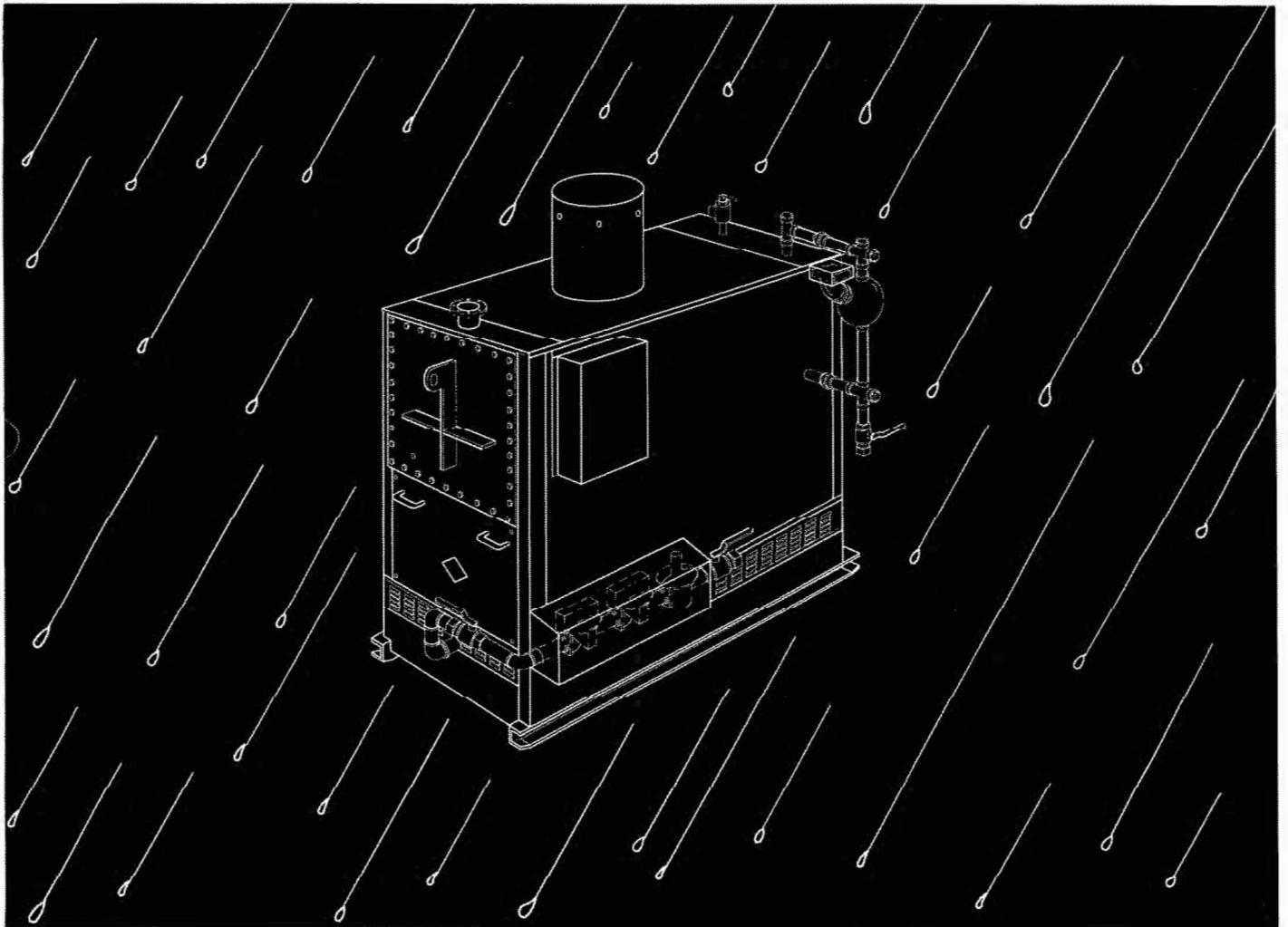


Rite BOILERS

INSTRUCTION MANUAL FOR UL LISTED **OUTDOOR** ATMOSPHERIC BOILERS



Read Instructions carefully before proceeding with installation
Post and maintain Instructions in legible condition

Rite Engineering & Mfg Corp.
Commerce, CA 90040
Tel: (562) 862-2135
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INTRODUCTION

Congratulations on your selection of a Rite Outdoor Boiler. You have purchased one of the finest boilers on the market today. It is our goal that this equipment gives you years of efficient, dependable service.

To get the best results from your new boiler please read this manual carefully. We also suggest you read the warranty policy on the back in order to fully understand its coverage and your responsibilities of ownership.

For easy reference this manual has been put together in chronological order beginning with receiving and ending with maintenance. Reading it before you receive your boiler can save you time and money on the installation. Referring to it afterwards can save you from preventable service calls.

When your boiler does need parts or service, or you have any questions about the product, keep in mind that your local Rite Representative is dedicated to your satisfaction and will be pleased to answer your questions and concerns.

Best Wishes,

Rite Engineering & Manufacturing Corp.

BOILER MODEL(S):

BOILER SERIAL NUMBER(S):

YEAR PURCHASED:

YOUR RITE REPRESENTATIVE IS:

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SAFETY WARNING NOTICES:

Your physical safety and the safety of others is very important. Throughout this manual we have provided safety warning notices to alert you to potential safety hazards. A safety notice will be preceded by:

DANGER

IT MEANS: You CAN be KILLED or SERIOUSLY HURT if you don't follow instructions.

EQUIPMENT WARRANTY NOTICES:

When properly installed, operated and maintained, Rite Boilers can easily offer forty or more years of service. Throughout this manual we have provided equipment warranty notices to alert you to potential practices that could lead to premature repairs. An equipment warranty notice will be preceded by:

NOTICE

IT MEANS: Failure to follow these instructions will void warranty and may lead to premature repairs.

RECEIVING

1. Before signing Bill of Lading, check for any signs of external damage. Be sure you have received all the pieces noted on the bill. Boiler stack cap(s), which must be installed on all Rite Outdoor Boilers, are always boxed separately.
2. Offload the boiler as shown in figure 1 :

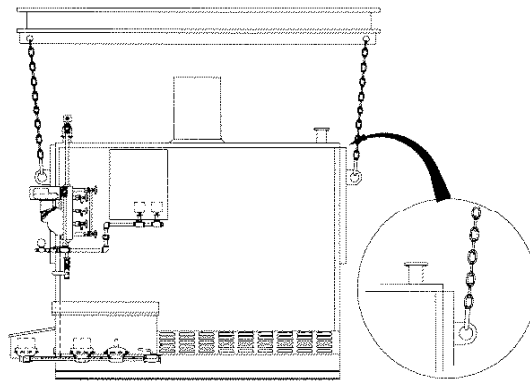


Figure 1 (Steam boiler shown)

3. **NOTICE** Place the boiler gently onto a firm, level surface. Hard drops may result in broken refractory.
4. Remove the firebox door attached by (4) 3/8" wingnuts.
 - 4.1 Carefully cut the steel strapping around the burner tiedown crating and remove. Do not disturb the pilot burner assembly.
 - 4.2 Be sure all the burners are in place.
 - 4.3 Check for any broken refractory panels. Superficial hairline cracks are part of the curing process and considered normal.
 - 4.4 Reinstall firebox door.

STORAGE

1. Unless the installation is to begin immediately, it is good idea to tarp the boiler.
2. Keep the stack cap(s) with the boiler, otherwise they may become lost.
3. If a tarp isn't available be sure to take the following precautions:
 - 3.1 Keep mud from caking onto combustion air louvers.
 - 3.2 Keep rain from entering boiler stack(s).
 - 3.3 Leave plastic cap plugs in place and keep debris from entering plumbing connections.

