Lattner Boiler Company

Electric Cabinet Style Steam Boilers

OPERATIONS MANUAL

December 2006

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Section I: General Description

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

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

1. Boiler Design

Lattner 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

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

3. Boiler Trim

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

3.1. Safety Relief Valve(s)

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

3.2. Float Control

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

3.3. Low Water Cut-Off

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

3.4. Pump Control

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

3.5. Auxiliary Low Water Cut-Off

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

3.6. Steam Pressure Gauge

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

4. Control Panel

A NEMA 1 enclosed control panel is mounted integral to the 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

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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.

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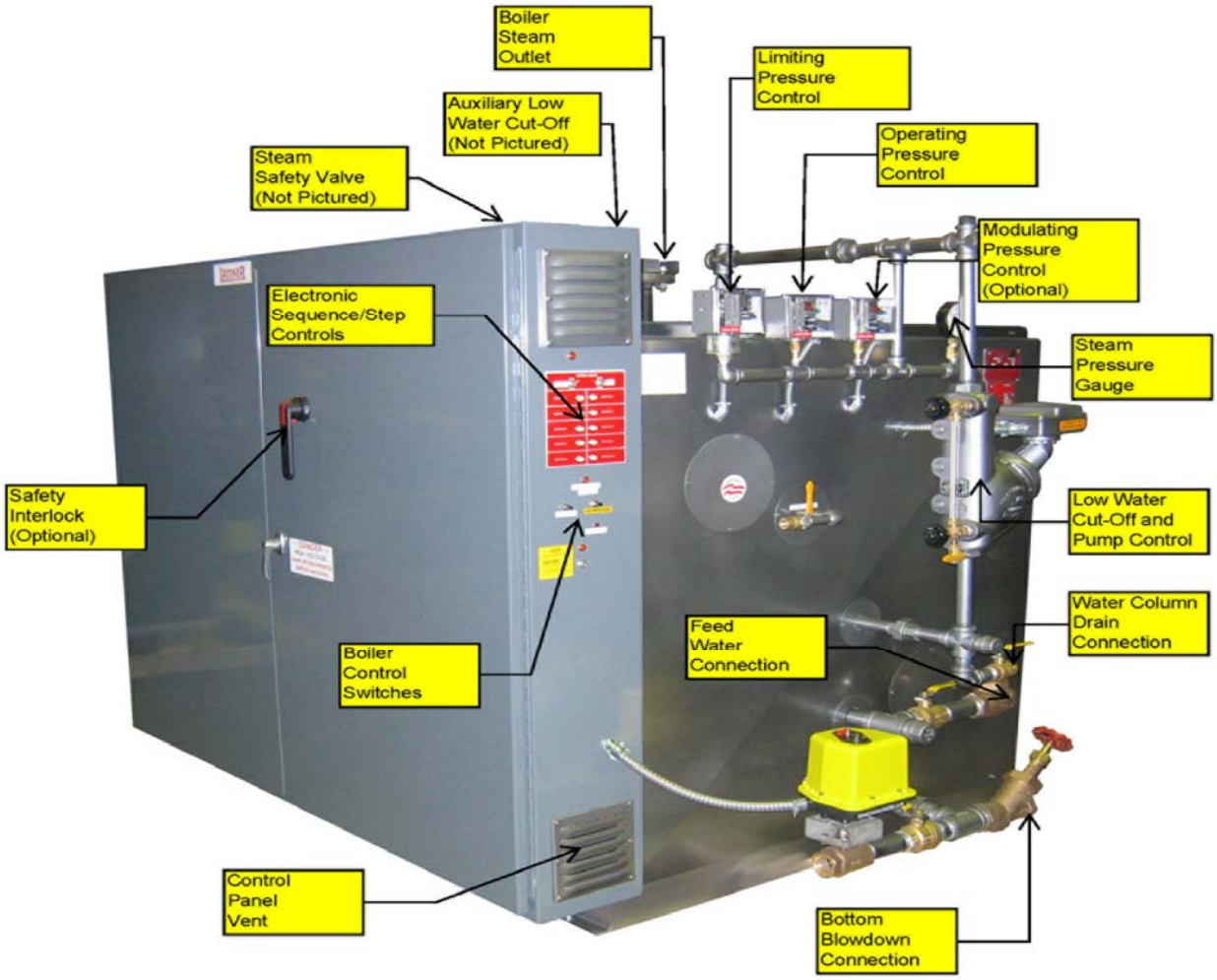
Section II: Instructions

