

#108643

Lattner Boiler Company

Electric Cabinet Style Steam Boilers



OPERATIONS MANUAL

December 2006

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

P.M. Lattner Manufacturing Company

1411 9th St. SW
P.O. Box 1527
Cedar Rapids, IA 52406
319/366-0778

Packing Slip

Date	S.O. No.
4/1/2011	J6259

<p>Ship To</p> <p>UNIVERSITY OF FLORIDA 1 BUCKEYE DRIVE PERRY, FL 32348-7702 ATTN: TONY SRADER @813/477-9082</p>
--

P.O. No.	Ship Date	Ship Via	FOB	Project
1100108687	5/6/2011	OLD DOM PPD	FACTORY	

Item	Description	Shipped	Ordered	U/M
BOILER, 120HS-4...	LATTNER CABINET STYLE ELECTRIC STEAM BOILER. 120 KW. 480/60/3. 121 AMPS. 2 STEPS. 300 PSIG DESIGN PRESSURE. ASME APPROVED PRESSURE VESSEL MOUNTED ON 4 INCH CHANNEL BASE. 30 GALLON WATER CAPACITY. 4 INCH INSULATION. VENTILATED NEMA-12 CONTROL CABINET. UL/CSD-1. SERIAL NO. <u>55434</u>			1 ea
DISCONNECT, N...	MAIN INTERLOCKING DISCONNECT, NON-FUSED (200A)			1 ea
DOOR INTERLOCK	DOOR INTERLOCK, SAFETY INTERLOCKING DEVICE. (120V)			1 ea
TRANSFORMER, ...	FUSED CONTROL CIRCUIT TRANSFORMER (480/120).			1 ea
NON STOCK PAR...	2-STAGE OPERATING CONTROL			1 ea
ALARM, LOW W...	LOW WATER LEVEL ALARM.			1 ea
NON STOCK PAR...	(6) INDICATOR LAMPS (ON/OFF, 2 STAGES, LOW WATER, HIGH PRESSURE, RUN/SAFETY STATUS)			1 ea
NON STOCK PAR...	ASME VALVE PACKAGE			1 ea
NON STOCK PAR...	300# SAFETY VALVE			1 ea
NON STOCK PAR...	PROGRAM CLOCK AND E-STOP SWITCH			1 ea
RETURN SYSTE...	LATTNER LV35 VERTICAL FEEDWATER AND CONDENSATE RETURN SYSTEM. INCLUDES 46 GALLON CARBON STEEL TANK, WATER GAUGE GLASS ASSEMBLY, SUCTION PIPING WITH SUCTION STRAINER AND SHUT-OFF VALVES, ONE (1) PUMP OUTLET, AND TANK DRAIN VALVE. SERIAL NUMBER <u>24332</u> .			1 ea
NON STOCK PAR...	NEMA 4 PANEL			1 ea
NON STOCK PAR...	INTERLOCKING DISCONNECT			1 ea
NON STOCK PAR...	HIGH AND LOW WATER ALARMS			1 ea
NON STOCK PAR...	HAND-OFF-AUTO SELECTOR SWITCH			1 ea

P.M. Lattner Manufacturing Company

1411 9th St. SW
P.O. Box 1527
Cedar Rapids, IA 52406
319/366-0778

Packing Slip

Date	S.O. No.
4/1/2011	J6259

<p>Ship To</p> <p>UNIVERSITY OF FLORIDA 1 BUCKEYE DRIVE PERRY, FL 32348-7702 ATTN: TONY SRADER @813/477-9082</p>
--

P.O. No.	Ship Date	Ship Via	FOB	Project
1100108687	5/6/2011	OLD DOM PPD	FACTORY	

Item	Description	Shipped	Ordered	U/M
NON STOCK PAR...	LEVEL INDICATOR		1	ea
NON STOCK PAR...	CHEMICAL PORTS		1	ea
NON STOCK PAR...	STOP VALVE		1	ea
FLOAT VALVE A...	FLOAT & VALVE ASSEMBLY, 1/2"		1	ea
PUMP, MTH 315C...	PUMP, MTH 1-1/2 HP 315CS5MTH BF 208-230/460 3PH		1	ea
BLOWDOWN SEP...	ASME CERTIFIED MODEL 810 BLOWDOWN SEPARATOR WITH 2 INCH VENT AND 2 INCH DRAIN. 1 INCH BLOWDOWN INLET. INCLUDES MODEL SL-2 LEG SET. SERIAL NUMBER <u>94039</u>		1	ea
AFTERCOOLER, ...	205 AUTOMATIC AFTERCOOLER FOR BLOWDOWN SEPARATOR. INCLUDES BALL VALVE, SWING CHECK VALVE, NIPPLES, STRAINER AND TEMPERATURE REGULATING VALVE. 2 INCH DRAIN AND 1/2 INCH COOLING WATER CONNECTION.		1	ea
THERMOMETER,...	THERMOMETER, DIAL 3" 50-300 F/C 1/2 NPT 6" STEM BT3106-06		1	ea
SKID PACKAGE ...	SKID PACKAGE A INCLUDES MOUNTING, WIRING, AND PIPING OF BOILER, BLOWDOWN, RETURN SYSTEM, AND WATER SOFTENER. ALTHOUGH SKID PACKAGES ARE HYDRO TESTED, PACKAGE PIPING MAY REQUIRE FIELD TIGHTENING AS A RESULT OF SHIPPING AND FINAL PLACEMENT ON BOILER PAD. FIELD TIGHTENING IS THE RESPONSIBILITY OF INSTALLER AND/OR GENERAL CONTRACTOR.		1	ea
FREIGHT, PREPA...	PREPAID FREIGHT.		1	ea

Index

Section I: General Description

Page 2

1.	Boiler Design	2
2.	Boiler Connections	2
3.	Boiler Trim	3
4.	Control Panel	3
5.	Factory Tests	4
6.	Nameplates & Stamping	4
7.	Guarantees	4

Section II: Installation

Page 5

1.	Illustration	5
2.	Unloading	6
3.	Rigging	6
4.	Placement of Boiler	6
5.	Steam Outlet	6
6.	Blowdown Piping	7
7.	Safety Valve	9
8.	Boiler Feed Systems	9
9.	Electrical Connections	11
10.	Before Starting the Boiler	11
11.	Pressuretrols: Controller & Limit	12
12.	Starting the Boiler	14
13.	Boil-Out Recommendations for New Lattner Boilers	14
14.	Water Quality Limits for Lattner Steam Boilers	15

Section III: Boiler Care & Maintenance

Page 16

1.	Routine Maintenance	16
2.	Monthly Procedures	16
3.	Quarterly Procedures	16
4.	Yearly Procedures	16
5.	Heating Elements	16
6.	Sight Glass Removal & Installation	17
7.	McDonnell Miller Servicing	18
8.	Warrick Relay Replacement	19
9.	Auxiliary Low Water Cut-Off Probe Cleaning	20

Section IV: Troubleshooting

Page 21

1.	Troubleshooting	21
----	-----------------	----

Additional Product Literature

Page 23



Lattner Boiler Company

Lattner Boiler Company
1411 9th St. SW
Cedar Rapids, IA 52404
Telephone: (800) 345-1527
Fax: (319) 366-0770
Web: www.lattnerboiler.com

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 cabinet style electric steam 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. Boiler ON/OFF switch;
7. Pressure control switches;
8. 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. Safety valve;
12. Hand and check valves for feed water inlet;
13. Terminals for connection of feed water equipment;
14. 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



Lattner Boiler Company

Lattner Boiler Company
1411 9th St. SW
Cedar Rapids, IA 52404
Telephone: (800) 345-1527
Fax: (319) 366-0770
Web: www.lattnerboiler.com

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 boiler or as an independent bracket mounted unit on the boiler base rail. This panel contains as a minimum the following components:

4.1. Boiler ON/OFF Switch

A boiler 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

Wiring and controls include but are not limited to fuses, contactors, incoming power terminal(s), auxiliary low water cut-off relay, pump relay, step controller, and other miscellaneous electrical controls.

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 "H" symbol for 15 psi design units and with the "S" or "U" symbol for 150 psi and greater designs. One copy of the ASME data sheet 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

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 maximum steaming 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 panel 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.



Lattner Boiler Company

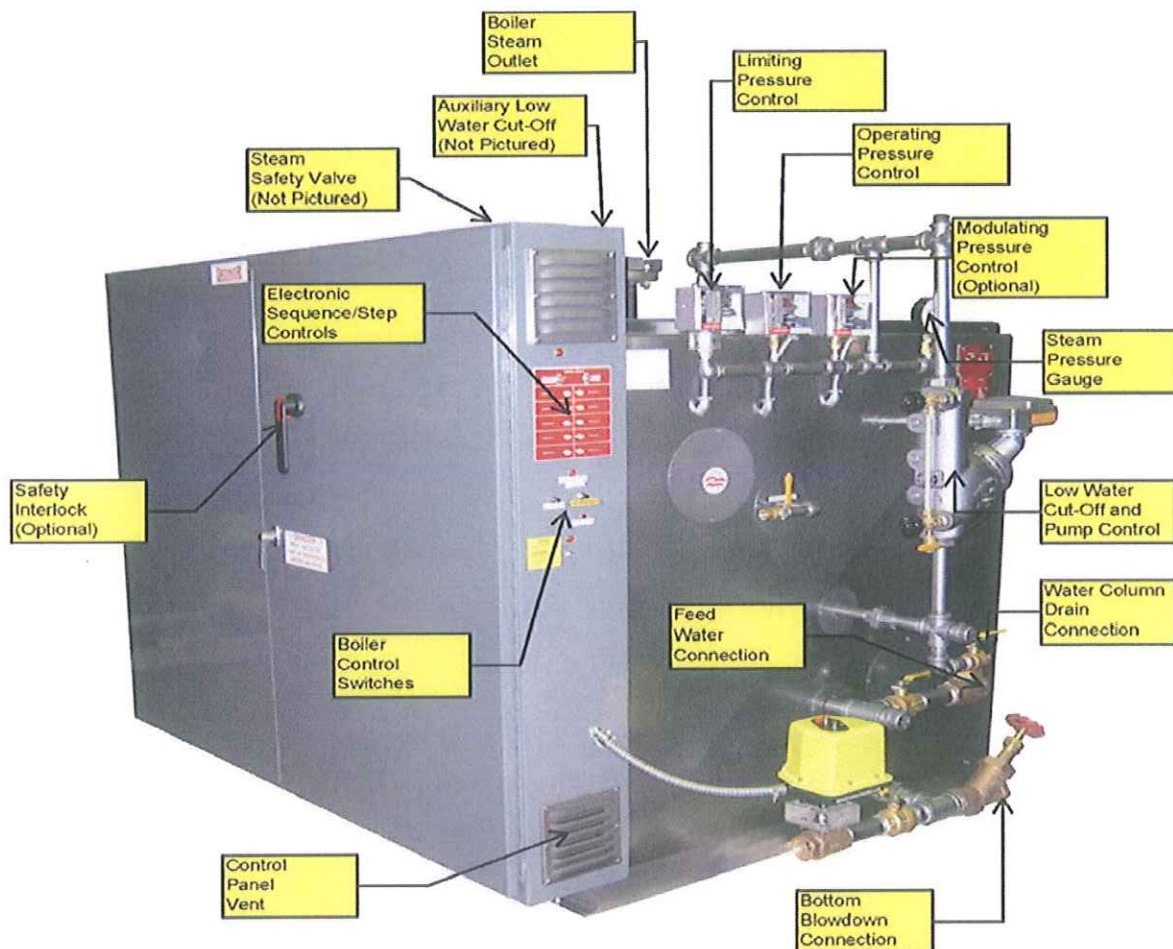
Lattner Boiler Company
1411 9th St. SW
Cedar Rapids, IA 52404
Telephone: (800) 345-1527
Fax: (319) 366-0770
Web: www.lattnerboiler.com

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



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.



Lattner Boiler Company

Lattner Boiler Company
1411 9th St. SW
Cedar Rapids, IA 52404
Telephone: (800) 345-1527
Fax: (319) 366-0770
Web: www.lattnerboiler.com

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. Valve should be rated for the maximum design pressure of the boiler.

5.4. Steam Piping

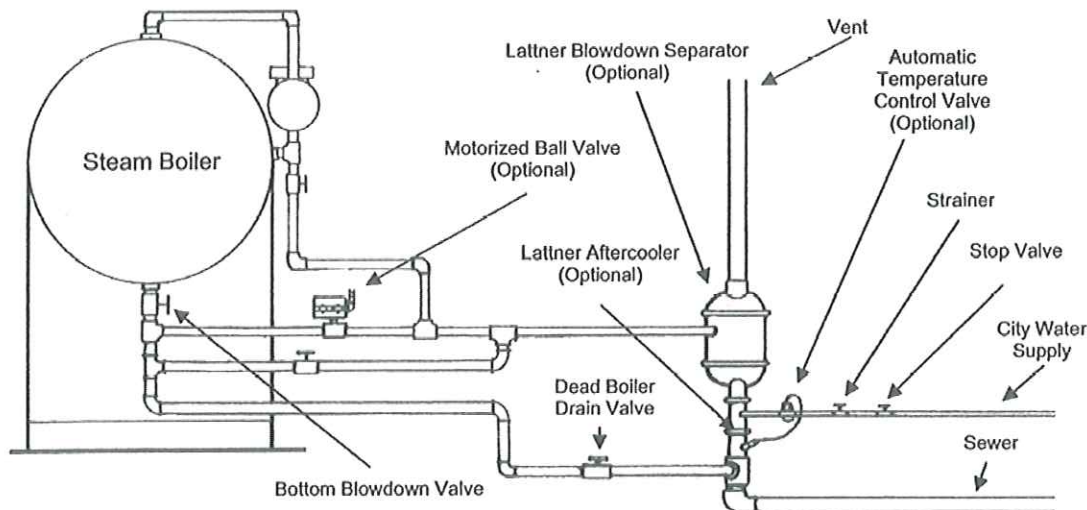
The steam line should be pitched downward slightly away from the boiler, toward a steam trap. If using a steam solenoid valve, the steam line should slope upward slightly to the solenoid valve. After the solenoid valve, the steam line should slope downward.

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.

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
Up to 1-1/2 inches	Model 1450

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
301A (auto) or 301M (manual)	Model 1450

6.10. Cooling Water Supply

Connect cold water supply pipe to aftercooler:

205A (auto) or 205M (manual)	1/2 inch NPT
301A (auto) or 301M (manual)	1 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-



Lattner Boiler Company

Lattner Boiler Company
1411 9th St. SW
Cedar Rapids, IA 52404
Telephone: (800) 345-1527
Fax: (319) 366-0770
Web: www.lattnerboiler.com

off valve in the water line.

LV8 through LV35	1/2 inch NPT
LV60 through LV100	3/4 inch NPT

8.1.2. Pump Suction Line

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

8.1.3. Pump Discharge Line

DO NOT reduce. Use 1 or 1-1/4 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.

8.1.4. 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.

8.1.5. 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
LV60	1-1/4 inch NPT
LV75	1-1/2 inch NPT
LV100	2-1/2 inch NPT

8.1.6. Condensate Return System Overflow

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

8.1.7. 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 operating 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

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 (See wiring diagram unique to boiler supplied for voltage requirements)

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"



Lattner Boiler Company

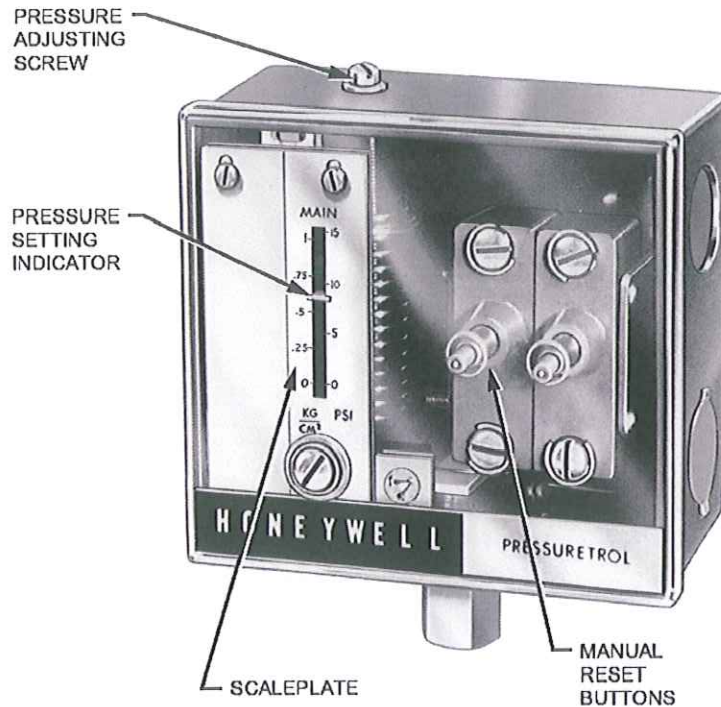
Lattner Boiler Company
1411 9th St. SW
Cedar Rapids, IA 52404
Telephone: (800) 345-1527
Fax: (319) 366-0770
Web: www.lattnerboiler.com

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.

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.

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, but may cause unwanted pressure drops before restarting.

11.3. Modulating Controller (Optional)

An optional modulating pressure controller may be supplied with boiler. Modulating pressure controller with potentiometer is controlled by a sequence or step controller for boilers with multiple stages. (See controller and sequencer/step controller manuals for additional information).

11.4. 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. Mercury switch limits have reset buttons on top. Snap switch limits have reset buttons on front.

11.4.1. 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.

11.5. 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.

11.6. 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 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.



Lattner Boiler Company

Lattner Boiler Company
1411 9th St. SW
Cedar Rapids, IA 52404
Telephone: (800) 345-1527
Fax: (319) 366-0770
Web: www.lattnerboiler.com

- 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 dissolved 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 your water treatment company.

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



Lattner Boiler Company

Lattner Boiler Company
1411 9th St. SW
Cedar Rapids, IA 52404
Telephone: (800) 345-1527
Fax: (319) 366-0770
Web: www.lattnerboiler.com

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 proper operation. 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.

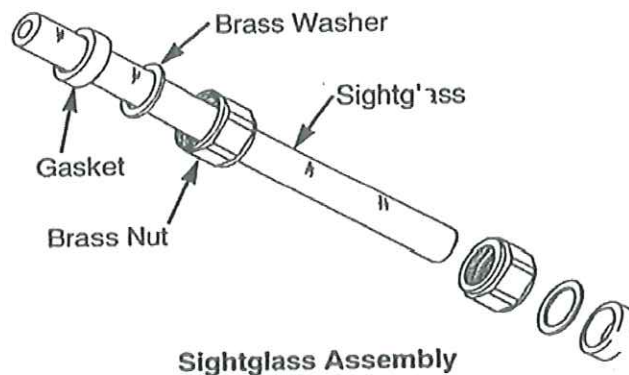
5. Heating Elements

- 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 off all power sources.
 - 5.1.2. Drain boiler.



