORZONTAL ELECTRIC STEAM BOILER

Job: _____ Date: _____

Location: _____ Serial No. _____

_____ Model No. _____

_____ N.B. No. _____

Contact: _____ Phone: _____

Fax: _____

Please verify and check off the following:

1. ____ **Disconnect** power to boiler and controls per lockout/tag-out procedure.
2. ____ Verify incoming service breaker size and ground.
3. ____ Review installation, operation manual provided with boiler.
4. ____ Check installation:
   a. ____ Check feed water & float valve – verify level.
   b. ____ Verify feed pump rotation/operation.
   c. ____ Piping service.
   d. ____ Wiring completed.
5. Check piping:
   a. ____ Feedwater check valves.
   b. ____ Bottom drain closed.
   c. ____ Water feed inlet valve open.
   d. ____ Safety valve verify size, capacity and piping
   e. ____ Safety valve set pressure _____ psi.
   f. ____ Steam outlet stop/gate valve open or closed with a vent valve open.
   g. ____ City water makeup valve open.
6. ____ Open softener (if used) bypass valve for initial fill with city water.
7. ____ Tighten all wiring connections.
8. ____ **Power off.** Check and record the OHMS of resistance across each leg of each contactor on the load side on all circuits.

Circuit #1	Circuit #2	Circuit #3	Circuit #4	Circuit #5	Circuit #6
T1 to T2	T1 to T2	T1 to T2	T1 to T2	T1 to T2	T1 to T2
T1 to T3	T1 to T3	T1 to T3	T1 to T3	T1 to T3	T1 to T3
T2 to T3	T2 to T3	T2 to T3	T2 to T3	T2 to T3	T2 to T3

9. ____ Review wiring diagram. Note remote interlock terminals with jumpers (if used).
10. ____ With the boiler switch "OFF", energize the main disconnect. (Optional)
11. ____ Verify that incoming voltage matches nameplate. _____volts, _____phase
12. ____ Press the manual reset on the high pressure switch.
13. ____ Press the manual reset on the low water cutoff (6 seconds).
14. ____ Set operating control to desired operating pressure. _____psig
15. ____ Set manual reset high pressure limit switch higher than operating pressure. _____psig
16. ____ **Energize power to panel**: turn pump switch on first and boiler switch on second.
17. ____ Verify water level in McDonnell Miller sight glass.
18. ____ Verify amber safety circuit light is "ON". (All safeties proven). **Boiler should now operate.**
19. ____ Perform "boil out" with supplied compound. Follow instructions in the Operating Manual
20. ____ Check all fittings for leaks. Tighten/repair as needed.
21. ____ Test high pressure limit switch and reset.
22. ____ Test low water cutoff using test switch and reset.
23. ____ Follow maintenance procedures for daily blowdown and chemical treatment.
24. ____ Observe boiler, return system and accessories for proper operation. Keep log of procedure and performance.

NOTES:

_____
_____
_____
_____
_____
_____

Start-up Technician Name:

_____

Telephone No. _____

Owner's Approval Signature:

_____

Owner's Name (Print):

_____

Company:

_____

Date: _____

WARRANTY VALIDATION & BOILER START UP REPORT

Start-up information must be verified for each boiler and returned to Lattner Boiler Manufacturing Co., P.O. Box 1527, Cedar Rapids, IA 52406, for warranty validation. If this information is not returned, warranty consideration may not be extended.

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Section I: General Description

WARNING: All installation procedures must be followed completely by a competent installer familiar with boilers and boiler accessories.

CAUTION: Read and follow all instructions before installing any boiler equipment. All cover plates, enclosures and guards must be maintained and in place at all times, except during maintenance and servicing.

1. Boiler Design

Lattner horizontal electric boilers are constructed in accordance to the appropriate ASME Code for low and high pressure steam boilers. Each boiler includes:

1. Flange mounted, incoloy sheathed heating elements with magnetic contactors;
2. Heavy duty construction of 1/4" or 3/8" steel;
3. 2" therma-fibre insulation and a metal jacket for efficient operation.
4. McDonnell Miller boiler water level and pump controls;
5. Probe-type auxiliary low water cut-off with manual reset;
6. A boiler ON/OFF switch;
7. Pressure control switches;
8. A limit switch;
9. Internal circuits sub-divided will all ungrounded circuits fused between contactors and terminals;
10. Blowdown valves for boiler and level controls;
11. A safety valve;
12. Hand and check valves for feed water inlet;
13. Terminals for connection of feed water equipment;
14. And hydrostatic testing of all joints and seams.

2. Boiler Connections

2.1. The following items are factory installed in accordance with the ASME Code:

2.1.1. Steam Connection

The supply connection is located on the top centerline of the boiler and is a threaded design. The operating and design pressure of the boiler, in accordance with the ASME Code, determines the pressure rating of the valve to be used for the main steam line.

2.1.2. Boiler Blowdown Connection

Boilers have one threaded fitting on the bottom centerline at the middle of the pressure vessel.

2.1.3. Feedwater Make-Up

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A tapping is provided on one end of the pressure vessel for connection to make-up water.

3. Boiler Trim

The following are factory installed standard trim and control items. Trim items are supplied in accordance with the ASME Code. Controls are UL listed and comply with ASME requirements.

3.1. Safety Relief Valve(s)

In compliance with the ASME Code, steam boiler pressure relief valves are provided. Size and quantity determined by the valve setting, valve capacity, and the ASME Code. These are shipped loose to prevent possible damage during shipment.

3.2. Float Control

Furnished complete with drain valve, minimum of 1 inch equalized piping, and crosses for inspection and clean-out. This is a dual purpose pump control and low water cut-off device.

3.3. Low Water Cut-Off

To prevent burner operation whenever a low water condition occurs, a single pole double throw float operated level switch is furnished in the float control. Cut-off is wired in series to the heating element contactors.

3.4. Pump Control

A single pole single throw float level switch is provided in the float control for ON/OFF operation of a feedwater make-up pump, starter, or solenoid water valve.

3.5. Auxiliary Low Water Cut-Off

An additional control, separate from the primary low water cut-off control is provided to prevent burner operation if a low-low water condition exists. This device is an internal probe control located on the top centerline of the pressure vessel.

3.6. Steam Pressure Gauge

3-1/2" dial pressure gauge is furnished as standard. The range of the gauge will be in accordance with the safety valve setting, based on 1.5 times the valve setting for high-pressure units, and 2 times the design pressure of low-pressure units.

4. Control Panel

A NEMA 1 enclosed control panel is mounted integral to the burner or as an independent bracket mounted unit on the boiler base rail. This panel contains as a minimum the following components:

4.1. Burner ON/OFF Switch

A burner ON/OFF switch is provided to interrupt control power to the 120-volt control circuit. This switch does not disconnect the main power source.

4.2. Wiring & Controls

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All devices and wiring are provided in accordance with the latest UL/NFPA 70 requirements. Each device is UL listed or recognized and bears the UL label and/or stamp.

5. Factory Tests

5.1. Pressure Vessel

The boiler is subjected to an ASME certified hydrostatic pressure test. This test, in accordance with the requirements of the ASME Code for Section IV Heating Boilers or Section I Power Boilers, is supervised by an independent inspection agency, to ensure the pressure vessel meets the standards of the ASME. Upon acceptance of the test by the independent inspector, the unit is stamped with the “M” symbol for 100 psi design units and with the "S" symbol for 125 psi and greater designs. One copy of the ASME data sheets is provided to the purchaser.

5.2. Boiler Piping Hydro (Optional)

As an option, Section I high pressure boilers (“S” stamped), built in accordance with the ASME Code, can be subjected to an additional hydrostatic pressure test. This test includes the integral steam and water trim piping and when included, the trim valves.

5.3. Heating Element & Controls

To ensure proper continuity of the controls, the heating element manufacturer subjects the packaged element to a preliminary factory fire test. All heating element and boiler controls are checked for circuit continuity after mounting and wiring the heating element onto the boiler.

6. Nameplates & Stamping

6.1. The National Board of Pressure Vessel Inspectors registration number is stamped on the pressure vessel with the boiler serial number, year built, maximum boiler output, and minimum safety valve capacity.

This information is located on the pressure vessel beneath an inspection plate, near the upper rear of the boiler. A facsimile nameplate of this data stamping is mounted near or on the front door of the boiler.

7. Guarantees

7.1. Warranty

The complete package is warranted for a period of one (1) year from the date of initial start-up or 18 months from the date of shipment or notice to ship, whichever occurs first. This guarantee does not include items that are damaged due to circumstances beyond the control of Lattner Boiler Company, carelessness, or neglect. Refer to the Lattner’s standard warranty and terms and conditions documents for more detailed information.

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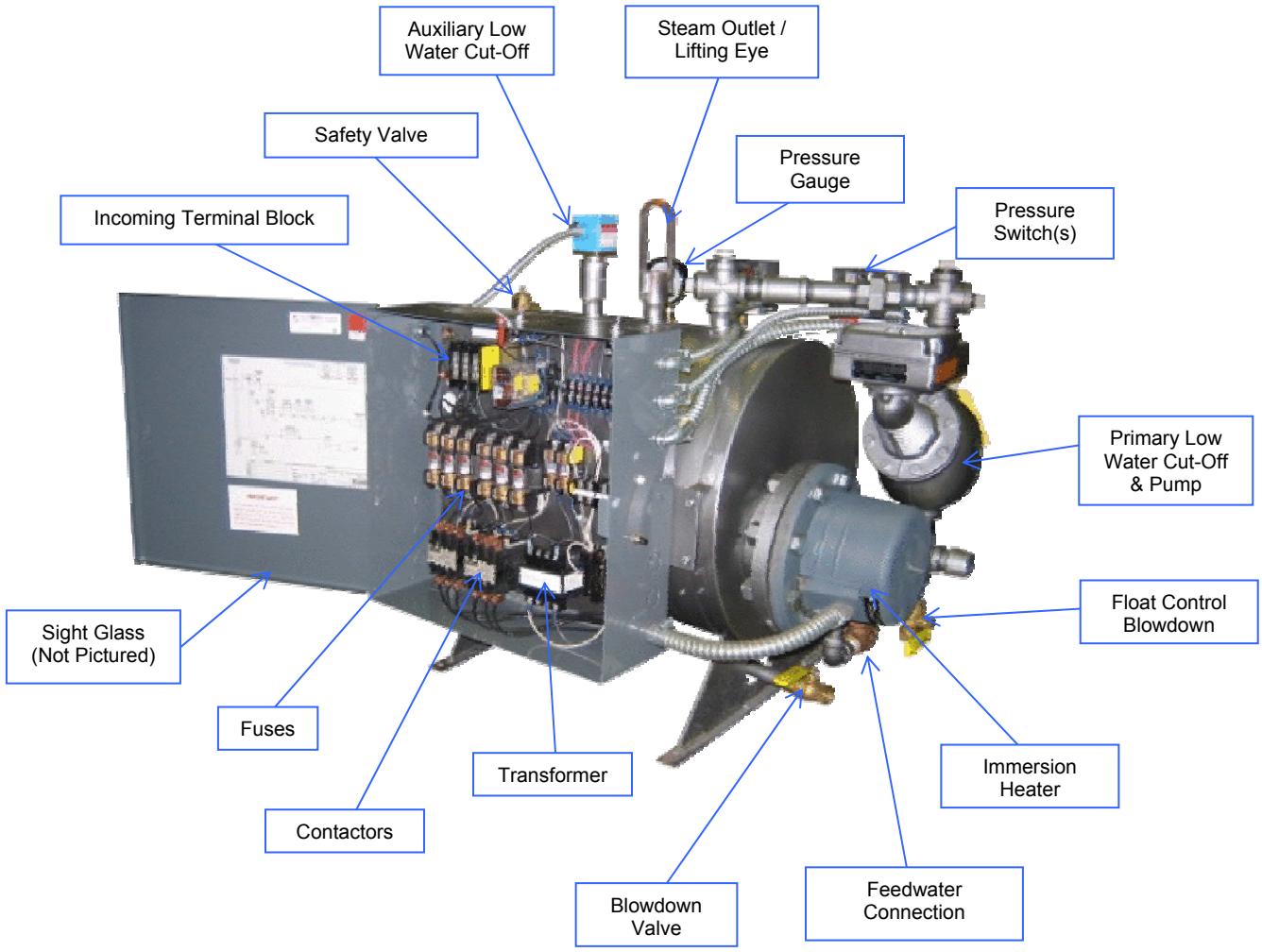
Section II: Instructions

WARNING: All installation procedures must be followed completely by a competent installer familiar with boilers and boiler accessories.

CAUTION: Read and follow all instructions before installing any boiler equipment. All cover plates, enclosures and guards must be maintained and in place at all times, except during maintenance and servicing.

1. Illustration (208 volt, 3 phase boiler pictured)



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2. Unloading

The boiler was loaded by Lattner (including any accessories) and accepted by the transport company as undamaged. Before unloading the equipment, determine whether any shipping damage is apparent. Once the equipment is lifted from the trailer, any damage sustained during transit and not filed with the transport company will be the responsibility of the rigger or purchaser.

2.1. Lifting

The boiler will arrive secured to a wooden skid/pallet and will include a lifting lug (top of the boiler). When moving or lifting the unit, **DO NOT** attach sling around the boiler in an attempt to pull the boiler.

2.2. Forklift

If lifting with a forklift, extended forks should be used beneath the skid. Care must be taken to ensure that the boiler sits correctly on the forks such that the unit does not topple. Always note the weight of the boiler relative to the lifting capacity of the forklift.

2.3. Crane or Boom

When lifting with a crane or boom, attach the hook to the lifting lug on top of the boiler. **DO NOT** attach slings or chains to any part of the boiler, or boiler piping.

3. Rigging

Always use a competent rigger that has experience moving and setting boilers. If the unit will be moved into the permanent location with a forklift, crane, or boom, follow the directions in section 1. However, if moving the unit through a tight space or into an area that will not permit a forklift, place the boiler on rollers or on 2 inch pipes and roll the boiler into place. If the unit is dragged, attach chains to the base frame only.

If the entry way is too narrow for the boiler and controls to pass through, removal of the trim and controls can be executed. One should properly denote all wiring and piping connections and match mark accordingly for attachment after the boiler is placed. It may be helpful to use a digital camera to record the location of trim items for reference.

4. Placement of Boiler

4.1. Floor

Boiler must be placed on a level, noncombustible surface. **NEVER** install boiler on a wood floor or any other combustible surface (i.e., carpet, linoleum).

5. Steam Outlet

5.1. Pipe Size

Size pipe according to system requirements.

5.2. Outlet Size

Refer to product literature sheet for steam outlet size on a particular boiler model.

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5.3. Steam Stop Valve

Install a steam stop valve in the steam line as close to the boiler as is practical. A steam stop valve allows the boiler to be isolated from the system during service work and may be helpful in throttling steam flow. Required by ASME Code if the boiler is operated over 15 psi.

5.4. Steam Piping

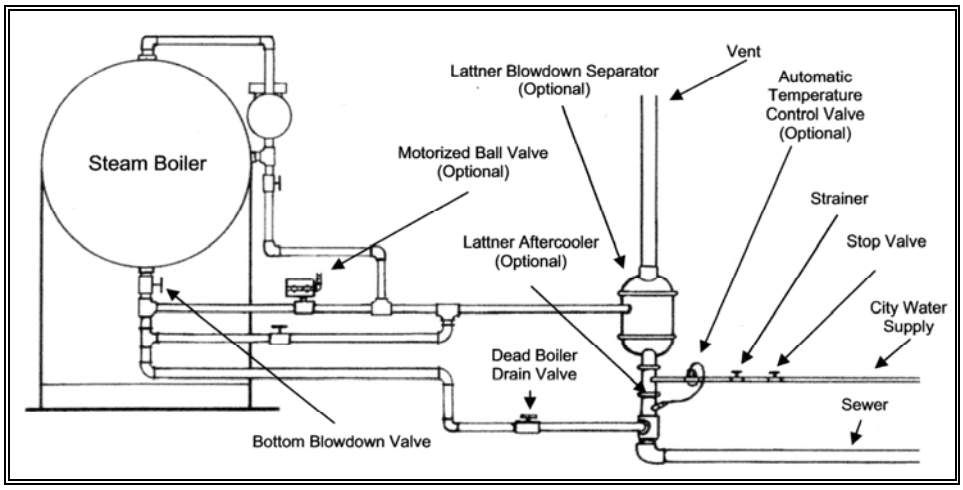
The steam line should be pitched downward slightly away from the boiler, toward a steam trap. If using a steam solenoid valve, the steam line should slope upward slightly to the solenoid valve. After the solenoid valve, the steam line should slope downward.

5.5. Codes & Standards

Piping must comply with all industry standards (especially ANSI B31.1) and all state and local codes.

6. Blowdown Piping

6.1. Boiler Bottom Blowdown (See Diagram Below)



6.1.1. **DO NOT REDUCE.** Blowdown piping and all fittings must be the same size as the boiler blowdown connection (refer to product literature sheets).

6.1.2. Low pressure boilers, operating at 15 psi or less, require one blowdown or drain valve. The pressure rating of the valve must be equal to or greater than the pressure of the boiler but not lower than 30 psi.

6.1.3. Boilers operating 16 psi to 100 psi require a single blowdown valve. A Y-type or a ball valve is acceptable.

6.1.4. Boilers operating 101 psi to 150 psi require piping designed for a pressure of 125% of the boiler safety valve set pressure (schedule 80 blowdown piping), one slow opening valve and one quick opening blowdown valve. If cast iron, these valves must be class 250. If steel, these valves must be class 150, or if bronze, a WSP rating of at least 200.

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6.1.5. Standard globe and gate valves that form a pocket inside the valve are not acceptable blowdown valves. Y-type and ball valves are acceptable blowdown valves.

6.1.6. All blowdown piping must meet ANSI B31.1 code and all city and state codes.

6.1.7. Galvanized piping is not acceptable for boiler blowdown piping.

6.2. Automatic Bottom Blowdown

A Lattner automatic bottom blowdown valve may be used in place of one of the manual blowdown valves.

6.3. Water Level Control Drain Valve

A water column type level control is supplied with one drain valve. Connect the control drain line into the bottom blowdown line after the second bottom blowdown valve.

6.4. Blowdown Discharge

All boiler blowdown water must be discharged to a safe location, specifically to a blowdown separator.

6.5. Blowdown Separator

Select a Lattner blowdown separator according to the size of the boiler blowdown connection:

¾ or 1 inch Model 810

6.6. Blowdown Separator Inspection Opening

The extra coupling in the separator vessel is an inspection opening. The inspection opening will be plugged.

6.7. Blowdown Separator Vent

The blowdown separator must be vented to atmosphere. Vent pipe must discharge outside through the roof. **DO NOT** reduce the vent pipe size. **DO NOT** connect the vent pipe from the condensate tank to the separator vent unless absolutely necessary.

6.8. Blowdown Separator Drain

The water leaving the separator through the drain should be piped to the sewer. Some codes require the water to pass through an air gap before entering the sewer.