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

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

1. Illustration



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2. Unloading

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

2.1. Lifting

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

2.2. Forklift

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

2.3. Crane or Boom

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

3. Rigging

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

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

4. Placement of Boiler

4.1. Floor

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

5. Steam Outlet

5.1. Pipe Size

Size pipe according to system requirements.

5.2. Outlet Size

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

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5.3. Steam Stop Valve

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

5.4. Steam Piping

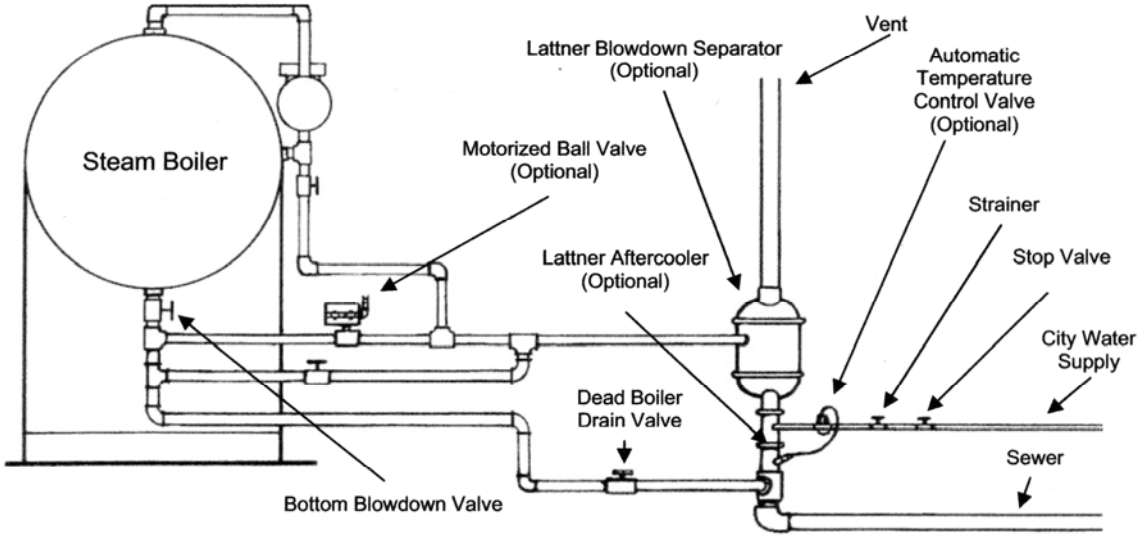
The steam line should be pitched downward slightly away from the boiler, toward a steam trap. If using a steam solenoid valve, the steam line should slope upward slightly to the solenoid valve. After the solenoid valve, the steam line should slope downward.

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

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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

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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-

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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

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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”