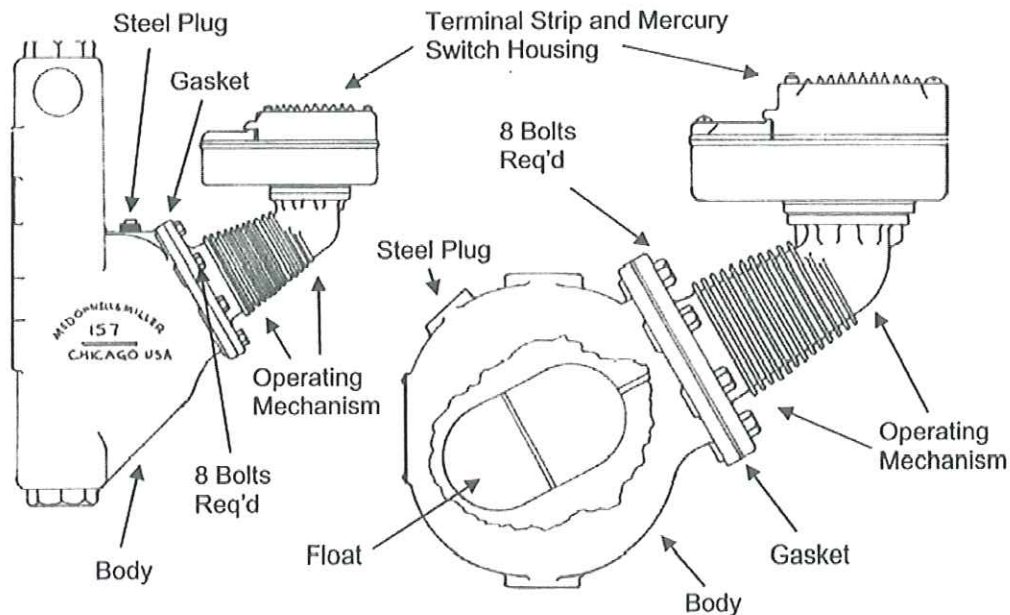
- 5.1.3. Disconnect wiring from the defective element and tape ring connectors with electrical insulating tape.
- 5.1.4. Remove both retaining nuts.
- 5.1.5. Pull element out approximately 6" and cut off with hacksaw.
- 5.1.6. Push element back into vessel.
- 5.1.7. Insert a short piece of 7/16" diameter 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, making sure to mark them for reconnection.
 - 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 into service, check all bolts and electrical fitting for tight connections.

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



- 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.

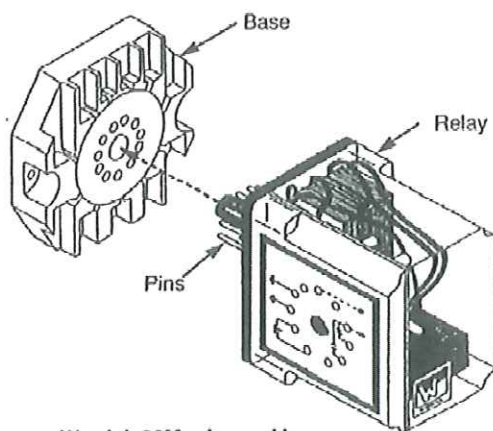
- 6.6. Pull glass down, out of the upper fixture tilting the glass slightly to clear the lower fixture. Be careful not to break the sight glass when removing.
 - 6.7. Assemble the new sight glass (as shown above). **ALWAYS** replace the gaskets and brass washers when installing a new sight glass.
 - 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.

- 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.

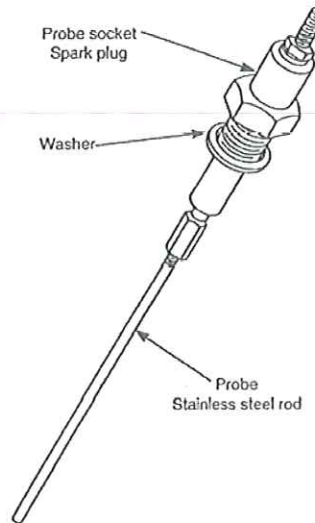
8. Warrick Relay Replacement



Warrick 26M relay and base

- 8.1. Disconnect all power to the boiler.
- 8.2. Pull relay out by hand. This may take a little force but be careful.

- 8.3. Replace the Warrick with a new 26M series Warrick. 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.

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 use 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.	<ol style="list-style-type: none">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.	<ol style="list-style-type: none">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.



Lattner Boiler Company

Lattner Boiler Company
1411 9th St. SW
Cedar Rapids, IA 52404
Telephone: (800) 345-1527
Fax: (319) 366-0770
Web: www.lattnerboiler.com

Boiler and pump switches are ON, pump does not run, low water level in boiler.	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 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.



INDEX FOR 120HS-575-5

Bill of Materials	Page 2
Certified Print	Page 5
Wiring Diagram	Page 6
Element Bussing	Page 7
Start-Up Form	Page 8
Gems / Warrick 26M Low Water Cut-Off	Page 11
McDonnell & Miller 157S-MD Low Water Cut-Off	Page 13
Honeywell L404F1060 PressureTrol Limit Control	Page 25
Honeywell L4079B1033 PressureTrol Limit Control	Page 31
Honeywell L91B1035 Pressuretrol Controller	Page 35
Viconics R851B-8 Step Controller	Page 45
Advantage Controls SSB2 Surface Conductivity Control	Page 51
Kunkle 6021 Safety Relief Valve	Page 83
Lattner Warranty	Page 86
Standard Terms & Conditions	Page 87
Data Reports	Page 88

BILL OF MATERIAL FC. .259-J; 120HS-480-2

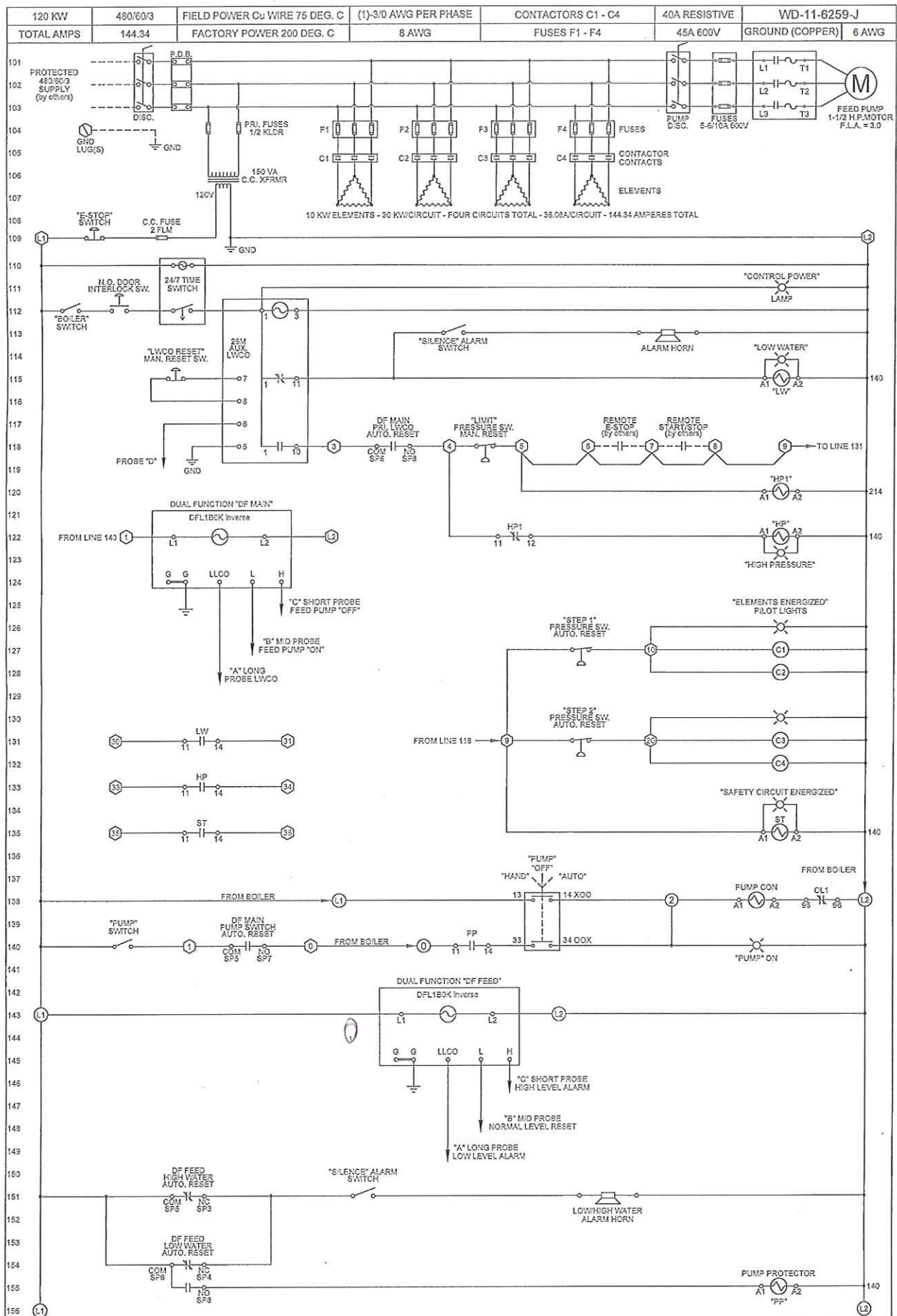
BILL OF MATERIALS FOR: 2503-97 2503-97 100 2									
	SHOP ORDER:	6259-J						VESSEL DIAMETER:	16"
	CUSTOMER:	UNIVERSITY OF FLORIDA						ASME STAMP:	S
	ORDER DATE:	11/12/2010						OUTLET DIAMETER:	1"
	RELEASED DATE:	2/22/2011						INLET DIAMETER:	3/4"
	PROJECTED SHIP DATE:	5/20/2011						DRAIN FOR BLOWDOWN DIAMETER:	1"
	QUANTITY:	1				(ITEMS SHOWN REFLECT NEEDS OF ONE BOILER)			
	BOILER MODEL:	120HS-480-2							
	KW:	120							
	VOLTS:	480							
	PHASE/HERTZ:	3/60							
	AMPS:	144.34							
	TOTAL HEATING ELEMENTS QTY:	12 (10KW - 480V)			030004				AB-3/22/2011
ITEM NO.	DESCRIPTION				LAT.P/N	MFG.	MODEL	DATE ORD.	DATE REC.
	NUMBER OF FLANGE(S): 1								
	DIAMETER OF FLANGE(S): 8"								
	HEATING ELEMENTS PER FLG: 12				030004				
	KW PER HEATING ELEMENT: 10								
	VOLTAGE PER HEATING ELEMENT: 480								
	INTERLOCKING DISCONNECT: 200 AMP								
	SHAFT: 6"								
	HANDLE: BLACK								
	LUG SET: 1 SET OF 3 (#4 - 300KCMIL)								
	LUG SET: 1 SET OF 3 ((6) 14 - 6AWG)								
	CONTACTOR QUANTITY: 4								
	CONTACTOR: 600V - 40AMP				022300	SQ. D	8910DPA33V02Y124		
	FUSE BLOCK QUANTITY: 4								
	FUSE BLOCK: 600V - 60AMP				038580				
	POWER FUSE QUANTITY: 12 (600V - 45AMP)								
					038106		"J"		
	WIRE QUANTITY(IN FEET): 144								
	AWG WIRE SIZE: 10				122800		FEP		

BILL OF MATERIAL FC. J259-J; 120HS-480-2

ITEM NO.	DESCRIPTION	LAT.P/N	MFG.	MODEL	DATE ORD.	DATE REC.
	HIGH PRRESSURE OPERATING CONTROLLER: (2) 0-300# (SET @ #) STEPS: 2 (NEED TWO)		HONEYWELL	L404F1094		
	CONTROL TRANSFORMER VA: 150	107872	SQ. D	9070TF150D1		
	CONTROL TRANSFORMER TYPE: DRY WITH FUSE KIT VOLTAGE FROM/TO: 480/120					
	PRIMARY FUSE QUANTITY: 2 VOLTAGE: 600 AMPS: 1/2	036960		KLDR-1/2		
	SECONDARY FUSE QUANTITY: 1 VOLTAGE: 250 AMPS: 2	038111		FLM-2		
	PILOT LIGHTS (RED): 2	085745		LOW WATER & HIGH PRESSURE		
	PILOT LIGHTS (AMBER): 2 (ON/OFF & SAFETY)	085738				
	PILOT LIGHTS (WHITE): 2 (STEPS)	085765				
	HIGH LIMIT MANUAL RESET: 0-300# (SET @ 290#)		HONEYWELL	L4079B1066		
	LOW WATER CUT-OFF WITH PROBE: 1	068075	WARRICK	26M		
	ELECTRODE FOR 26M: 1	067620	WARRICK	3B1B		
	FLOAT LEVEL CONTROL: MM 157 (WITH SIGHT GLASS)	066426	M.M.	157S-MD		
	MM DRAIN VALVE (BALL): 1"	115240				
	PRESSURE GAUGE: 0-600#					
	SAFETY VALVE QUANTITY: 1		KUNKLE	6021		
	SAFETY VALVE SIZE: 1/2"					
	SAFETY VALVE SETTING (PSI): 300#					
	ENCLOSURE QUANTITY: 1 (IN STOCK)					
	ENCLOSURE SIZE: 36"H x 40"W x 8"DEEP					
	DOOR INTERLOCK SWITCH: 1	104647		Z-15GQ-B7-K		

BILL OF MATERIAL FL 3259-J; 120HS-480-2

ITEM NO.	DESCRIPTION	LAT.P/N	MFG.	MODEL	DATE ORD.	DATE REC.
	VENT FANS QUANTITY: 1	035322				
	VENT FANS: AIR IN ON BOTTOM LEFT OF THE CONTROL PANEL					
	TOGGLE SWITCH(S): 2	104660				
	TOGGLE SWITCH(S) FOR: PUMP SWITCH & ALARM SILENCE					
	PUSH BUTTON SWITCH(S): 1	068095				
	PUSH BUTTON SWITCH(S) FOR: LWCO					
	ALARM HORN: 1	047850		MIDI #123A-N5		
	ALARM HORN SOUNDS FOR: LOW WATER					
	ALARM AND STATUS RELAYS SPDT: 3	106268				
	ALARM AND STATUS RELAYS BASE: 3	106272				
	ALARM AND STATUS RELAYS FOR: LOW WATER, HIGH PRESSURE, & STATUS					
	GROUND LUGS QUANTITY: 1					
	GROUND LUGS SIZE: #6 AWG					



KEY:
 LW = LOW WATER RELAY, HP = HIGH PRESSURE RELAY
 ST = STATUS RELAY, PP = PUMP PROTECTOR RELAY
 LWCO = LOW WATER CUTOFF
 FIELD WIRE (-----)
 ○ = FEEDWATER ENCL. TERM. ○ = BOILER ENCL. TERMINAL
 NOTE:
 TRANSFORMER IS FOR CONTROL CIRCUIT PILOT DUTY ONLY.

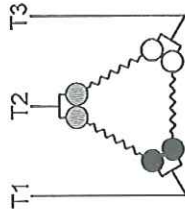
REV	DESCRIPTION	DATE	DRAWING NO.	WD-11-6259-J	DESCRIPTION	B
					WIRING DIAGRAM	REV.
					ELECTRIC STEAM BOILER SKID	
					APPROVALS	
					DATE	
					SCALE	
					DRAWN BY	
					CHECKED BY	
					DATE	
					BY	
					DATE	



2002-6-12 300

6" ELEM FLG - 12 ELEM BLADES

3 PHASE
ONE CIRCUIT
SHOWN




6" CLASS 300 LB. ELEMENT FLANGE 12 ELEMENT BLADES

NOTES:

1. RAISED FACE IS FACING DOWN.
2. ----- = ELEMENT BLADES THAT MAKE UP A COMPLETE CIRCUIT
3. MORE THAN ONE CIRCUIT MAY BE CONNECTED TO A SINGLE CONTACTOR
4. SEE WIRING DIAGRAM FOR COMPLETE WIRING OF ELEMENT(S).
5. 6" CLASS 300 LB. BLIND FLANGE WITH 6 12 XY LAYOUT.

STAMP "T" FOR
TOP OF FLANGE

REV	DESCRIPTION	DATE	ITEM NO:	APPROVALS	DATE
			MODEL	ENGR.	
			ORDER NO.	Q.C.	
			SCALE: N.T.S.	DRAWN BY: J. BURR	7/19/11
			DESCRIPTION: 6" CLASS 300 FLANGE 12 ELEMENT BLADES - ELEMENT BUSSING		
			DRAWING NO: 2002-6-12 300		
PROPERTY OF LATTER BOILER COMPANY CEDAR RAPIDS, IOWA 52405-1627					REV. - A



Latter Boiler Company



Lattner Boiler Company

START-UP FORM FOR LATTNER ELECTRIC STEAM BOILER

Job UNIVERSITY OF FLORIDA Date 4-18-12
Location #1 BUCKEYE DRIVE Serial No. 94096
PERRY, FL 32348 Model No. 120 HS
NB # 55434
Contact RALPH HOFFMAN Phone 850-584-4507
Fax _____

Please check to verify 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 for boiler.
4. ☒ Check installation:
 - a. ☒ Check feed water tank & float valve – verify level.
 - b. ☒ Verify feed pump rotation/operation.
 - c. ☒ Piping service.
 - d. ☒ Wiring completed.
5. ☒ Check piping:
 - a. ☒ Feedwater w/(2) spring check valves.
 - b. ☒ Bottom drain closed.
 - c. ☒ Inlet valve open.
 - d. ☒ Safety valve outlet piping.
 - e. ☒ Safety valve set pressure 300 psi.
 - f. ☒ Steam outlet stop/gate valve closed.
 - g. ☒ City water makeup open and float adjusted.
6. ☒ Open softener bypass valve for initial fill with city water.
7. ☒ Tighten all wiring connections.
8. See page 3
9. ☒ Review wiring diagram. Note remote interlock terminals with jumpers.
10. ☒ With the boiler switch "OFF" energize the main disconnect. (optional)
11. ☒ Verify incoming voltage is correct.
12. ☒ Press the manual reset on the high pressure switch.
13. ☒ Press the manual reset on the low water cutoff (6 seconds).