6.9. Aftercooler

If the water must be cooled before entering the sewer (required by some city and/or state codes), then an aftercooler must be used. The aftercooler attaches to the blowdown separator drain connection and mixes cold water with the hot drain water. Units may be either manual or automatic. Select the aftercooler according to blowdown separator drain size.

205A (auto) or 205M (manual) Model 810

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6.10. Cooling Water Supply

Connect cold water supply pipe to aftercooler:

205A (auto) or 205M (manual) 1/2 inch NPT

6.11. Dead Boiler Drain Valve

For draining the boiler when it is cool and not under pressure, the entire drain line must be lower than the bottom of the boiler. Pipe to sewer or floor drain. Valve must be rated up to the maximum allowable working pressure of the boiler.

6.12. Codes & Standards

All blowdown piping, drain and sewer connections, water piping and separator connections must be done in strict compliance with all applicable codes.

7. Safety Valve

7.1. Installation

Be sure safety valve is threaded securely into the boiler or into the boiler. The safety valve will always be installed in the upright position.

7.2. Discharge

Pipe the safety valve outlet to a safe point of discharge. **DO NOT** reduce the safety valve discharge piping. **NEVER** plug the safety valve outlet.

7.3. Supports

Safety valve piping should be secured by clamps or braces to a wall or structural member. Do not allow the discharge piping to hang on the safety valve.

7.4. Codes & Standards

All safety valve piping and supports must conform to all applicable codes.

8. Boiler Feed Systems

8.1. Condensate Return Systems

8.1.1. Make-Up Water Supply

Connect city water line to the float valve with the boiler feed system. Install a manual shut-off valve in the water line.

LV8 through LV35 1/2 inch NPT

8.1.2. Pump Suction Line

This is pre-piped from the factory with an isolation valve and strainer.

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Pump Discharge Line

DO NOT reduce. Use 1 inch NPT pipe and fittings between pump and boiler. Install two **spring-loaded** check valves. Install a hand shut-off valve between the last check valve and the boiler. Keep the number of elbows and fittings to a minimum.

8.1.3. Condensate Return Line

Condensate from all steam traps should be tied into a common return line. The condensate return line should be pitched downward toward the condensate return tank.

8.1.4. Condensate Return System Vent

Condensate return tank must be properly vented to atmosphere. Vent should discharge through the roof or through a wall to the outside. **DO NOT** reduce the vent pipe size.

LV8 through LV35 1 inch NPT

8.1.5. Condensate Return System Overflow

Pipe to floor drain. Overflow connection should be at least as large as the condensate return.

8.1.6. Condensate Return System Drain Connection

Pipe to floor drain. Install a valve in the line. 1 inch NPT line is sufficient.

8.2. Solenoid Water Valve

8.2.1. Water Pressure

This system will work only if the water supply pressure is at least 10 psi higher than the boiler pressure.

8.2.2. Water Inlet

Refer to the boiler assembly print for correct connection and location of the feedwater inlet.

8.2.3. Piping

The solenoid water valve assembly will be piped in the following order: Y-type strainer, solenoid valve, spring-loaded check valve, globe valve, and boiler. All pipe is 1/2 inch NPT.

8.2.4. Water Supply

Connect water supply to the strainer.

9. Electrical Connections

CAUTION: All electrical work shall be done by a competent electrician. All wiring must be done in strict accordance with the National Electrical Code and any state or local codes.

9.1. Reconnecting Controls

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If the boiler was shipped with controls removed, re-connect the wires according to the wiring diagram. All wires that need to be reconnected will have a tag indicating the control or terminals to which they must be connected.

9.2. Electrical Supply

9.2.1. Connect incoming power supply from a fused disconnect or circuit breaker to the incoming terminal blocks in the boiler panel.

9.2.2. Supply 120 volt single phase from a separate fused disconnect. Use a 15 amp circuit breaker or fused disconnect if the boiler has a solenoid water feed valve or a pump motor 1/2 hp or less or a motor starter for a three phase pump. Use a 20 amp circuit breaker or fused disconnect if the boiler has a 3/4 hp pump motor, 120 volt single phase.

9.2.3. If boiler has a control circuit transformer, there is no need for a separate 120 volt power source.

9.3. Wiring Water Feed System

Wire the solenoid water valve, boiler feed pump or pump motor starter as indicated on the wiring diagram.

10. Before Starting the Boiler

10.1. Spare Fittings

Check that all unused pipe nipples are plugged or capped.

10.2. Float Block

Remove the float block screwed into the body of the McDonnell Miller level control. Replace with a malleable iron plug (supplied with the boiler).

10.3. Condensate Return System

Make sure there is make-up water supply to the tank. Make sure there is water in the tank.

10.4. Turn Pump Switch “ON”

Turn on the pump switch. Pump or solenoid valve should start immediately. If not, see the troubleshooting section of this manual.

10.5. Check for Leaks

While the boiler is filling, check for leaks in the piping and around the boiler. If there are leaks, turn off the pump switch and fix all leaks before continuing.

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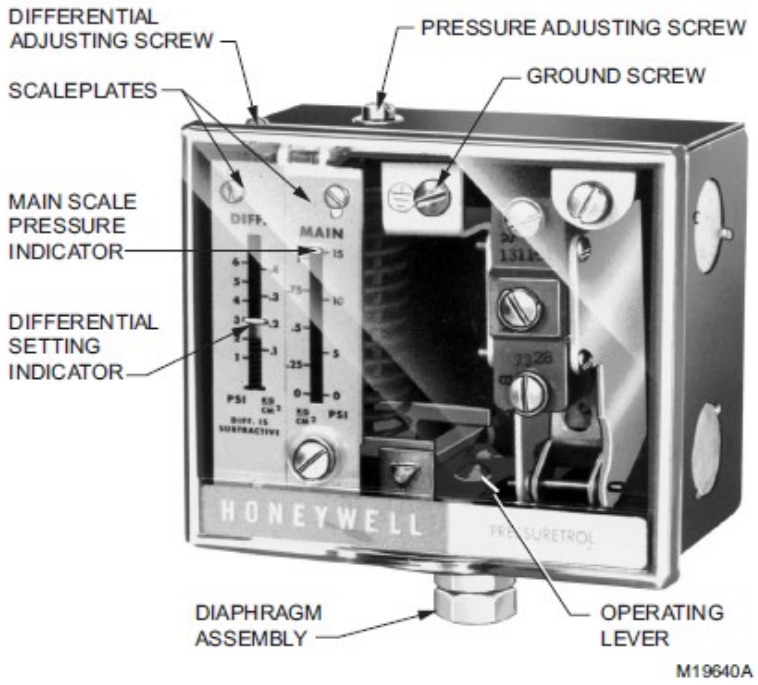
11. Pressuretrols: Controller and Limit (See Diagram Below)



11.1. Standard

All Lattner boilers will have at least two pressure switches, a “controller” and a “limit”.

11.2. Controller

Before the boiler is started, the steam pressure is 0 psi. At this point, the controller is in the "on" condition and is calling for heat. When the boiler switch is turned on, the boiler will start generating steam. As the boiler warms, the steam pressure will rise. When the steam pressure reaches the controller's set point, the controller will shut off the burner. As steam is used, the pressure will begin to drop. When steam pressure drops enough, the controller will start the heating element again. The controller will continue to operate in this manner to maintain boiler pressure.

11.2.1. Controller (See Pressuretrol Diagram on Page 12)

On the left side of the pressuretrol is the set point indicating scale labeled "MAIN". Turn the main scale adjustment screw until the set point indicator aligns with the desired operating pressure. Turn screw clockwise to increase pressure, counterclockwise to decrease pressure.

11.2.2. Differential

When the boiler pressure reaches the set point the controller shuts off the heating element. The pressure must drop by a set amount before the controller will turn on the heating element again. That amount is called the differential. The differential is adjustable.

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11.2.3. Setting the Differential (See Pressuretrol Diagram on Page 12)

On the far left side of the pressuretrols is the differential indicating scale labeled "DIFF". Turn the differential adjusting screw until the indicator aligns with the desired differential. A minimum differential will maintain the boiler pressure closer to the set point. A larger differential will help prevent rapid on and off cycling of the boiler.

11.3. Limit

The limit switch is similar in operation to the controller but has a slightly higher set point. If the controller fails to shut off the boiler and the steam pressure continues to rise, the limit switch will shut down the boiler. The controller is an operating switch; the limit serves as an auxiliary safety cut-off. The limit switch is supplied with a manual reset function. If the steam pressure trips the high limit switch, the limit locks in the off position. The limit switch will not reset until the manual reset lever is pressed.

11.3.1. Setting the Limit

This is done using the same procedure as for the controller. The limit setting will be higher than the controller's set point. For low pressure boilers (15 psi or less), set the limit switch 1 psi lower than the safety valve setting. For high pressure boilers, set the limit switch at least 10 psi higher than the controller and 5 psi lower than the safety valve setting.

11.4. Night Operating Pressure Switch

A third pressure switch may be supplied as an option. This switch allows the boiler to operate at low pressure at night for heating the building. Set the night operating pressure switch at approximately 10 psi. The boiler panel box will also be wired with a High/Low selector switch. Setting the selector switch at “Low”, the boiler will operate at 10 psi. When the switch is turned to “High”, the night operating switch is by-passed and the boiler operates at the normal operating pressure.

11.5. Example

Boiler with a 100 psi safety valve. Set the controller at 80 psi with an 8-10 psi differential. Set the limit switch at 90 psi. Turn on the boiler, heating element will start. When the steam pressure reaches 80 psi, the controller shuts down the heating element. When the pressure drops to 70-72 psi the heating element restarts. The boiler continues to cycle to maintain 80 psi. If the steam pressure rises to 90 psi, the limit switch shuts off the boiler. The manual reset on the limit switch must then be reset before the boiler will operate again.

For any additional information on the Honeywell Pressuretrols, refer to the Honeywell product sheet in the back of this manual.

12. After filling the boiler and setting the controls, turn the boiler switch to the ON position. Note: The boiler will not start until the manual reset buttons for low water and the steam limit are reset. Boiler should now energize.

13. Boil-out recommendations for new Lattner boilers

With proper operation and maintenance you can expect years of trouble free service from your new Lattner boiler. The procedure for correct operation and care of your unit is not complicated, nor is it time consuming. In this bulletin, we outline the proper boil-out procedure for you boiler prior to placing it into

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service.

If is necessary to clean the inside of the new boiler of oil and grease used as tube rolling lubricants, threading, and/or other various reasons beyond the manufacturer's control. Since these coatings may lower the heat transfer rate of the heating surfaces, failure to remove these coatings will result in your unit foaming, priming, carry-over or other damage. The boil-out operation is easily accomplished by following the procedure as outlined below:

13.1. Fill the boiler to the normal water line.

13.2. Close boiler steam stop valve in the steam line.

13.3. Remove safety valves at the top of the boiler. The safety valves must be removed to prevent any contaminants or boil-out solution from entering them.

13.4. Tri-sodium phosphate and caustic soda each in the amount of one pound per 50 gallons of water are the suggested chemicals for cleaning boilers. Dissolve these compounds in water and add dissolved chemicals through an opening at the top of the boiler.

NOTE: When dissolving and mixing the boil-out chemicals, the use of a suitable face mask, goggles, rubber gloves, and protective clothing is mandatory. DO NOT permit the dry chemicals or the concentrated solution to come in contact with skin or clothing.

13.5. After adding the boil-out solution, add water to the boiler until it is completely filled.

13.6. Operate the boiler intermittently for 1 hour. Maintain just enough heat to hold the solution at the boiling point. Be patient.

13.7. Continue the process until the overflow water appears clear.

13.8. Stop the heating element and allow the water to cool to about 120°F. Drain the boiler while the water is still warm.

NOTE: Prior to draining the boiler, check with local water treatment facilities to determine whether special instructions or permits are required to dispose of the water.

13.9. After closing the openings and reinstalling the safety valves, fill the boiler to its normal water level and fire it until the water temperature is at least 180°F to drive off any dissolves gasses and oxygen which might otherwise corrode the metal.

On a steam system, the condensate should be wasted until test show the elimination of undesirable impurities. During the period the condensate is wasted, attention must be given to the treatment of the raw water used as make up so that an accumulation of unwanted materials or corrosion does not occur. Follow the advice of you water treating company.

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14. Water Quality Limits for Lattner Steam Boilers

Constituent	Recommended Value or Limit
Oxygen	0 parts per million
Carbon Dioxide	0 parts per million
pH	9.0 to 10.0
Total Hardness	1 parts per million as $CaCO_3$
Total Alkalinity	600 parts per million as $CaCO_3$
Total Dissolved Solids	2200 to 2500 parts per million
Total Iron	<0.1 parts per million
Specific Conductance	3500 umho/cm non-neutralized
Silica	<150 parts per million
Oily Matter	<0.1 parts per million

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Section III: Boiler Care & Maintenance

WARNING: All maintenance procedures must be performed by competent personnel familiar with boilers and boiler accessories.

CAUTION: Always disconnect main power before attempting to service equipment.

NOTE: Certain maintenance items concerning specific components may be found in the product literature specifications of this manual.

1. Routine Maintenance

    1.1. Make visual check of all controls.
    1.2. Check for buzzing contactors in control panel. Clean or replace if necessary.
    1.3. Observe pressure gauge for normal operation.
    1.4. Inspect for water or steam leaks at piping connections and at tube bundle end.

2. Monthly Procedures

    2.1. Inspect all wiring in control panels and check for tightness.
    2.2. Check all piping connections and fittings for tightness.

3. Quarterly Procedures

    3.1. Check low water cut-off for proper operating and for possible clogging.
    3.2. Check all other valves and controls for preparation. Replace defective parts immediately.

4. Yearly Procedures

    4.1. Shut down entire boiler and conduct complete inspection.
    4.2. Replace any defective heating elements which may have been plugged.
    4.3. Inspect heating elements for scale. If scale has formed, clean with a commercially available descaling compound suitable for use with incoloy elements (Ni, Cr, Fe), such as OAKITE DRYCID.

5. Heating Elements

    5.1. If a bad heating element is detected, remove that element from service. To perform this task, follow the steps below:

        5.1.1. Turn of all power sources.
        5.1.2. Drain boiler.

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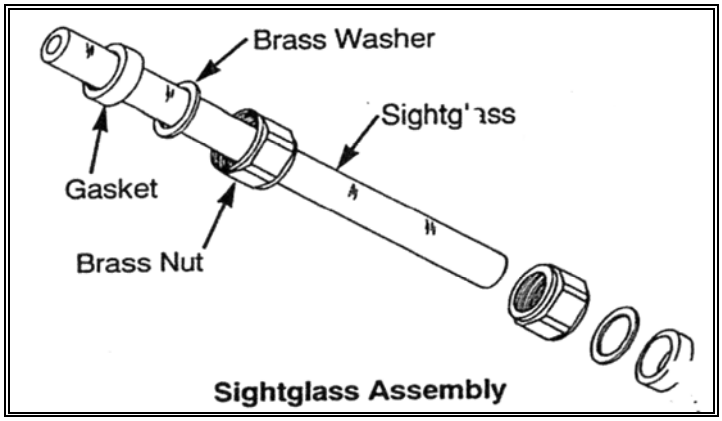
5.1.3. Disconnect wiring from the defective element and tape ring connectors with electrical insulating tape.
5.1.4. Remove both retaining nuts.
5.1.5. Pull element out approximately 6" and cut off with hacksaw.
5.1.6. Push element back into vessel.
5.1.7. Insert a short piece of 7/16" diameter round rod (approximately 2" to 3" long) in place of the element, and using a new compression sleeve and the old retaining nut, tighten the rod into place.
5.1.8. At the next scheduled maintenance shut down, replace all defective elements with new ones by removing flange assembly.

5.2. To replace heating element flange assembly, proceed as follows:

5.2.1. Turn off all power sources.
5.2.2. Drain the boiler.
5.2.3. Disconnect element leads.
5.2.4. Remove flange bolts and entire heating flange.
5.2.5. Clean matching flange on boiler and remove all traces of old gasket.
5.2.6. Use new gasket and apply gasket compound to both sides.
5.2.7. Align flange in same concentric position as before (top is marked).
5.2.8. Tighten flange bolts and rewire using wiring diagram and element layout drawing as reference.
5.2.9. Make sure all terminals are clean and bright and that nuts are tightened to at least 25 inch-lbs. of torque. **DO NOT** over tighten.
5.2.10. Before boiler is put back intro service, check all bolts and electrical fitting for tight connections.

6. Sight Glass Removal & Installation (See Diagram Below)



Sightglass Assembly

6.1. Boiler and pump should be switched off.

6.2. Boiler should be cool and the water level should be below the lower water gauge fixture.

6.3. Close the upper and lower water gauge valves.

6.4. Loosen both sight glass packing nuts (top and bottom) with a wrench.

6.5. Slide glass carefully upward into the upper fixture. Glass should lift out of the lower fixture.

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6.6. Pull glass down, out of the upper fixture tilting the glass slightly to clear the lower fixture. Be careful not to break the sight glass when removing.

6.7. Assemble the new sight glass as shown. **ALWAYS** replace the gaskets and brass washers when installing a new sight glass.

6.8. Slide the new glass into the upper fixture. Glass should clear the lower fixture and tilt into position.

6.9. Slide the sight glass down into the lower fixture. Equalize the gap between the upper and lower fixtures.

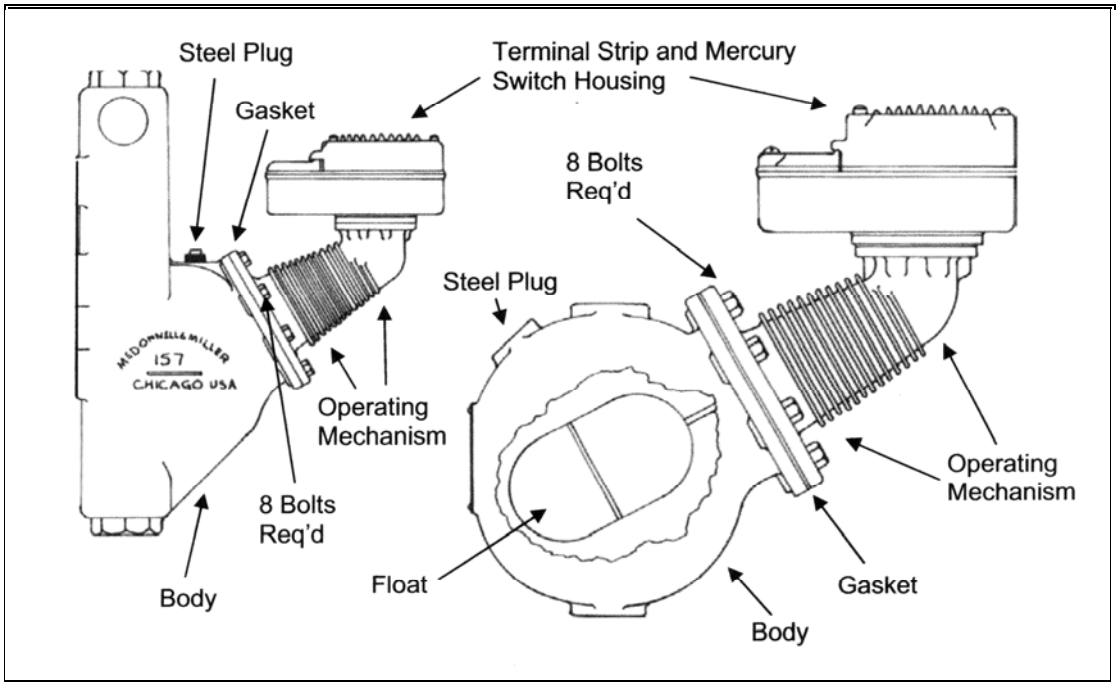
6.10. Tighten the sight glass packing nuts hand tight.