PLACEMENT

1. Rite Outdoor Boilers are completely sealed underneath the combustion chamber. They may be installed on "sleepers" or piers (non combustible) as well conventional concrete pads. **DANGER** If installed on "sleepers" or piers, the same requirements for safe anchoring as listed below apply.
2. **DANGER** This equipment has a relatively high center of gravity (see catalog's "CG" dimension) and may tip over if not placed on a firm, level surface and properly anchored.
3. When anchoring the boiler observe the following:
 - 3.1 Consult job specification for seismic anchorage requirements.
 - 3.2 If in doubt, contact your local Building & Safety Dept. or a qualified mechanical engineer for assistance.
 - 3.3 Refer to catalog for boiler weights, dimensions and center of gravity ("CG") location.
 - 3.4 Anchor plates are by others.

PLACEMENT

4. When installing on a concrete pad be sure the pad is big enough in length and width. The current minimum requirement is that the pad must extend beyond the anchor plate hole(s) by at least six (6) times the anchor bolt diameter.

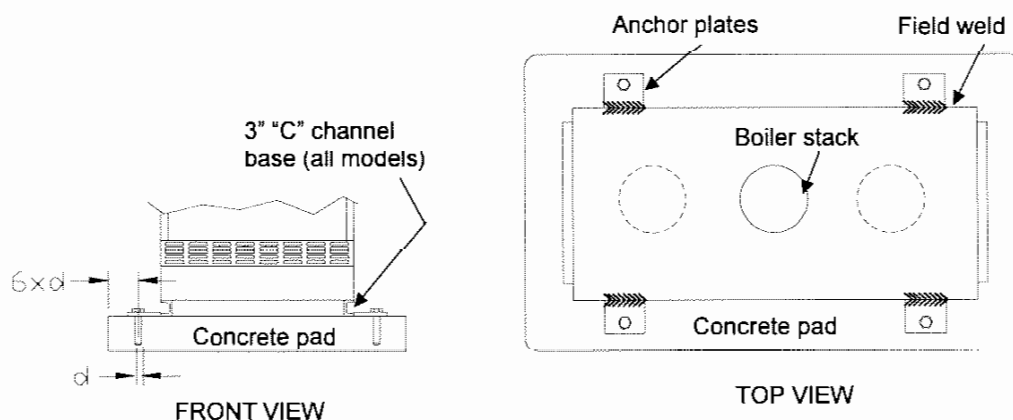


Figure 2

INSTALLATION

NOTE: For typical closed loop hot water heating system piping layouts see pages 24 and 25. For typical steam boiler piping layouts see pages 26 through 29.

1. In most cases the installation will be carried out by a licensed contractor who must pull the required permits before starting the job.
2. The installing contractor must carry out the work according to numerous codes that include Uniform Mechanical Code, Uniform Plumbing Code, National Fire Protection Agency, ASME CSD-1, National Electric Code, etc., all per latest editions. Additional insurance requirements or job specifications may also be required. For example, Section I Boilers such as a Rite WP-50 requires that the piping must be carried out in accordance with B31.1 ASME Power Piping Code.
3. Before a permit to operate the boiler is issued, the work permits must be signed off by Building & Safety Inspectors. This process usually insures a safe and proper installation.

INSTALLATION

4. Two minimum requirements must be followed when installing this boiler to maintain its UL 795 Listing as an outdoor boiler. These are 4.1 and 4.2 as follows:

4.1 CLEARANCE TO COMBUSTIBLE MATERIALS

MODELS	FROM ABOVE	FROM FRONT*	SIDES & REAR	VENT CONNECTOR
W48W - WA200W (Water) W48S-W150S (Low Pressure Steam)	6"	18"*	6"	6"
W225W - W500W WA150S - W500S	18"	48"*	18"	18"
WP9.5 - WP125 (High Pressure Steam)	48"	96"*	36"	36"

*See maintenance clearance in catalog for additional requirement.

- 4.2 The stack cap(s) shipped loose with the boiler must be installed directly on the boiler stack(s). Do not add any additional stack. Do not substitute another type of cap. Do not modify what is supplied. Install as shown in figure 3:

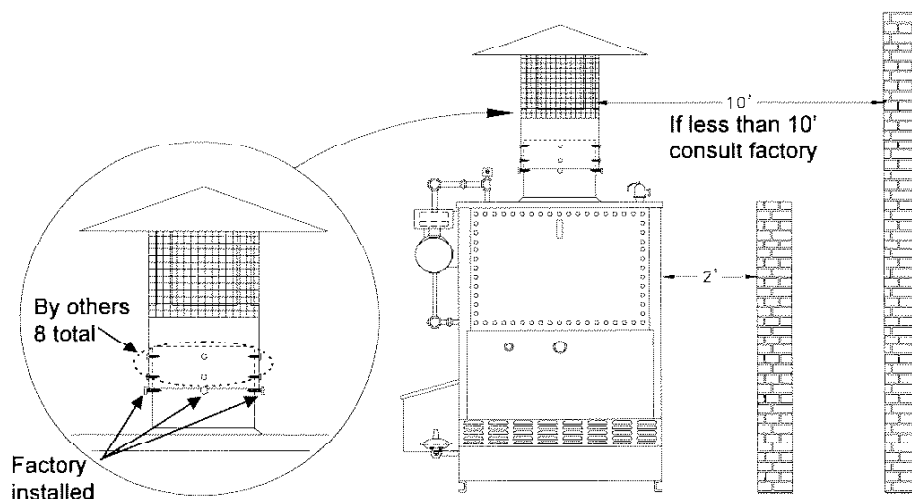
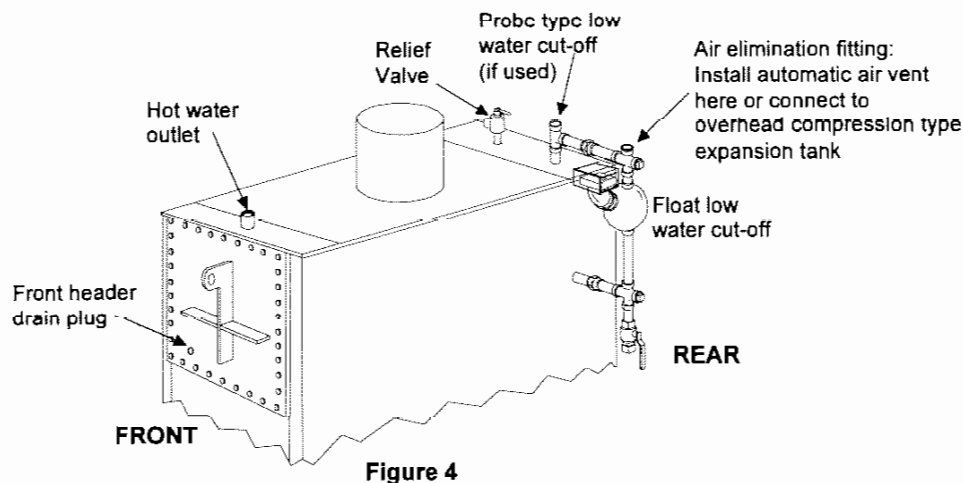


Figure 3

INSTALLATION

5. **DANGER** Boiler must be installed so that products of combustion will not enter an occupied building via open windows, open air ducts or forced air inlet ducts.
6. Be sure to leave plenty of room in front of the boiler and some at the back for tube cleaning and maintenance. Allow roughly the length of the boiler in front (see dimension "H" in catalog) and 24" or more at the rear.
7. Avoid blocking the rear headplate with the return water piping. For boilers with hinged headplates, make allowances for headplate swing. Hinges are installed with removable pins in case headplates must be removed.
8. For hot water boilers pipe the air elimination fitting as shown in figure 4:



9. **NOTICE** Always use dielectric unions or flange kits when connecting copper piping to any Rite Boiler.
10. **NOTICE** A good electrical ground to the boiler panel per NEC is essential for two reasons: Poor grounding may cause the flame safeguard control to malfunction. Stray voltages may cause electrolysis within the pressure vessel.
11. Rite Outdoor Boilers are normally supplied with 18 gauge, galvanized steel jackets with a G90 coating. This finish will provide excellent galvanic protection against rust for the life of the boiler. Avoid scratching the surface or the galvanic protection will be compromised. Use cardboard or other means of protection if it becomes necessary to stand or place things on the boiler.