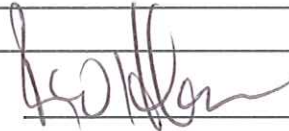
14. ☒ Set operating control to desired operating pressure.
15. ☒ Set automatic reset high pressure limit to 10# higher than operating pressure.
16. ☒ Set manual reset high pressure limit to 5# higher than automatic high pressure limit.
17. ☒ Set 2nd stage control or progressive sequencer (#of steps). ____ time delay = 15 sec.
(verify dip sw's)
18. ☒ Energize power and control circuits.
19. ☒ Verify amber safety circuit light is "ON." (all safeties proven)
20. ☒ Clean pressure vessel with "boil out" compound dissolved in water; flush until water clears.
21. ☒ check all fitting for leaks. Tighten/repair as needed.
22. ☒ Test high pressure limit switch and reset
23. ☒ Test low water cutoff using test switch and reset
24. ☒ Operating pressure 200 min. 225 max.
25. ☒ Instruct owner/operator to connect condensate line to return tank after two (2) days of operation.
26. ☒ Follow maintenance procedures for daily blowdown and chemical treatment.
27. ☒ Observe unit for proper operation. Keep log of procedure and performance.

NOTES: _____



Startup Technician

Tele. No. 321-228-5366



Owner's Approval Signature


Print Name Ralph Hoffman

Company Ux

Date 9/18/12

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.

8.  **POWER OFF.** Check the OHMS of resistance on each leg of each circuit at the contactor.

Circuit #1	Circuit #2	Circuit #3	Circuit #4	Circuit #5	Circuit #6
T1 to T2 14.6	T1 to T2 14.4	T1 to T2 14.4	T1 to T2 14.5	T1 to T2	T1 to T2
T1 to T3 14.5	T1 to T3 14.2	T1 to T3 14.5	T1 to T3 14.6	T1 to T3	T1 to T3
T2 to T3 14.4	T2 to T3 14.3	T2 to T3 14.3	T2 to T3 14.6	T2 to T3	T2 to T3
Circuit #7	Circuit #8	Circuit #9	Circuit #10	Circuit #11	Circuit #12
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
Circuit #13	Circuit #14	Circuit #15	Circuit #16	Circuit #17	Circuit #18
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
Circuit #19	Circuit #20	Circuit #21	Circuit #22	Circuit #23	Circuit #24
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
Circuit #25	Circuit #26	Circuit #27	Circuit #28	Circuit #29	Circuit #30
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

Circuit #31	Circuit #32	Circuit #33	Circuit #34	Circuit #35	Circuit #36
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
Circuit #37	Circuit #38	Circuit #39	Circuit #40	Circuit #41	Circuit #42
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
Circuit #43	Circuit #44	Circuit #45	Circuit #46	Circuit #47	Circuit #48
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
Circuit #49	Circuit #50	Circuit #51	Circuit #52	Circuit #53	Circuit #54
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
Circuit #55	Circuit #56	Circuit #57	Circuit #58	Circuit #59	Circuit #60
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



Warrick® Series 26M Controls Installation and Operation Bulletin

This bulletin should be used by experienced personnel as a guide to the installation of series 26M controls. Selection or installation of equipment should always be accompanied by competent technical assistance. We encourage you to contact Gems Sensors or its local representative if further information is required.

Specifications

Control Design: Solid State components enclosed in clear lexan plug-in style housing. Housing carries no NEMA ratings.

Contact Design: SPDT (1 form C): One normally open (N.O.) and one normally closed (N.C.) powered contacts.

Contact Ratings: 10 A @ 120,240 VAC resistive (120°F), 1A @ 120, 240 VAC resistive (150°F), 1/3 H.P. @ 120, 240 VAC (120°F)

Contact Life: Mechanical- 5 million operations Electrical- 100,000 operations minimum at rated load.

Supply Voltage: 120, 240 or 24 VAC models: +10% -15% 50/60 Hz. 208/240 model: 187 Vmin to 255 Vmax. VAC 50/60Hz

Supply Current: Relay energized at 4.4 VA

Secondary Circuit: 12 VAC RMS Voltage on probes. 1.5 milli-amp Current.

Sensitivity: Models operate from 4.7K to 100K maximum specific resistance.

Temperature: -40 TO 150°F ambient

Terminals: All connections #6-32 screw type terminals with pressure clamps.

Time Delays: Standard – LLCO probe, 3 seconds standard for lowering level.

Listings: U.L. limit control recognition (353). 240 and 208 volt units are not U.L. limit control recognized.

Installation

1. Install octal socket in appropriate enclosure using two #6 or #8 metal screws.

1A. Install rail mount socket on appropriate rail (DIN mount) in appropriate enclosure if applicable.

2. Wire control per wiring diagram, following N.E.C. and local codes

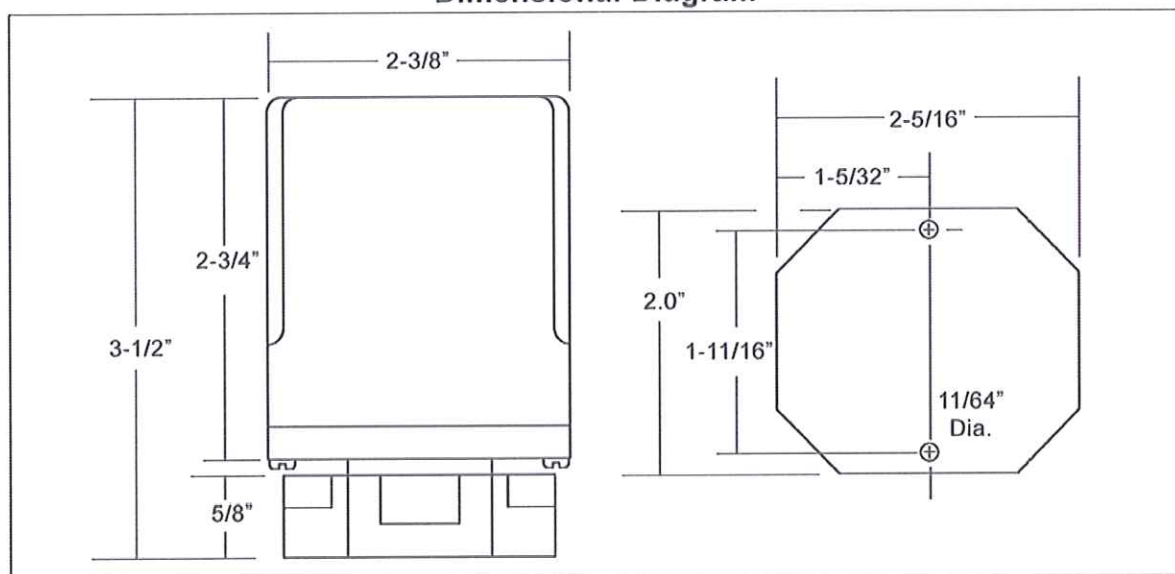
3. Install control module in socket.

Sensitivities vs Maximum Probe Wire Distance*

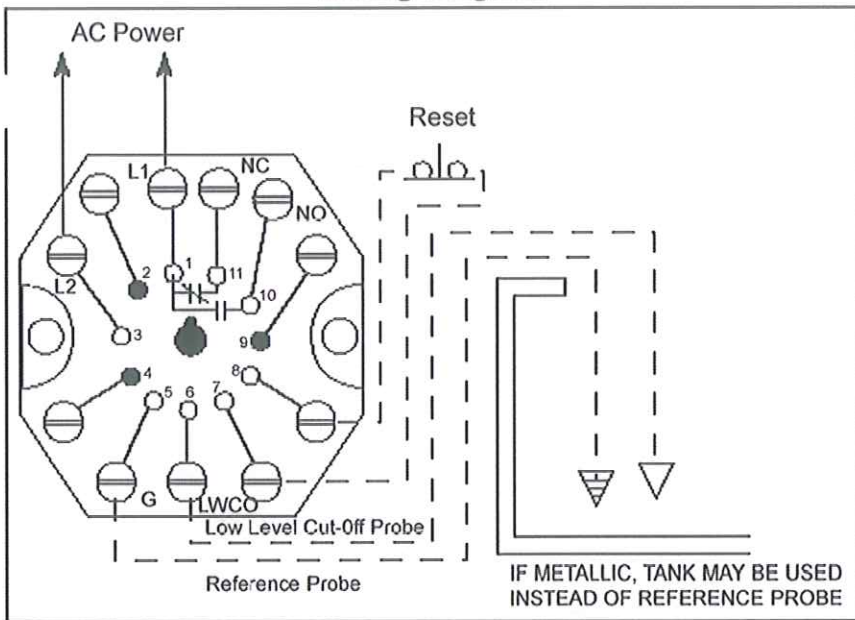
SENSITIVITY CHARACTER	SENSITIVITY (KOHMS)	DISTANCE (FT)
A	4.7	900
B	10	600
C	26	250
D	50	100
E	100	50

* Based on type MTW or THHN wire, #14 or #16 Awg

Dimensional Diagram



Wiring Diagram



Options:

Automatic Reset: (Reset terminals not used): When the liquid rises to the electrode on terminal 6, the control energizes, changing state of the load contacts. (LED will be lit) The control remains energized until the liquid level recedes below electrode on terminal 6. The control then de-energizes, (LED 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 probe on terminal 6 for a full three seconds before control de-energizes.

Manual Reset: (Normally closed pushbutton installed across terminals #7 and #8): When the liquid rises to the electrode on terminal 6, the control will remain de-energized until the pushbutton is depressed. The control will then energize, (LED will be lit) changing the state of the contacts. The control remains energized until

the liquid level recedes below electrode on terminal 6. The control then de-energizes, (LED will not be lit) returning load contacts to their original state. Unless otherwise specified, there is a three second time delay on decreasing level. Liquid must be below probe on terminal 6 for full three seconds before control de-energizes.

Manual Reset with Optional Power Outage Feature: (Normally closed pushbutton across reset terminals) Control will ignore power loss to control. With liquid above electrode on terminal 6, a power outage will cause the control to de-energize, but will automatically energize upon return of power. However, loss of liquid will cause control to de-energize and remain so until liquid again rises to electrode and pushbutton is depressed.

Dirty Electrode Detection: The LED will flash every half-second once the probe resistance reaches a value greater than the nominal control sensitivity rating. The relay state will not change until it exceeds the nominal sensitivity by more than 25% (typically) at nominal input voltage. At which time the LED and relay contact return to the dry state. Such a condition may suggest electrode maintenance is required.

Test Feature Allows LLCO circuit to be tested. Holding down the reset button for 3 seconds will allow the LLCO circuit to trip which simulates the loss of water, without the need of draining the water level in the boiler. The control will return to normal operation once the reset button is pressed a second time.

26M X X X X X X X X

- Dirty Probe: Blank = No Dirty Probe, A = With Dirty Probe
- Time Delay Increasing Level: 00-90 seconds. Blank = 0 seconds
- Time Delay Decreasing Level: 03-90 seconds. Blank = 3 seconds
- Optional Character: Optional character chart
- Enclosure: 0=None, 1=NEMA 1, 4=NEMA 4
- Socket Style: A=11 Pin Octal, B=DIN mount, M=None, module only
- Supply Voltage: 1=120VAC, 2=240VAC, 3=24VAC, 8=208/240VAC
- Sensitivity: A=4.7K, B=10K, C=26K, D=50K, E=100K

Optional Character Chart

	N.C. Pushbutton	Power Outage	Test Feature
A	X	X	X
B			X
C	X		
E		X	
F	X	X	
Y	X		X
Z		X	X
X	No Option		



Gems Sensors Inc.
One Cowles Road
Plainville, CT 06062-1198
Tel: 860-793-4579
Fax: 860-793-4580



Warrick® Dual Function Controls Installation and Operation Bulletin

Form 222B
Sheet P/N 100205-1
Rev. E

This bulletin should be used by experienced personnel as a guide to the installation of Dual Function Controls. Selection or installation of equipment should always be accompanied by competent technical assistance. We encourage you to contact Gems Sensors or its representative if further information is required.

Specifications

Control Design: Open circuit board design
Contact Design: SPDT (1 form C): one normally open (N.O.) and one normally closed (N.C.), non powered contacts for limit control and SPDT (1 form C): one normally open (N.O.) and one normally closed (N.C.), non powered contacts for level control

Contact Ratings: 10A @ 120, 208/240, 240 VAC resistive (120°F), 1A @ 120, 208/240, 240 resistive (150°F), 1/3 Hp @ 120, 208/240, 240 VAC

Contact Life: Mechanical - 5 million operations
Electrical - 100,000 operations minimum at rated load

Supply Voltage: 120, 240, or 24 VAC models, +10%, -15%, 50/60 Hz. 208/240 Model: 187V Min to 255V Max, VAC 50/60 Hz

Power Consumption: 120, 208/240, 240, or 24 VAC both relays energized - 4.4 VA.

Secondary Circuit: 12 VAC RMS voltage on probes, 1.5 milli-amp current.

Sensitivity: Models operate from 0-100K ohms maximum specific resistance (factory set)

Temperature: -40° to 150° F ambient

Terminals: Probe connections 3/16" male quick connects, Line and Power connections 1/4" male quick connects

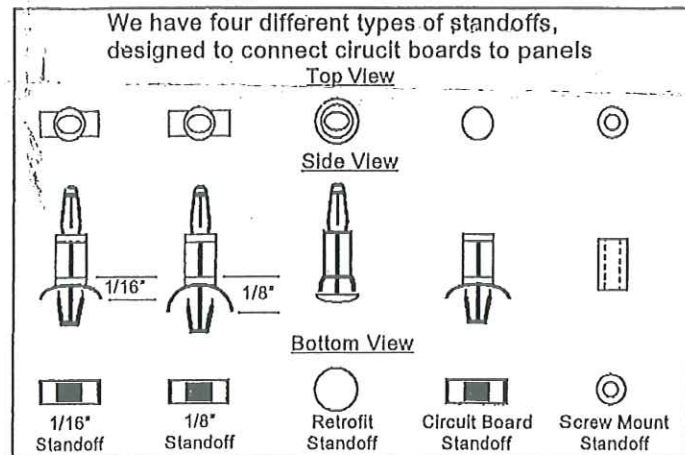
Time Delays: Standard, 0.5 seconds rising level, LLCO probe, 3 seconds standard for lowering level.

Listings: Entire control carries U.L. motor controller recognition (UL 508) and U.L. Limit control recognition (UL 353). 208/240 and 240 VAC models carry only motor controller recognition (UL 508)

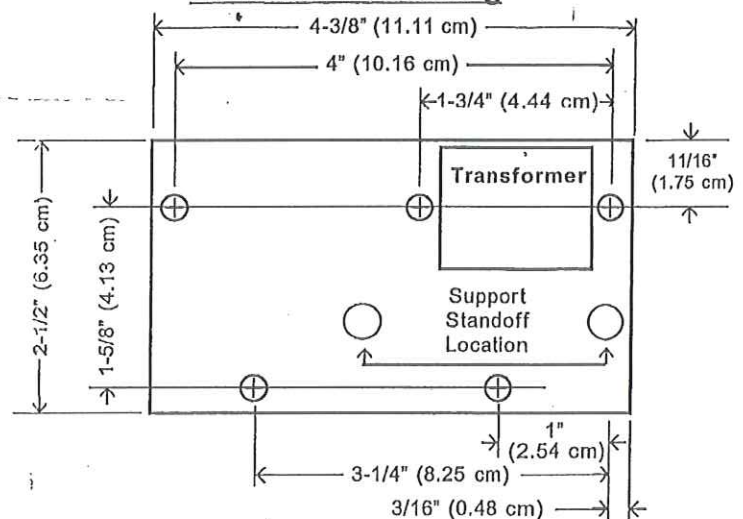
Installation

1. Drill five .187 holes in customer supplied back plate using stick on template supplied with control. Standard standoffs are designed for back plate thickness of 0.062 (1/16"). Standoffs are available for back plates of 0.125 (1/8") nominal thickness. If retrofit plate standoffs are used, drill 5 (five) 0.250 dia. Holes in proper locations.
2. Install five standoffs into back plate. Install two support standoffs into circuit board. Snap circuit board onto standoffs. See sketch for proper installation. Install control in an appropriate enclosure.
3. Wire control per wiring diagram, following N.E.C. and local codes. Use appropriately sized spade terminals.

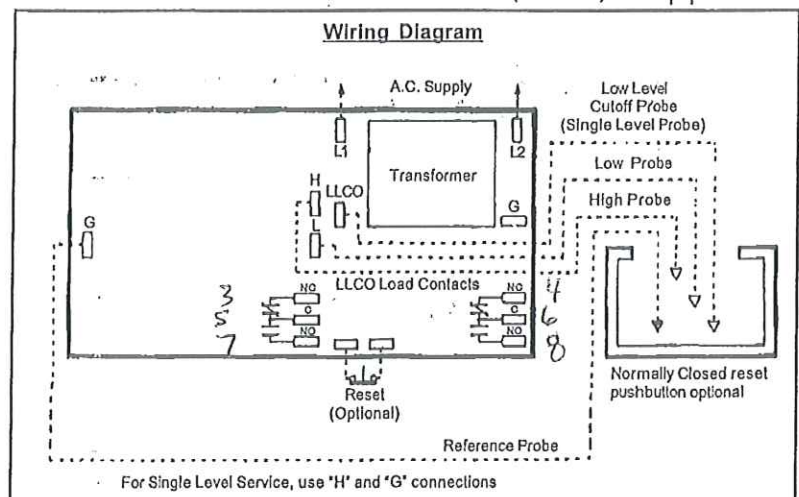
Standoffs



Dimensional Drawing



Wiring Diagram



Operation

DIRECT MODE BOTH FUNCTIONS

LLCO Function: When the liquid rises to the electrode on terminal LLCO, the relay associated with terminal LLCO energizes, changing state of the load contacts. (LED will be lit). The relay remains energized until the liquid level recedes below electrode on terminal LLCO. The associated relay then de-energizes, (LED 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 probe on terminal LLCO for full three seconds before control de-energizes.

H-L Function: When the liquid rises to the electrode on terminal H, the associated relay energizes, changing the state of the load contacts. (LED will be lit). The relay remains energized until the liquid level recedes below electrode on terminal L. The associated relay then de-energizes, (LED will not be lit) returning load contacts to original state. Unless otherwise specified, there is a one half second time delay on increasing level. Liquid must be in contact with probe on terminal H for a full half second before control energizes. This function can be wired for single level service by using only the H terminal.

INVERSE MODE

LLCO Function: LLCO always functions in direct mode only see above for operation.

H-L Function: Associated relay energizes with power, (LED will be lit) changing the state of the load contacts. When the liquid rises to the electrode on terminal H, the relay de-energizes, returning load contacts to shelf state. (LED will not be lit). The associated relay remains de-energized until the liquid level recedes below electrode on terminal L. The relay then energizes.