6.11. Use a wrench to tighten 1/4 turn past hand tight. **NEVER** over tighten the sight glass. This will crack the glass and cause it to shatter under pressure.

6.12. Open the upper and lower gauge valves.

6.13. Switch on boiler and pump.

7. McDonnell Miller Servicing (See Diagram Below)



7.1. Disconnect all power to the boiler.

7.2. The boiler should be cool and drained of all water just below the McDonnell Miller control.

7.3. Make sure all water is drained from the McDonnell Miller control by opening the control blowdown valve.

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7.4. Disconnect the wiring and conduit connection to the McDonnell Miller. Tag all wires to ensure they are reconnected properly.

7.5. Remove the eight bolts holding the operating mechanism to the McDonnell Miller body. Use a 9/16" wrench or a crescent wrench.

7.6. It may be necessary to tap near the base of the operating mechanism to free it from the body.

7.7. Lift the McDonnell Miller operating mechanism out of the body. Be careful to avoid damaging the float and float arm which extend into the body of the McDonnell Miller.

7.8. Carefully scrape the old gasket from the body and the operating mechanism of the McDonnell Miller.

7.9. Remove any scale in the McDonnell Miller body. Always check the operating mechanism for any scale that might be blocking the float or float arm.

7.10. Check the float for any holes.

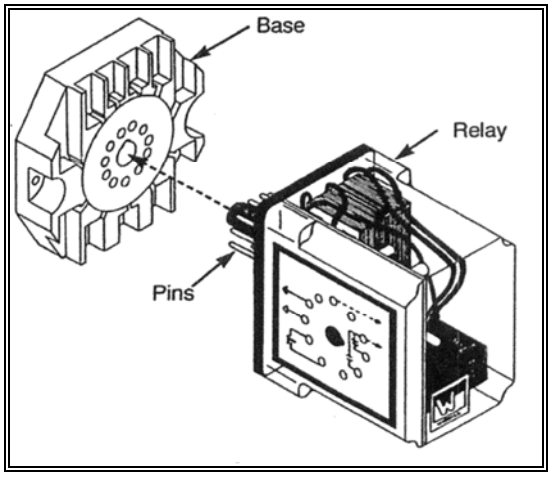
7.11. Hold the float submerged in a bucket of water and look for any air bubbles coming from the float.
7.12. Always reassemble the McDonnell Miller operating mechanism to the body with a new gasket.

7.13. Reinstall the eight bolts to the operating mechanism. Draw up the bolts evenly to prevent damage to the gasket, body or operating mechanism. Do not over tighten the bolts.

7.14. Reconnect the McDonnell Miller per wiring diagram.

7.15. Reconnect all power to the boiler.

8. Aux LWCO Relay Replacement



8.1. Disconnect all power to the boiler.

8.2. Pull relay out by hand. This may take a little force but be careful.

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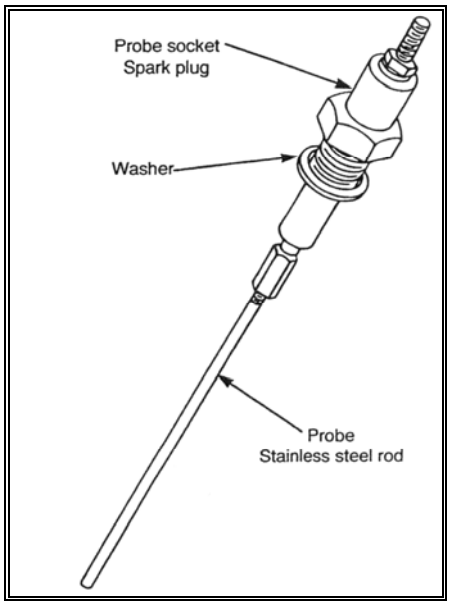
8.3. Replace the relaywith a new 26M or PDI relay. The relay has a small tab so that it can be installed only one way.

8.4. Reconnect the power to the boiler.

9. Auxiliary Low Water Cut-Off Probe Cleaning (See Diagram Below)



9.1.1. Disconnect all power to the boiler.

9.1.2. Remove the four screws on top of the probe enclosure with a Phillips screwdriver.

9.1.3. Remove the wire from the probe using a 5/16" wrench or a crescent wrench. Only the wire on the probe is to be removed.

9.1.4. Use a 13/16" spark plug socket and remove the probe.

9.1.5. Clean the stainless steel probe and probe fitting.

9.1.6. Reinsert the probe using a 13/16" spark plug socket. Only tighten the probe enough to stop any steam leaks. Over tightening will destroy the threads of the enclosure.

9.1.7. Reinstall the probe wire to the probe.

9.1.8. Reassemble the cover to the enclosure with the four Phillips screws.

9.1.9. Reconnect power to the boiler.

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Section IV: Troubleshooting

WARNING: All troubleshooting procedures must be followed completely by competent personnel familiar with electric boilers and accessories.

CAUTION: Read and follow all instructions before troubleshooting any boiler equipment.

1. Troubleshooting

The chart below is a general chart that shows common problems that may occur in boiler operation. This chart is only to be used by competent service personnel familiar with Lattner boiler equipment and controls. To us this chart, read down the side of the chart from the problem, then read the right side for possible causes. The causes are arranged with the most common first. If the problem and/or cause is not on the chart below, consult a trained boiler service company.

Problem	Possible Causes
Boiler will not operate.	1. Fuses may have opened due to electrical short or burned out elements. Use clamp-on ammeter on each wire to ensure fuse is passing approximately 80% of its rating. 2. Step controller may be defective. See controller data sheets for trouble shooting assistance. 3. Control circuit fuses mounted inside panel may have opened. Replace if defective. 4. Low water cut-off may have opened because of low water level. Verify water level and refer to manufacturer's data sheet for assistance.
Boiler not generating full power.	1. Check for element failure by measuring current. 2. Check for blown fuses. 3. Replace defective elements (see Section III). 4. Supply voltage may be too low. 5. Verify that line currents in all three phases do not vary more than 10% from each other.

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Boiler and pump switches are ON, pump does not run, low water level in boiler.	1. Circuit breaker tripped or fuse blown. 2. McDonnell Miller piping is plugged. 3. McDonnell Miller float is stuck. 4. McDonnell Miller is wired incorrectly. 5. Pump or solenoid water valve is wired incorrectly.
Pump runs but does not maintain water level in boiler.	1. Hand valve between pump and boiler is closed. 2. Bad check valve. Always replace with a spring-loaded check valve. 3. Bad steam traps. 4. Water temperature is too hot. 5. Strainer is plugged. 6. Pump isolation valve is closed. 7. No water is supplied to the pump. 8. Pump out of adjustment.
Pump or solenoid overfills the boiler.	1. Solenoid water valve is not seating properly. 2. McDonnell Miller float is operating incorrectly. 3. McDonnell Miller snap switch is malfunctioning. 4. McDonnell Miller is wired incorrectly. 5. Pump is wired incorrectly.
Limit switch always shuts down boiler.	1. Scale build-up inside of the boiler. 2. Operating pressure switch is set higher than limit switch. 3. Operating pressure switch is not operating properly.
Boiler shuts down with auxiliary low water cut-off.	1. Pump switch is turned off. 2. Probe wired incorrectly. 3. Auxiliary level control relay wired incorrectly. 4. Probe has scale, dirt, or debris on it. 5. Foaming problem in boiler. 6. Water in boiler is too soft. 7. McDonnell Miller is not operating correctly. 8. Pump is not functioning properly. 9. Bad check valve. Always replace with spring-loaded check valve. 10. No water supplied to the pump. 11. Probe is out of probe socket.
Safety valve(s) fail.	1. Pressure in boiler exceeds pressure setting of safety valve. 2. Operating and/or limit switch set higher than safety valve. 3. Scale build-up inside boiler. 4. Operating and/or limit switch wired incorrectly.

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LATTNER BOILER LIMITED WARRANTY

A Lattner boiler shell is guaranteed to be constructed in accordance with the ASME Code. An independent ASME boiler inspector inspects the construction of each boiler and: (1) checks mill test reports on all materials used to ensure that the chemical and physical analysis of such materials complies with the ASME Code; (2) inspects each boiler shell during construction to see that workmanship complies with the Code; and (3) witnesses the final hydrostatic test and then places the ASME stamp on the boiler shell and signs an ASME data report certifying the boiler is ASME approved.

Lattner warrants the boiler and any other equipment of its manufacture to be free from defects in material and workmanship for one (1) year from the date of shipment from the factory, provided the boiler is operated under the normal use and service for which it was intended, and only if the boiler has been properly installed by a qualified technician in accordance with but not limited to ASME, ANSI, and NFPA Codes and applicable local, state, and national codes.

Lattner's obligation under this Warranty is limited, at Lattner's option, to replacing or repairing any defective part of the boiler or other equipment it manufactures. No allowance will be made for labor, transportation, or other charges incurred in the replacement or repair of defective parts. Merchandise not manufactured by the Company, supplied in one piece or in component assemblies, is not covered by the above warranty, but the Company will give the Purchaser the benefit of such adjustment as it can make with the manufacturer of such items.

Lattner shall not be liable for special, indirect, or consequential damages. Lattner shall not be liable for any loss or damage resulting, directly or indirectly, from the use or loss of use of the boiler. This exclusion from liability includes the Purchaser's expenses for downtime or for making up downtime, damages for which the Purchaser may be liable to other persons, or damages to property.

The remedies set forth in this Warranty are exclusive, and the liability of Lattner with respect to any contract or sale shall not exceed the cost of repair or replacement of the boiler or other equipment manufactured by Lattner.

The above Warranty shall not apply to any boiler or other equipment manufactured by Lattner which:

1) has been repaired or altered without Lattner's written consent;
2) has been altered in any way so as, in the judgment of Lattner, to adversely affect the stability or reliability of the boiler;
3) has been subject to improper water treatment, scale, corrosion, misuse, negligence, or accident;
4) has not been operated in accordance with Lattner's printed instructions or specifications;
5) has been operated under conditions more severe than or otherwise exceeding those set forth in the specifications for such boiler; or
6) has not been properly installed by a qualified technician in accordance with but not limited to ASME, ANSI and NFPA Codes and all applicable local, state and national codes.

THIS WARRANTY IS EXPRESSLY MADE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. LATTNER MAKES NO WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR ANY PARTICULAR PURPOSE.

Purchaser must notify Lattner of a breach of Warranty within thirty (30) days after discovery thereof, but not later than the one-year guarantee period; otherwise, such claims shall be deemed waived. No allowance will be granted for any repairs or alterations made by Purchaser without Lattner's prior verbal or written consent. Items returned to Lattner must be accompanied by a factory-supplied return goods authorization (RGA). **Such authorization may be obtained by calling the factory at 319/366-0778 or by writing to P.O. Box 1527, Cedar Rapids, IA 52406.**

Lattner neither assumes nor authorizes any person to assume for it any other liability in connection with the sale or use of the boiler or other equipment manufactured by Lattner, and there are no oral agreements or warranties collateral to or affecting this Agreement.

LATTNER BOILER COMPANY
Cedar Rapids, IA USA

Form W01-17

STANDARD TERMS & CONDITIONS

LIMITATION ON QUOTATION

Unless otherwise stated in the quotation, the quotation will remain valid for a period of thirty (30) days from the date hereof, at which time it will automatically expire unless extended by a signed document issued by the Company, from its headquarters in Cedar Rapids, IA.

EQUIPMENT SELECTION

The Purchasers selection of sizes, types, capacities, and specifications and suitability thereof for the specific application shall be the unshared responsibility of the Purchaser or Purchaser's representative or consultant.

PRICES

Unless defined otherwise in the quotation, prices are F.O.B. Cedar Rapids, IA – USA, exclusive of freight, storage, off-loading, installation, service, start-up, extended warranty or local delivery charges, if any.

TAXES

Purchaser shall be liable for all Federal, State, and local taxes with respect to the purchase of the equipment proposed, unless exclusively exempted from any taxes and proof thereof is on file with the Company.

PAYMENT

Purchaser shall pay with US funds, the full amount of the invoiced purchase price within thirty (30) days of the Company's invoice, whether the equipment has shipped or has been delayed through no fault of the Company and subject to approved credit. Beginning thirty (30) days after the invoice date, Purchaser shall pay a late payment charge of two percent (2%) per month, which is an annual rate of 24%, on any unpaid portion of the purchase price. The Company reserves the right to revoke or modify these credit terms.

SHIPMENT

Any shipping date shown in the body of the quotation or order acknowledgement, represents the Company's approximated schedule as of the date of the quotation, and is subject o change as determined by shop loading if and when this quotation should be realized as an actual sale. The Company shall no incur any liability of any kind for failure to ship on any particular date unless a firm shipping date has been expressly agreed to by an officer of the Company, in a separate written document.

CANCELLATION AND DELAYS

Subsequent to the receipt of Purchaser's Purchase Order and the Company's issued order acknowledgement, the Purchaser may not change nor cancel the order in whole or in part, without the written approval and acceptance by the Company of such cancellation or change. The price change to reflect the Company's cost to implement the change, or to offset costs incurred by the Company in order preparation, engineering, purchasing, and or in actual production of the order in the event of a cancellation. In the event that Purchaser delays shipment of the equipment up the Company's notice to ship, the equipment shall be place in storage at the Purchaser's risk and expense, and transfer to storage shall occasion shipment and the order shall be invoice as if shipped.

RETURNS AND RESTOCKING

Equipment may be returned to Lattner at 1411 9th Street SW, Cedar Rapids, IA 52406, only upon prior written authorization of the Company. Consent, if given, will be upon the condition the purchaser assumes all carrier charges, responsibility for damages in transit, and a minimum 15% restocking charge, and the only if the so authorized material is in new and .unused condition and returned within one year from original date of shipment. The credit will be based on the original invoice price or the current price; whichever is lower, less the applicable restocking charge.

SECURITY INTEREST

For the purposes of securing payment, the Company may issue a lien on the equipment, following the invoice 30 days time, and until such time that payment has been received in full. Upon receipt of payment in full, the Company will rescind the lien.

FORCE MAJEURE

In no event shall the Company be liable for loss or damage resulting from any delay or failure to ship or other failure, loss or damage that is the proximate result of any act of government authority, revolution, riot, civil disorder, art of war, delay or default in transportation, inability to obtain materials or facilities from normal sources, fire, flood, act of God, or any cause not within the reasonable control of the Company. The Company may, without causing a breach or incurring liability, allocate goods which are in short supply irrespective of the reasons therefore among customers in any manner which the Company in its sole discretion deems advisable. If an event occurs that is beyond the control of the Company, and that even delays the Company's performance and causes its cost of production to increase because of the delay, the Company may pass such increased cost(s) on to the Purchaser.

DAMAGE LIMITATION

Under no circumstance shall the Company be held liable for any loss of profits, down time, or any incidental or consequential damages of any kind with respect to its products or the transaction by which its products are sold.

WARRANTY AND PERFORMANCE

Products shall be warranted in accordance with the Company's standard warranty statement, form No. W01 - 17. The Company's warranty shall be voiced by any abuse, misuse, neglect, unauthorized modification or service, lack of maintenance and service, or use not in accordance with the Company's instructions. Warranty shall also be voided if water treatment has not been provided or by improper start-up of the equipment. The Company's sole warranty statement and this paragraph contain the Company's sole warranty and the Company makes no implied warranty, and there is no implied warranty of merchantability or fitness for any particular purpose.

SERVICE

Unless otherwise noted herein, the cost of the equipment does not include service or installation. All services performed by the Company are subject to purchaser's payment of the Company's prevailing charges plus necessary travel and living expenses. Whenever service is quoted, please refer to Lattner's Service Policy for specific details.

EXCLUSION OF OTHER TERMS

This constitutes an offer on behalf of Lattner Boiler Manufacturing (the Company); to sell the goods described in the quotation, exclusively on the terms and conditions stated. Acceptance of this by the Purchaser is hereby expressly limited to these Terms and Conditions and shall be applicable to any order issued by the Purchaser unless other terms have been agreed to in a written document issued by the Company.

GOVERNING LAW

The transaction with respect to the goods, which are subject hereof, shall be governed by the interpreted and construed in accordance with the laws of the State of Iowa. The Courts in the State of the Iowa. The Courts in the State of Iowa will have the sole jurisdiction over any claim arising under this contract of sale.

ASSIGNMENT

All sales as evidenced by the Company's acknowledgement hall be binding up on and inure to the benefit of the Purchaser and the Company and their respective heirs, successors, or assigns.

LATTNER BOILER COMPANY
Cedar Rapids, IA USA

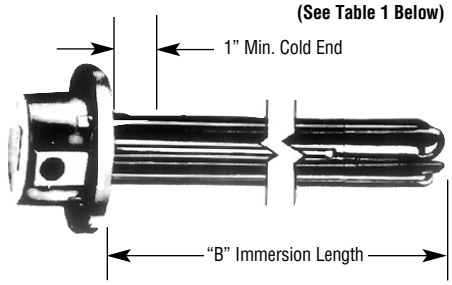
Chromalox®

Installation, Operation and Maintenance Instructions

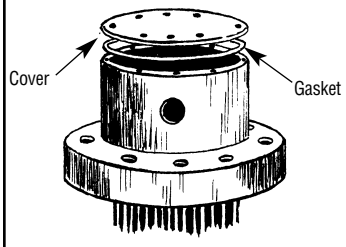
SERVICE REFERENCE	
DIVISION 4	SECTION TM
SALES REFERENCE (Supersedes PD408-18)	PD408-19
	161-048422-001
DATE MAY, 2006	

Type TM, TMI, TMO, TMS, TMIS and TMSS Series Industrial Flanged Immersion Heater

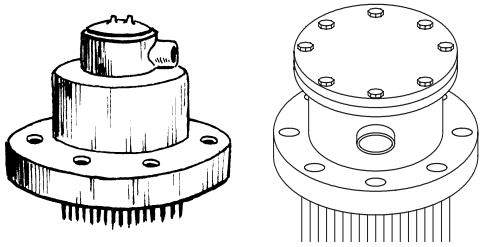
Note: These instructions relate to all enclosure styles shown within.