INSTALLATION

12. On hot water boilers, always install the system pump so that the suction side is nearest the boiler hot water outlet. This lowers the risk of air entering the system and does not impose the system head on the boiler. Pressure drop through all Rite Hot Water Boilers is less than 3 feet of water or, 1.3 PSIG.
13. On Rite steam boilers (low and high pressure) the boiler feed pump should be sized to deliver the following G.P.M. per boiler horsepower:

BOILER HORSEPOWER	INPUT BTU/HR (1000'S)	STEAM LB/HR	RECOMMENDED GPM FEED RATE
9.5	398	328	.79
10	419	345	.83
12	502	414	.99
15	628	518	1.24
20	838	690	1.66
30	1255	1035	2.48
40	1674	1380	3.31
50	2093	1725	4.14
60	2511	2070	4.97
70	2931	2415	5.8
80	3348	2760	6.6
100	4185	3450	8.3
125	5230	4313	10.4

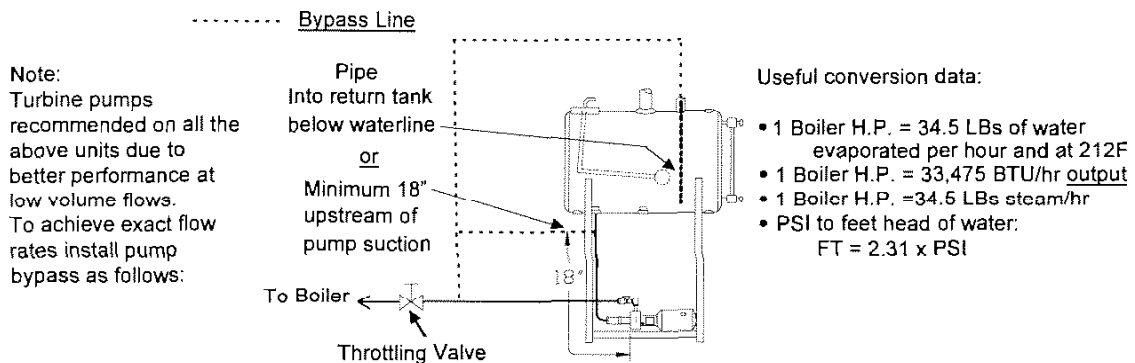


Figure 5

14. Rite Hot Water Boilers can be fired safely with the system pump off as long as there is water in the boiler and the low water cut-offs are made. A flow switch is not a safety requirement.
15. **NOTICE** Rite Hot Water Boilers must not be operated with return water temperatures continually less than 135° F. Outdoor reset controls must be carefully programmed not to reset boiler water temperatures below 135° F return.
16. Expansion tanks must be installed in all hot water heating systems. Tanks may be compression type or bladder/diaphragm. To properly size these tanks you must know: total system volume; supply & return water temperatures; static system pressure at the boiler; system cold fill setting and boiler relief valve setting. **NOTICE** Static system pressure at the boiler should be given to your Rite Representative before ordering boiler.
17. **NOTICE** Never let chilled water from a cooling system circulate through the boiler even when the boiler is off line during the summer months.
18. It is a good idea to install a relatively inexpensive water meter in the water make-up line. On closed heating systems it may be the only way to identify system water loss. For steam boilers it can provide a useful record of water make-up activity that can help keep a water treatment program on track.
19. It is a good idea to install a flue gas thermometer in the boiler stack 4" above the boiler casing(See figure 6). Note the net stack temperature (gross minus ambient equals net) in the beginning and if you notice it going up it might be time to check the tubes for sediments or scale.

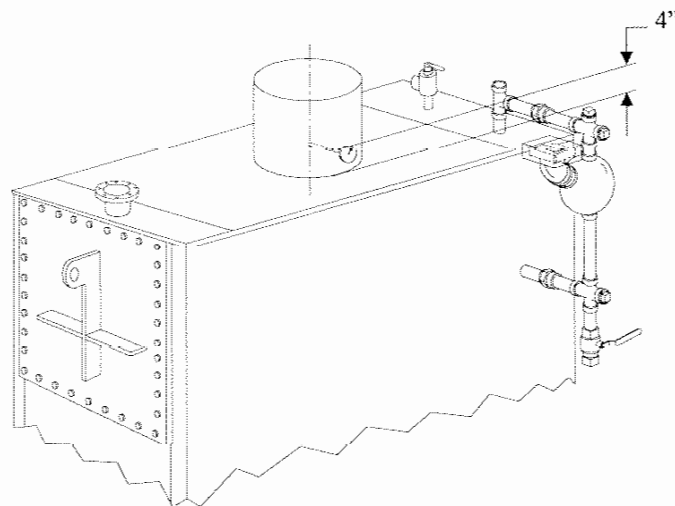


Figure 6

INSTALLATION

20. **NOTICE** When pressure testing a new gas line be sure the boiler's main and pilot cocks are in the closed (off) position. If not, downstream gas valves may be damaged from over pressure.
21. **NOTICE** Many parts of the country experience grave winter conditions. In freezing weather, gas valves have been known to stick open and water gauges can freeze solid even when boilers are operating. Don't ignore local custom: If outdoor boilers are not used in your area, choose an indoor model instead.

WATER TREATMENT

1. **INITIAL CLEANING/BOILING OUT:** Every new installation will have a certain amount of cutting oil, grease, weld slag, pipe dope and other contaminants inside the system piping. Your particular job may call out a specific cleaning procedure before the system is put into operation. If not, and you wish to clean the system anyway, you may use the following procedure provided you check first with local agencies regarding disposal into the sewer line.
 - 1.1 Choose one of the following three chemicals at the proportions given. Preference is in the order shown: Trisodium phosphate: 1lb. for every 50 gallons in the system. Sodium carbonate: 1lb. for every 30 gallons in the system. Sodium hydroxide: 1lb. for every 50 gallons in the system.
 - 1.2 Add the chemical to the system through a bypass pot feeder for hot water systems or into the condensate return tank for steam systems making sure it is well mixed.
 - 1.3 For hot water systems, after filling with water and venting the air, turn the pump and boiler on and run at normal operating temperatures for 3 - 4 hours. Drain the system completely and then refill with fresh water. Enough chemical should remain in the piping to make the water in the system slightly alkaline. A pH reading between 7 and 8 is good.