Options

Optional Manual Reset (Normally closed pushbutton across reset terminals. Pushbutton ordered separately): Manual reset only applies to the function associated with terminal LLCO. When the liquid rises to the electrode on terminal LLCO, the control will remain de-energized (load contacts in original state) until the pushbutton is depressed. The control will then energize, (LED will be lit) changing the state of the contacts. The control remains energized until the liquid level recedes below electrode on terminal LLCO. The control then de-energizes, (LED will go off) returning load contacts to their original state. Unless otherwise specified, there is a three second time delay on decreasing level. Liquid must be below probe on terminal LLCO for full three seconds before control de-energizes.

Manual Reset with optional Power Outage Feature: Reset (Normally closed pushbutton across reset terminals. Pushbutton ordered separately) Control will ignore power loss to control. With liquid in contact with electrode on terminal LLCO, a power outage of less than 250 m sec. Will cause the control to de-energize, but will automatically energize upon return of power. However, loss of liquid will cause control to de-energize and remain so until liquid again rises to electrode and pushbutton is depressed.

Time Delays associated with terminals H and L: With time delay on increasing level, the liquid must be in contact with the high electrode for the full duration of the time delay before control will operate. With delay on decreasing level, the liquid must be below the low electrode for the full duration of the time delay before control will operate. In single level service, terminals 3 and 4 must be jumpered together to achieve time delays on both increasing and decreasing levels or just decreasing level.

Time Delays associated with terminal LLCO: 3 Second time delay on decreasing level is standard. Delay up to 90 seconds, can be specified and would act in the same manner as listed above.

Dirty Electrode Detection: The LED will flash every half-second once the probe resistance reaches a value greater than the nominal control sensitivity rating. The relay state will not change until it exceeds the nominal sensitivity by more than 25% (typically) at nominal input voltage. At which time the LED and relay contact return to the dry state. Such a condition may suggest electrode maintenance is required.

e Out Option: The latching circuit for the high and low electrode has an optional timer. In some applications the High or Low electrode may become short circuited or disconnected. Such an occurrence may potentially over fill in fill applications, or cause the pump to run dry in pump down applications. The time option is custom programmed up to 3 minutes. When a fault condition occurs, the Fill LED will have a blink sequence of .5 seconds on 2 seconds off. See Chart A-1 for time delay options.

Test Feature: Allows LLCO circuit to be tested. Holding down the reset button for 3 seconds will allow the LLCO circuit to trip which simulates the loss of water, without the need of draining the water level in the boiler. The control will return to normal operation once the reset button is pressed a second time. (Test feature option only available with the manual reset function.)

DF X X X X XX XX XX X

Dirty Probe/Timeout Timer Option:
(See Chart A-1)

Time Delay Decreasing Level:
LLCO function 3-90 seconds,
blank = 3 seconds

Time Delay Decreasing Level:
H/L function 0-90 seconds,
blank = 0 seconds

Time Delay Increasing Level:
H/L function 0-90 seconds,
blank = 0 seconds

Optional Character: (See Chart B-1)

Enclosure: 0-None, 1-Nema 1, 4-Nema 4

Standoff Style/Socket Type:

A - 1/16" Panel C - Screw Mount
B - 1/8" Panel D - Retrofit

Supply Voltage:

1 - 120 VAC 3 - 24 VAC
2 - 240 VAC 8 - 208/240 VAC

Mode/Sensitivity:

Direct Inverse
A - 4.7K K - 4.7K
B - 10K L - 10K
C - 26K M - 26K
D - 50K N - 50K
E - 100K P - 100K

Chart A-1

OPTIONAL CHARACTER	Time Out Option					
	DIRTY PROBE	30 SEC	60 SEC	90 SEC	120 SEC	180 SEC
A	X					
B	X	X				
C	X		X			
D	X			X		
E	X				X	
F	X					X
G	X					X
K		X				
L			X			
M				X		
N					X	
P						X
Q						X

Chart B-1

	Reset Function	N.C. Pushbutton	Power Outage	Retrofit Plate	Test Feature
A	x	x	x		x
B	x				
D	x				x
G	x	x	x		
J	x	x	x	x	
K	x		x		
L	x		x	x	
R				x	
S	x	x			
T	x	x		x	
W	x			x	
Y	x	x			x
Z	x		x		x
X	No Option				



GemS Sensors Inc.
C. Jowles Road
Plainville, CT 06062-1198
Tel: 860-793-4579
Fax: 860-793-4580



McDonnell & Miller

Installation & Maintenance
Instructions
MM-217(I)

Series 150S and 157S



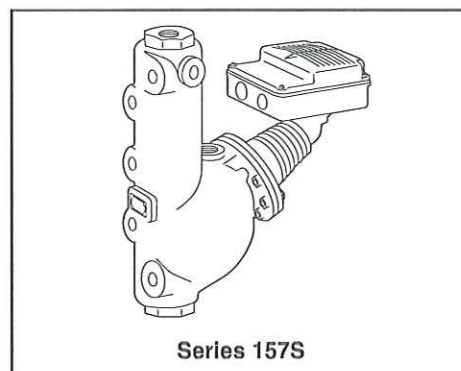
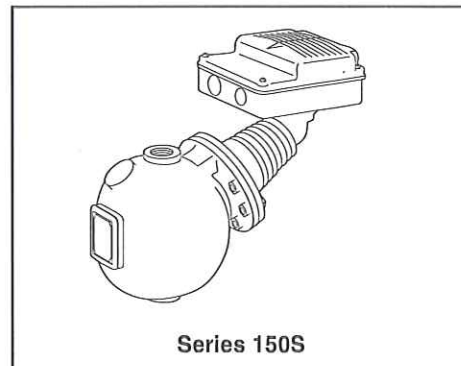
(Snap Switch, All Models except 157S-RB-P)

Low Water Cut-Off/Pump Controllers

For Steam Boilers and Other Level Control Applications

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/cm²)

Electrical Ratings

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

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

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

Enclosure rating: NEMA 1 General Purpose

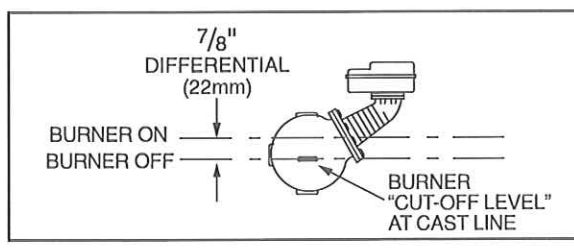
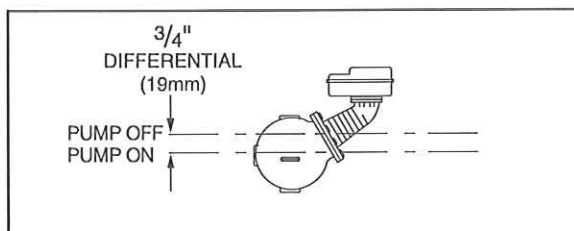
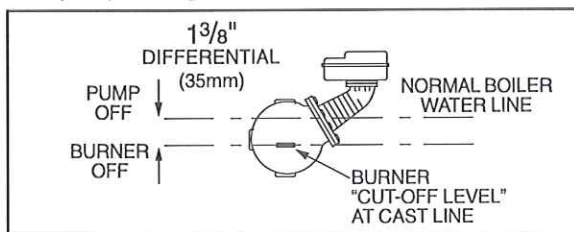
Settings and Differential Pressures

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

Series 150S, 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	13/8 (41)	3/4 (19)
	Pump On	5/8 (16)	
	Burner On	7/8 (22)	7/8 (22)
	Burner Off	0 (0)	

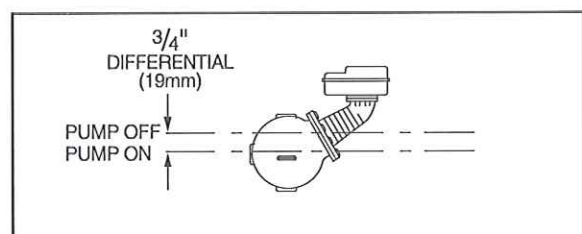
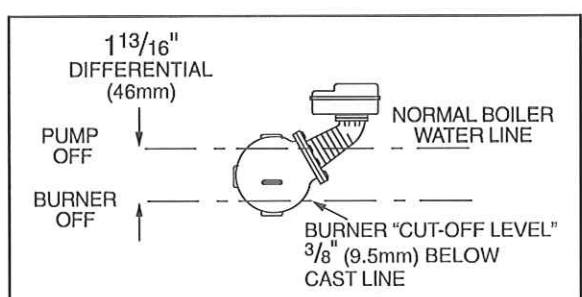
150 psi (10.5 kg/cm²) Levels



Model 150S-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	17/16 (37)	3/4 (19)
	Pump On	11/16 (17)	
	Burner Off	- 3/8 (-16)	N/A

150 psi (10.5 kg/cm²) Levels



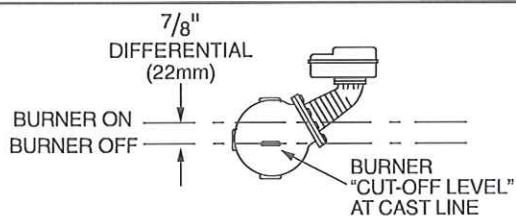
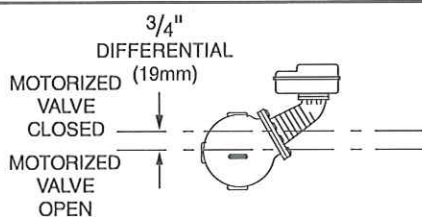
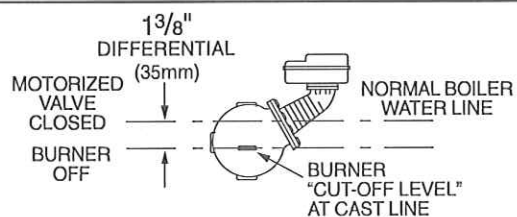
Settings and Differential Pressures (continued)

Values are $\pm \frac{1}{8}$ " (3.2mm).

Model 158S

Pressure	Setting	Approximate Distance Above Cast Line In. (mm)	Differential In. (mm)
0 psi (0 kg/cm²)	Motorized Valve Closed	$\frac{15}{16}$ (24)	$\frac{5}{16}$ (8)
	Motorized Valve Open	$\frac{5}{8}$ (16)	
	Burner On	$\frac{5}{8}$ (16)	$\frac{3}{8}$ (16)
	Burner Off	$\frac{1}{4}$ (6.4)	
150 psi (10.5 kg/cm²)	Motorized Valve Closed	$\frac{13}{8}$ (41)	$\frac{3}{4}$ (19)
	Motorized Valve Open	$\frac{5}{8}$ (16)	
	Burner On	$\frac{7}{8}$ (22)	$\frac{7}{8}$ (22)
	Burner Off	0 (0)	

150 psi (10.5 kg/cm²) Levels

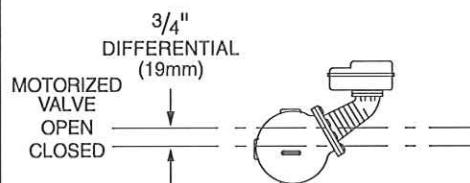
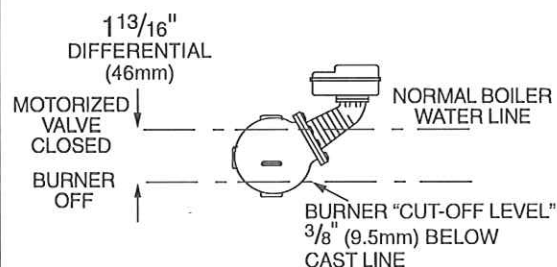


NOTE: Due to the slower operation of some motorized valves, complete valve opening or closing will occur at slightly different levels than indicated above.

Model 158S-MD

Pressure	Setting	Approximate Distance Above Cast Line In. (mm)	Differential In. (mm)
0 psi (0 kg/cm²)	Pump Off	$\frac{15}{16}$ (24)	$\frac{3}{8}$ (16)
	Pump On	$\frac{9}{16}$ (14)	
	Burner Off	0 (0)	N/A
150 psi (10.5 kg/cm²)	Pump Off	$\frac{17}{16}$ (37)	$\frac{3}{4}$ (19)
	Pump On	$\frac{11}{16}$ (17)	
	Burner Off	$-\frac{3}{8}$ (-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.

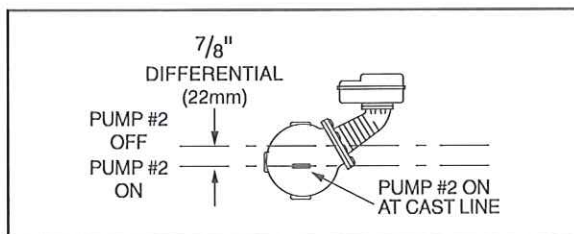
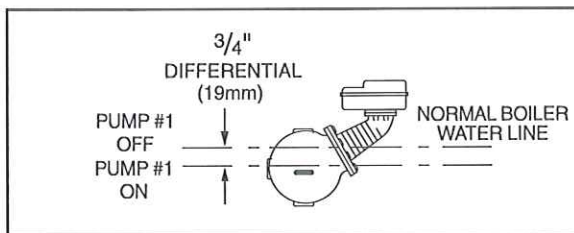
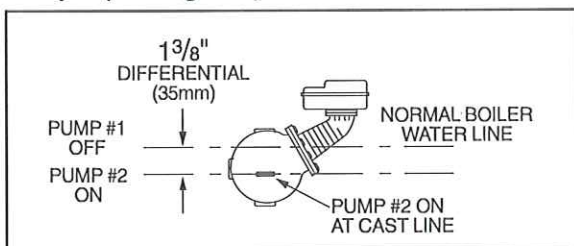
Settings and Differential Pressures (continued)

Values are $\pm \frac{1}{8}$ " (3.2mm).

Model 159S

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

150 psi (10.5 kg/cm²) Levels



INSTALLATION

TOOLS NEEDED:

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

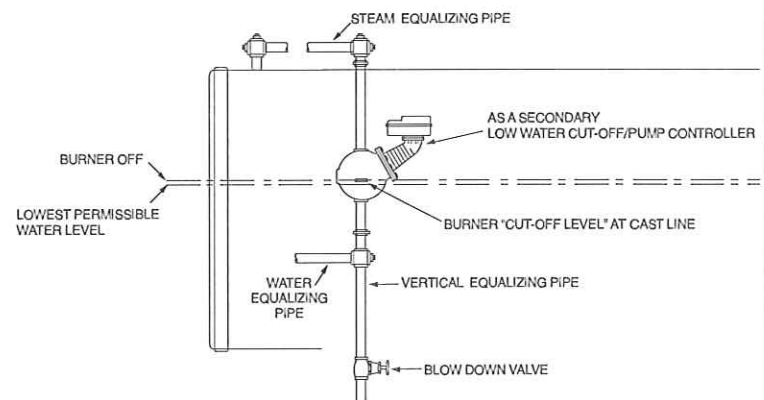
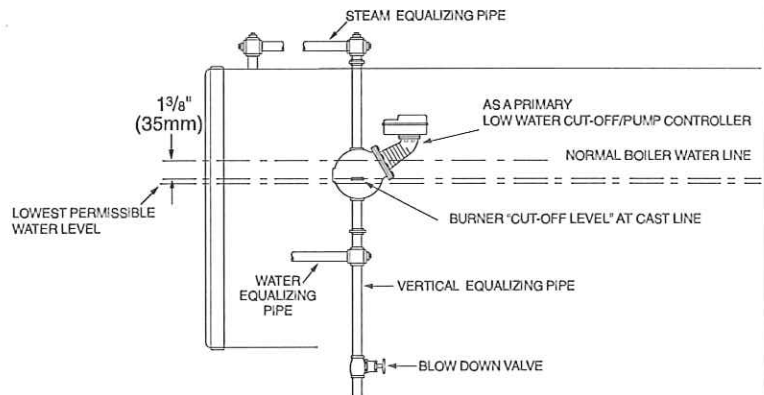
IMPORTANT: Follow the boiler manufacturer's instructions along with all applicable codes and ordinances for piping, blow down valve and water gauge glass requirements.

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

If the control will be the **primary low water fuel cut-off**, size the steam (top) and water (bottom) equalizing pipe lengths so that the horizontal cast line on the body is **1 $\frac{3}{8}$ " (35mm) below the boiler's normal water level, but not lower than the lowest, safe permissible water level, as determined by the boiler manufacturer.**

OR

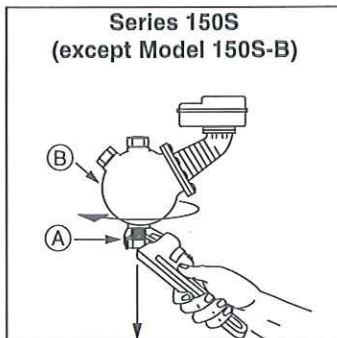
If the control will be the **secondary low water fuel cut-off**, size the steam (top) and water (bottom) equalizing pipe lengths so that the horizontal cast line on the body is **at or above, the lowest, safe permissible water level, as determined by the boiler manufacturer.**



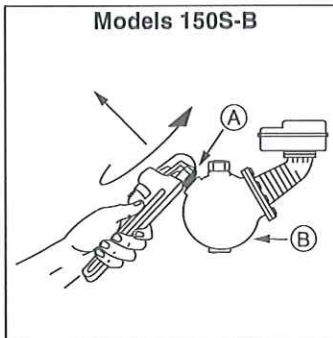
STEP 2 - Installing the Low Water Cut-Off

- a. Using a pipe wrench, unscrew the plastic float blocking plug (A) from the low water cut-off body (B).

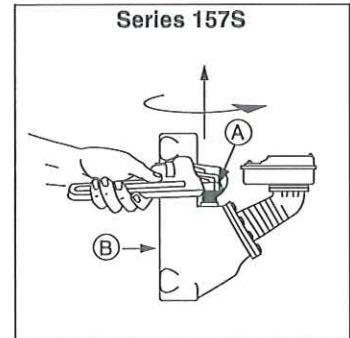
Series 150S
(except Model 150S-B)



Models 150S-B



Series 157S



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

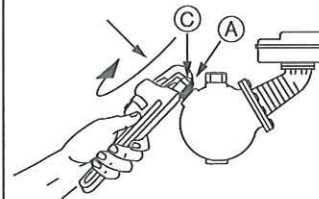
Screw the 3/4" NPT steel plug (C) (provided) in tapping (A).



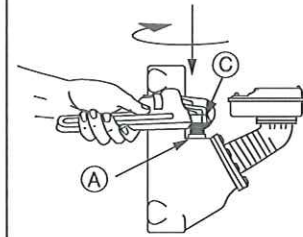
CAUTION

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 150S-B



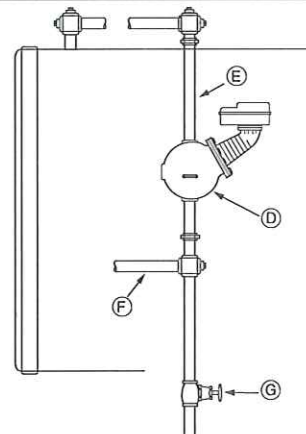
Series 157S



- 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 tapings are provided, with the exception of some 157 and 157S models which are 1 1/4" NPT.