TM Series Flanged Immersion Heater with General-Purpose (E1) Terminal Enclosure



Moisture Resistant (E4) Terminal Enclosure



Explosion Resistant & Moisture Resistant (E2/E3) Terminal Enclosure

GENERAL

⚠WARNING

FIRE/EXPLOSION HAZARD. Do not exceed the Pressure-Temperature rating of the flange as listed in ANSI B16.5.

Chromalox TM, TMI, TMO, TMS, TMIS and TMSS Series industrial flanged immersion heaters are designed for a wide variety of heating applications.

1. **Heater Construction Characteristics:**
   - **A.** High quality resistance wire held in place by compacted Magnesium Oxide Refractory enclosed in a wide variety of sheath materials.
   - **B.** Low to high watt densities.
   - **C.** Standard selection of sheath materials include copper, steel, INCOLOY® alloy and stainless steel. This broad selection of sheath materials will operate successfully in many corrosive solutions.

IMPORTANT: It is the responsibility of the purchaser of the heater to make the ultimate choice of sheath material based upon their knowledge of the chemical composition of the corrosive solution, character of the materials entering the solution, and controls which he maintains on the process.

⚠WARNING

FIRE/EXPLOSION HAZARD. Sheath corrosion can result in a ground fault which, depending upon the solution being heated, can cause an explosion or fire.

- **D.** Pipe flange sizes in 3, 5, 6, 8, 10, 12 and 14 inches are standard. Other sizes are also available.
- **E.** Units are available with E1 General Purpose, E4 Moisture Resistant and E2/E3 Explosion/Moisture-Resistant terminal enclosures.

⚠WARNING

FIRE HAZARD. An integral thermostat, if provided, is designed for temperature control service only. Because the thermostat does not fail safe, it should not be used for temperature limiting duty. Wiring to this device is the responsibility of the user.

⚠WARNING

The system designer is responsible for the safety of this equipment and should install adequate back-up controls and safety devices with their electric heating equipment. Where the consequences of failure could result in personal injury or property damage, back-up controls are essential.

Table 1

Flange Size	Cold End
3"	4"
5"	4"
6"	4"
8"	6"
10"	6"
12"	6"
14"	6"

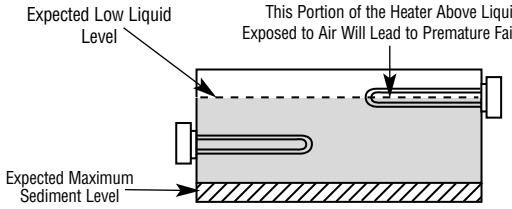
Note:
Cold ends listed are standard. However, special cold ends may be used upon request.

INSTALLATION

⚠WARNING

ELECTRIC SHOCK HAZARD. Disconnect all power before installing or servicing heater. Failure to do so could result in personal injury or property damage. Heater must be installed by a qualified person in accordance with the National Electrical Code, NFPA 70.

1. Before installing, unpack and check your TM series immersion heater for any damage that may have occurred during shipment. Report any claims to you carrier if damage has ocurred in shipment. ***Do not operate damaged equipment. Consult factory for instructions.***
2. Check to ensure that the line voltage is the same as that stamped on the nameplate. Verify wattage and capacity versus the requirements at installation site.
3. Do not bend the heating elements. If bending is necessary, consult factory.
4. **IMPORTANT:** Mount the heater in the tank so that the liquid level will always be above the effective heated portion of the heater. If the heater is not properly submerged, it may overheat and damage the heating elements (see Figure 1).



Note: Locate Heater as low as possible for maximum heated liquid storage capacity. Heat does not move downward.

Figure 1 - Open Tank Installation

⚠WARNING

FIRE HAZARD. If the heater is not properly submerged, the heating elements will overheat and could result in a fire or damaged equipment.

5. Where work will pass over or near equipment, additional protection such as a metal guard may be needed.
6. Heater must not be operated in sludge.
7. The gasket surface must be clean and dry before the heater is seated (see Figure 2).
8. Closed Tank Installation

   Note: When heating in closed vessels, controls and back-up controls must be used to prevent buildup of temperature and/or pressure.

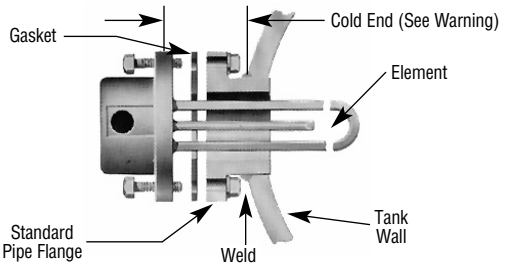


Figure 2 - Flanged Mounting

⚠WARNING

Care must be taken to insure the heated portion does not extend into the coupling area.

A. Horizontal Position (Figure 3)

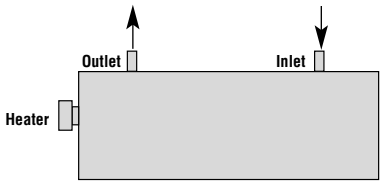


Figure 3 Closed Tank in Horizontal Position

A1. Place heater at an elevation so that natural circulation can take place.

A2. Position outlet and inlet in a vertical plane, facing upward to prevent air pockets. Be sure all trapped air is removed from the closed tank. Bleed the air out of the liquid piping system and heater enclosure prior to operation.

A3. IMPORTANT: Heater should never be located at the highest point of the water system. Provide expansion tank if necessary.

A4. Heaters shall be supported if the immersion length is greater than 36".

B. Vertical Position (Figure 4)

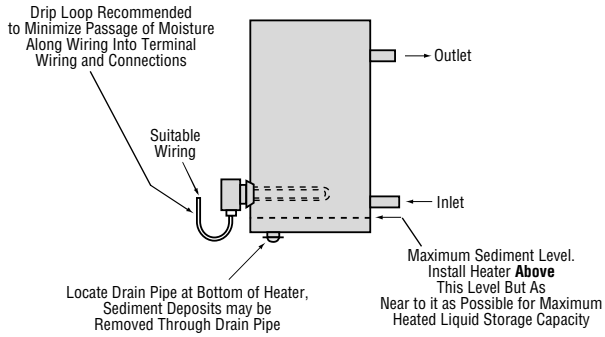


Figure 4 - Closed Tank in Vertical Position

9. A drip loop is recommended to minimize passage of moisture from condensation along wiring into terminal box enclosure and connections.

⚠WARNING

FIRE HAZARD. Since heaters are capable of developing high temperatures, extreme care should be taken to:

A. Use explosion-resistant terminal enclosures in hazardous locations. See Chromalox catalog for selection of explosion-resistant terminal enclosure for hazardous locations.

B. Avoid contact between heater and combustible materials.

C. Keep combustible materials far enough away to be free of the effects of high temperatures.

⚠CAUTION

FREEZE HAZARD. This unit may be equipped with a thermowell for process control or over-temperature control. Do not allow moisture to accumulate in thermowell. Freezing temperatures can cause damage that may result in the heated medium leaking into terminal enclosure.

INSTALLATION (cont'd)

10. To prevent moisture accumulation in cryogenic applications or when heater is exposed to freezing temperatures:
- **A.** Slope conduit away from enclosure (drip loop).
- **B.** Seal all conduit openings to moisture/explosion resistant terminal enclosure.
- **C.** Insulate terminal enclosure.
- **D.** Fill thermowell(s) with silicone fluid when heater is mounted with terminal enclosure up.

BEFORE ENERGIZING

1. Check that the gasket is in place and the flange is securely bolted to the tank.

2. Check that power supply connections are made according to the wiring diagram. Also check for positive connection of all bus bars and power supply leads.

⚠WARNING

FIRE OR SHOCK HAZARD: Moisture accumulation in the element refractory material, element over-temperature, or sheath corrosion can cause ground fault to the element sheath, generating arcing and molten metal. Install Ground Fault Circuit-Interrupter (GFCI) to prevent personal injury or Equipment Ground Fault Protection to prevent property damage.

THERMOSTATS

1. Integrally mounted thermostats are available: single throw models.

2. Electrical rating of thermostats:

Voltage	Thermostat Type	
	T1	T2
120	30 Amps	30 Amps
240	30 Amps	30 Amps
480	Pilot Duty	Pilot Duty

3. Thermostats may be connected directly to heaters that are rated within the electrical capacities specified above. When the heater amperage exceeds the contact rating of the thermostat, the heater should be controlled by a magnetic contactor with the thermostat wired for pilot duty. Refer to the thermostat instruction sheet packed with the heater.

WIRING

⚠WARNING

ELECTRIC SHOCK HAZARD. Disconnect all power before installing or servicing heater. Failure to do so could result in personal injury or property damage. Heater must be installed by a qualified person in accordance with the National Electrical Code, NFPA 70.

⚠WARNING

ELECTRIC SHOCK HAZARD. Any installation involving electric heaters must be performed by a qualified person and must be effectively grounded in accordance with the National Electrical Code to eliminate shock hazard.

1. Electric wiring to heater must be installed in accordance with the National Electrical Code and with local codes by a qualified person.

⚠CAUTION

Use copper conductors only.

2. When element wattages are not equal, heaters must not be connected in series.

3. Electrical wiring to heater should be contained in rigid conduit or in sealed flexible conduit to keep corrosive vapors and liquids out of the terminal enclosure. If high humidity is encountered, the conduit should slope away from the heater.

4. If flexible cord is employed, a watertight connector should be used for entry of the cord into the terminal enclosure. Outdoor applications require liquid-tight conduit and connectors.

5. Bring the power line wires through the opening in the terminal box.

6. Heaters are prewired and tagged for easy installation of electrical wiring to the heater. Tagging of the individual circuits of Chromalox TM industrial flanged heaters are shown in the following tabulation:

TM Series (No. of Elements)	No. Circuits (Standard)	Phase	Tagging
3	1 1	1 3	L1 & L2 L1, L2 & L3
6	1 1	1 3	L1 & L2 L1, L2 & L3
	2	3	1L1, 1L2, 1L3 2L1, 2L2, 2L3
12	2	3	1L1, 1L2 & 1L3 2L1, 2L2 & 2L3
18 Thru 45	3	3	1L1, 1L2 & 1L3 2L1, 2L2 & 2L3 3L1, 3L2 & 3L3

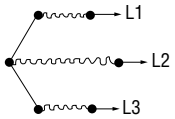
7. Check for loose terminal connections and tighten if necessary.

Made to order items are prewired and tagged at the factory. Wiring of made to order items may differ from those shown in the tabulation. **Carefully check voltage and phase on the heater nameplate and select either the appropriate wiring shown above or check for the appropriate wiring diagram in the heater terminal enclosure.** For reference purposes, some typical wiring diagrams are shown in the following figures.

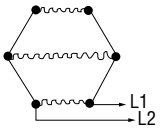
8. The current carrying capacity of the power supply leads should exceed the heater amperage by at lease 25%. Be sure to consider the ambient operating temperature and apply the appropriate correction factor to the ampacity rating of the wire. Heaters with the same voltage and wattage may be connected in series for operation at a higher voltage.

TYPICAL WIRING DIAGRAMS

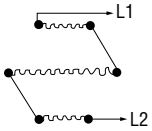
TM Series - 3 Element (All sheath materials)



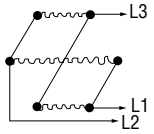
208-600V, 3Ø Y



208-600V, 1Ø

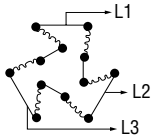


380-600V, 1Ø, SERIES

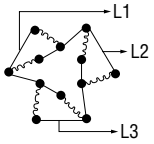


208-600V, 3ØΔ

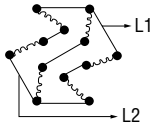
TM Series - 6 Element (All sheath materials)



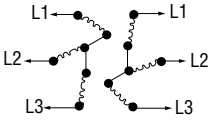
380-600V, 3Ø, SERIES Δ



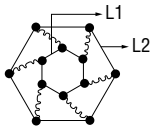
208-240V, 3Ø, PARALLEL Δ



380-600V, 1Ø, SERIES

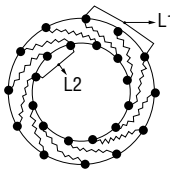


208-600V, 3Ø Y
2 CIRCUITS

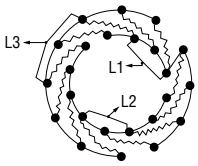


240V, 1Ø (15 kW Max)
208-230V, 1Ø (12 kW Max)

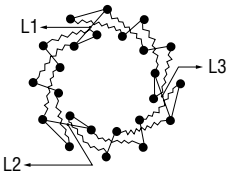
TM Series - 12 Element (All sheath materials)



380-600V, 1Ø PARALLEL

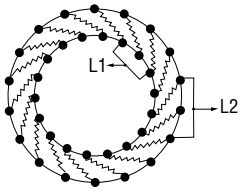


208-600V, 3Ø, PARALLEL Δ

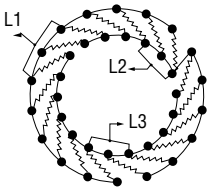


380-600V, 3Ø, SERIES Δ

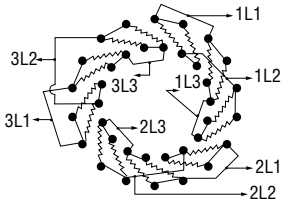
TM Series - 18 Element (All sheath materials)



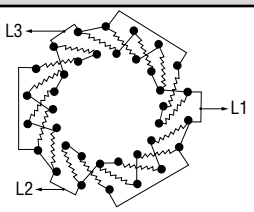
380-600V, 1Ø, PARALLEL



208-600V, 3Ø, PARALLEL Δ

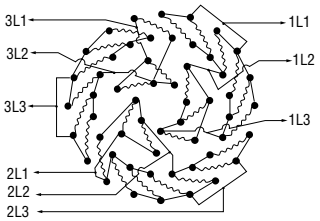


208-600V, 3Ø, PARALLEL Δ, 3 CIRCUITS



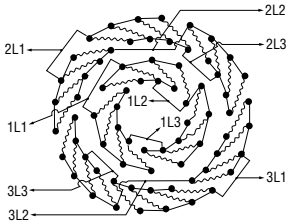
380-600V, 3Ø, SERIES Δ

TM Series - 27 Element (All sheath materials)



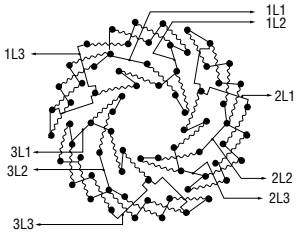
208-600V, 3ØΔ, 3 CIRCUITS

TM Series - 36 Element (All sheath materials) 208-600V



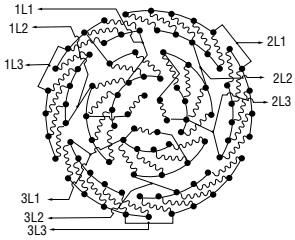
208-600V, 3ØΔ, 3 CIRCUITS

TM Series - 36 Element (All sheath materials) 380-600V



380-600V, 3Ø, 3 CIRCUITS, SERIES Δ

TM Series - 45 Element (All sheath materials)



208-600V, 3ØΔ, 3 CIRCUITS

SPECIAL REQUIREMENTS

Wiring

Use only Type E2/E3 terminal enclosures in hazardous location environments. The proper use of Type E2/E3 terminal enclosures on electric heaters located in hazardous areas requires that all electrical wiring comply with National Electrical Code (NEC) requirements for hazardous locations.

Maximum Temperatures

Safe operation in a hazardous location requires the maximum operating temperatures of all exposed surfaces of the heater including temperatures on the outside of the vessel, piping, flanges, screw plugs, enclosures and other heat conducting parts be limited. The flammable liquids, vapors or gases present determine the maximum surface temperature permitted in any hazardous location. The end user or purchaser of the electric heating equipment is responsible for determining the proper classification of an area and for providing Chromalox with hazardous area specifications and requirements for proper equipment design. (NEC Articles 500 and 501 provide guidelines for evaluating and classifying hazardous locations.)

Safety Devices

Approved pressure and/or temperature limiting controls must be used on electric heaters and heating elements to ensure safe operation in the event of system malfunctions.

Note: Class I Group B locations include Hydrogen gas. These areas require additional conduit seals and thread engagement.

OPERATION

1. Do not operate heaters at voltages in excess of that stamped on the heater since excess voltage will shorten heater life.
2. Always maintain a minimum of 2" of liquid above the heated portion of the element to prevent exposure of the effective heated length. If the heater is not properly submerged, it may overheat and shorten heater life. DO NOT OPERATE HEATER IF DRY.
3. Be sure all trapped air is removed from a closed tank. Bleed the air out of the liquid piping system and heater enclosure prior to energizing.
   Note: The tank or heating chamber in closed tank systems must be kept filled with liquid at all times.
4. Keep heating elements above sediment deposits.
5. **Low Megohm Condition —** The refractory material used in electric heaters may absorb moisture during transit, storage or when subject to humid environments that will reduce the cold insulation resistance (low megohm). Low megohm may result in high leakage current to ground and nuisance trips of ground fault protection equipment. Normally, the megohm value increases after heat-up.

   Typical insulation valves are 5 megohm or greater on complete assemblies of unsealed elements or 20 megohm on individual unsealed elements. It is recommended that heaters with 1 megohm or less be dried out before applying full power. If dried properly low megohm will not effect heater life or efficiency.

   To correct a low megohm condition, remove terminal enclosure cover, gaskets, and terminal hardware. Bake heaters in an oven at 300 to 350˚F for several hours or preferably overnight.

   An alternate procedure is to cycle the heater in 10 to 15 minute periods at low voltage until megohm values are normal. Sheath temperatures should not exceed 350˚F.

   Note: Low megohm on heating elements with epoxy or hermetic seals cannot be serviced in the field. Typical resistance values when sealed are 200 megohm or greater. Contact Chromalox service center at number listed.

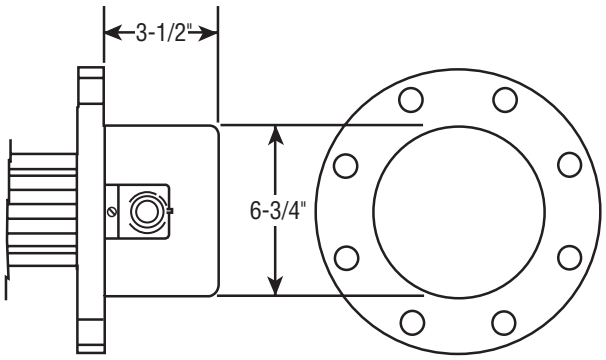
MAINTENANCE

⚠WARNING

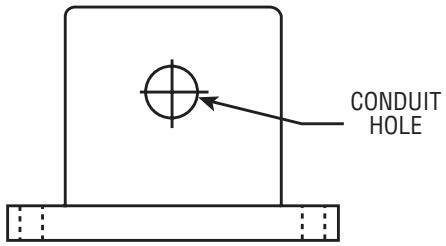
ELECTRIC SHOCK HAZARD. Disconnect all power before installing or servicing heater. Failure to do so could result in personal injury or property damage.