WATER TREATMENT

- 1.4 For steam systems, operate the boiler for 3 - 4 hours at normal operating pressures making sure the feed pump has fed most of the original treated water in the return tank into the boiler. With the boiler under pressure, turn the boiler and feed pump off and completely blow down the boiler and drain the return tank. Refill the return tank from the soft water supply, turn the feed pump back on and make sure the boiler refills to its normal operating level. The boiler water pH reading should be between 7 and 8.
2. **CHEMICAL TREATMENT FOR CLOSED HOT WATER SYSTEMS:**
Your particular job may call out for chemical treatment of the heating system. Generally these chemical blends consist of corrosion inhibitors, scale and pH control. **NOTICE** These products can become aggressive if overfed and lead to leaks where the tubes are rolled into the tubesheets. Most hot water boilers operating in a closed loop system require little or no water treatment. Keeping the system tight by introducing as little make-up water as possible is the best water treatment.
3. **CHEMICAL TREATMENT FOR STEAM BOILERS** is more complex in that water make-up is expected because the system is generally open. There are three basic components to effective scale and corrosion prevention as follows:
 - 3.1 **SOFT WATER MAKE-UP:** All fresh water make-up must come through a softener 100% of the time.
 - 3.2 **BLOWDOWN:** Blowdown the boiler enough to maintain TDS (Total Dissolved Solids) levels below 2500 PPM. Always turn boiler feed pump back on immediately after blowdown (unless preparing for an internal inspection) to prevent leftover solids from drying and hardening inside the pressure vessel.
 - 3.3 **CHEMICAL TREATMENT:** Use an automatic chemical metering pump to inject the proper chemicals into the boiler feed line. The metering pump should be wired in series with the boiler feed pump and the injection port should be after the check valves and just before the shutoff valve installed at the boiler's feedwater inlet connection.

WATER TREATMENT

- 3.4 In conjunction with the water treatment company you choose, the following should be checked once a month to be sure your water treatment program is on track:
- A. TDS levels
 - B. Condensate return analysis
 - C. Water softener
 - D. Amount of (soft) water make-up
 - E. Blowdown valves
 - F. Chemical metering system
 - G. Electrolysis
4. **ELECTROLYSIS** can cause major damage to the boiler's pressure vessel. One cause is use of dissimilar metals in the piping (see page 5, para. 9). Another cause is stray voltage due to electrical problems. **NOTICE** There should be zero (0) voltage present (AC or DC) between the boiler and up to 30 feet of piping from the boiler's inlet and outlet to what you know to be a good earth ground. As little as 300 millivolts can cause severe electrolysis.
5. **ETHYLENE GLYCOL:** Rite Hot Water Heating Boilers are compatible for use with a mixture of ethylene glycol and water up to a 50% concentration. Because glycol has a lower specific heat and therefore lower thermal conductivity than water, keep in mind the following derations of boiler output at percent of glycol concentration: at 10% concentration derate boiler output by 5%; at 30% concentration derate output 17% and at 50% concentration derate 25%. Note that glycol deration and elevation deration are not cumulative; use only the greater of the two derations when applicable. Minimum 50 PSIG operating pressure is recommended for all Rite Hot Water Heating Boilers used with glycol.

START-UP

1. Verify that all installation permits have been signed off by inspectors prior to start-up.
2. **NOTICE** Boiler start-up should be performed by qualified boiler technicians only.

START-UP

3. **NOTICE** Verify that 120VAC has been brought to terminals 1 & 2 inside boiler's electrical panel as well as a ground conductor to the panel's grounding screw. Be sure there is less than .5 VAC between the neutral (L2) wire on terminal 2 and ground.
4. Verify that the burner tiedown crating was removed and the firebox door reinstalled. (See page 1, para. 4).
5. **NOTICE** Make sure air has been bled from the natural gas supply line and that the supply pressure is between 7" and 14" water column. A pipe tee with plug has been provided in the boiler's pilot gas line near the main gas cock for this purpose. If the supply gas pressure is over 14" wc, make sure the boiler has been supplied with suitable high pressure regulators (main and pilot) or consult with your authorized Rite factory representative before proceeding.
6. **NOTICE** Make sure there is water in the boiler. For hot water systems make sure the system has been filled and air bled from any manual bleed valves.
7. **NOTICE** Verify that the stack cap(s) are correctly installed. (see page 4, para. 4.2).
8. **DANGER** Make sure the boiler has been anchored as specified. (see pages 2 & 3).
9. For hot water boilers, verify that an expansion tank has been installed and is open to the system. An elevated, compression type tank should have water in the lower third of the gauge glass when filled and vented. A floor mounted bladder/diaphragm type tank must be charged with air before being put into service. Check the boiler's pressure gauge. It should be at least 10 PSIG less than the boiler's relief valve setting.

START-UP

10. For hot water boilers set aquastats as labeled in the following manner:

OPERATOR or LOW FIRE:	Between 155° F. and 230° F.
MEDIUM FIRE (if used):	5 to 10 degrees less than low fire
HIGH FIRE (if used):	5 to 10 degrees less than medium or low fire
MODULATION (if used):	same as operator or low fire control
HIGH LIMIT:	20 degrees above operator or low fire control

11. For low pressure steam boilers (15 PSIG) set pressure controls as follows:

OPERATOR or LOW FIRE:	Between 3 and 12 PSIG
MEDIUM FIRE (if used):	1 - 3 PSIG less than low fire
HIGH FIRE (if used):	1 - 3 PSIG less than medium or low fire
MODULATION (if used):	same as operator or low fire control
NIGHT SETBACK (if used):	Usually 1 - 2 PSIG
HIGH LIMIT:	13 - 14 PSIG

12. For High Pressure Steam Boilers (150 PSIG) set pressure controls using similar ratios to low pressure steam boilers. **NOTICE** On High Pressure Steam Boilers the High Limit Pressure Control should be set at least 10 -15 PSIG less than the boiler's relief valve setting.

13. Open boiler's main manual shutoff valve but leave the pilot cock off.

14. Remove boiler's electrical panel cover. **DANGER** Hazard of electrical shock. Avoid touching live terminals. Reset all switches marked "reset" in the panel.

15. Open hinged sheetmetal cover protecting the gas train and reset high and low gas pressure switches (if used).

16. Turn the boiler's toggle switch on. Because the pilot cock is off, after a pilot trial for ignition the flame safeguard control should lock out.

START-UP

17. Wait 5 minutes as per the lighting and relighting instruction tag located under the boiler's nameplate. Then reset the flame safeguard, open the pilot cock and turn the toggle switch back on. Once the pilot is proved, the main burners should ignite.
18. The cast iron burners are of a drilled, raised port, upshot design. The orifices were drilled at the factory to give the proper firing rate at your elevation. There is no air adjustment to make. Install a manometer or a gas pressure gauge with a 0 - 10" wc. range in the ¼" plugged tapping located on any one of the manifold pipes below the firebox door. **NOTICE** Be sure the gas pressure is 4.5" wc. or less when the boiler is firing. If not, back off on the main gas pressure regulator until it is 4.5" or less.
19. Check the main and pilot burner flames visually through the firebox door viewport. The main burner flame should have bluish cones near the burner ports. The major portion of the flame should be a luminous orange-yellow with only minimal yellow tips reaching the tubes. The pilot flame should be strong and stable.
20. Using a multimeter with the proper ranges, check both the pilot flame signal strength and the main flame signal strength and record for future reference. Make sure they are in the proper range for reliable operation as given in the flame safeguard cut sheet. **NOTICE** Do not attempt to bend the flame rod into the more "visible" part of the pilot flame or you will crack the porcelain insulator. The pilot burner's visible flame represents only 10% of the total flame current being generated.
21. If the burner is more than single stage fire, be sure all the stages properly ignite or modulate. Be sure all aquastats or pressure controls respond correctly as the system heats up.
22. Check the low water cut-off(s) to verify that they will shut the burner down in the event of low water.
23. As the system heats up, re-tighten the headplate bolts uniformly. There is no specific torque requirement. Tighten from the centers toward the corners making sure all the bolts are moderately tight when finished. If handholes are supplied make sure the crab nut is snug as well.