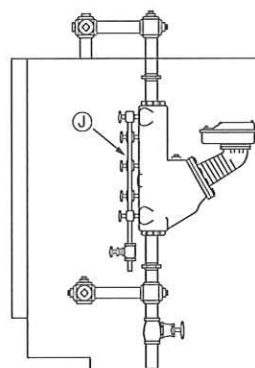


STEP 3 - Installing a Water Gauge Glass (Required on all steam boilers)

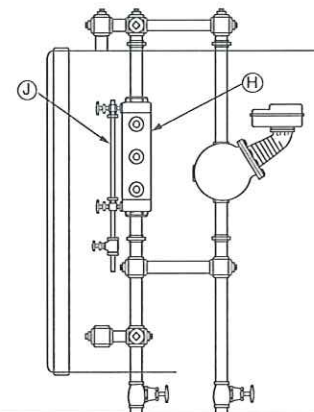
- a. Install a water column (H) (not included with product) for all models except Series 157S (with integral water column).**

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

Series 157S



All Other Models



STEP 4 - Electrical Wiring

WARNING



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



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

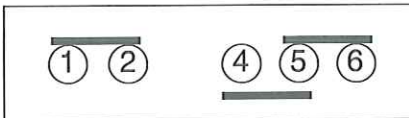
Switch Operation

For all Models except 158S and 159S

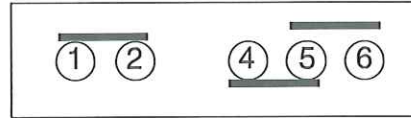
Boiler feed pump off,
burner on, alarm off.



Boiler feed pump on,
burner on, alarm off.

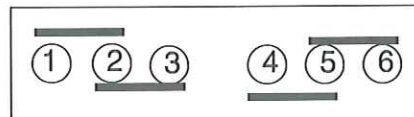


Boiler feed pump on,
burner off, alarm on.

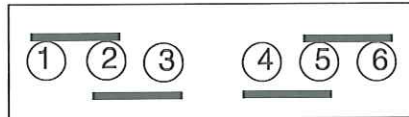


For Model 158S

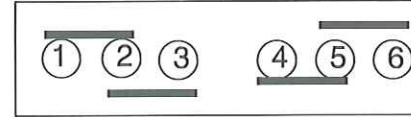
Motorized valve closed,
burner on, alarm off.



Motorized valve open,
burner on, alarm off.

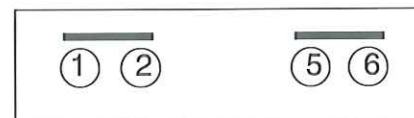


Motorized valve open,
burner off, alarm on.



For Model 159S

Pump #1 off,
pump #2 off.



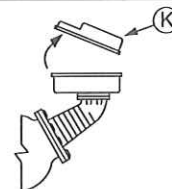
Pump #1 on,
pump #2 off.



Pump #1 on,
pump #2 on.



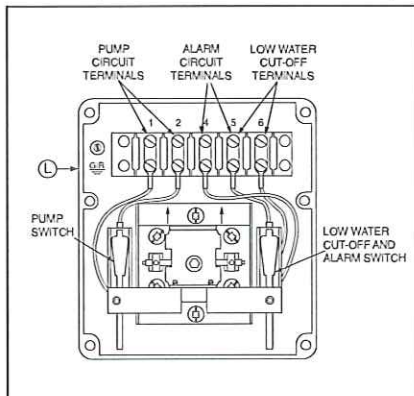
- a. Using a flathead screwdriver, remove the junction box cover (K).



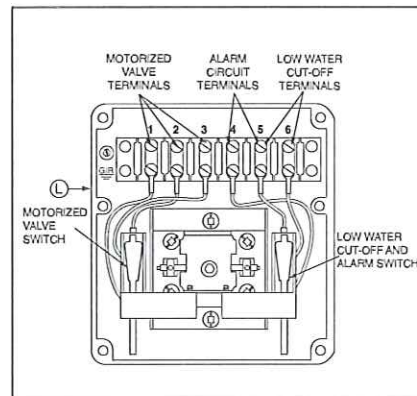
- b. Following the appropriate wiring diagram, (refer to page 9) based on your application requirements, and using BX armored cable or Thinwall electrical metal tubing connector fittings, make electrical connections to the junction box (L).

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

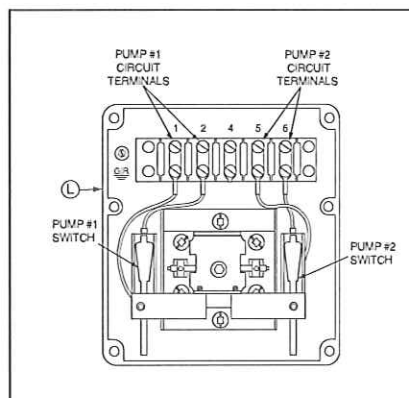
Snap Switches (Series 150S and 157S)



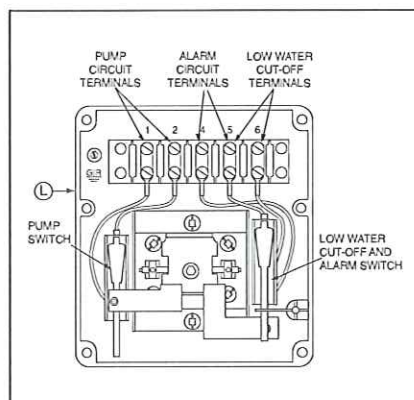
Automatic Reset
(All models except 158S and 159S)



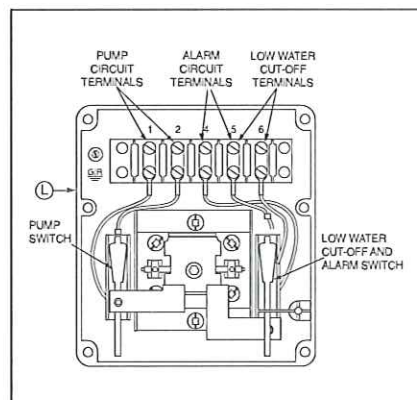
Automatic Reset
Model 158S



Automatic Reset
Model 159S



Manual Reset
(All models except 158S)



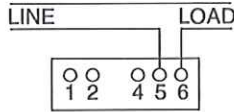
Manual Reset
Model 158S-M

WIRING DIAGRAMS

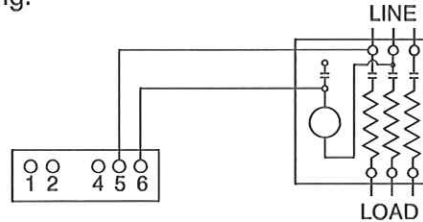
For Motorized Valves, refer to the valve manufacturer's wiring instructions.

Low Water Cut-Off Only

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



OR

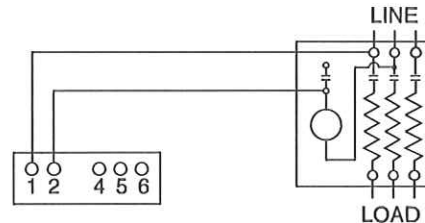


Pump Control Only

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

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

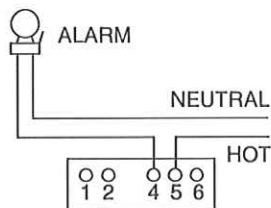
2. Connect wires from holding coil of pump starter or relay to terminals 1 and 2 as shown.



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

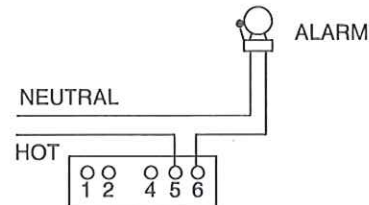
Alarm Circuit Only

1. Low Water Alarm



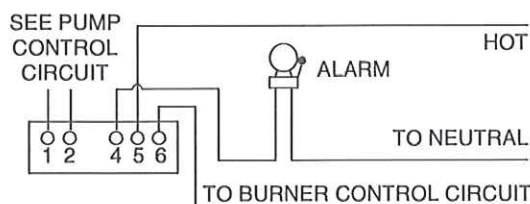
2. High Water Alarm

OR

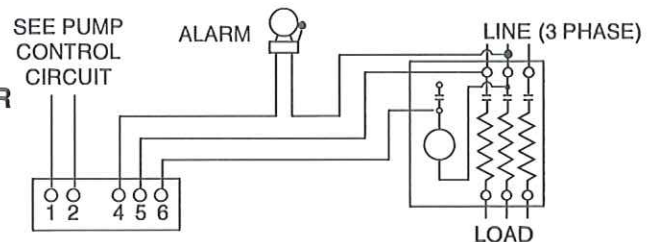


Combination Pump Control, Low Water Cut-Off and Alarm

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

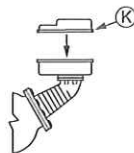


OR



6. Re-attach the junction box cover (K).

Note:
Cover must be installed correctly as shown

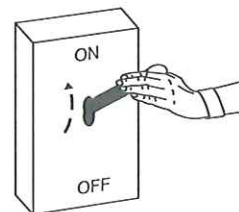


STEP 5 - Testing

This control is factory calibrated for specific applications. The following testing procedure is only meant to serve as a verification of proper operating sequence. Dimensions provided are typical for a boiler not being fired and/or not at pressure. Actual operating ranges are shown on page 2 in the "Operation" section.

IMPORTANT: Follow the boiler manufacturer's start-up and operating instructions along with all applicable codes and ordinances. **Note:** Water levels stated below are only for 150 psi (10.5 kg/cm²) operation.

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



WARNING

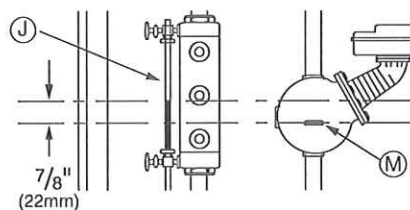


If the burner comes on, immediately turn the boiler off and make the necessary corrections.

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

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

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

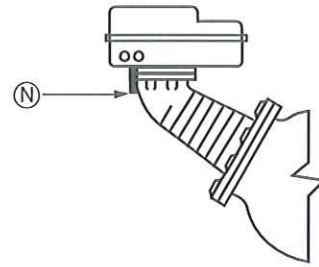


- c. **For automatic reset models only.** When the water level reaches approximately $\frac{7}{8}$ " (22mm) above the horizontal cast line (lower for MD models) the burner should come on (pump #2 should shut off with Model 159S).

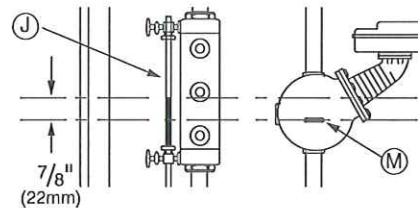
OR

For manual reset models only. When the water level reaches approximately $\frac{7}{8}$ " (22mm) above the horizontal cast line press the reset button (N). The burner should then come on.

Snap Switch Models



- d. Continue watching the gauge glass (J) to see that the water continues to rise to approximately $1\frac{3}{8}$ " (35mm) ($1\frac{7}{16}$ " (37mm) for MD models) above the horizontal cast line (M). The pump should shut off (the motorized valve should close with Models 158 and 158S, or with Models 159 and 159S, pump #1 should shut off).



CAUTION



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

Failure to follow this caution could cause personal injury.

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

INSTALLATION COMPLETE

MAINTENANCE

SCHEDULE:

Blow down control as follows when boiler is in operation.

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

NOTE

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

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

NOTE

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

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

Replace head mechanism every 5 years.

More frequent replacement may be required when severe conditions exist.

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

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

BLOW DOWN PROCEDURE:

CAUTION



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

Failure to follow this caution could cause personal injury.

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

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

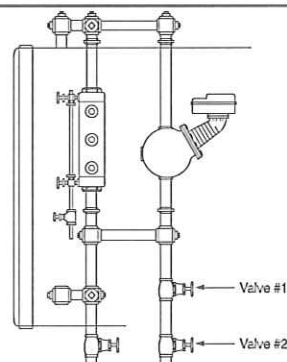
NOTE: Refer to page 2 for switch operating points.

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

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

NOTE

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

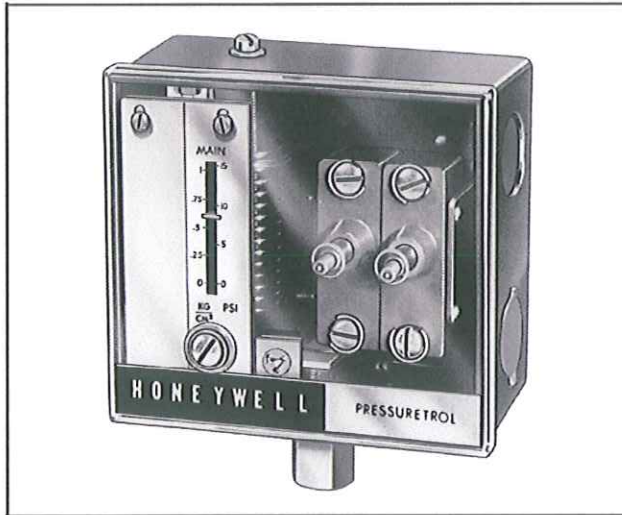


©2008 ITT Corporation
Printed in U.S.A. 10-08 210341



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

Application	1
Features	1
Specifications	2
POUR COMMANDER	2
French	
Installation	3
Wiring	3



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 Association (CSA): File No. LR95329, Certificate No. 1720340

Accessories:

14026 Steam Trap.

33312B Knurled adjustment knob.

Dimensions: See Fig. 1.

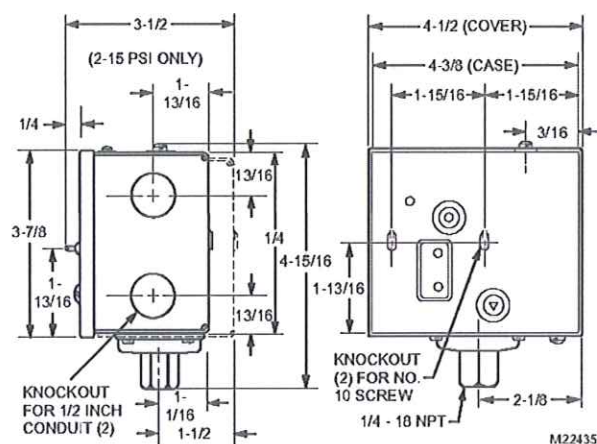


Fig. 1. L4079A,B,W PressureTrol® Limit Control dimensions in inches.

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.

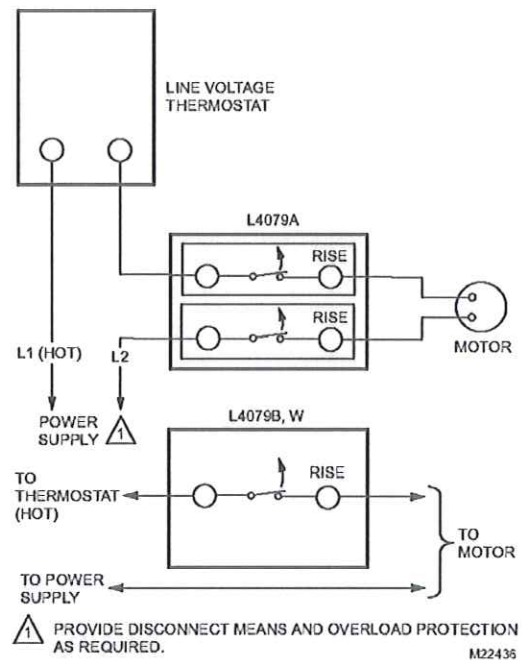


Fig. 2. Schematics and wiring. L4079A breaks both sides of power supply; L4079B,W breaks hot side only.

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.

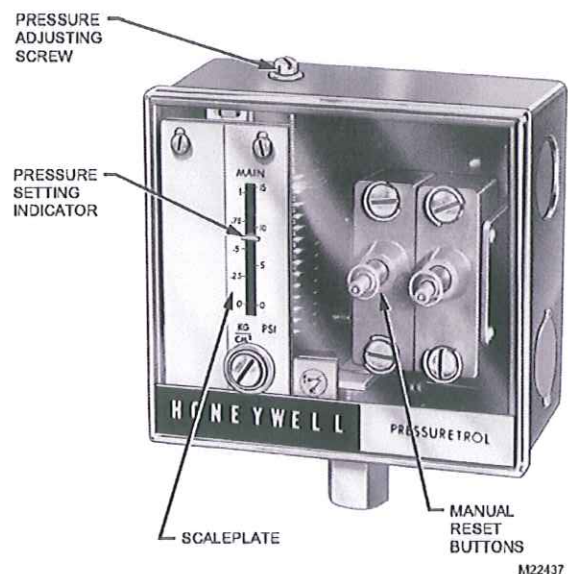


Fig. 3. Controls and indicators on L4079A. L4079B,W is the same except for having only one reset button.

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

Honeywell

® U.S. Registered Trademark
© 2006 Honeywell International Inc.
60-2156—2 C.H. Rev. 02-06



Printed in U.S.A. on recycled
paper containing at least 10%
post-consumer paper fibers.

JOHN C. ERNST CO., INC. P.O. BOX 1600 Dover, New Jersey 07802			Title: Medium Pressure Reflex/Transparent Gages IOM	Drawing No. E48024	Rev G
Date: 10-May-00	Dr. by: DMF	Size:	Tolerances, unless otherwise specified: Fraction Decimal Angle ⊥ ⊥ ⊥		
Scale: 2950M-9/96	App. by: JCW	Sheet: 1 of 9			

Flat Glass Gages

Model 480 Reflex
Model 490 Transparent



Installation/Operation/Maintenance Instructions

Installation/Operation/Maintenance Instructions For Models 480 Reflex & 490 Transparent Gages

This manual has been prepared as an aid and guide for personnel involved in installation or maintenance. All instructions must be read and thoroughly understood before attempting any installation, operation or maintenance. Failure to follow any instructions could result in a malfunction of the gage or glass breakage with resulting sudden release of pressure, property damage and injury to personnel.

CAUTION: John C. Ernst does not have any control over the manner in which its liquid level gage is handled, installed or used. John C. Ernst cannot and will not guarantee that a liquid level gage is suitable or compatible for the user's specific application.

WARNING: Contained fluids may be pressurized and can unexpectedly exit the vessel connection due to apparatus or material failure. Safety glasses must be worn when installing a liquid level gage; failure to do so could result in serious physical injury to personnel.