1. Heaters should be checked regularly for coatings and corrosion and cleaned if necessary.
2. The tank should be checked regularly for sediment around the heater as sediment can act as an insulator and shorten heater life.
   Note: applies to all items, not just # 2.
   Note: User is responsible for maintenance schedule based on their knowledge of the heated medium and operating conditions.
3. Remove any accumulated sludge deposits from heater and from tank.
4. Check for loose terminal connections and tighten if necessary.
5. If corrosion is indicated in the terminal enclosure, check terminal enclosure gasket and replace if necessary. Check conduit layout to correct conditions that allow moisture to enter the terminal enclosure.
6. Clean terminal ends of all contamination.
7. The heater can be protected from possible mechanical damage by placing a screen or grill around the elements.
8. Protect the terminal end of the heater from spray, condensation, dripping and vapors. A protective terminal enclosure should be used if the heater is to be subjected to these conditions.

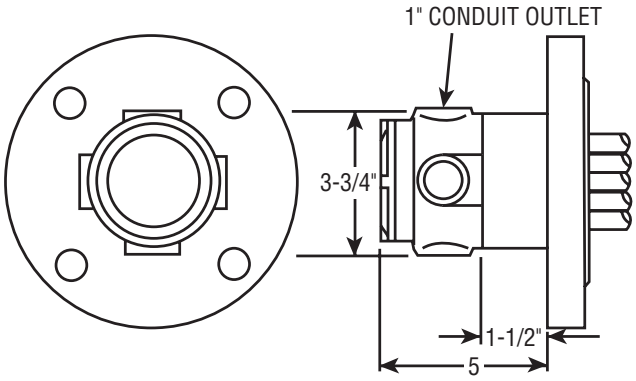
ENCLOSURE STYLES



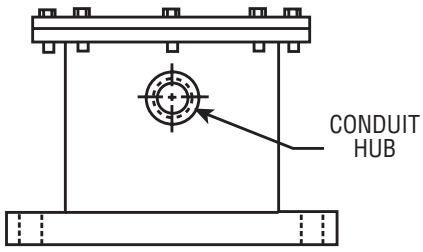
E1 GENERAL PURPOSE ENCLOSURE FOR UP TO 5" FLANGE



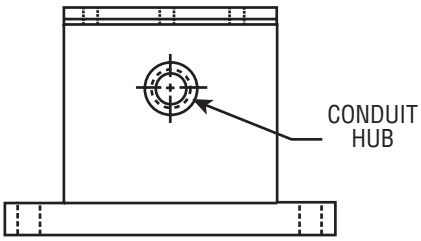
E1 GENERAL PURPOSE ENCLOSURE FOR 6" AND LARGER FLANGE



E2/E3 EXPLOSION RESISTANT ENCLOSURE FOR 2" AND 3" FLANGE



E2/E3 EXPLOSION RESISTANT ENCLOSURE FOR 6" AND LARGER FLANGE



E4 MOISTURE RESISTANT ENCLOSURE WITH GASKET

Note: These are typical enclosure styles. The heater purchased may vary slightly.

Chromalox®
PRECISION HEAT AND CONTROL

2150 N. RULON WHITE BLVD., OGDEN, UT 84404
Phone: 1-800-368-2493 www.chromalox.com

ITT

McDonnell & Miller

Installation & Maintenance Instructions
MM-217(H)

Series 150 and 157

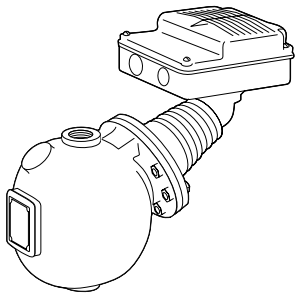
(Mercury Switch)

Series 150S and 157S

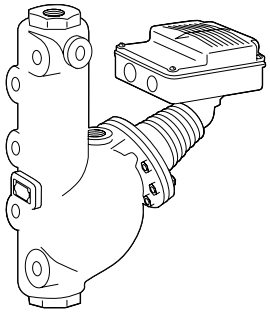
(Snap Switch, All Models except 157S-RB-P)

Low Water Cut-Off/Pump Controllers

For Steam Boilers and Other Level Control Applications



Series 150 and 150S

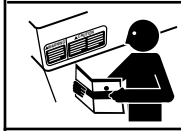


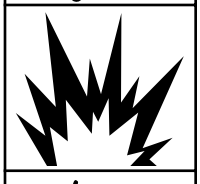
Series 157 and 157S

Typical Applications:

- **Primary or secondary pump controller/ low water fuel cut-off for steam boilers**
- **Motorized valve controller**
- **Low water cut-off**
- **High water cut-off**
- **Alarm actuator**

⚠ 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: 150 psi (10.5 kg/cm^2)

Electrical Ratings

Voltage	PumpCircuit 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

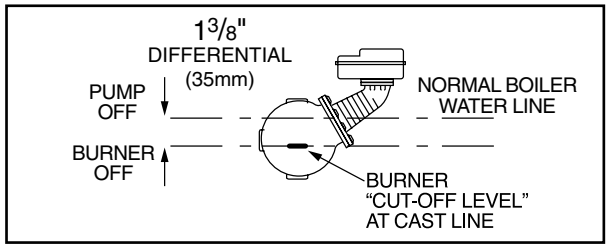
Settings and Differential Pressures

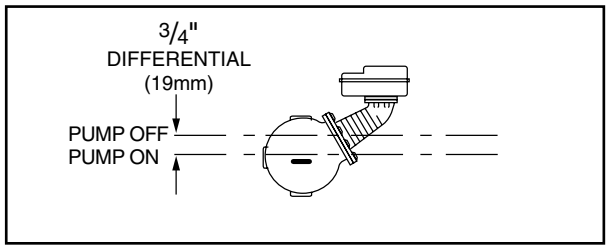
Values are ± ⅛" (3.2mm).

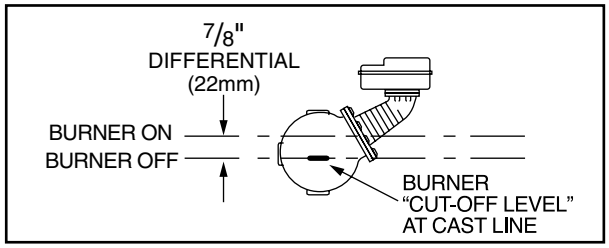
Series 150, 150S, 157 and 157S

Pressure	Setting	Approximate Distance Above Cast Line In. (mm)	Differential In. (mm)
0 psi (0 kg/cm^2)	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)	
150 psi (10.5 kg/cm^2)	Pump Off	1 3/8 (41)	3/4 (19)
	Pump On	5/8 (16)	
	Burner On	7/8 (22)	7/8 (22)
	Burner Off	0 (0)	

150 psi (10.5 kg/cm^2) Levels



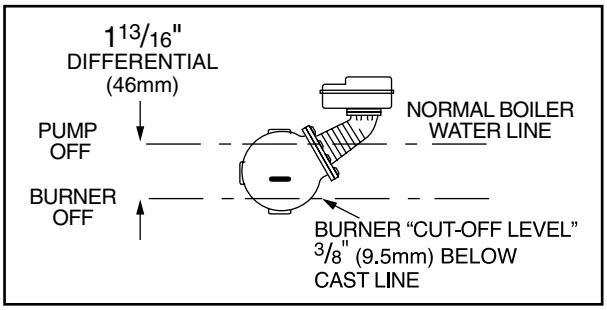


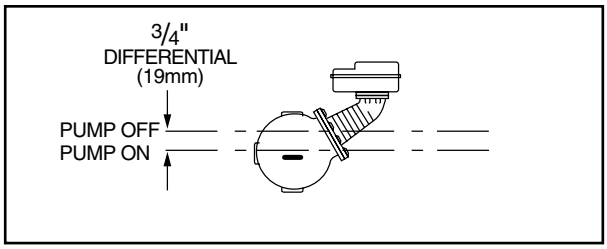


Model 150-MD, 150S-MD, 157-MD and 157S-MD

Pressure	Setting	Approximate Distance Above Cast Line In. (mm)	Differential In. (mm)
0 psi (0 kg/cm^2)	Pump Off	15/16 (24)	3/8 (16)
	Pump On	9/16 (14)	
	Burner Off	0 (0)	N/A
150 psi (10.5 kg/cm^2)	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^2) Levels





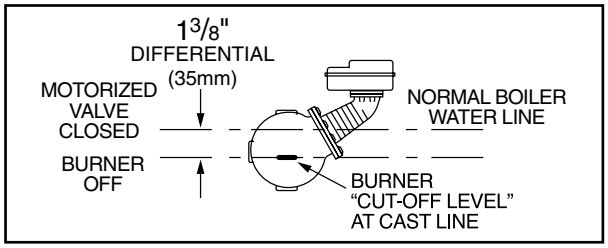
Settings and Differential Pressures (continued)

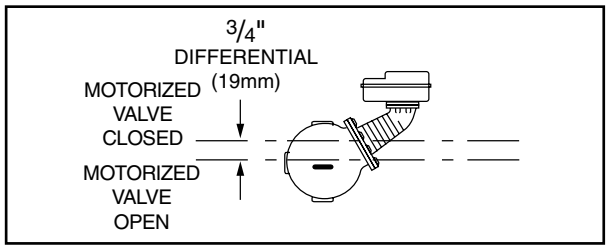
Values are ± 1/8" (3.2mm).

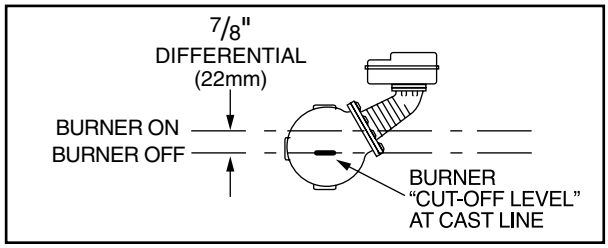
Model 158/158S

Pressure	Setting	Approximate Distance Above Cast Line In. (mm)	Differential In. (mm)
0 psi (0 kg/cm²)	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)	
150 psi (10.5 kg/cm²)	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/cm²) Levels





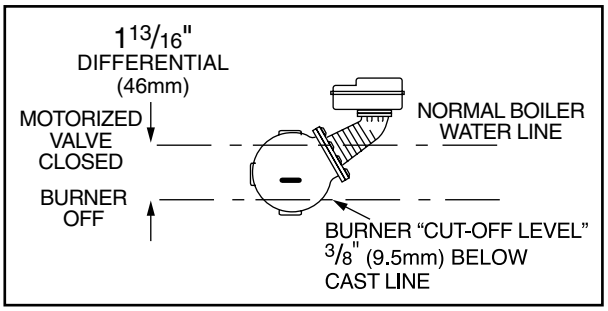


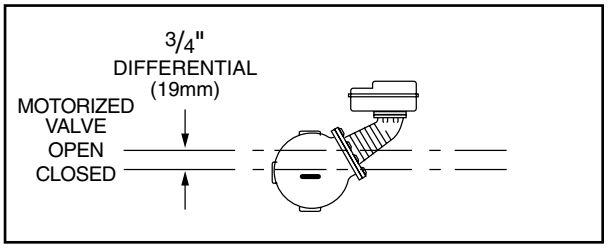
NOTE: Due to the slower operation of some motorized valves, complete valve opening or closing will occur at slightly different levels than indicated above.

Model 158-MD/158S-MD

Pressure	Setting	Approximate Distance Above Cast Line In. (mm)	Differential In. (mm)
0 psi (0 kg/cm²)	Pump Off	15/16 (24)	3/8 (16)
	Pump On	9/16 (14)	
	Burner Off	0 (0)	N/A
150 psi (10.5 kg/cm²)	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/cm²) 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.

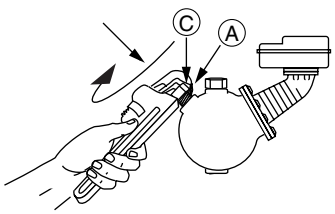
b. For Models 150-B and 150S-B and Series 157 and 157S (For all other models, proceed to Step 3).

Screw the ¾" NPT steel plug (C) (provided) in tapping (A).

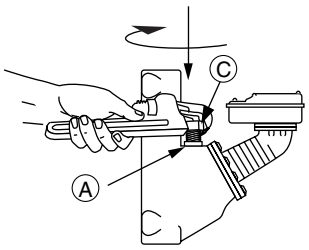
⚠ CAUTION

The plug must be reinstalled before control is shipped installed on the boiler, and removed when boiler is installed after shipment. Failure to follow this caution may damage float and operating mechanism.

Models 150-B and 150S-B



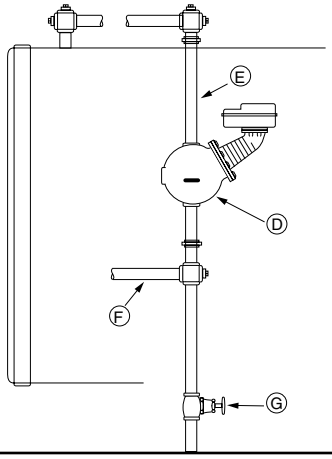
Series 157 and 157S



c. Mount and pipe the low water cut-off (D) on a vertical equalizing pipe (E) at the required elevation level, as determined in Step 1.

Install a full ported blow down valve (G) directly below the lower cross of the water equalizing pipe (F).

Note: 1" NPT tappings are provided, with the exception of some 157 and 157S models which are 1¼" NPT.

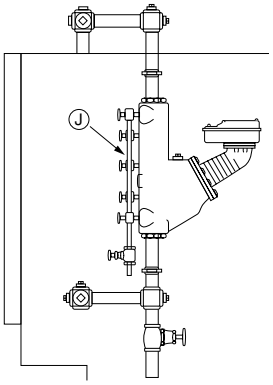


STEP 3 - Installing a Water Gauge Glass *(Required on all steam boilers)*

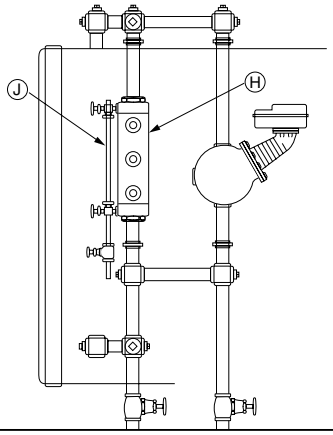
a. Install a water column (H) (not included with product) for all models except Series 157 and 157S (with integral water column).

b. Install a water gauge glass (J).
Note: Gauge glass and tri-cocks not included with product.

Series 157 and 157S



All Other Models



ITT

McDonnell & Miller

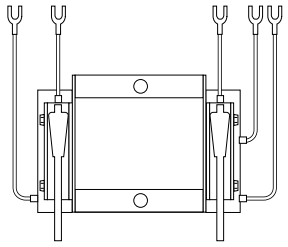
MAINTENANCE

SCHEDULE:

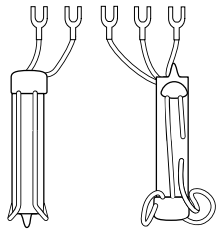
- **Blow down control as follows when boiler is in operation.**
  - **– Daily if operating pressure is above 15 psi.**
  - **– Weekly if operating pressure is below 15 psi.**

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

- **Disassemble and inspect annually. Replace the low water cut-off/pump controller 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.



Replacement Switch Assembly



2-Wire Pump **3-Wire Burner**

Replacement Mercury Tubes

⚠ CAUTION

Snap switches must be replaced as an assembly.

BLOW DOWN PROCEDURE:

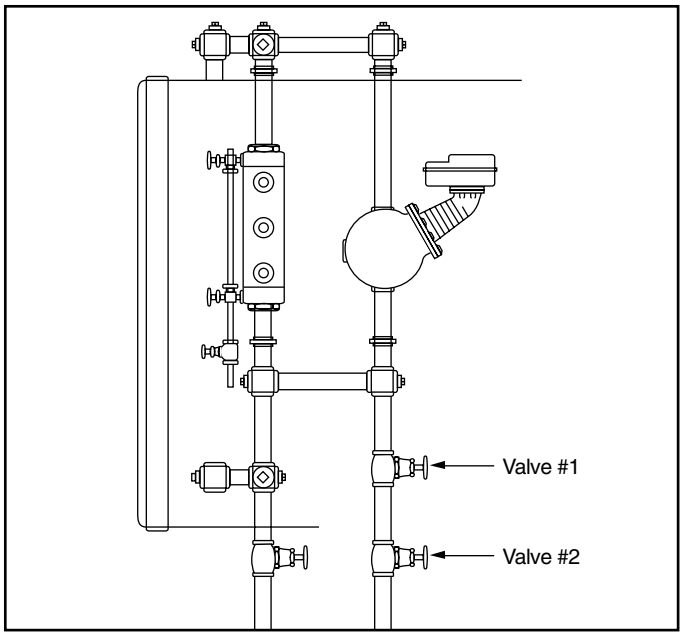
⚠ CAUTION

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.

Blow down the control when the water in the boiler is at its normal level and the burner is on. **Slowly** open the upper then the lower blow-down valves and observe the water level fall in the sight glass. Close the valves (lower first then upper) after verifying that the pump contacts have closed and the burner shuts off. If this does not happen, immediately shut off the boiler, correct the problem and retest.

For Models 158 and 158S, close the blow down valve after the motorized valve opens and the burner shuts off. For Models 159 and 159S, close the blow down valve after both pumps come on. If this does not happen, immediately shut off the boiler and correct the problem.



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

Printed in U.S.A. 8-06 210341

ProtoDesign Inc.

50495 Corporate Dr. Suite 106 Utica MI. 48315
Phone: 586-739-4340 Fax: 586-739-4341
www.teampdi.com

INSTALLATION & OPERATING INSTRUCTIONS FOR THE LW CONTROL

This document should be used by trained personnel as a guide to install the ProtoDesign Inc. low water control. Follow necessary wiring practices as defined by the national electric code (NEC). Installation or selection of equipment should always be accompanied by trained technical personnel. Reset and probe wires runs should be separated from high voltage wire runs.

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 and probes should be dismantled, inspected, cleaned, and checked for proper calibration and performance. If used as a LWCO, the control must be installed in series with all other limit and operating controls.

SPECIFICATIONS:

Ambient Operation Temp: 0 to 150 deg. F.
Humidity: 85% (non-condensing)
UL Approval: UL353 limit control
Supply Voltage: 120/220/240/24VAC 50/60 Hz.,10% line variation.
(220/240VAC for operating control only, non-limit)
Contact Ratings: SPDT, 10A, 1/3H.P. 120/240VAC. Rated 100,000 cycles rated load.
Power Consumption: 1.5VA
Wiring Terminals: Optional 11 Pin Plug-In Module socket, #6-32 screws with pressure clamps. Open board design ¼" quick connects on high voltage and 3/16" quick connects on low voltage.
Probe wire distances: 100 feet max. using MTW or THHN #14 or #16 AWG wire.
Reset terminal wires: 50 feet max. using same wire type described above.