START-UP

24. Considerable condensation will occur in a cold firebox and may be observed for several minutes after start-up. Also, some sweating from the refractory may be noted. This is normal and will stop after a few hours of operation.
25. For hot water boilers, check the boiler's pressure gauge with the system pump running and when it has reached operating temperature. If the expansion tank was correctly sized and is working properly, the pressure should only have risen slightly from when the boiler was cold.
26. Secure the boiler's electrical panel cover and make sure all other cover plates, enclosures and guards are in place.
27. Be sure the owner receives a copy of this O & M manual along with the detailed cut sheets of all safety and operating devices furnished with this boiler. Provide a copy of your start-up report to the owner as well.

OPERATION, MAINTENANCE AND SERVICE (See next page for Warrick Blink Codes)

1. Maintaining a Boiler Log and following the recommendations in this section will help your boiler operate at peak efficiency and reduce service calls.
2. For closed hot water heating systems the most important thing to avoid is fresh water make-up. At least once a month check the discharge piping from the boiler relief valve(s) and drain valve for any sign of leaks as well as around the boiler head gaskets, pump seal(s), valve packing(s), piping, etc. A water meter installed in the fresh water make-up line can alert you to leaks in inaccessible areas.
3. On hot water heating boilers verify the following when the system is at or near operating temperature: The boiler pressure gauge should read well below the boiler's relief valve set pressure. The boiler's temperature gauge should not read below 155° F.

Single Channel Design(Newest design)

Fault Code(Blinks)	Fault mode	Possible Remedies
0	NO FAIL	
1	NOISY SWITCH DETECTED	For Manual Reset or Test Mode Option only. Check for faulty/intermittent switch, intermittent wiring
2	MANUAL MODE WRONG RESET STATE ON POWER UP	Check for faulty or unconnected Manual Reset Switch or open circuit wiring of this switch circuit.
3	AUTO MODE WRONG RESET STATE ON POWER UP	Ensure Reset 1 and Reset 2 (Reset) Terminals are unconnected.
4	STUCK RESET SW INPUT WITH TEST MODE DISABLED	Check for faulty or unconnected Reset Switch or open-circuit/intermittent wiring of this switch circuit.
5	RESET INPUT STUCK	Check for faulty or unconnected Reset Switch or open-circuit/intermittent wiring of this switch circuit.
6	INVALID BOARD TYPE	Not serviceable - contact Gems factory for assistance.
7	INVALID S26 MODE CONFIG	Not serviceable - contact Gems factory for assistance.
8	Unused in single channel design	Not serviceable - contact Gems factory for assistance.
9	ILLEGAL POWER UP	Not serviceable - contact Gems factory for assistance.
10	TRIANGLE AMPLITUDE	Not serviceable - contact Gems factory for assistance.
11	TRIANGLE ZERO CROSSING	Not serviceable - contact Gems factory for assistance.
12	REFERENCE VOLTAGE LIMITS	Not serviceable - contact Gems factory for assistance.
13	CAPTURE EDGES OUT OF RANGE	Not serviceable - contact Gems factory for assistance.
14	Unused in single channel design	Not serviceable - contact Gems factory for assistance.
15	Unused in single channel design	Not serviceable - contact Gems factory for assistance.
16	Unused in single channel design	Not serviceable - contact Gems factory for assistance.
17	Unused in single channel design	Not serviceable - contact Gems factory for assistance.
18	Unused in single channel design	Not serviceable - contact Gems factory for assistance.
19	OUT OF RANGE 5 VOLT	Not serviceable - contact Gems factory for assistance.
20	Unused in single channel design	Not serviceable - contact Gems factory for assistance.
21	LLCO PROBE BELOW LOW LIMIT FAIL	Not serviceable - contact Gems factory for assistance.
22	HIGH PROBE BELOW LOW LIMIT FAIL	Not serviceable - contact Gems factory for assistance.
23	LOW PROBE BELOW LOW LIMIT FAIL	Not serviceable - contact Gems factory for assistance.
24	Unused in single channel design	Not serviceable - contact Gems factory for assistance.
25	Unused in single channel design	Not serviceable - contact Gems factory for assistance.
26	HP ZERO CROSSING	Possible excessive system noise. Ensure system wiring effecting control does not have noisy wire runs in wiring bundle. Contact Gems factory for assistance.
27	LP ZERO CROSSING	Possible excessive system noise. Ensure system wiring effecting control does not have noisy wire runs in wiring bundle. Contact Gems factory for assistance.
28	LLCO ZERO CROSSING	Possible excessive system noise. Ensure system wiring effecting control does not have noisy wire runs in wiring bundle. Contact Gems factory for assistance.
29	WRONG FIRMWARE VERSION DETECTED	Not serviceable - contact Gems factory for assistance.
30	EEPROM CRC ERROR	Not serviceable - contact Gems factory for assistance.
31	RAM EEPROM VERIFY ERROR	Not serviceable - contact Gems factory for assistance.
32		
33	INTERNAL WDT FAILURE	Not serviceable - contact Gems factory for assistance.
34	DIO TEST FAILURE	Not serviceable - contact Gems factory for assistance.
35	POST RAM TEST FAILURE	Not serviceable - contact Gems factory for assistance.
36	PROGRAM COUNTER TEST FAILURE	Not serviceable - contact Gems factory for assistance.
37	PERIODIC RAM TEST FAILURE	Not serviceable - contact Gems factory for assistance.
38	POST CPU REGISTER TEST FAILURE	Not serviceable - contact Gems factory for assistance.
39	HARDWARE COMPARATOR FAILURE	Not serviceable - contact Gems factory for assistance.
40	DIRECT RELAY DRIVE FAILURE	Not serviceable - contact Gems factory for assistance.
41	FLASH CHECKSUM ERROR	Not serviceable - contact Gems factory for assistance.
42	POST FLASH CHECKSUM ERROR	Not serviceable - contact Gems factory for assistance.
43	PROB MINDER VALUES OUT OF RANGE	Not serviceable - contact Gems factory for assistance.
44	WRONG INSTRUCTION DECODING	Not serviceable - contact Gems factory for assistance.
45	TOO FAST INTERRUPTS	Not serviceable - contact Gems factory for assistance.
46	TOO SLOW INTERRUPTS	Not serviceable - contact Gems factory for assistance.
47	LAST FAILCODE PLUS 1	Not serviceable - contact Gems factory for assistance.

OPERATION, MAINTENANCE AND SERVICE

4. On hot water heating boilers check the low water cut-off operation once a month. If you have a float type low water cut-off, quickly open the ball valve beneath it while the boiler is firing. The main burners should go off. Close the ball valve and reset the low water cut-off (if required). The boiler should attempt to relight. If you have a probe type low water cut-off, hold in the "test" button for about six seconds while the boiler is firing. The main burners should go off during this time. The boiler should not attempt to relight until you push in the reset button.
5. Some low pressure steam boilers are installed in closed loop heating systems that operate on gravity return without a return tank or feed pump. In most of these cases there is no chemical water treatment taking place. If so, it is strongly recommended that you use soft water make-up and install a water meter in the make-up line. Check the low water cut-offs once a month but otherwise do not blowdown the boiler on a regular basis.
6. Most low pressure steam boilers and all high pressure steam boilers operate to some degree in an open system. Refer to page 9, paragraph 3 of this manual for waterside maintenance recommendations.
7. If you notice flue gas temperatures are going up (see page 7, para. 19) it might be time to clean your tubes. It is neither difficult nor expensive to waterside clean a Rite Boiler and doesn't require chemicals. You will need a couple of headplate gaskets and one or two heavy duty tube brushes which can be purchased from your local authorized Rite Representative. You will need to remove the front and rear headplates, or simply swing them open if they are hinged from the factory, to gain complete waterside access. Most boilers can be cleaned and put back into operation in half a day. See Figures 7-10 on pages 16-17.