I. INTRODUCTION:

John C. Ernst liquid level gages are used to allow direct visualization of liquid level in vessels. By peering through the glass, it is possible to monitor color, clarity and level of gas/liquid interface. Gages are available in varying lengths and configurations (end connect, slide connect, multiple section, NPT or flange connection, etc.). Visual indication can be enhanced by using reflex glass or illuminators (accessory).

II. AVAILABLE MODELS:

John C. Ernst medium (Model 480/490) pressure liquid level gage are designed for applications other than steam/water: 1) requiring pressure ratings lower than that of John C. Ernst Model 481/491 liquid level gages, 2) where pressure ratings are greater than those possible using low pressure (Model 479/489) liquid level gages, or 3) for Model 479/489 pressure ranges where iron covers are not allowed.

The pressure and temperature ratings may deviate from the above tables if the gasketing materials of construction and/or bolting are

A. Design Ratings at Maximum and Minimum Operating Temperatures (Table 1)

Gasket Material	Glass Size	Model 480 Reflex	
		Wetted Parts Material Alloy Steel or 316 Stainless Steel/B7 Bolting	
Grafoil® (standard) or Non-Asbestos	1	-20°F (-29°C) to 100°F (37°C)	600°F (315°C)
		3000 PSIG (20685 kPa)	2220 PSIG (15305 kPa)
	2	2910 PSIG (20065 kPa)	2150 PSIG (14825 kPa)
	3	2820 PSIG (19445 kPa)	1080 PSIG (14340 kPa)
	4	2725 PSIG (18790 kPa)	2040 PSIG (14065 kPa)
	5	2630 PSIG (18135 kPa)	1950 PSIG (13445 kPa)
	6	2535 PSIG (17480 kPa)	1875 PSIG (12930 kPa)
	7	2440 PSIG (16825 kPa)	1805 PSIG (12445 kPa)
	8	2345 PSIG (16170 kPa)	1740 PSIG (12000 kPa)
9	2250 PSIG (15515 kPa)	1660 PSIG (11445 kPa)	
PTFE/Top-Chem 2000®	1-9	3000 PSIG (6205 kPa) at -20°F (-29°C) to 500°F (260°C) reference Application Report for gage pressure limitation at specific temps.	
NBR/Buna N®	1-9	300 PSIG (2070 kPa) at -20°F (-29°C) to 100°F (37°C) 225 PSIG (1550 kPa) at 250°F (121°C)	
FKM/Viton®	1-9	300 PSIG (2070 kPa) at -20°F (-29°C) to 100°F (37°C) 180 PSIG (1240 kPa) at 400°F (204°C)	
PTFE/Teflon®	1-9	300 PSIG (2070 kPa) at -20°F (-29°C) to 100°F (37°C) 150 PSIG (2275 kPa) at 500°F (260°C)	
25% glass filled PTFE	1-9	900 PSIG (6205 kPa) at -20°F (-29°C) to 100°F (37°C) 450 PSIF (3105 kPa) at 500°F (260°C)	
Note: Lower temperatures are possible with metallic material variation (e.g. 316 Stainless Steel construction. Grafoil® gasket/cushions good to -325°F [198°C])			

Table 2

Gasket Material	Glass Size	Model 490 Transparent	
		Wetted Material Carbon Steel or 316 Stainless Steel/B7 Bolting	
Grafoil® (standard) or Non-Asbestos	1	-20°F (-29°C) to 100°F (37°C)	600°F (315°C)
		2500 PSIG (17325 kPa)	1850 PSIG (12755 kPa)
	2	2315 PSIG (15960 kPa)	1720 PSIG (11860 kPa)
	3	2130 PSIG (14685 kPa)	1575 PSIG (10860 kPa)
	4	1940 PSIG (13375 kPa)	1435 PSIG (9895 kPa)
	5	1750 PSIG (12065 kPa)	1295 PSIG (8930 kPa)
	6	1565 PSIG (10790 kPa)	1160 PSIG (8000 kPa)
	7	1375 PSIG (9480 kPa)	1015 PSIG (7000 kPa)
	8	1190 PSIG (8250 kPa)	880 PSIG (6070 kPa)
9	1000 PSIG (6895 kPa)	740 PSIG (5100 kPa)	
PTFE/Top-Chem 2000®	1-9	2500 PSIG (6205 kPa) at -20°F (-29°C) to 500°F (260°C) reference Application Report for gage pressure limitation at specific temps.	
NBR/Buna®	1-9	300 PSIG (2070 kPa) at -20°F (-29°C) to 100°F (37°C) 225 PSIG (1550 kPa) at 250°F (121°C)	
FKM/Viton®	1-9	300 PSIG (2070 kPa) at -20°F (-29°C) to 100°F (37°C) 180 PSIG (1240 kPa) at 400°F (204°C)	
PTFE/Teflon®	1-9	300 PSIG (2070 kPa) at -20°F (-29°C) to 100°F (37°C) 150 PSIG (2275 kPa) at 500°F (260°C)	
25% glass filled PTFE	1-9	900 PSIG (2070 kPa) at -20°F (-29°C) to 100°F (37°C) 450 PSIG (3105 kPa) at 500°F (260°C)	
PCTFE/Kel-F® Shields 0.063" (1.6 mm) thick	1-9	300 PSIG (2067 kPa) at -20°F (-29°C) to 100°F (37°C) 180 PSIG (1240 kPa) at 400°F (148°C)	
Note: Lower temperatures are possible with metallic material variation (e.g. 316 Stainless construction, Grafoil® gaskets/cushions good to -325°F [198°C])			

other than those specified. Higher and/or lower temperature ratings are available with different materials of construction.

To determine the maximum allowable working pressure for a specific temperature within the design limits stated in the tables, the user should refer to the John C. Ernst dimension sheets, or when provided, the specifically stated design limits on a John C. Ernst product proposal.

NOTE: Under no circumstances should shields be used in reflex style gages. Installation of shields in reflex style gages will keep the liquid from coming in contact with the refractive prism, thereby prohibiting visualization of the liquid level in the gage.

WARNING: Never exceed these design ratings or application data. Exceeding design ratings or application data may result in mechanical failure of gage components resulting in death, serious personal injury and property damage.

III. INSPECTION:

Upon receipt of a liquid level gage, check all components carefully for damage incurred in shipping. If damage is evident or suspected, do not attempt installation. Notify carrier immediately and request damage inspection.

John C. Ernst's standard 1 section 490 gage consists of: (1) chamber, (2) gaskets, (2) borosilicate flat glass, (2) rubber bands, (2) cushions, (2) covers, (1) washer, (1) nameplate, and (6-14) bolting sets, depending on the size.

A. Glass Inspection

The self-stick caution tape was applied at the factory to protect the glass during shipping, handling and installation. Do not remove the tape from the glass until installation procedures have been completed, except during receiving inspection to momentarily inspect the glass for shipping damage. Glass that is not protected will be vulnerable to dust, grit, tools and any other object that may scratch, chip or break the glass.

WARNING: DO NOT use glass that is chipped or even slightly scratched. Glass surface defects weaken the glass breakage and fluid loss under pressure resulting in serious personal and property damage.

B. User Rating Inspection

The user should confirm that:

1. The Model 480/490 liquid level gage model and assembly number stamped on the nameplate conforms to the description on the user's purchase order.
2. The operating conditions described in the purchase order agree with the actual operating conditions at the installation site.
3. The actual operating conditions at the installation site are within the application data shown on the John C. Ernst Technical Data Bulletin or product proposal referred to above.
4. The materials of construction of the liquid level gage are compatible with both the contained media and surrounding atmosphere in the specific application.

WARNING: If the size, model or performance data of the liquid level gage as received does not conform to any of the criteria above, do not proceed with installation. Contact the John C. Ernst Co. for assistance. The incorrect gage can result in unacceptable performance and potential damage to the gage and injury to personnel.

IV. INSTALLATION:

Qualified personnel who are familiar with this equipment of this type should only undertake installation. They should have read and thoroughly understood all of the instruction in this manual. The user should refer to the John C. Ernst dimension sheets or the John C. Ernst product proposal sheets to obtain the dimensional information for the specific size and model liquid level gage.

Bolt Torque Values (Table 3)

Gage Models and Gasket Material	FT . LB
480, 490 with Grafoil® (standard)	25 to 30
480, 490 with Non-Asbestos (optional)	30 to 35
Top Chem 2000®	25 to 30
25% glass filled PTFE	20
All models with Teflon®, Viton® or elastomeric (optional)	10
490 with PCTFE/(Kel-F®) Shields (opt.) 0.063"	10

John C. Ernst recommends that all liquid level gage installations be provided with gage valve sets equipped with ball check shut-off. Gage valve sets are designed to isolate the gages from the pressure vessel when it becomes necessary to drain or service the gages. The ball check shut-off is designed to retard leakage of the contained fluid in the event of gage glass breakage. Ball checks are available for both positive and negative vessel pressures.

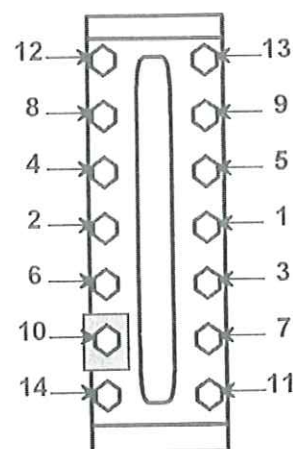
The number of different types of gage and valve installations is too great to adequately detail in an installation manual. It is, therefore, the user's responsibility to assure that the knowledgeable personnel plan and carry out the installation in a safe manner. The following procedures are some of the installation guidelines that should be employed.

A. Piping Strain

The gage should be mounted and connected so that it does not support any piping weight. Piping not properly supported, independent of the gage, may be subject to stresses that can cause leaks or glass breakage. Support brackets are available as an accessory.

B. Differential Thermal Expansion

High mechanical loads may be imposed on a gage by expanding and contracting pipes due to hot or cold service. Such mechanical loads on the gage must be minimized by the use of expansion loops in the system. Failure to allow for expansion or contraction can result in leaks or glass breakage.



**Nut Tightening Sequence
Figure 1**

C. Mirror Viewing

For added safety, a system of indirect viewing by means of mirrors should be installed to protect personnel from hazards of possible gage failure.

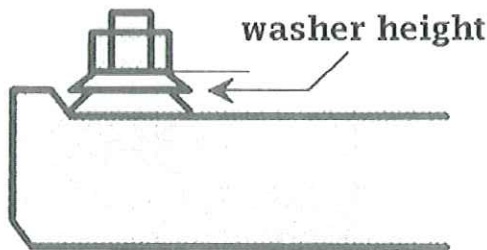
D. Nut Retorquing (not applicable for gages with Belleville washers) see section Section IV. Para. 5.

Nut retorquing is vital to the operation of a liquid level gage because gaskets take permanent set under initial bolt loading at assembly. Tightening of nuts before installation to values specified in Table 3 above, is necessary to insure pressure-retaining capabilities of liquid level gage to specific design ratings. The user must refer to the liquid level gage model and assembly number and to the purchase order or tag to determine materials of construction.

Using a torque wrench, tighten nuts in five FT . LB increments following the spiral sequence in Figure 1. Until the torque values shown in Table 3 above for the specific liquid level gage are reached. For multiple section gages, torque the center section(s) and progressively work toward the ends of the gage.

If bolting, gasketing or glass on any of a multi-section gage is disturbed, all sections must be checked for integrity and retorqued if necessary.

WARNING: Failure to comply with the proper torquing sequence of force/height value can lead to leakage, gasket blow-out or glass breakage resulting in gage failure, serious injury to personnel and property damage.



**Belleville Washer Height
Figure 2**

NOTE: Depending on gage size there may be less bolting than shown in Figure 1. Start at the center and spiral outward to the limit of bolting on a specific gage.

E. Belleville Washers

Belleville washers are used to reduce or eliminate the need to retorqued nuts. This is especially important for gages subject to pressure and/or thermal cycling and also in offshore applications where use of wrenches often crack or chip the protective coat. The conical washers allow for material expansion and contraction while maintaining axial bolt loading and, therefore, compression on the gasket.

The effective range of a Belleville washer is measured in height (or compression distance) of the washer **NOT TORQUE**. Refer to Figure 2 and Table 4 for proper compression height. Do not tighten nuts until the washers are flat. Belleville washers cannot absorb expansion when flat.

If bolting, gasketing or glass on any section of a multi-section gage is disturbed; all sections must be checked for integrity and retorqued if necessary.

V. OPERATION:

Before initializing liquid level gage operation, check that all installation procedures have been completed. Use only qualified, experienced personnel who are familiar with liquid level gage equipment and thoroughly understand the implications of the tables and all the instructions. Check to determine that all connections are pressure tight. Assure that nuts have been retorqued to their proper value as specified. Remove self-stick caution tape from the glass and inspect to be sure that glass is clean and free of any damage as such as cracks, scratches, pits and chips.

Conical Spring Height For Belleville Washers (Table 4)		
Gage Models	No. of Washers per nut	Spring Height (top of cover to bottom of nut) inch (mm)
480	4	0.264 (6.7)
490	2	0.136 (3.5)

A. Hydrostatic Test

WARNING: Liquid level gage installation should be brought into service slowly to avoid excessive shock or stress on the glass. Rapid pressurization or sudden changes in temperature may cause glass breakage. To avoid excessive thermal shock or mechanical stress on glass, the connecting valves should be opened slightly, and the gage temperature and pressure allowed to slowly equalize. If the valves are equipped with ball checks, the valves must be opened all the way after the pressure and temperature have equalized to permit operation of the automatic ball checks in the event of failure. Failure to follow the recommended operating procedures can result in death, severe personal injury and/or property damage.

Take all precautions necessary to handle the possibility of leakage during the test. Hydrostatically pressure tests all installations to at least 100 PSIG but less than design pressure and correct any leakage before proceeding.

VI. MAINTENANCE:

WARNING: Use only qualified, experienced personnel who are familiar with liquid level gage equipment and thoroughly understand the implications of the tables and all the instructions. Don not proceed with any maintenance unless the liquid level gage has been relieved of all pressure or vacuum, has been allowed to reach ambient temperature and has been drained or purged of all fluids. Failure to do so can cause serious personal injury and property damage.

The rate at which components degrade is dependent upon a variety of conditions. Pressure, temperature and process media all influence the rate at which gage components deteriorate. Higher temperatures can accelerate the corrosion of gaskets, cushions, glass and materials. Acids and similar chemicals can break down the integrity of almost any material. Concentration of chemicals can accelerate the corrosion rate. John C. Ernst cannot create a blanket maintenance schedule for every application.

The end user is the most familiar with the process media and conditions and must be responsible for creating a maintenance

schedule. The user must create maintenance schedules, safety manuals and inspection details for each liquid level gage. Realistic maintenance schedules can only be determined with full knowledge of the services and application situations involved. These will be based upon the user's own operating experience with their specific application.

If bolting, gasketing or glass on any section of a multi-section gage is disturbed; all sections must be checked for integrity and retorqued or repaired if necessary.

On all installations the user for purposes of maintenance should regularly evaluate the following items:

1. Glass, for cleanliness and signs of damage or wear.
2. Shields, if used, for signs of clouding, wear or deterioration.
3. Gage, for signs of leakage around gaskets or at connections
4. Gage, for signs of internal or external corrosion.

A. Maintenance Procedures

GLASS- should be given regular and careful attention. Keep glass clean using a commercial glass cleaner and a soft cloth. Inspect the surface of the glass for any clouding, etching or scratching or physical damage such as bruises, check or corrosion. Glass that is damaged is weakened and may break under pressure. Shining a light at a 45° angle will aid in detecting some of these conditions. Typical damaged areas will glisten more brightly than the surrounding glass because the light is reflected.

Detection of any damage, problem areas or surface wear is sufficient evidence to take the liquid level gage out of service. DO NOT proceed with operation of the liquid level gage until the glass has been replaced with a glass replacement kit following the assembly instructions in Section VII.

SHIELDS - showing any signs of clouding, wear or deterioration are an indication that the gage glass has been exposed, or could soon be exposed to the contained fluid. Immediately take liquid level gage out of service. DO NOT proceed with operation of the liquid level gage until shields and glass have been replaced by following the disassembly-reassembly instructions in Section VII.

GASKET LEAKS - must be repaired immediately. DO NOT proceed with operation of a liquid level gage until gaskets have been replaced by following Section VII assembly instructions.

CONNECTION LEAKS - at a flanged or threaded connection should be corrected by tightening the bolting at the connection or by taking the liquid level gage out of service and wrapping the connection threads with Teflon® tape on all male pipe threads.

CORROSION - may occur if the user has selected an improper material for the liquid level gage application. It is the responsibility of the user to choose a material of construction compatible with both the contained fluid and the surrounding environment. If internal or external corrosion is present, the user must immediately perform an investigation. It may be necessary to contact John C. Ernst to better determine the origin of the corrosion.

B. Troubleshooting

Problem

Glass becomes prematurely etched or clouded in service.

Cause	Cure
Fluid being handled is not compatible with the glass or shields	Replace the glass & install shields that will not be affected by contained fluid

Problem

Glass continually breaks in service despite careful attention to maintenance procedures.

Cause	Cure
Thermal shock, hydraulic shock, mechanical loads, exceeding design ratings or a combin. of these	Check entire system to determine possible sources of loads. Check application to determine actual operating conditions & contact John C. Ernst on how to proceed.

VII. REMOVAL - DISASSEMBLY - REASSEMBLY

WARNING: Use only qualified experienced personnel who are familiar with this equipment and thoroughly understand the instruction given in this manual. DO NOT proceed with any installation unless the liquid level gage has been relieved of all pressure or vacuum, has been allowed to reach ambient temperature, and has been drained or purged of all fluids. Failure to do so can cause serious personal injury and property damage.

A. Disassembly

Secure workbench longer than the liquid level gage, and sufficiently wide enough to lay out parts as they are removed.

1. Lay gage on its back.
2. Hold gage firmly, and loosen nuts starting at both ends of each section and then proceed from both ends to the center of each section as shown in Figure 3.
3. Nut loosening Sequence
 - a. Remove nuts, washer and nameplate
 - b. Tap covers with rubber hammer as needed to loosen and remove
 - c. Remove cushions, glass, shields (if any) and gaskets
 - d. Tap liquid chamber or remaining covers as necessary with rubber hammer to break loose, and remove remaining components
 - e. Remove, destroy and dispose of all glass, cushions, gaskets and shields. Under no circumstances should these components be re-used or installed on a gage

NOTE: If size of gage is smaller than shown, follow spiraling sequence from the ends until all bolting is loosened.

WARNING: Once used cushions, gaskets and shields are permanently deformed by compression and if re-use, may cause leaks and high stress points resulting in glass breakage. Glass may contain hidden damage and internal stresses caused by previous usage. If re-used, the glass may break under pressure causing personal and property damage.