OPERATION:

TEST FEATURE (Option A) Allows the LWCO circuit to be tested. Holding down the reset button for 3 seconds will allow the LWCO circuit to trip, which simulates the loss of water without the need to drain the water in the boiler. The control will return to normal operation once the reset button is pressed a second time or after a one-minute timeout.

Manual Reset With a normally closed pushbutton installed across RESET terminals **TB7** & **TB8**, and after a low water condition, the relay will remain de-energized until the pushbutton is pressed after the liquid rises to the level of the probe. With no pushbutton installed control will be in **Automatic Reset.** Ordering **Option F** allows 85 sec. before manual reset is required, eliminating nuisance Lockouts.

LWCO - When the liquid rises to the LOW electrode on terminal **TB6**, the control energizes, changing state of the (LW) load contacts (LED2 will be lit). The control remains energized until the liquid level recedes below LOW electrode on terminal **TB6**. The control then de-energizes, (LED2 will not be lit) returning load contacts to original state. Unless otherwise specified, there is a three-second time delay on decreasing level. Liquid must be below LOW probe on terminal **TB6** for a full three seconds before control de-energizes.

POWER OUTAGE FEATURE:

The power outage feature is a standard feature for the LW. When using the manual reset feature, if power interruption occurs when the probes are in liquid the relay will de-energize. When power is restored if the liquid is in contact with the probe the relay will energize without a manual reset. This feature eliminates boiler lockouts due to power outages when using the reset function.

CSD-1 CODE COMPLIANCE

On Manual Reset units, if the control is in a low- water condition (water off probe) when there is an interruption of power, the control will remain in a low-water condition when power is restored. The reset button will need to be pressed when the water level is restored to a level above the probe.

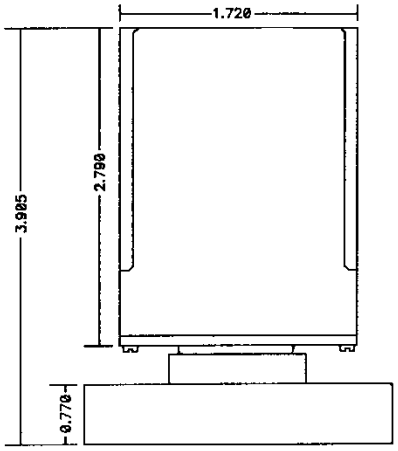
PROBE BUILD UP DETECTION

If the resistance of the probe to ground increases to approximately 10k above sensitivity set point the control will turn off and indicate probe buildup (LED blinking). To clear error, clean or replace probe. In manual reset mode, probe must be in liquid and reset button pushed for 30 seconds. In automatic reset mode, error will clear 30 seconds after probe is in liquid.

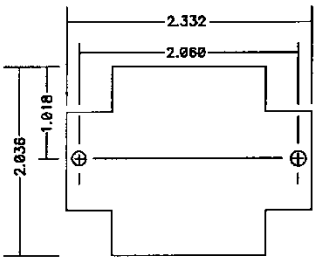
Maintenance Schedule

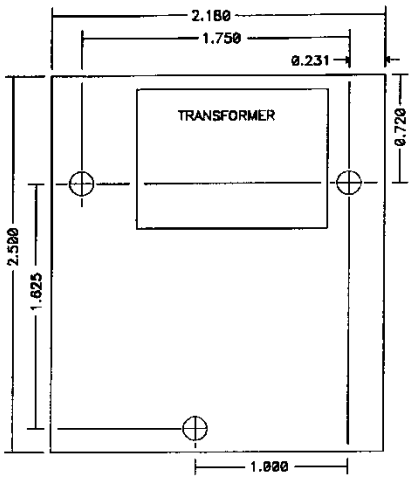
- Inspect probe annually for scale build-up and clean if necessary. Make certain there is no scale or build-up on the probe or its white insulator.
- Replace probe every 10 years. More frequent replacement of the probe is required if it is used in locales where significant water treatment is required, where more frequent cleaning is necessary, or in applications with high make-up water requirements.
- Replace the low water cut-off every 15 years or after 100,000 cycles on the relay.

DIMENSIONAL DRAWING



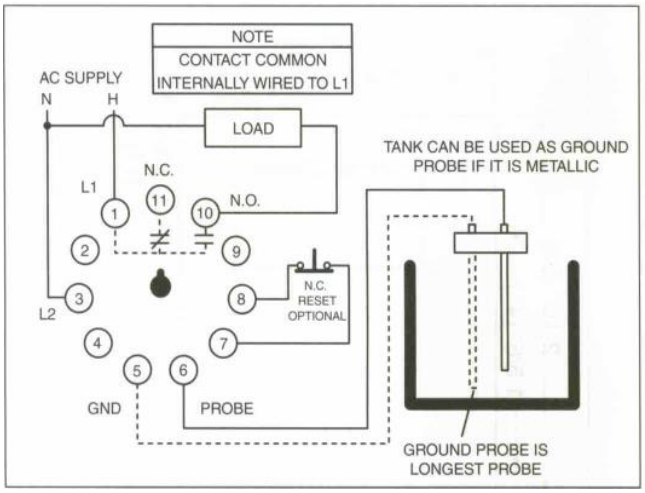
PLUG–IN MODULES

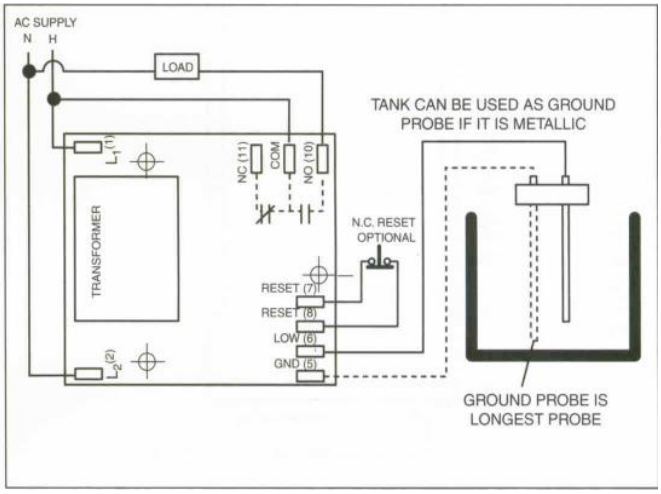




OPEN CIRCUIT BOARD

TYPICAL WIRING DIAGRAM





MODEL NUMBER DESIGNATION

LW – X – X – X – X – XX – X

OPTIONAL CHARACTERS (any combination):
Blank, A=Test feature, C=Conformal Coat, D=RoHS, F=Alternate lockout

FALLING LEVEL TIME DELAY:
03 = 3 sec. (Standard), 30 = 30 sec.

MODE: A = Direct (Standard)

SUPPLY VOLTAGE: 1=120VAC (Standard), 2 = 240VAC, 3 = 220VAC, 4 = 24VAC
(240VAC and 220VAC for operating control only, not for limit control)

SENSITIVITY:
C=26K (Standard), (contact factory for other sensitivity options)

PACKAGE:
1 = 11 pin Plug-In Module with powered contacts
2 = Open board with 1/8" panel mount standoffs
3 = Open board with 1/16" panel mount standoffs (Standard)

MODULE SOCKET P/N: LCS – 11

Honeywell

L404F,T,V
PressureTrol® Controllers

PRODUCT DATA

APPLICATION

L404F PressureTrol® Controllers provide operating control with automatic limit protection for pressure systems of up to 2070 kPa, or 300 psi.

L404T,V PressureTrol® Controllers are for use on oil burner systems for pressures up to 1035 kPa or 150 psi.

FEATURES

- **Models available in a series of control ranges, and pressure scales in kPa and psi.**
- **All models automatically reset and have an adjustable differential.**
- **Models have snap switch to open or close a circuit on a pressure rise.**
- **Case has a clear plastic cover so setpoints can be observed.**
- **1/4 inch—18 NPT connection for pipe on diaphragm assembly.**
- **Ground screw terminal.**

L404F:

- **Controllers may be used with steam, air, or noncombustible gases, or fluids noncorrosive to the pressure sensing element.**

L404T:

- **High pressure limits, break a circuit on oil pressure rise above setpoint.**

L404V:

- **Low pressure limits, makes a circuit on oil pressure rise above setpoint.**

Contents

71-2429—3

SPECIFICATIONS

Model:
L404F,T,V PressureTrol® Controllers. See Table 1.

Table 1. Models with kPa—psi.

Model Number	Operating Ranges		Subtractive Differential[a]		Maximum Diaphragm pressure	
	kPa	psi	kPa	psi	kPa	psi
L404F1060	15 to 100	2 to 15	15 to 40	2 to 6	170	25
L404F1078	35 to 350	5 to 50	40 to 100	6 to 14	590	85
L404F1094	140 to 2070	20 to 300	140 to 345	20 to 50	2410	350[b]
L404F1102	70 to 1035	10 to 150	70 to 150	10 to 22	1550	225
L404F1219[c]	15 to 100	2 to 15	15 to 40	2 to 6	170	25
L404F1243[c]	35 to 350	5 to 50	40 to 100	6 to 14	590	85
L404F1227[c]	70 to 1035	10 to 150	70 to 150	10 to 22	1550	225
L404F1235[c]	140 to 2070	20 to 300	140 to 345	20 to 50	2410	350[b]
L404F1300[c]	415 to 1240	60 to 180	40 fixed	6.0 Fixed	1550	225
L404F1326	0 to 100	0 to 15	15 to 40	2 to 6	170	25
L404F1334	0 to 350	0 to 50	40 to 100	6 to 14	590	85
L404F1342	35 to 1000	5 to 145	70 to 150	10 to 22	1550	225
L404F1359	70 to 2000	10 to 290	140 to 345	20 to 50	2410	350[b]
L404F1367	7 to 55	1 to 8	5 to 14	0.75 to 2	170	25
L404F1375[d]	35 to 350	5 to 50	40 to 100	6 to 14	590	85
L404F1383[d]	70 to 1035	10 to 150	70 to 150	10 to 22	1550	225
L404F1391[d]	140 to 2070	20 to 300	140 to 345	20 to 50	2410	350[b]
L404F1409[d]	15 to 100	2 to 15	15 to 40	2 to 6	170	25
L404T1055	35 to 350	5 to 50	40 to 100	6 to 14	590	85
L404T1063	70 to 1035	10 to 150	70 to 150	10 to 22	1550	225
L404V1087[d]	70 to 1035	10 to 150	70 to 150	10 to 22	1550	225
L404V1095[d]	35 to 350	5 to 50	40 to 100	6 to 14	590	85

[a] Nominal at midscale operating range.

[b] Brass bellows instead of stainless steel diaphragm.

[c] Models with 1/4-19 BSPT thread instead of 1/4-18 NPT thread.

[d] Make-on-rise models with terminal B omitted for miswiring compliance.

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Automation and Control Products Sales Office (check white pages of your phone directory).
2. Honeywell Customer Care
   1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386

In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Scarborough, Ontario M1V 4Z9.
International Sales and Service Offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

Table 2. Conversion Table.

Operating Range Conversions			Subtractive Differential Conversions		
kg/cm^2	kPa	psi	kg/cm^2	kPa	psi
0.1 to 1.05	15 to 100	2 to 15	0.15 to 0.4	15 to 40	2 to 6
0.4 to 3.5	35 to 350	5 to 50	0.4 to 1.0	40 to 100	6 to 14
0.7 to 10.0	70 to 1035	10 to 150	0.7 to 1.6	70 to 150	10 to 22
1.5 to 20.0	140 to 2070	20 to 300	1.5 to 3.5	150 to 300	20 to 50

Table 3. Switch Ratings (Amperes).

Switch State	120 Vac	240 Vac
Full Load	8.0	5.1
Locked Rotor	48.0	30.6

Pressure Sensing Element: Stainless steel diaphragm (140 to 2070 kPa models) has brass bellows.

Maximum Ambient Temperature: 66°C (150°F). Also, refer to note under Mounting.

Adjustment Means: Screws on top of control case. Scales are marked in psi or kPa.

Mounting Means: 1/4 inch-18 NPT connection on diaphragm assembly; or surface mounts using holes in back of case.

Dimensions: See Fig. 1.

Switching Action: Snap switch breaks R-B (closes R-W) on pressure rise. Make-on-rise devices omit terminal B.

Grounding Means: Ground screw terminal marked with a circled ground symbol.

Accessories:
14026 Steam Trap (118023 for BSPT models).
33312B Knurled Knob—fits on top of adjusting screws.
129564 Range Stop—range stop screw, Part No. 107194, and wrench, Part No. 23466, to limit setpoint range.

Approvals:
Underwriters Laboratories Inc. Listed: file no. MP466, vol. 10, guide no. MBPR.
Canadian Standard Association certified: file no. LR1620, guide no. 400E-0.

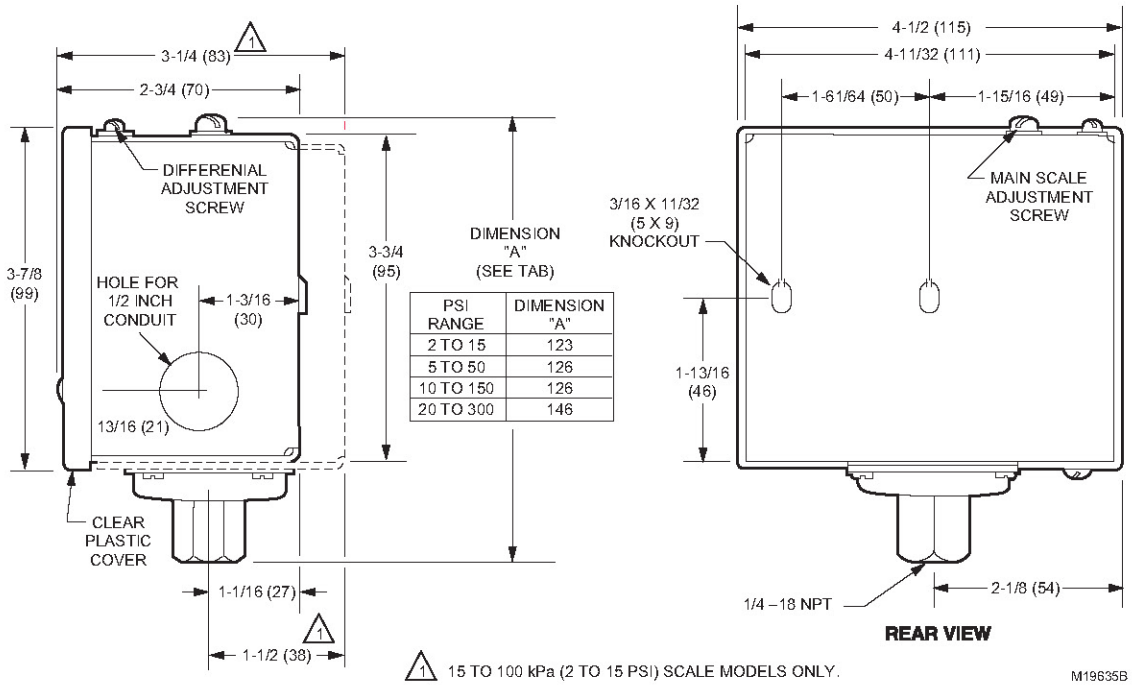


Fig. 1. L404F,T,V approximate dimensions in inches (millimeters in parentheses).

INSTALLATION

When Installing This Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check on the ratings given in the instructions and marked on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.

4. After installation is complete, check out the product operation as provided in these instructions.

IMPORTANT

When making pipe connections, use pipe dope sparingly to seal the joints; any excess dope may clog the small hole in the fitting and prevent the controller from operating properly.

Location and Mounting (L404F)

Locate the L404F where the ambient temperature will not exceed 66°C (150°F). The L404F can be mounted near the pressure gauge, at a remote location, in a fitting provided by the boiler manufacturer, or in a special mounting on low water cutoffs. The L404F should always be mounted above the water line in steam boiler applications.

NOTE: For accurate operation, supplemental heat should be added to installations where temperatures fall below -29°C (-20°F).

A steam trap must be connected between the L404F and the boiler (see Fig. 2) to prevent boiler scale and corrosive vapors from attacking the elbows or diaphragm.

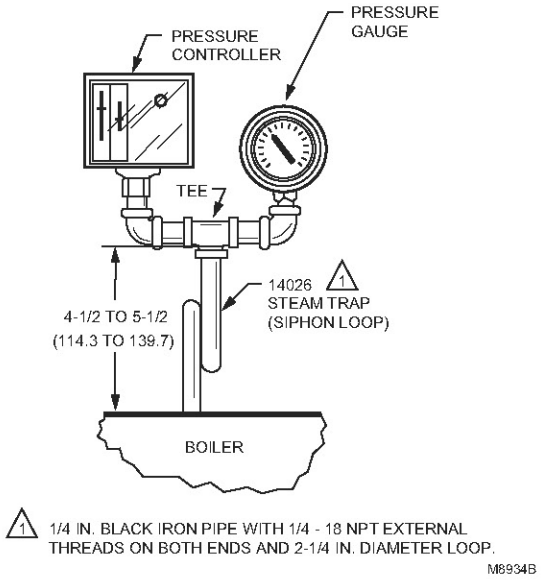


Fig. 2. Steam trap mounting.

Pressure Gauge Mounting

To mount beside a pressure gauge, remove the gauge, and install in its place the steam trap with a tee on top. Mount the PressureTrol® unit and pressure gauge on the side of the tee by means of nipples and elbows (see Fig. 2).

Remote Mounting

Excessive vibration at the boiler may affect the operation of the L404F. In these cases, the L404F should be remotely located, subject to the following:

1. All piping must be suitable and properly pitched to drain all condensation back to the boiler.
2. The remote mounting must be solid.
3. A steam trap must be used at one end of the piping.

Boiler Mounting

If it is not convenient to mount the L404F adjacent to the pressure gauge, install a steam trap at the location recommended by the boiler manufacturer, then screw the device directly to the steam trap.

Location and Mounting (L404T,V)

Location

NOTE: For most accurate operation, supplemental heat should be added to installations where the temperature falls below -20°F (-29°C).These controllers can be mounted at any location in the oil supply line, depending on the application. Typical locations are shown in Fig. 3. The low oil pressure controller should be located upstream from the safety shutoff valve(s). In a downstream location, there would be zero pressure when the burner is not running and the safety shutoff valve(s) is (are) closed. This could prevent startup or require manual reset every time the burner is started. The high oil pressure controller should be located as near to the burner as possible.

Mounting

Mount the oil pressure controller directly on the main pipe. Insert a tee in the pipe line, and connect a pipe nipple of appropriate size to the tee (see Fig. 4). Screw the hexagonal fitting (1/4-18 NPT internal thread) of the pressure controller to the pipe nipple. To avoid leaks and damage to the case, use a parallel jaw wrench on the hexagonal fitting close to the pipe nipple. Do not tighten the pressure controller by hand by holding the case.