OPERATION, MAINTENANCE AND SERVICE

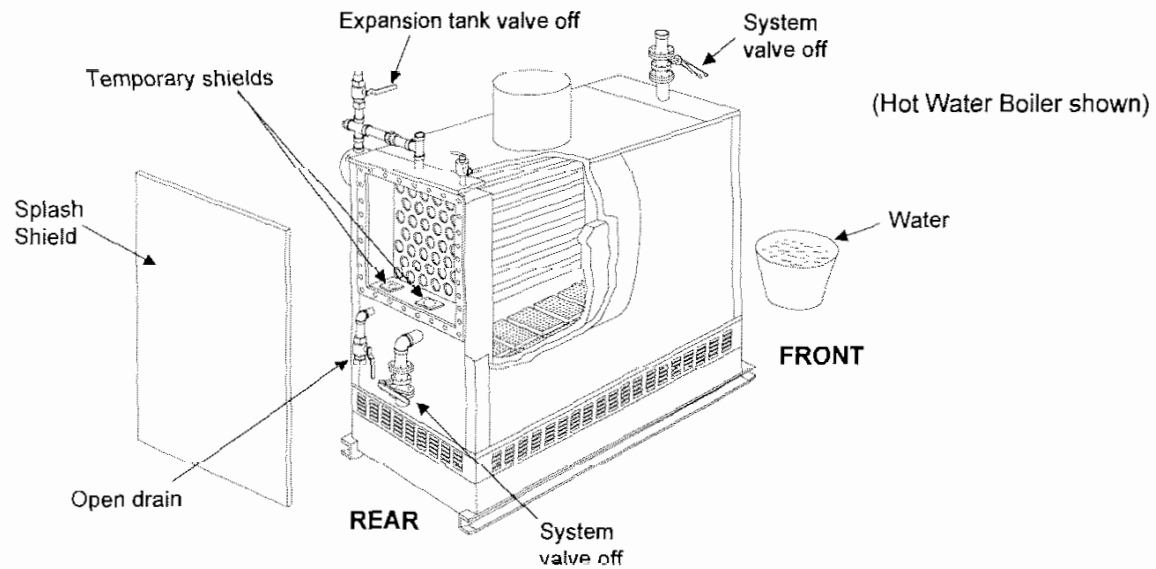


Figure 7

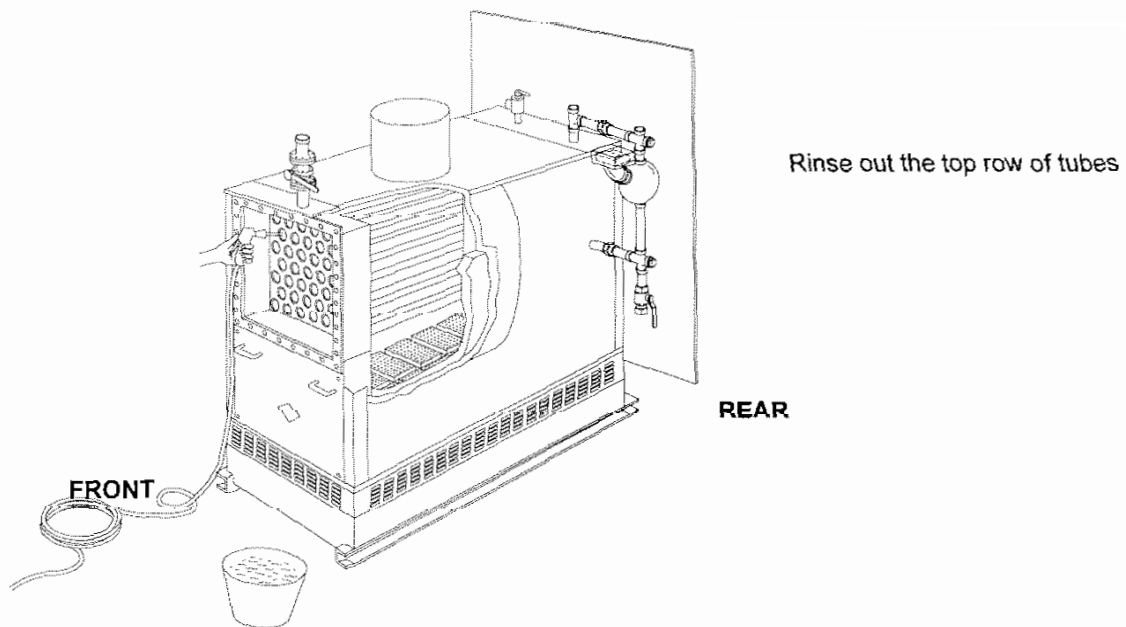
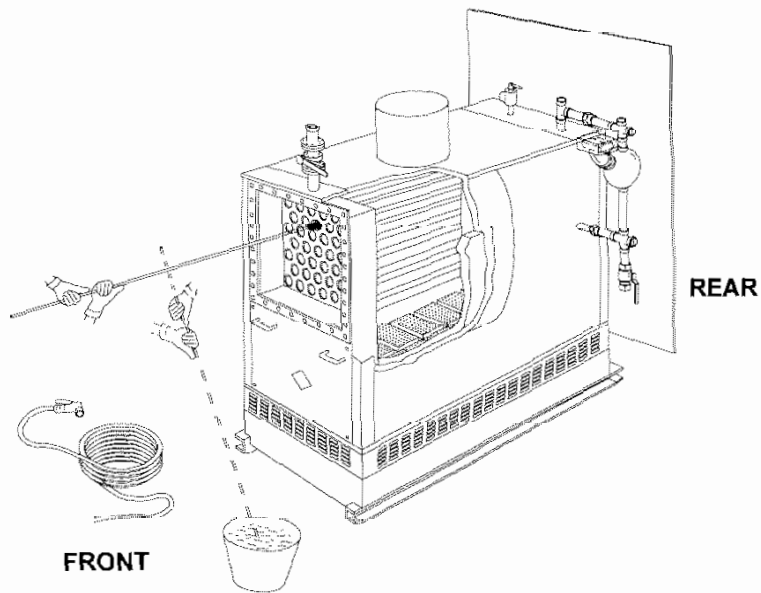


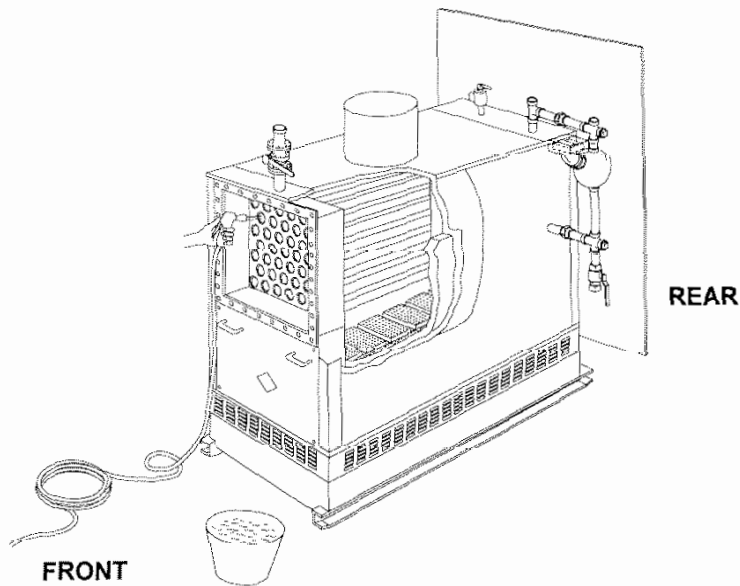
Figure 8

OPERATION, MAINTENANCE AND SERVICE



Brush out the top row of tubes, making two full passes per tube. Because mud or scale will load up the brush, dip the brush into a bucket of water after each pass.