B. Inspection of Glass Seating Surfaces

Clean the glass seating surfaces on the liquid chamber and cover with a soft metal scrapper (preferably brass) to remove all burs, rust and remnants of the previous gaskets and cushions. Exercise extreme care to avoid gouging or scarring gasket and cushion seating surfaces. Use a known flat piece of metal the same approximate length as the glass or a new piece of glass and a thickness gage to check flatness of each glass seating surface on the liquid chamber and under cover. Surface must be flat within 0.002 inch. If any one surface is found to be beyond a tolerance of 0.002 inch, the entire gage must be disposed of and replaced. Gasket seating surface must have a final surface finish of 450 to 500 AARH.

WARNING: Flatness of glass seating surfaces outside 0.002 inch (0.051 mm) tolerance specified is an indication of the gage having been over stressed through repeated exposure to mechanical, thermal or hydraulic shock during its previous service or material has degraded due to corrosion or erosion. Operation of a liquid level gage in this condition will result in abnormal stresses on the glass that may cause glass to break with resulting sudden release of pressure, leakage of contained fluid, personal injury, or property damage.

Glass seating surfaces should NOT be machined to achieve seating tolerance. The chamber and cover are designed for a critical thickness to achieve the pressure/temperature ratings. Machining glass-seating surfaces may result in non-compliance to the necessary critical thickness due to material removal.

C. Reassembly

If all glass seating surfaces are found to be within the 0.002 inch (0.051 mm) tolerance described in the previous section, proceed to obtain new glass, gaskets, cushions and shields (if used) and proceed to reassemble as follows (refer to exploded parts view in Section VIII if needed):

1. Clean threads on bolts and nuts to remove all paint, rust and scale. Apply a light coat of oil to the threads.
2. For transparent gages, insert bolts through half the cover and lay out covers along bench, side by side, with the liquid chambers. Use chambers to space covers and line them up with vision slots.
3. For reflex gages, lay out covers along bench, side by side, with liquid chambers. Use chambers to space covers and line them up with vision slots.
4. For transparent Belleville reflex style gages, threads nuts on stud, place two Belleville washers under the nut with the pointed end toward the (nut see Figure 2), insert stud through each cover and lay out covers along the bench, side by side, with liquid chamber. Use chambers to space covers and line them up with vision slots.
5. Install one cushion inside each cover.

WARNING: Separate installation instructions are supplied with replacement glass. All instructions supplied with the glass must be followed, as there are precautions to be

taken when handling gage glass. Among the precautions is avoidance of bumping or sliding glass against any surface and inspection of individual pieces. Failure to follow any of the replacement gage glass installation instructions could result in glass breakage with resulting sudden release of pressure, personal injury or property damage.

6. Install a rubber band around each piece or glass, then place glass centered inside each cover.
7. Install shields, if used, and a gasket on glass being careful to keep components centered.
8. Place liquid chamber on the gaskets (shields - if used) making sure all components are aligned with vision slot.
9. For reflex gage, install U-bolts in place by tapping as needed with rubber hammer, being careful not to loosen alignment with vision slot.
10. For reflex gage, quickly turn over assembly onto backside of U-bolts. Assemble nameplate, washer and nuts to U-bolts. Tighten nuts with fingers. Using a torque wrench, tighten nuts in five ft./lb. increments, following the sequence in Figure 1 until the torque values shown in Table 3 are reached.

NOTE: Depending on gage size there may be less bolting than shown in Figure 1. Start at the center and spiral outward to the limit of bolting on a specific gage.

11. For transparent gage, install gaskets in place and shields if used.
12. Install one cushion on each piece of glass.
13. Install a rubber band around each piece of glass.
14. Install covers in place being careful to maintain components alignment inside.
15. Install nameplate, washer and nuts to studs. Tighten nuts with fingers. Using a torque wrench, tighten nut in five ft./lb. increments, following the sequence in Figure 1 until the torque values shown in Table 3 are reached.
 - a. For reflex Belleville style gages: install nameplate and four Belleville washers under each nut with pointed end toward the nut (See Figure 2). Finger tighten nuts.

NOTE: The following procedure is to be done on only one side of the gage.

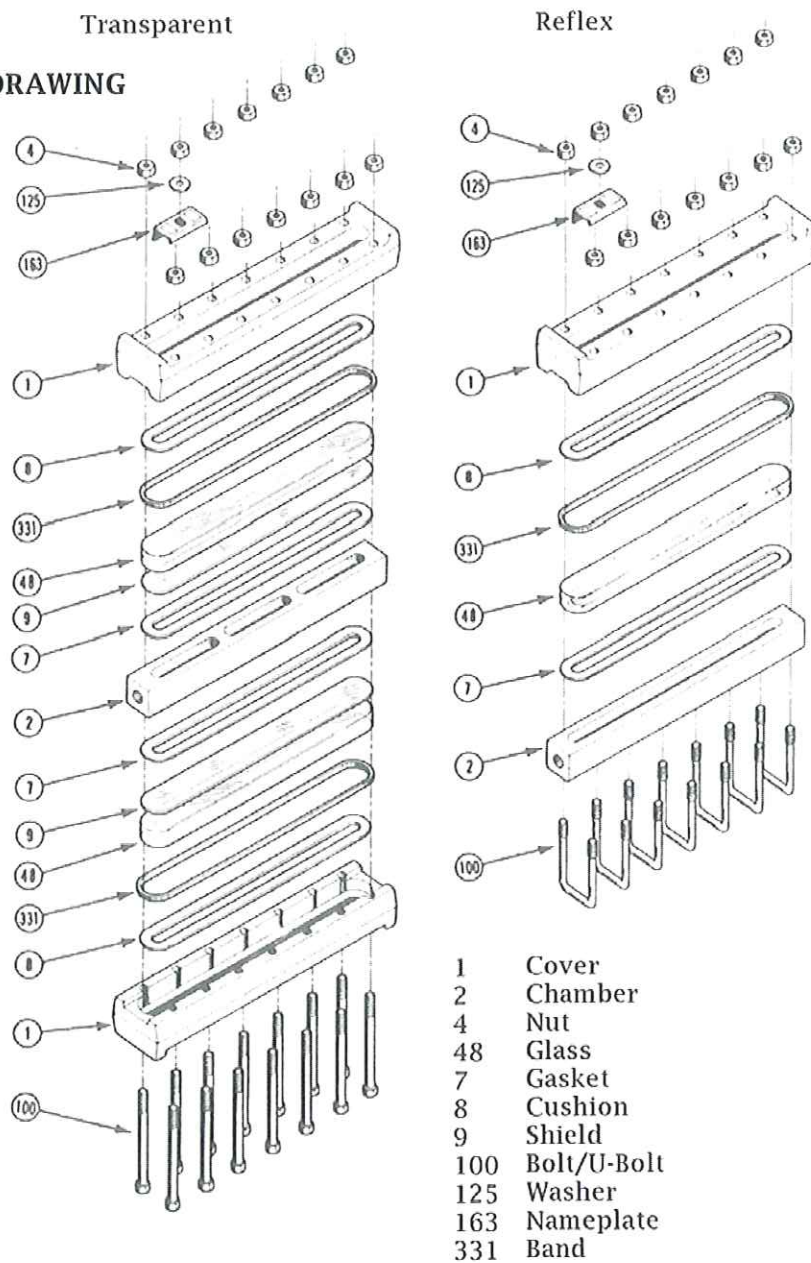
- b. For reflex Belleville style gages: install nameplate and four Belleville washers under each nut with pointed end toward the nut (See Figure 2). Finger tighten nuts.

16. Using a torque wrench, tighten nuts in five ft./lb. increments, following the sequence in Figure 1. Once 20 ft./lb. is reached, begin measuring stack height. Tighten nuts in five ft./lb. increments until stack spring height is within 0.008" (0.02 mm) of proper height. Individually tighten each nut until stack height is achieved, (See Table 4) to estimate washer height, add thickness of the nut to the compressed height requirement and use this value to compare to the measurement from the top of the nut to the face of the cover.

Recommended Spare Parts		
Ref. No.	Item	Qty.
100	Bolt/U-bolt	2/1 per sect
4	Nut	2 per sect
48	Glass	1
7	Gasket	2
8	Cushion	2
9	Shield	2

Refer to Section IV for Installation and Section V for Operation of liquid level gage when returning to service.

VIII. EXPLODED PARTS DRAWING



Model 537

KUNKLE

ASME Section IV, Low Pressure Steam and Hot Water Boilers, 'HV', National Board Certified, Safety Valves

Features

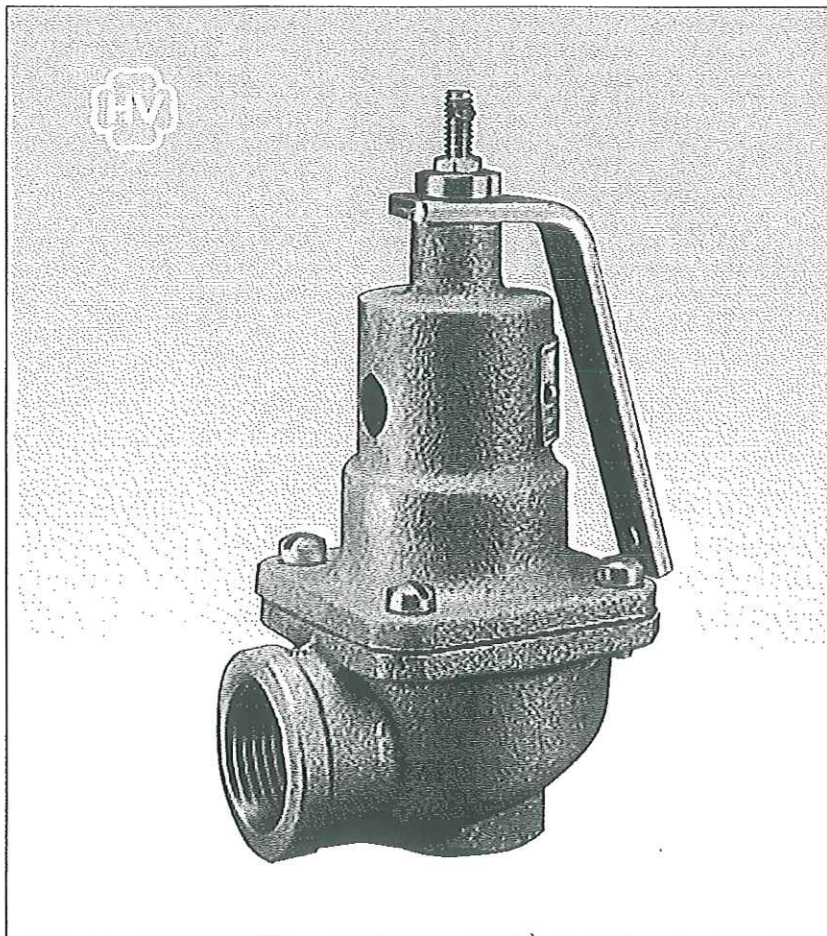
- Extra heavy construction provides long life.
- Top guided disc assembly incorporates resilient seal in seating area.
- An Isolating diaphragm protects working parts from corrosion caused by discharged liquid.
- Pivot between disc and spring corrects for misalignment and compensates for spring side thrust.
- These safety relief valves serve the dual purpose of relieving (1) overpressure created by thermal expansion under normal 'on and off' firing conditions, and (2) overpressure in the form of *water* or *steam* created in over-firing due to failure of electrical or other controls.

Applications

Hot water boiler, heat exchangers and generators.

Pressure and Temperature Limits

15 to 160 psig
-20° to 250°F



tyco / Flow Control

Total Flow Control Solutions™

Kunkle is either a trademark or registered trademark of Tyco International Services AG or its affiliates in the United States and/or other countries. All other brand names, product names, or trademarks belong to their respective holders.

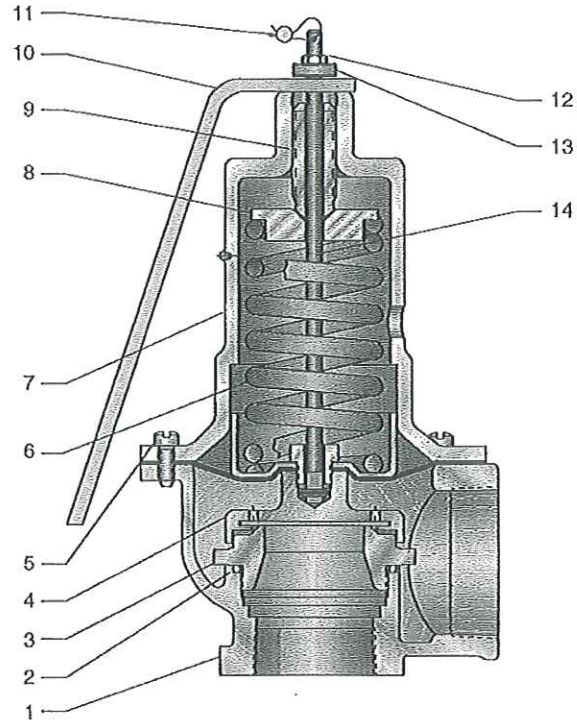
Kunkle Safety and Relief Products

Model 537

Parts and Materials

Model 537

No.	Part Name	Materials
1	Body	1
2	Seat O-ring	BUNA-N ²
3	Seat	Bronze, B584 Alloy 84400
	Disc Holder	Bronze, B584 Alloy 84400
4	Insert	Ethylene Propylene (EPDM)
	Diaphragm	BUNA-N/Nylon
	Guide	Brass, B36 Alloy C26000
5	Screw	SS
6	Spring	SS, A313-631
7	Bonnet	1
8	Spring Step	Brass, B16
9	Compression Screw	Brass, B16
10	Lever	Steel, Zinc Plated
11	Seal and Wire	Lead seal and SS wire
12	Lift Washer Nut	SS
13	Lift Washer	SS
	Stem	SS, A479-316
14	Spring Pin	SS
	Disc Locknut	Brass

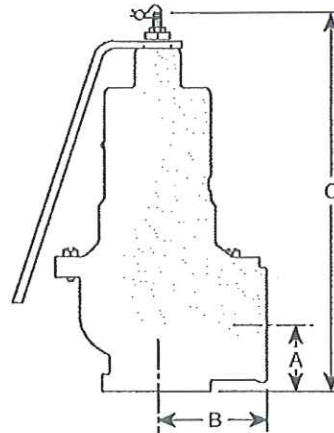


Specifications

Size		Dimensions, in			Weight (lb)
Inlet	Outlet	A	B	C	
3/4"	1"	15/16	17/8	6 1/8	2
1"	1 1/4"	15/16	2 3/8	7 1/8	5
1 1/2"	2"	1 3/4	2 15/16	10 1/8	12
2"	2 1/2"	2 1/8	3 9/16	11 3/4	22

NOTE:

- 3/4" and 1": Bronze, B584 Alloy 84400
1 1/2" and 2": Cast Iron, A126 Class A/B
- D and E orifice sizes have an integral seat.
G and H orifice sizes have a BUNA-N O-ring.



Kunkle Safety and Relief Products

Model 537

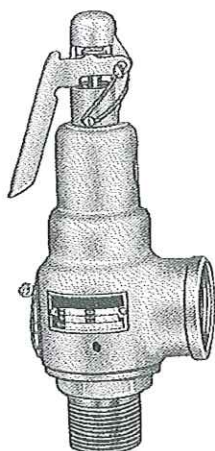
ASME Section IV Steam (Hot water boiler)

Set Pressure (psig)	Orifice Area, in ²							
	3/4"		1"		1 1/2"		2"	
	(0.533 in ²) lb/h	BTU/h	(0.833 in ²) lb/h	BTU/h	(1.767 in ²) lb/h	BTU/h	(3.142 in ²) lb/h	BTU/h
15	690	689608	1078	1077755	2286	2286186	4065	4065193
20	811	811173	1268	1267744	2689	2689200	4782	4781814
30	1054	1054304	1648	1647721	3495	3495227	6215	6215055
40	1297	1297435	2028	2027699	4301	4301254	7648	7648296
50	1541	1540566	2408	2407677	5107	5107281	9082	9081537
60	1784	1783697	2788	2787655	5913	5913308	10515	10514779
70	2027	2026828	3168	3167632	6719	6719335	11948	11948020
80	2270	2269959	3548	3547610	7525	7525362	13381	13381261
90	2513	2513090	3928	3927588	8331	8331389	14815	14814502
100	2756	2756221	4308	4307565	9137	9137417	16248	16247744
110	2999	2999352	4688	4687543	9943	9943444	17681	17680985
120	3242	3242483	5068	5067521	10749	10749471	19114	19114226
125	3364	3364049	5258	5257510	11152	11152484	19831	19830847
130	3486	3485614	5447	5447498	11555	11555498	20547	20547467
140	3729	3728745	5827	5827476	12362	12361525	21981	21980708
150	3972	3971876	6207	6207454	13168	13167552	23414	23413950
160	4215	4215007	6587	6587432	13974	13973579	24847	24847191

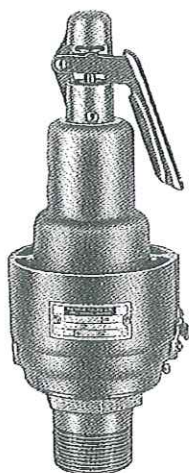
Model Number/Order Code

Model Number Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Example	0	5	3	7	-	D	0	1	-	H	M	0	1	6	0
Model															
0537															
Inlet Size															
D - 3/4-Inch															
E - 1-Inch															
G - 1 1/2-Inch															
H - 2-Inch															
Variation (01 through 99)															
01 - Catalog Standard															
Design Revision															
Indicates non-interchangeable revision.															
Dash (-) if original design.															
Service															
H - Steam ASME Section IV - hot water															
Spring Material															
M - SST															
Set Pressure															
15 psig (0015)															
160 psig (0160)															

**MODEL
6000
SERIES**



MODELS
6010-6021-6030
6221-6230
6283
(Replaces 83-4)



MODELS
6182
(Replaces 82-4)
6121-6130
6186
(Replaces 86)
(Original Equipment Only)

PRESSURE LIMITS

Steam to 250 PSIG 406°F
Air/Gas to 300 PSIG 300°F
Model 6030, 6130, 6230 to 300 PSIG Steam 422°F
Model 6186 to 150 PSIG Air/Gas 300°F

APPLICATIONS

- Steam Boilers and Generators.
- Air/Gas Compressors — reciprocating or rotary — portable or stationary, intercoolers and aftercoolers.
- Pressure Vessels — containing steam, air or non-hazardous gas. Including tanks, receivers, sterilizers and autoclaves.
- Pressure Reducing Valves — protection of the discharge or low pressure side of system.