Make all pipe connections in accordance with approved standards. Use only a small amount of pipe compound to seal the connection joints. Excess pipe compound may clog the orifice in the pipe fitting and prevent the controller from operating properly.

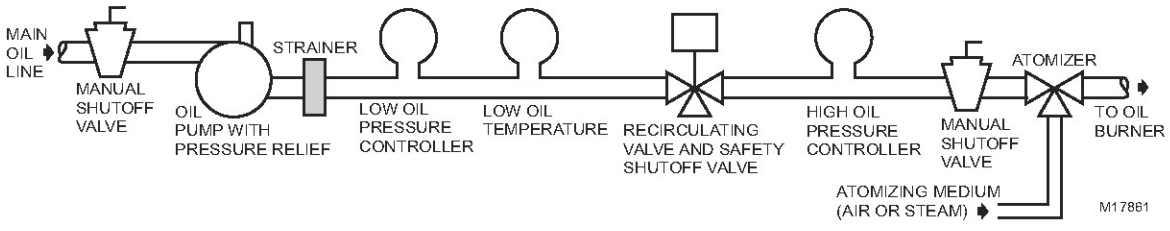


Fig. 3. Typical locations of pressure controllers in an oil burner system.

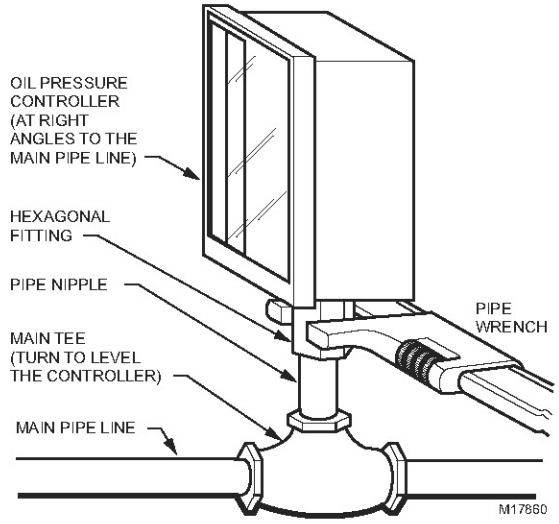


Fig. 4. Mounting an oil pressure controller directly on the main pipe.

Using with Preheated Oil

When used with preheated oil, a siphon loop (part number 14026) must always be connected between the controller and the main pipe (see Fig. 5) to provide thermal buffering.

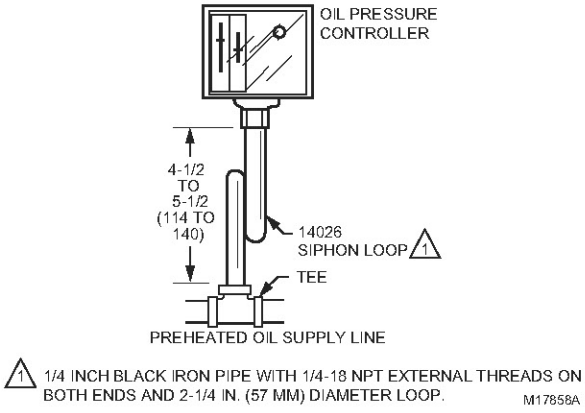


Fig. 5. Mounting of a siphon loop, with approximate dimensions in in. (mm).

WIRING

⚠ WARNING

Electrical Shock Hazard.
Can cause severe injury, death or property damage.
Disconnect the power supply before beginning wiring. More than one power supply disconnect may be required.

All wiring must comply with applicable codes and ordinances. All models have terminals (on the MicroSwitch® snap-acting switch) inside the cover and knockouts for conduit and cable. Refer to manufacturer installation and wiring instructions, if available, and to typical hookups shown in Fig. 6 to 10.

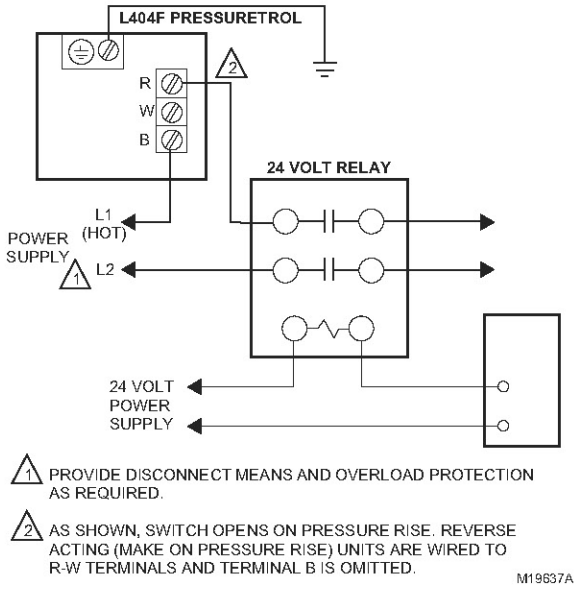


Fig. 6. L404F in low voltage relay circuit.

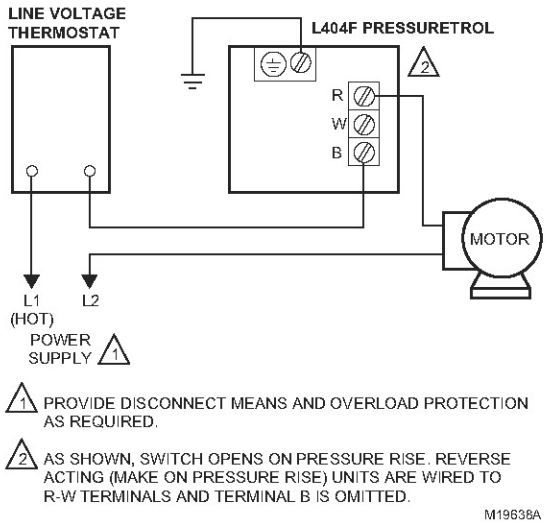


Fig. 7. L404F in a typical 2-wire control circuit.

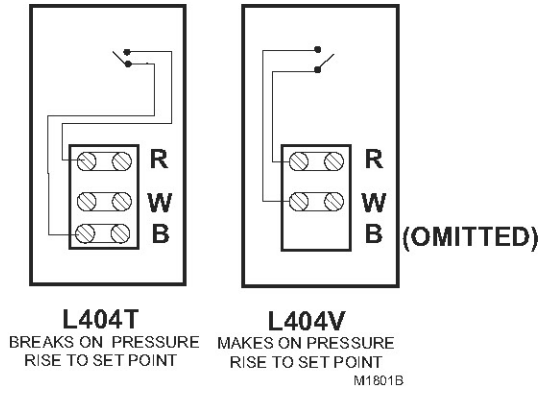


Fig. 8. L404T,V terminal blocks and internal schematics.

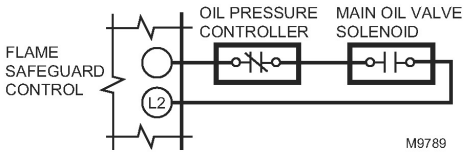


Fig. 9. Hookup of an oil pressure controller used on a single burner system with an integral oil pump.

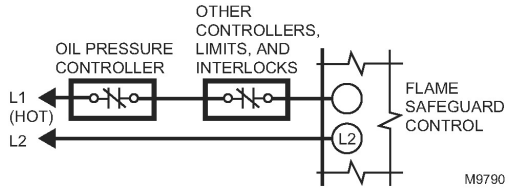


Fig. 10. Hookup of an oil pressure controller used on a single burner or multiburner system with an external oil pump.

SETTINGS AND ADJUSTMENTS

When the pressure at the control rises above the L404 setpoint, a circuit opens between the R-B terminals. During a pressure fall, R-B will close at the setpoint pressure minus the switch differential.

For example, if a controller is set to differential **B** (see Fig.11) with a controller setpoint of **A**, R-B will open when the pressure rises to **A**. Then during a pressure fall, the R-B terminals will close when the pressure drops to **C** (**A** minus differential **B**).

For make on rise applications, the switch is wired to R-W terminals. The R-W circuit will close on pressure rise to the setpoint. R-W will open again on a pressure drop past the switch differential.

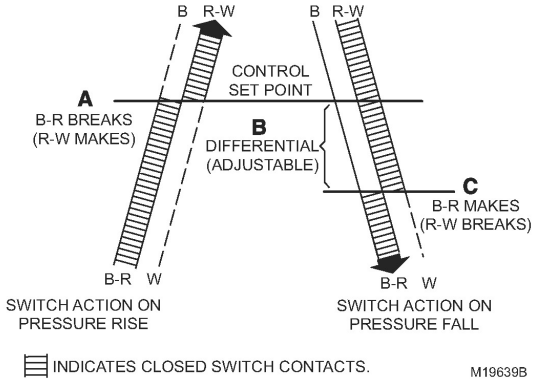


Fig. 11. Operation of switch on pressure rise and fall.

Setpoint Adjustment

Turn the pressure adjusting screw on the top of the controller (Fig. 12) to adjust the setpoint. Turn the differential adjusting screw to the desired pressure difference between switch opening and switch closing.

NOTE: When the main scale setting is at the lower end of the operating range, the differential range will be less than the differential setting by approximately 20 percent.

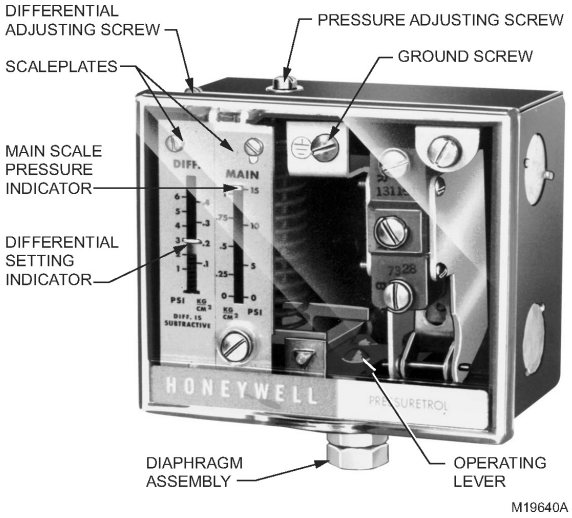


Fig. 12. view of L404 PressureTrol® Controller.

Scaleplate Adjustment

The L404F,T,V has been carefully calibrated during manufacture and should not require recalibration.

However, if recalibration is necessary, remove the cover and loosen the setscrews which hold the scaleplate. Adjust the plate up or down, as required, to bring the device into calibration. Tighten the setscrews securely and replace the cover.

CHECKOUT

After the controller has been installed, wired and adjusted, it should be tested with the system in operation. First, allow the system to stabilize. Then, observe the operation of the controller while raising and lowering its setpoint. Pressure should increase when the setpoint is raised and decrease when the setpoint is lowered.

Also, check the make and break points of the controller. If they do not agree with a separate, accurately calibrated pressure gauge, a slight adjustment of the scaleplate(s) may be necessary.

Use accurate pressure testing equipment when checking out the controller. Do not rely on inexpensive gauges. The controllers are carefully calibrated at the factory.

Honeywell

L4079A,B,W
PressureTrol® Limit Control

PRODUCT DATA

FEATURES

- **L4079A has two ganged spst switches; breaks two circuits (may be both sides of the power supply) simultaneously.**
- **L4079B has one spst switch.**
- **L4079W is the same as L4079B, but with seals for oil applications.**
- **MICRO SWITCH® snap-acting switches are visible through transparent cover.**
- **Switches open automatically, but must be reset manually.**
- **Trip-free reset mechanisms do not permit the limiting role of the PressureTrol® Control to be defeated by jamming the reset lever.**
- **Control does not need leveling.**
- **The L4079 is unaffected by moderate vibration.**

APPLICATION

The L4079A,B, and W PressureTrol® Limit Controls are high pressure limit switches which break electrical circuits when pressure rises to a preset value.

The L4079A and B can be used with steam, air, noncombustible gases, and fluids noncorrosive to the sensing element.

L4079W is for use on oil burner systems.

Contents

60-2156—2

SPECIFICATIONS

Models: Pressure and Electrical Specifications: See Table 1.

Table 1. Pressure and Electrical Ratings.

Model Number	Range		Maximum Diaphragm Pressure		Ratings in Amperes			
					120 Vac		240 Vac	
	psi	kPa	psi	kPa	Full Load	Locked Rotor	Full Load	Locked Rotor
L4079A[a] and L4079B[b]	2 to 15	15 to 100	25	170	9.8	58.8	4.9	29.4
	5 to 50	35 to 350	85	590	9.8	58.8	4.9	29.4
	10 to 150	70 to 1035	225	1550	9.8	58.8	4.9	29.4
L4079B1066[b]	20 to 300	140 to 2070	350	2410	9.8	58.8	4.9	29.4
L4079W1000[b]	10 to 150	70 to 1035	225	1550	9.8	58.8	4.9	29.4

[a] Ratings apply to each of two separate circuits.

[b] One circuit only.

Switching Action:
L4079A—Snap-switch. Breaks two circuits automatically on pressure rise. Each circuit must be manually reset.
L4079B,W—Snap-switch. Breaks one circuit automatically on pressure rise. Circuit must be manually reset.

Adjustment means: External adjustment screw. Scale is calibrated in psi and kPa.

Maximum Ambient Temperature: 150°F (66°C).

Mounting Means:
Pipe fitting—1/4-18 NPT. Steam trap for mounting furnished on some models. These devices may be either boiler mounted directly to a boiler fitting, or may be surface mounted, such as on a wall, by using the knockouts in the case.

Approvals:
Underwriters Laboratories Inc. (UL) Listed: File No. MP466, Guide No. MBPR.
Canadian Standards Assocuation (CSA): File No. LR95329, Certificate No. 1720340

Accessories:
14026 Steam Trap.
33312B Knurled adjustment knob.

Dimensions: See Fig. 1.

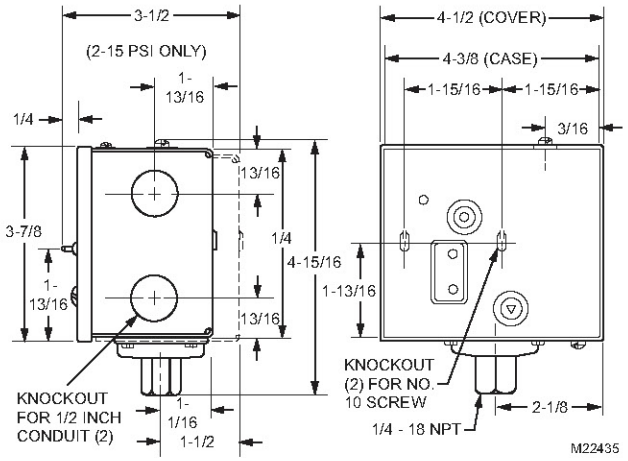


Fig. 1. L4079A,B,W PressureTrol® Limit Control dimensions in inches.

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Automation and Control Products Sales Office (check white pages of your phone directory).
2. Honeywell Customer Care
   1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386

In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Scarborough, Ontario M1V 4Z9.
International Sales and Service Offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

INSTALLATION

When Installing This Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check on the ratings given in the instructions and marked on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out the product operation as provided in these instructions.

Location

PressureTrol® Limit Controllers must be mounted above the water line in steam boilers. They can be mounted alongside the pressure gauge, at a remote location, in a fitting provided by the boiler manufacturer, or in special mountings on low-water cutoffs.

Mounting

See Fig. 1 for mounting dimensions.

A steam trap must always be connected between the PressureTrol® unit and the boiler. The steam trap prevents boiler scale and corrosive vapors from attacking the diaphragm.

Pressure Gauge Mounting:

To mount the limit control beside a pressure gauge, remove the gauge and install in its place a steam trap with a tee on top. Mount the PressureTrol® unit and pressure gauge on the side of the tee by means of nipples and elbows.

Remote Mounting:

If excessive vibration seems likely to affect the operation of the control, it may be located remotely, as long as all piping is suitable and properly pitched to drain all condensation back to the boiler.

Boiler Mounting:

If it is not convenient to mount the control adjacent to the pressure gauge, install a steam trap at a location on the boiler recommended by the boiler manufacturer and screw the unit directly to the steam trap.

WIRING

⚠ WARNING

Electrical Shock Hazard.
Can cause severe injury, death or property damage.
Disconnect the power supply before beginning wiring. More than one power supply disconnect may be required.

All wiring must comply with local codes and ordinances. See Fig. 2 for internal schematics and wiring.

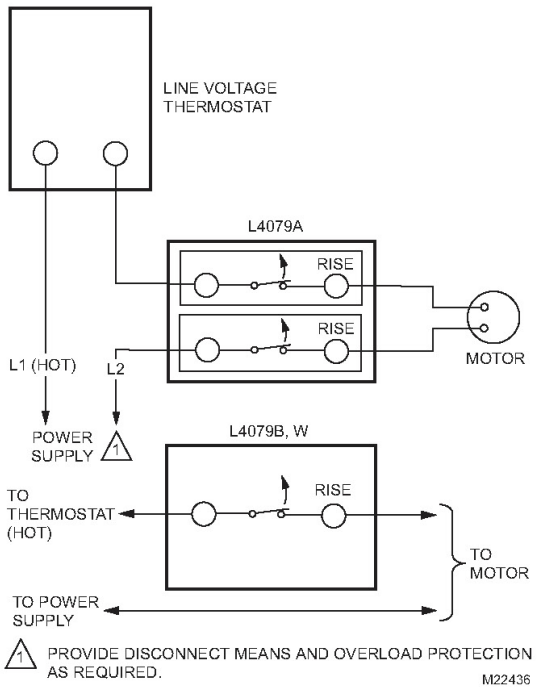


Fig. 2. Schematics and wiring. L4079A breaks both sides of power supply; L4079B,W breaks hot side only.

Setting

To set the control, turn the pressure adjusting screw (see Fig. 3) until the pressure setting indicator on the front of the case is in line with the required control pressure setpoint. The indicator setting is the point at which the switch breaks contact.

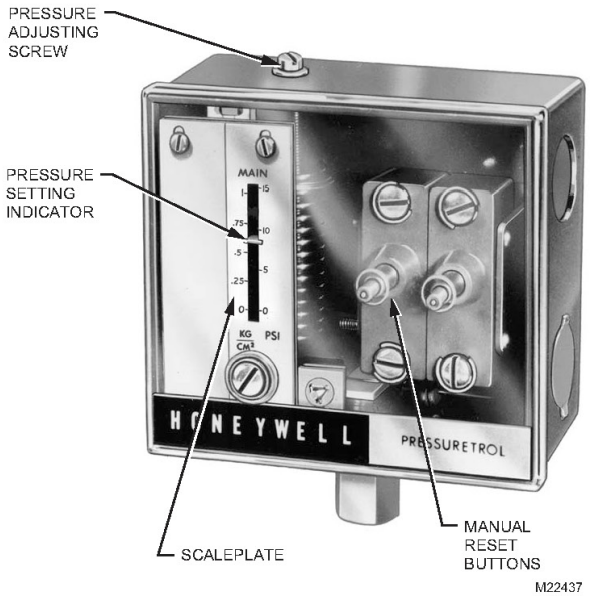


Fig. 3. Controls and indicators on L4079A. L4079B,W is the same except for having only one reset button.