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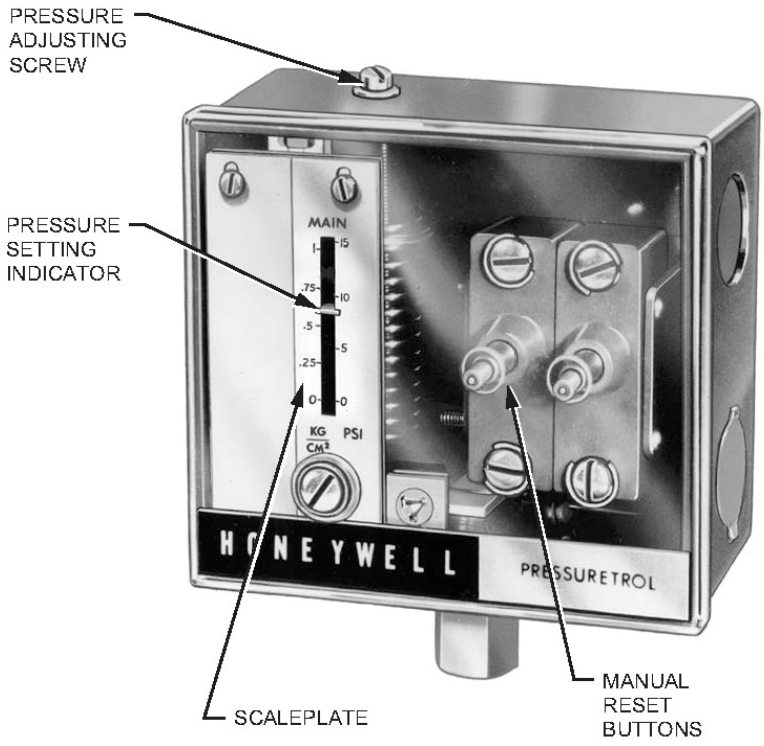
Turn on the pump switch. Pump or solenoid valve should start immediately. If not, see the troubleshooting section of this manual.

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

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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

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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.

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

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

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Section III: Boiler Care & Maintenance

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

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

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

1. Routine Maintenance

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

2. Monthly Procedures

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

3. Quarterly Procedures

    3.1. Check low water cut-off for proper operating and for possible clogging.
    3.2. Check all other valves and controls for 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 of all power sources.
        5.1.2. Drain boiler.

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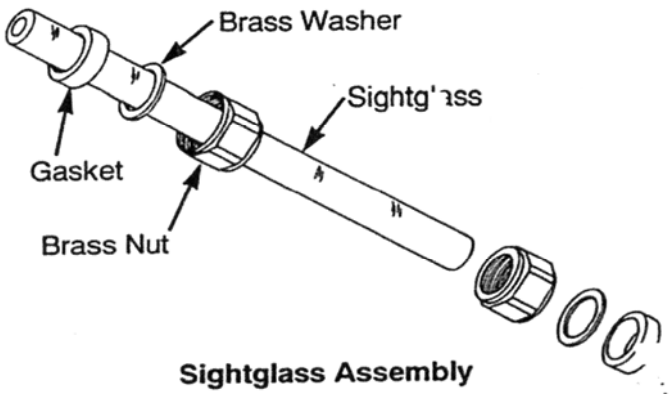
5.1.3. Disconnect wiring from the defective element and tape ring connectors with electrical insulating tape.
5.1.4. Remove both retaining nuts.
5.1.5. Pull element out approximately 6" and cut off with hacksaw.
5.1.6. Push element back into vessel.
5.1.7. Insert a short piece of 7/16" diameter round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

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

5.2.1. Turn off all power sources.
5.2.2. Drain the boiler.
5.2.3. Disconnect element leads, 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 intro service, check all bolts and electrical fitting for tight connections.