Figure 9



Rinse the top row of tubes out again after brushing. Repeat this process one row at a time until all tubes are clean.

Figure 10

OPERATION, MAINTENANCE AND SERVICE

8. The following chart shows efficiency loss due to scale in the tubes and applies to all boilers:

SCALE THICKNESS (IN INCHES)	EFFICIENCY LOSS
1/64"	4%
1/32"	8%
1/16"	12%
1/8"	18%
3/16"	27%

It pays to have a clean boiler. It pays to have a boiler that's easily cleaned!

9. On steam systems check the steam traps regularly. Steam loss through stuck open traps can be staggering and yet hard to find since a failed trap doesn't look any different on the outside from a good trap. If the vent pipe off the condensate return tank is blowing a continuous plume of steam, chances are one or more traps have failed open.
10. On steam boilers sometimes the feed pump is on but the water level won't rise in the sight glass until the pressure drops. If this happens, chances are the check valve(s) between the boiler and the pump have failed. For this reason Rite recommends two spring loaded check valves piped in series in the boiler feed line after the throttling valve (if used).
11. A steam boiler that is shut off and cooling down will eventually draw a vacuum. Usually this vacuum is broken by air seeping in through the gauge glass packing on the boiler's water column. If not, the vacuum can be strong enough to pull water out of the condensate return tank and flood the boiler. A full gauge glass in the morning is an indication of this. If this becomes a problem, a vacuum breaker of the proper rating can be installed by adding a tee in the boiler's control piping.
12. On steam boilers check the low water cut-off(s) and feedwater operation once a month. At least once a year remove all low water and pump start/stop probes and remove any scale formations from the sensors. If a float chamber is used, open it up and be sure the float is in good condition, check the linkage to it to be sure it moves freely up and down and clean out all sediment in the bottom of the float chamber and lower equalizing line into the boiler. If a water column is used, remove all plugs in crosses above and below and rod out any sediment in the chamber as well as the lower equalizing line into the boiler. Be sure water gauge glass valves are not

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blocked with sediment. A buildup of sediment in the water column or float chamber is an indication of not blowing down these devices often enough. The leading cause of boiler failure is improperly maintained low water cut-offs.

13. On a steam boiler, clean the inside of the gauge glass while the boiler is on line following this method: **DANGER** Always wear safety glasses when working on or around gauge glass:
 - 13.1 Fill a cup with household ammonia.
 - 13.2 Close the top and bottom gauge glass valves. Open the drain valve at the bottom of the lower gauge glass valve.
 - 13.3 Crack open the top gauge glass valve until steam blows all the water out of the drain line and the glass contains only steam.
 - 13.4 With a very gentle flow of steam out of the drain line, hold the cup of ammonia up to the end of the drain line so steam bubbles up through it.
 - 13.5 Close the top gauge glass valve. Steam will condense in the glass causing a vacuum. The resulting contraction will suck the ammonia up into the gauge glass. Repeat until the glass is clean.
14. **“LAY-UP”** of an idle **hot water heating boiler** over the summer basically involves turning the boiler off. Do not drain the boiler but do leave the automatic pressure regulator fill valve open to maintain pressure in the system. The system pumps should be run a few minutes at least once a month to be sure they don't seize up. Fire the boiler up at least once before the heating season to be sure there are no problems.
15. **“LAY-UP”** of an idle **steam boiler** can be either “wet” or “dry” depending on how long it will be out of service. Either way, be sure the tubes are clean first.
 - 15.1 A **wet lay-up** is recommended if the boiler will be out of service for 3 months or less. If there is any possibility of freezing add glycol to the boiler water. Add chemicals as recommended by your water treatment company to the condensate in the return tank. Caustic soda at a concentration of 450 PPM with an oxygen scavenger such as sodium sulfite at 200 PPM is often used for this purpose.

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Override the boiler's feed pump circuit and flood the boiler up to the steam nozzle outlet. Close the steam header valve and turn the feed pump off when the boiler's pressure gauge reaches 5 PSIG. If the check valves are holding and all air is vented out of the boiler up to the steam header valve, this pressure should hold.

- 15.2 A **dry lay-up** is recommended if the boiler will be out of service for more than three months. Completely drain the boiler after making sure the boiler feed pump is electrically disconnected. Tightly close the main steam header valve and water feed valve(s). Open up both headplates. Soak a rag in WD-40 and swab it down each tube, coating the insides. Spray or wipe down the complete steam drum chests at each end with WD-40 as well. To prevent condensation from forming in the electrical panel, keep the control circuit energized and turn all the boiler's manual gas cocks to the off position. Before putting back into service, swab tubes out with clean rags and wipe residual WD-40 off steam drum surfaces.
16. The boiler's refractory and insulation should last many, many years provided the boiler has been: a) Operated with return water temperatures above 140° b) The boiler's outer sheet metal casing seams have stayed caulked, c) Long term tube leaks have not caused refractory to become water saturated. You should not consider changing out refractory unless sections of the panels are falling (or threatening to fall) into the burner bed or the sheet metal sides of the boiler are showing signs of heat discoloration.
17. The cast iron burners should require no maintenance for the life of the boiler. Once every couple of years the tops of the burners should be vacuumed clean of any incidental refractory particles and the burner ports checked for deterioration due to excess heat - the latter a sign of overfiring that must be corrected. Look through the boiler's firebox door viewport when all the burners are on. Note the position of any burners that exhibit long, yellow lazy flames and then shut the boiler off. Remove only those burners and venturis and clean off the top of the brass orifices below. A partially obstructed orifice will cause a lazy yellow flame.
18. Most boiler shutdowns can be traced by referring to the wiring diagram inside the boiler's electrical panel. If your boiler is equipped with a Rite Lite Panel, it has the following lights to help you: Power On, Limits Proven, Call for Heat, Main Fuel, Flame Failure and Low Water. If your boiler does not have a Rite Lite Panel, remove the cover from each limit

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beginning with the first limit shown after the burner switch on the diagram and check with a voltmeter until you find the one that is locked out. After correcting the problem, manually reset the switch. **DANGER** Electrical work should be carried out by qualified electricians only.

19. If your boiler is off due to flame failure it will be indicated on the Rite Lite Panel or a small LED light on the front of the flame safeguard control. Flame failure lockouts are difficult to solve since they can happen sporadically and for a variety of reasons. A few of the more common causes and cures are listed below:

19.1 PROBLEM: LACK OF SPARK

WHAT TO CHECK FOR: Remove firebox door and pilot burner windshield (if supplied) for visual confirmation that no spark is present during the Pilot Trial for Ignition (PTFI). If no spark, proceed as follows: Check for grounding of the 6000V ignition circuit including carbon arcing between the tip and post of the pilot burner and a wet or cracked ignition porcelain insulator. Check for broken, cracked or frayed ignition wire by sliding back the heat shield sleeving over the ignition wire's point of connection at the pilot burner. Make sure the point of connection at the ignition transformer's output post is sound. Make sure the primary side of the transformer is receiving 120VAC during PTFI. Check for a faulty ignition transformer using a spare piece of insulated wire and checking the high voltage output the same way you would an ignition wire off a car's distributor.

CORRECTION: Replace defective parts. Dry out wet pilot assembly with mild heat from a small propane torch. When ordering parts, always give the boiler model and serial number to your Rite Representative.