Manual Resetting

When the circuits have broken automatically, they must be manually reset. After the pressure returns to normal, manually reset by depressing the manual reset button(s) firmly and releasing. The circuit is not complete until the reset button is released. The trip-free manual reset mechanism prevents the limit controller from operating as an automatic controller (self-resetting) even if the manual reset button has been tied down.

CHECKOUT

After the control has been installed and wired, test as follows:

Note the boiler pressure by checking the boiler pressure gauge (boiler pressure should be near the middle of the PressureTrol® pressure scale to perform this test properly).

Rotate the PressureTrol® pressure adjusting screw (see Fig. 3) until the pressure setting indicator on the front of the case corresponds to the boiler pressure gauge reading.

The limit control should break the control circuit(s) when the boiler pressure gauge reading equals or slightly exceeds the PressureTrol® pressure setting.

If the limit control is operating properly, manually reset it and adjust the pressure adjusting screw until the pressure setting indicator is in line with the required limit setpoint.

Automation and Control Solutions

Honeywell International Inc.
1985 Douglas Drive North
Golden Valley, MN 55422
customer.honeywell.com

Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Scarborough, Ontario M1V 4Z9

60-2156—2 C.H. Rev. 02-06

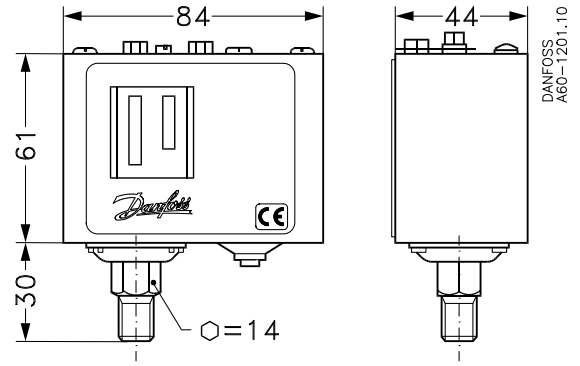
Honeywell

Instructions

060R9310

060R9310

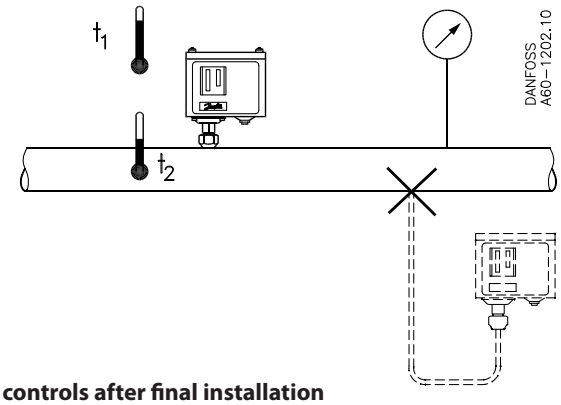
Pressure Controls
KP 35, KP 36 and KP 37



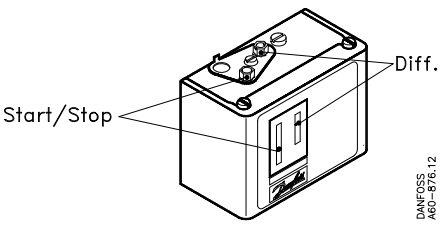
KP 35, KP 36, KP 37
t_1 min. –40 ºC
t_1 max. 65ºC

t_2 min. –40 ºC
t_2 max. 100ºC

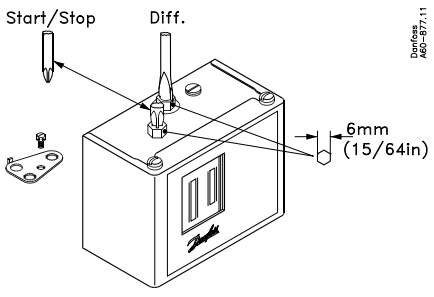
P_{test} max.
KP 35: 22 bar
KP 36: 22 bar
KP 37: 32 bar

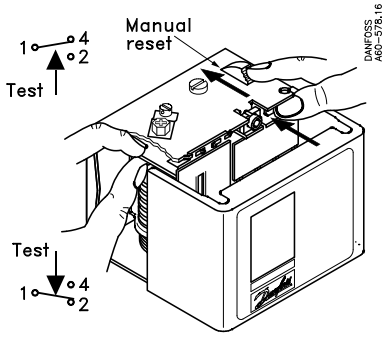


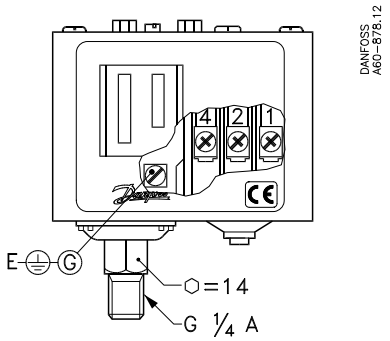
No maintenance is required for the controls after final installation

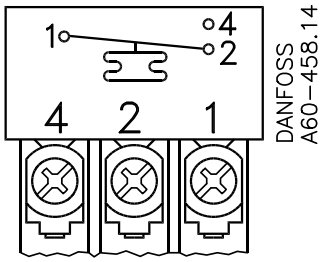


Please note: scale in KP units is indicative only. For accurate setting or when using according to FM approval use additional pressure gauge to set the unit.







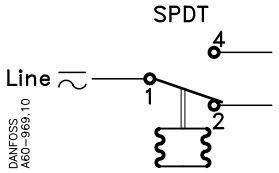


Contact system with standard AG contacts
Single pole changeover switch (SPDT)

Alternating current:

AC-1:	**16, 400 V**
AC-3:	16A, 400 V
AC-15:	10A, 230 V

Direct current:
DC-13: 12W, 230 V

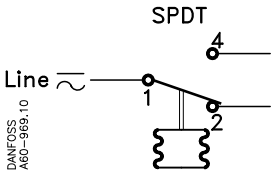


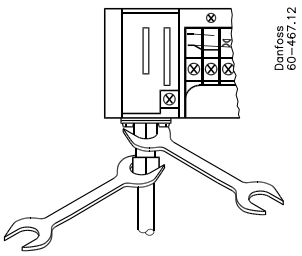
Contact system with gold contacts
Single pole changeover switch (SPDT)

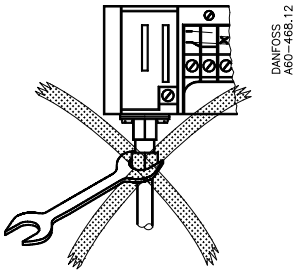
Alternating current:

AC-1:	10, 400 V
AC-3:	6A, 400 V
AC-15:	4A, 230 V

Direct current:
DC-13: 12W, 230 V





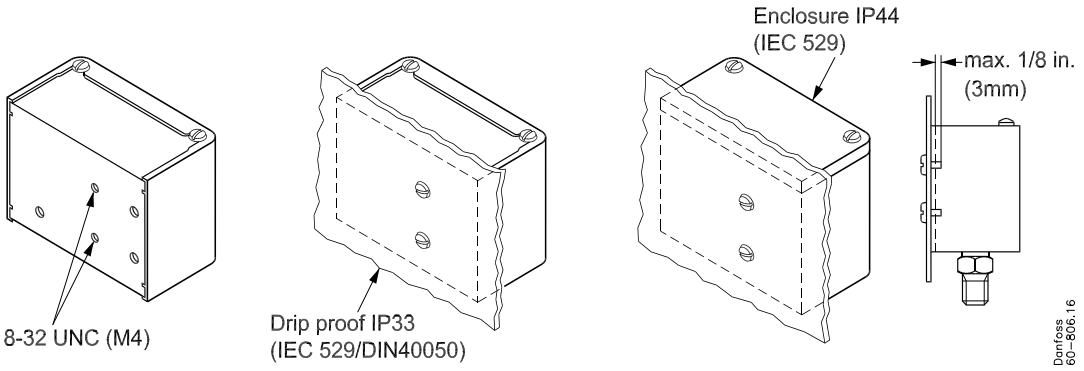


When used acc. to UL or FM regulations

c UL us Listed refrigeration controller 61B5

Voltage AC	Voltage DC	FL A	LR A	Resist. lead	Pilot duty
240		8	48	8 A	3 A
120		16	96	16 A	
	240				12 W

Use copper wire only
Tightening torque 20 lb. in.



CAUTION: The mounting panel must be plane to avoid damage of control

WATER GAUGE & GAUGE GLASS INSTALLATION GUIDE

20100, 20200, 20300, 20400, 20600, 20700, 20800, 21100, 21200, 22000, 22100, 22200, 23400, 23600, 24300, 24400, 24600, 24700, 24800, 25200, 25400, 25500, 25600, 20LF SERIES

Only properly trained personnel should install and maintain water gauge glass and connections. Remember to wear safety gloves and glasses during installation. Before installing, make sure all parts are free of chips and debris.

1. Apply thread sealant or tape to pipe threads. Install top gauge fitting (fitting without a drain valve) into the uppermost tapping. Wrench tighten the fitting until it is snug and the glass outlet is pointing at five o'clock (about 1/8 turn from its final downward vertical position).

2. Install the bottom gauge fitting (the fitting with a drain valve) until it is snug and the glass outlet is pointing directly upward.

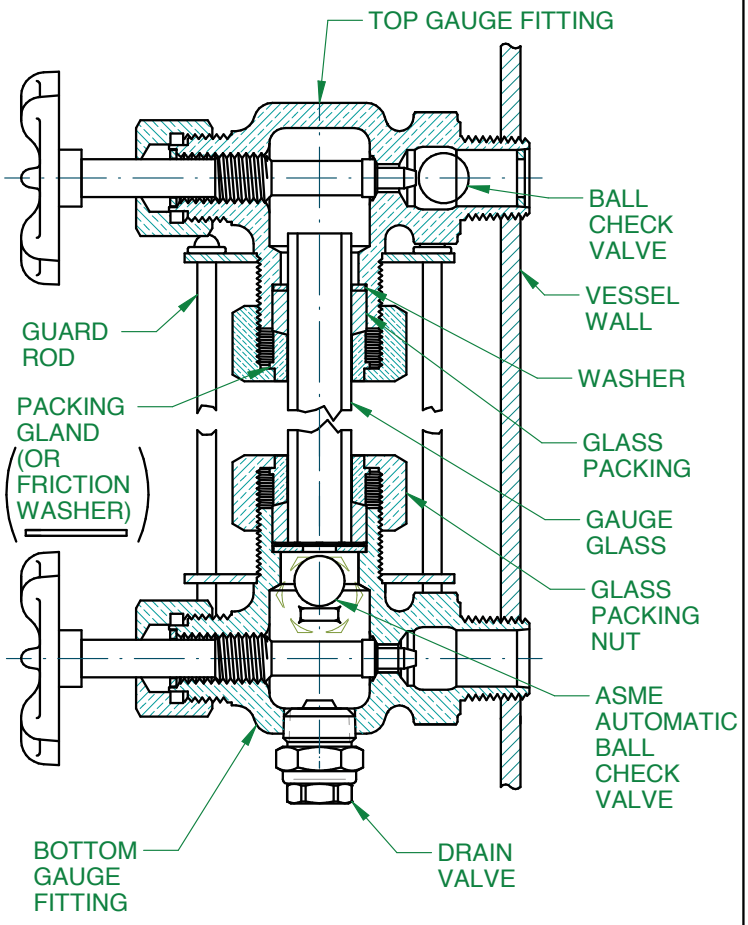
3. Remove glass packing nut, friction washer (or packing gland, depending on the model),and glass packing from each gauge fitting. Slide the packing nut, then friction washer or packing gland, then and glass packing onto each end of glass.

4. Gently insert one end of the glass into the top gauge fitting. Keeping the glass inside the top fitting, gently rotate the top gauge fitting clockwise until vertically aligned with the bottom gauge fitting, then insert glass into bottom fitting until glass bottoms out on the shoulder inside the bottom fitting.

5. Carefully raise glass about 1/16" and slide lower glass packing down until the glass packing contacts the lower gauge fitting. DO NOT allow the glass to remain in contact with any metal!

6. Carefully slide upper glass packing up as far as possible.

7. Hand tighten both glass packing nuts, then tighten 1/2 turn more by wrench. Tighten only enough to prevent leakage. DO NOT OVER TIGHTEN! If any leakage should occur, tighten slightly, a quarter turn at a time, checking for leakage after each turn.



NOTE: NOT ALL WATER GAUGES ARE EQUIPPED WITH BALL CHECK VALVES

WARNING!

VALVE MUST BE USED IN THE FULLY OPEN POSITION FOR PROPER OPERATION OF BALL CHECK. FAILURE TO DO SO COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.

This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. (California law requires that this warning be given to the consumers in the State of California).

U.S. SAFE DRINKING WATER ACT WARNING:
It is illegal to use products that contain lead for potable water services (Water intended for human consumption) in the United States.

WATER GAUGE GLASS

NOTICE:

READ ALL WARNINGS AND INSTRUCTIONS BEFORE PERFORMING INSTALLATION OR MAINTENANCE.

WARNING!

SAFETY GLASSES AND GLOVES SHOULD BE WORN AT ALL TIMES WHEN WORKING WITH OR EXAMINING WATER GAUGE GLASS AND CONNECTIONS.

IMPROPER INSTALLATION OR MAINTENANCE OF GAUGE GLASS AND CONNECTIONS CAN CAUSE IMMEDIATE OR DELAYED BREAKAGE RESULTING IN BODILY INJURY AND/OR PROPERTY DAMAGE.

MAINTENANCE

Examine the gauge glass regularly for any signs of clouding, scratching, erosion, or corrosion. The glass should be inspected daily until the need for replacement becomes apparent. This will help establish the routine inspection and routine replacement schedules.

CLEANING

Use commercial non-abrasive glass cleaners to keep the glass clean. Use diluted acids such as Hydrochloric (muriatic) acid when regular cleaners do not seem to work. Do not use wire brushes or any other abrasive materials which could scratch the glass.

INSPECTION

Examine the surface of the glass for scratches, corrosion, chips, cracks, surface flaws, or nicks. To do this, shine a very bright concentrated light at an angle of about 45 degrees. A defective glass will glisten as the light strikes imperfections. Glass which appears cloudy or roughened,will not respond to cleaning, and should be replaced.

STORING

Keep gauge glass in original packaging until ready to install.

WATER GAUGE GLASS

DO's

DO verify proper gauge has been supplied.

DO examine gauge glass and packings carefully for damage before installation.

DO install protective guards and utilize automatic ball checks where necessary to help prevent injury in case of glass breakage.

DO inspect the gauge glass daily, keep maintenance records, and conduct routine replacements.

DO protect glass from sudden changes in temperatures such as drafts, water spray, etc.

DO NOT's

DO NOT use the glass if it contains any chips or any other visible signs of damage.

DO NOT reuse any tubular glass or glass packings.

DO NOT subject gauge glass to bending or torsional stresses.

DO NOT over tighten glass packing nuts.

DO NOT allow glass to touch any metal parts.

DO NOT exceed the recommended pressure of the gauge or gauge glass.

DO NOT clean the gauge or gauge glass while pressurized or in operation.

"Apollo" Valves

Made In The USA

Manufactured by Conbraco Industries, Inc.
1418 S. PEARL ST.
PAGELAND, SC 29728
TELEPHONE (704) 841-6000
www.apollovalves.com

I-5334-00 REV. H

KUNKLE PRESSURE RELIEF VALVES

Installation and Operating Instructions

Pre-Installation Handling

This pressure relief valve is designed to protect equipment from overpressure. The valve should be handled with care, not subjected to heavy shock loads, and protected to prevent contamination from getting inside. It should be installed correctly per A.S.M.E. Boiler & Pressure Vessel Code requirements. Failure to do so could result in property damage or serious injury to personnel. When hoisting the valve into position for installation, care should be exercised so that lifting straps do not contact the valve lift lever.

Installation

Always wear proper safety equipment, including safety glasses and ear protection.

1. Mount the valve in a vertical position so that the valve body is self-draining. If a body drain port is provided, make sure it is open when required by the ASME code. Do not plug any bonnet vent openings. The inlet piping should be as short as possible, with no elbows, and equal to or greater than the size of the pressure relief valve inlet connection. This will help to limit the inlet pressure drop to 3% or less when the valve is relieving.

2. When discharge piping is connected to valve outlet, make sure it is self draining if a body drain port is not used. The valve should not be connected to any discharge pipe that contains pressure before the valve opens or to any pipe where the pressure build-up is greater than 10% of the set pressure when the valve is open and relieving.

   Discharge piping, other than a short tailpipe, must be supported. For steam service, a drip pan elbow or flexible connection between the valve and the pipe should be used to prevent excessive pipe stress, due to thermal expansion, from being imposed on the valve body.

3. For threaded valves, to prevent sealing compound from entering and damaging the valve, apply a small amount of pipe thread sealing compound to external threads only. Do not put any sealing compound on the first thread or on any internal threads. To do so may cause the sealing compound to enter the valve and cause seat leakage.

   Do not use the valve body or bonnet for installing the valve in threaded connections. Use the wrench flats provided to tighten the valve to the connecting pipe, and do not overtighten. To do so may cause valve leakage.

4. For flanged valves, use new gaskets and tighten the mounting studs evenly.

Operation

1. Maintain a system operating pressure at least 5 psig or 10% below the set pressure of the valve, whichever is greater. Operating too close to the valve set pressure will cause seat leakage and will shorten the time between valve maintenance.

2. Do not use the safety valve as a control valve to regulate system operating pressure. Excessive operation will cause the seat to leak and will require more frequent valve maintenance.

3. ASME Section I and VIII valves equipped with lift levers are designed to be operated only when the system pressure is 75% of set pressure or greater. ASME Section IV valves may be operated at any set pressure. When hand operating the valve, hold it open long enough to purge any foreign matter from the seat area. If a cable or wire is attached to the lift lever for remote actuation, make sure the direction of pull is the same as it would be if the lever were pulled directly by hand.

Maintenance

Maintenance should be performed on a regular basis. An initial inspection interval of 12 months is recommended. Depending on the service conditions and the condition of the valve, the inspection interval may be decreased or increased. Use only Kunkle parts for repair. Depending on the local jurisdictional requirements where the valve is installed, repairs may have to be made by a repair facility holding a VR stamp.

WARNING!

Removal of the seal wires or any attempt to adjust, repair or modify this product by non-qualified or non-authorized persons voids the product guarantee and may cause serious damage to equipment, personal injury, and death. Kunkle Valve is not liable for any damage resulting from misuse or misapplication of its products.