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



Sightglass Assembly

6.1. Boiler and pump should be switched off.

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

6.3. Close the upper and lower water gauge valves.

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

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

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

6.7. Assemble the new sight glass (as shown 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.

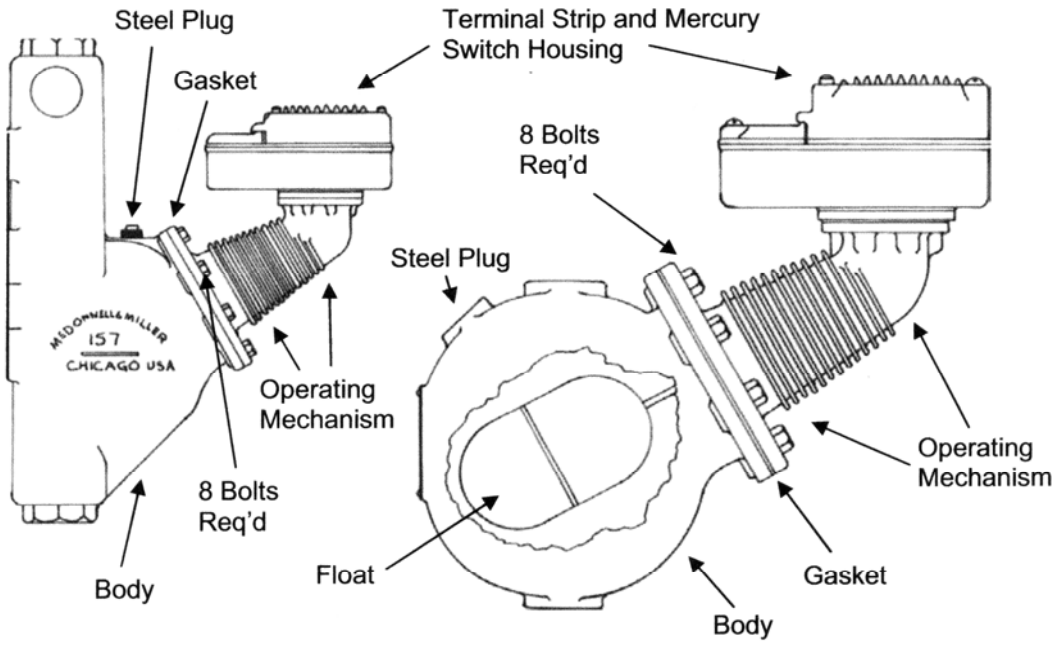
6.10. Tighten the sight glass packing nuts hand tight.

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.

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

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

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

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

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

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

7.10. Check the float for any holes.

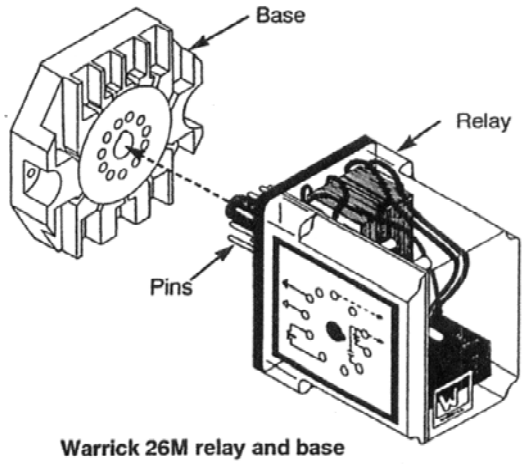
7.11. Hold the float submerged in a bucket of water and look for any air bubbles coming from the float.
7.12. Always reassemble the McDonnell Miller operating mechanism to the body with a new gasket.

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

7.14. Reconnect the McDonnell Miller per wiring diagram.

7.15. Reconnect all power to the boiler.

8. 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.

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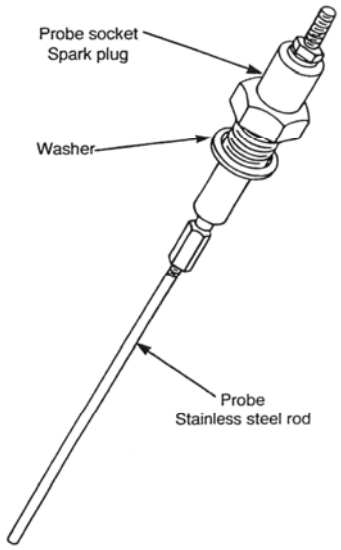
8.3. Replace the Warrick with a new 26M series Warrick. The relay has a small tab so that it can be installed only one way.

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.

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Section IV: Troubleshooting

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

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

1. Troubleshooting

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

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

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

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LATTNER BOILER LIMITED WARRANTY

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

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

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

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

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

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

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