FEATURES

Valve housing is heavy duty casting. Wide hex on valve body provides clearance for easy installation. Seats lapped to optical flatness. Dual control rings offer easy adjustability for precise opening with minimum preopen or simmer and exact blowdown control. Ball bearing pivot between disc and spring corrects misalignment and compensates for spring side thrust. Grooved piston type disc reduces sliding area and friction. Heavy duty lift lever assembly. Every valve is 100% tested/inspected for pressure setting, blowdown and leakage. All adjustments are factory sealed to prevent tampering or dis-assembly. Models 6021, 6121, 6221 and 934 offer teflon (PFA) disc insert for exceptional leak free performance (Use on steam only) Models 6030, 6130, 6230 and 935 supplied with stainless steel disc and nozzle for use on severe applications and/or set pressure up to 300 psi.

- MODEL 6010** Side outlet. Full nozzle design with Bronze/Brass trim.
- MODEL 6021** Same as 6010 with Teflon (PFA) Disc Insert. For exceptional leak free performance. (Use on steam only).
- MODEL 6030** Same as 6010 except S/S Trim (Nozzle and Disc).
- MODEL 6182** Top outlet. Full nozzle design with Bronze/Brass trim. Replaces Model 82-4.
- MODEL 6121** Same as 6182 with Teflon (PFA) Disc Insert. For exceptional leak free performance (Use on steam only).
- MODEL 6130** Same as 6182 except S/S Trim (Nozzle and Disc).
- MODEL 6186** Top outlet. Full nozzle design with Bronze/Brass trim. 150 PSI Maximum set pressure. Replaces Model 86. (Original Equipment Only.)
- MODEL 6283** Side outlet. Full nozzle design with Bronze/Brass trim. Replaces Model 83-4.
- MODEL 6221** Same as 6283 with Teflon (PFA) Disc Insert. For exceptional leak free performance. (Use on steam only).
- MODEL 6230** Same as 6283 except S/S Trim (Nozzle and Disc).
- MODEL 933** Same as 6010 except Certified for ASME code Sec. IV-Low Pressure Steam Heating Boilers set 15 PSIG only.
- MODEL 934** Same as 6021 except Certified for ASME code Sec. IV-Low Pressure Steam Heating Boilers set 15 PSIG only.
- MODEL 935** Same as 6030 except Certified for ASME code Sec. IV-Low Pressure Steam Heating Boilers set 15 PSIG only.



ASME Standard — N.B. Certified

DIMENSIONS/SPECIFICATIONS

MODEL NO.	INLET MALE NPT	ORIFICE	OUTLET FEMALE NPT	A	B	C	APPROX. WT. LBS.
60**DC	1/2	D	3/4	6 1/2	1 5/8	2 1/8	1 1/2
60**DD	3/4	D	3/4	6 1/2	1 5/8	2 1/8	1 1/4
61**DC	1/2	D	—	6 1/2	—	—	1 1/4
60**ED	3/4	E	1	7 1/2	1 3/4	2 3/8	2 1/2
60**EE	1	E	1	7 5/8	1 3/4	2 1/2	2 3/4
61**ED	3/4	E	—	7 1/2	—	—	2 1/4
62**ED	3/4	E	1 1/4	7 1/2	1 3/4	2 1/8	2 3/4
60**FE	1	F	1 1/4	8 1/2	2	2 5/8	3 1/2
60**FF	1 1/4	F	1 1/4	8 3/4	2	2 1/2	3 3/4
61**FE	1	F	—	8 1/2	—	—	3 1/4
62**FE	1	F	1 1/2	8 1/2	2	2 1/8	3 3/4
60**GF	1 1/4	G	1 1/2	9 5/8	2 3/8	3 1/8	5 1/2
60**GG	1 1/2	G	1 1/2	10	2 3/8	3 3/8	5 3/4
61**GF	1 1/4	G	—	9 5/8	—	—	5
62**GF	1 1/4	G	2	9 5/8	2 1/4	3 3/8	5 3/4
60**HG	1 1/2	H	2	10 5/8	2 3/4	3 3/8	7 3/4
60**HH	2	H	2	11 1/8	2 3/4	4 1/8	8
61**HG	1 1/2	H	—	10 5/8	—	—	7 1/4
62**HG	1 1/2	H	2 1/2	10 5/8	3	3 3/8	8
60**JH	2	J	2 1/2	13 5/8	3 3/8	4 1/4	15 1/2
60**JJ	2 1/2	J	2 1/2	14	3 3/8	4 1/2	15 3/4
61**JH	2	J	—	13 5/8	—	—	15
62**JH	2	J	3	13 5/8	3 3/8	4 1/8	15 1/2

** Replace asterick with desired model number.

Model 6030 available only 1/2" x 3/4", 3/4 x 1", 1" x 1 1/4", 1 1/4" x 1 1/2", 1 1/2" x 2" and 2" x 2 1/2".

Models 933, 934 and 935 have same dimensions as model 6010.

MODEL NUMBER/ORDER GUIDE

MODEL NO. POSITION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
EXAMPLE	6	0	1	0	H	G	0	1	—	A	M	0	1	5	0
	6	0	2	1											
	6	0	3	0											
	6	1	8	2											
	6	1	2	1											
	6	1	3	0											
	6	1	8	6											
	6	2	8	3											
	6	2	2	1											
	6	2	3	0											
	0	9	3	3											
	0	9	3	4											
	0	9	3	5											

ORIFICE
D G
E H
F J

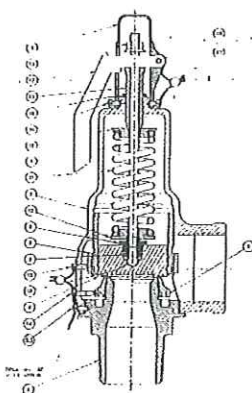
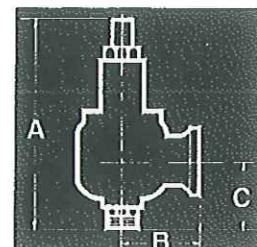
INLET SIZE
C — 1/2" G — 1 1/2"
D — 3/4" H — 2"
E — 1" J — 2 1/2"
F — 1 1/4"

VARIATION (01 thru 99)
Number Provided Only by Kunkle to
Cover Specific Feature or Option.

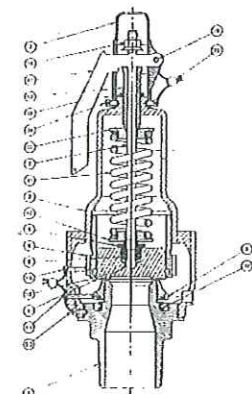
PARTS AND MATERIALS

NO.	PART NAME	MATERIAL
1	Nozzle	Bronze/Brass/St. St'l.
2	Body	Bronze
3	Cap-Plain Lift	Brass
4	Disc	Brass/St. St'l.
5	Warn Ring	Brass
6	Control Ring	Brass
7	Stem	Brass
8	Retainer	Brass
9	Locknut-Retainer	Brass
10	Ball	Stainless Steel
11	Spring	Stainless Steel
12	Spring Step	Brass
13	Screw-Compression	Brass
14	Screw-Warn Ring	Steel/Pltd.
15	Screw-Control Ring	Steel/Pltd.
16	Lift Nut	Steel/Pltd.
17	Lever	Steel/Pltd.
18	Rivet	Steel
19	Locknut-Comp. Scr.	Brass
20	Screw-Plain Lift Cap	Steel/Pltd.
21	Drive Screw	Steel/Pltd.
22	Seal	Lead & Wire
23	Screw-Body	Steel/Pltd.
24	Spring Vib. Damp. ②	Bronze
25	Nameplate	Aluminum
26	Spring Warn Ring	Stainless Steel

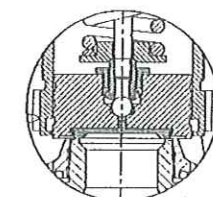
② Optional at extra cost.



MODELS
6010-6030-6230
6283-933-935



MODELS
6130-6182
6186



Disc Assembly
Models 6021, 6121, 6221
and 934

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.

Kunkle Valve Division

Phone: 828-669-5515

953 Old US 70, Black Mountain, NC 28711

Rev B 01/14/2002

Fax: 828-669-4017

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 technical 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

2-98-06

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 Purchaser's 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.

PERMISSABLE VARIATIONS, STANDARDS, AND TOLERANCES

Except in the particulars specified by the Purchaser and expressly agreed to in writing by the Company, all materials shall be produced in accordance with the Company's standard practices. The Company reserves the right to deviate from tolerances and variations in the equipment without notice, provided that the substitute part(s) or deviation(s) are consistent with the usage and performance of the product.

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 to change as determined by shop loading if and when this quotation should be realized as an actual sale. The Company shall not 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 or cancel the order in whole or in part without the written approval and acceptance by the Company of such cancellation or change. The Company may condition its approval of a change or cancellation upon a 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, or in actual production of the order. In the event that the Purchaser delays shipment of the equipment upon the Company's notice to ship, the equipment shall be placed in storage at the Purchaser's risk and expense, and shall be invoiced as if shipped.

RETURNS AND RESTOCKING

Equipment may be returned to Lattner at 1411 9th Street SW, Cedar Rapids, IA 52404, 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 only if the 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, for past due accounts, 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, act 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 event 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. 2-98-R06. The Company's warranty shall be voided 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 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 the 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, interpreted, and construed in accordance with the laws of the State of 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 shall be binding upon and insure to the benefit of the Purchaser and the Company and their respective heirs, successors, or assigns.

LATTNER BOILER COMPANY
Cedar Rapids, IA USA

TC06

FORM P-2A MANUFACTURER'S DATA REPORT FOR ALL TYPES OF ELECTRIC BOILERS
As Required by the Provisions of the ASME Code Rules, Section I

PART I — To Be Completed by the Manufacturer of the Boiler Pressure Vessel

1. Manufactured by P.M. Latner Mfg. Company, 1411 9th Street SW, Cedar Rapids, Iowa 52404
(Name and address of manufacturer of boiler pressure vessel)

2. Manufactured for Unknown - Built for Stock
(Name and address of purchaser)

3. Location of Installation Unknown - Built for Stock
(Name and address)

4. Type Resistance Element Boiler No. 94096
(resistance element, electrode) (Mfr's. Serial No.) (CRN)
192-6201 55434 Year Built 2011
(Drawing No.) (Nat'l. Brd. No.)

5. The chemical and physical properties of all parts meet the requirements of Material Specifications of the ASME BOILER AND PRESSURE VESSEL CODE. The design, construction, and workmanship conform to Section I of the ASME BOILER AND PRESSURE VESSEL CODE 2010,
Addenda to (Date) (If applicable), and Code Cases (Numbers) (Year)

Manufacturer's Partial Data Reports properly identified and signed by Commissioned inspectors are attached for the following items of this report:

6. Shells or drums 1 SA-106 Gr. B 0.375" 15.25" 40.625"
(no.) (mat'l. spec. gr.) (thickness) (diameter (ID)) (length, inside) (diameter (ID)) (length, inside)

7. Joints Seamless 100% 1
(long (seamless, welded)) (efficiency (as compared with seamless)) (girth (seamless, welded)) (no. of shell courses)

8. Heads SA-516 Gr. 70, 3/8" - 80% Hi Crown - 25.6" Radius of Dish SA-516 Gr. 70, 3/8" - 80% Hi Crown - 25.6" Radius of Dish
(Mat'l. Spec. No.: thickness — flat, dished, ellipsoidal — radius of dish)

9. Other Parts. 1. Element 2. Control 3. Control
Brief description — i.e., dome, boiler piping, etc.)

1. (1) SA-106 6" Sch. 80 Pipe Nozzle with SA-105 Class 300 Weld Neck Flange, Head
2. (1) SA-105 1" NPT 3000# Forged Steel Coupling, Head
3. (1) 1" NPT Drill and Tapped, Shell
(Mat'l. Spec., Gr., size, material thickness, MAWP)

10. Openings: (a) Steam (1) 1" NPT, SA-106 Gr. B, Threaded (b) Pressure Relief Valve (1) 1/2" NPT, SA-106 Gr. B, Threaded
(No., size, and type) (No., size, and type)
(c) Blowoff (1) 1" NPT, SA-106 Gr. B, Threaded (d) Feed (1) 3/4" NPT, SA-105 3000# F.S. Coupling, Head
(No., size, and type) (No., size, type, and location)
(e) Manholes: No. None Size Location
(f) Handholes: No. (2) Size 3" x 4" Location Head (3" x 4" Ellip.)
(g) Elements/Electrodes: No. (1) Size 6" NPT Pipe Sch. 80 Location Head

11. Boiler Supports: No. 2 Type Legs - Material is SA-36
(saddles, legs, or lugs)

Attachment Welded
(bolted or welded)

12. MAWP 300 psi Based on PG-49.1
(Code para. and/or formula)

13. Shop Hydrostatic Test 450 psi 14. Maximum Designed Steaming Capacity 420.0 lb/hr

15. Remarks Item 9.3: Internal backing pad for 1" NPT is 5/16" thick, SA-516 Gr. 70 in Shell.
Item 10 (a), 10 (b), 10 (c): Internal backing pad for 1" NPT and 1/2" NPT is 5/16" thick, SA-516 Gr. 70 in Shell.
Item 10: 3/8" NPT drilled and tapped hole, control.

CERTIFICATE OF COMPLIANCE OF BOILER PRESSURE VESSEL

We certify the statements in Part I of this Data Report to be correct.

Our Certificate of Authorization No. 110 to use the (S) or (M) S

Symbol expires February 28th, 2013

Date May 6, 2011 Signed [Signature] Name P.M. Latner Mfg. Company
(Authorized Representative) (Mfr. of boiler pressure vessel)

FORM P-2A

Boiler No. 94096
(Mfr's. Serial No.)

(CRN)

192-6201
(Drawing No.)55434
(Nat'l Board No.)

CERTIFICATE OF SHOP INSPECTION OF BOILER PRESSURE VESSEL

Boiler pressure vessel made by P.M. Lattner Mfg. Company at 1411 9th Street SW, Cedar Rapids, Iowa 52404
 I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province
 of Iowa and employed by H.S.B.Ct.

 have inspected parts of this boiler pressure vessel referred to as data items 1, 2, 4 thru 15
 and have examined Manufacturer's Partial Data Reports for items
 and state that, to the best of my knowledge and belief, the manufacturer has constructed this boiler pressure vessel in accordance with the applicable
 sections of the ASME BOILER AND PRESSURE VESSEL CODE.

By signing this certificate, neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the boiler pressure vessel
 described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal
 injury or property damage or a loss of any kind arising from or connected with this inspection.

Date May 6, 2011
(Authorized Inspector)Commissions NB 14084A 1622 1A

(Nat'l. Board (incl. endorsements), State, Province, and No.)

Part II—To Be Completed by the Manufacturer Responsible for the Completed Boiler

16.

Item	Piping				Valves			
	Size	Sch.	Spec.	Bolted, Threaded, or Welded	Size	Type	Rating	No.
(a) Steam Pipe								
(b) Feed Water					Stop			
Feed Water					Check			
(c) Blowoff								

17. Pressure Relief Valve(s) No. (1) Size 1/2" NPT Set Press 300 psi Total Capacity 18. Heating Elements Installed: Quantity 1 Total Power Input 120 KW19. Electrodes: Quantity Total Power Input 20. Hydrostatic Test of Completed Boiler 300 psi MAWP of completed boiler 300 psi21. Serial No. Assigned by Manufacturer Responsible for Completed Boiler 94096

CERTIFICATE OF COMPLIANCE OF COMPLETED BOILER

We certify that this completed boiler conforms with the requirements of Section I of the ASME BOILER AND PRESSURE VESSEL CODE.

Our Certificate of Authorization No. 110 to use the (S), (M), or (E) SSymbol expires February 28th, 2013Date Signed By P.M. Lattner Mfg. Company(Check one) ☐ Authorized Representative
☐ Certified Individual

(Assembler)

CERTIFICATE OF SHOP INSPECTION OF COMPLETED BOILER

Boiler made by at I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province
of and employed by of and have inspected the completedboiler and have examined Manufacturer's Partial Data Reports for
and state that, to the best of my knowledge and belief, the Manufacturer has constructed this boiler in accordance with the applicable sections of the
ASME BOILER AND PRESSURE VESSEL CODE.By signing this certificate, neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the boiler described in this
Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property
damage or a loss of any kind arising from or connected with this inspection.Date
(Authorized Inspector)Commissions

(Nat'l. Board (incl. endorsements), State, Province, and No.)

1. Manufacturer (or engineering-contractor) P.M. Lattner Mfg. Company, 1411 9th Street SW, Cedar Rapids, IA 52404
(name and address)

2. Purchaser University of Florida, 1 Buckeye Drive, Perry, FL 32348
(name and address)

3. Type of boiler 120 max KW Electric Steam Boiler

4. Boiler no. 94096 192-6201 55434 2011
(mfrs. serial no.) (state or prov.) (CRN) (drawing no.) (Nat'l. Bd. no.) (year built)

[illegible]

This form may be obtained from The National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Ave., Col's, OH 43229

FORM P-2A

CERTIFICATE OF FIELD ASSEMBLY COMPLIANCE OF THE COMPLETED BOILER

We certify that the field assembly of the completed electric boiler identified on this form conforms to the requirements of Section I of the ASME BOILER AND PRESSURE VESSEL CODE.

Our Certificate of Authorization No. _____ to use the (S) or (E) _____ Symbol expires _____.

Date _____ Signed _____ Name _____ (Assembler)

Check one ☐ Authorized Representative ☐ Certified Individual

CERTIFICATE OF FIELD ASSEMBLY INSPECTION BY ASSEMBLER OF THE COMPLETED BOILER

BOILER FIELD ASSEMBLED BY _____ at _____

I, the undersigned, as an authorized Certified Individual representing and employed by _____ have examined this Manufacturer's Data Report (including any Manufacturer's partial data reports) and have compared the documentation with the described field assembled electric boiler. The completed field assembled boiler was inspected by me and subjected to a hydrostatic test of _____ psi. To the best of my knowledge and belief I state that the electric boiler identified in this report has been constructed, assembled, inspected, and tested by the Assembler in accordance with the applicable section(s) of the ASME BOILER AND PRESSURE VESSEL CODE.

Date _____ Signed _____ Assembler _____

(Certified Individual)

CERTIFICATE OF FIELD ASSEMBLY INSPECTION BY AN AUTHORIZED INSPECTOR OF THE COMPLETED BOILER

BOILER FIELD ASSEMBLED BY _____ at _____

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the state or province of _____ and employed by _____ of _____ have inspected the completed field assembled electric

boiler, have examined the Manufacturer's Partial Data Reports for _____ and state that, to the best of my knowledge and belief, the Assembler has constructed, assembled, and tested this boiler in accordance with the applicable section(s) of the ASME BOILER AND PRESSURE VESSEL CODE.

By signing this certificate, neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the boiler described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date _____ Signed _____ Commissions _____

(Authorized Inspector)

(Nat'l. Board Including Endorsements, State, Province, and No.)