19.2 PROBLEM: SPARK BUT NO PILOT

WHAT TO CHECK FOR: Install a 0"-35" wc gas pressure gauge in the plugged pipe tee located near the main gas cock and confirm that the supply gas pressure is between 7" and 14" wc (see page 11, para. 5). Excessive use of pipe dope can flow across the inside of the pilot port boss located on the upstream side of the main gas cock and block the port hole. Verify that during PTFI there is an adequate flow of gas through the pilot valve by loosening the pilot tube ferrule nut

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and temporarily removing at the valve. Check for breaks or kinks in the pilot tubing-especially at the connections. Check that the vent on top of the pilot regulator is not plugged or blocked. Check that the pilot burner orifice is not plugged or blocked.

CORRECTION: Restore supply gas pressure to proper range. Remove pilot gas train and clean pilot side tap hole if necessary. Open the vent on top of pilot regulator if necessary. Replace pilot valve if it receives 120VAC during PTFI and fails to open. Replace pilot regulator if defective. Replace pilot tubing and fittings if necessary. Remove and clean pilot orifice with a strand of wire no larger than .024". **NOTICE** Always replace defective gas valves and regulators, do not attempt to repair them.

19.3 PROBLEM: PILOT BUT NO MAIN FLAME

WHAT TO CHECK FOR: Weak pilot flame. Pilot flame burning under the ground shield only-does not carry around front to pilot burner tip. Check flame signal strength with multimeter and see that it is within flame safeguard's normal operating range (Refer to current flame safeguard spec. sheet; as of 1/98 Fireye's flame safeguard control range is 6-18VDC and Honeywell's range is 1.5-5VDC). Check that the gas pressure from the pilot valve is between 3" (minimum) and 8" wc. Check for grounding of the flame rod circuit including carbon arcing between the flame rod and ground and a wet or cracked flame rod porcelain insulator. Check for broken, cracked or frayed flame rod sensing wire by sliding back the heat shield sleeving over the flame rod wire's point of connection at the pilot burner. Make sure the pilot flame is **off** before the PTFI cycle begins.

CORRECTION: Pilot flame should burn medium hard with a bluish-orange color. Clean partially obstructed pilot burner orifice with a strand of wire no larger than .024". Replace defective pilot burner if pilot flame does not carry around toward the tip of the flame rod. Raise pilot regulator outlet pressure if necessary. Dry out a wet pilot assembly with mild heat from a small propane torch. Replace defective flame sensing wire if necessary. Replace pilot valve if it fails to close when de-energized.

19.4 MISCELLANEOUS PROBLEMS AND CORRECTIONS: Electrical power to boiler not within flame safeguard specification. (Restore to proper range). Ambient temperatures or humidity not within flame safeguard specification (Make necessary corrections). Defective flame

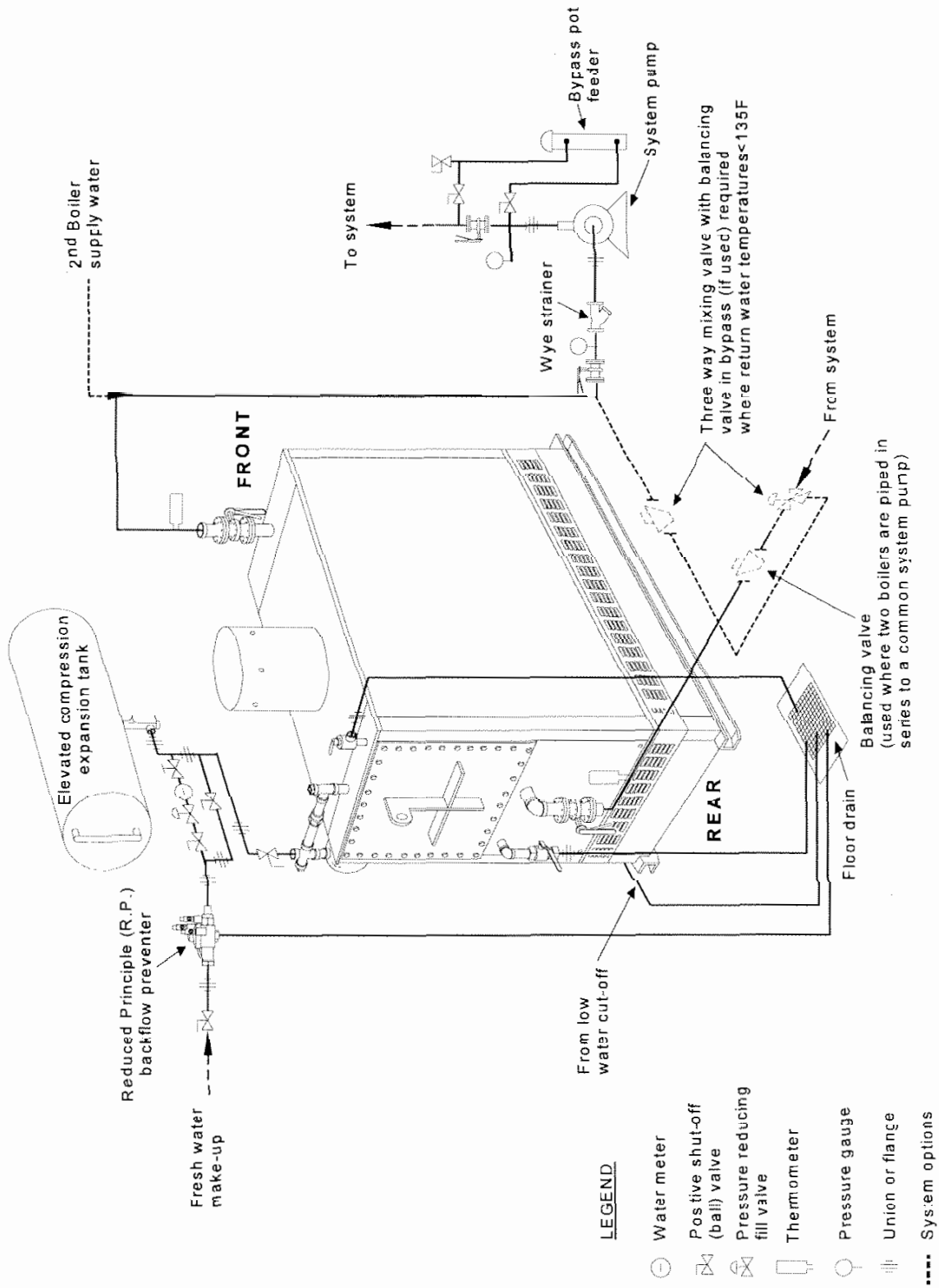
safeguard control (Bench test before replacing to confirm exact defective component. If a second boiler is operating nearby with exactly the same flame safeguard control installed temporarily replace it with the one you believe is defective). Unusual high winds or downdraft conditions (Extreme conditions may have to be waited out).

20. Gas train components are well protected from the weather and should last many years. They are maintenance free controls. Once a month you should check to see that when a call for heat has been satisfied the burners go off immediately. If your particular boiler was equipped with a normally open vent valve in the gas train, at least once a month check that no gas is being discharged through it when the boiler is firing and that some gas is discharged only briefly when the burners go off. If the boiler is equipped with motorized (hydromotor) gas valves, check once a month for hydraulic oil leakage from the actuator.
21. It is impossible to cover all potential problems or questions when it comes to operation, maintenance and service. The detailed cut sheets of the various components provided on your boiler may cover things not covered here. Relubing and refractory replacement have not been covered here since these repairs require trained boiler repair personnel to carry them out. Unless you are a skilled technician we highly recommend you call one when you spot a problem rather than attempt to repair it yourself. Above all else, use common sense.

Rite Hot Water Boiler

Recommended Piping Diagram for Close Loop

Featuring Compression Expansion Tank Hook-up and System Options



Rite Hot Water Boiler Recommended Piping Diagram for Closed Loop. Featuring Bladder/Diaphragm Expansion Tank Hook-up

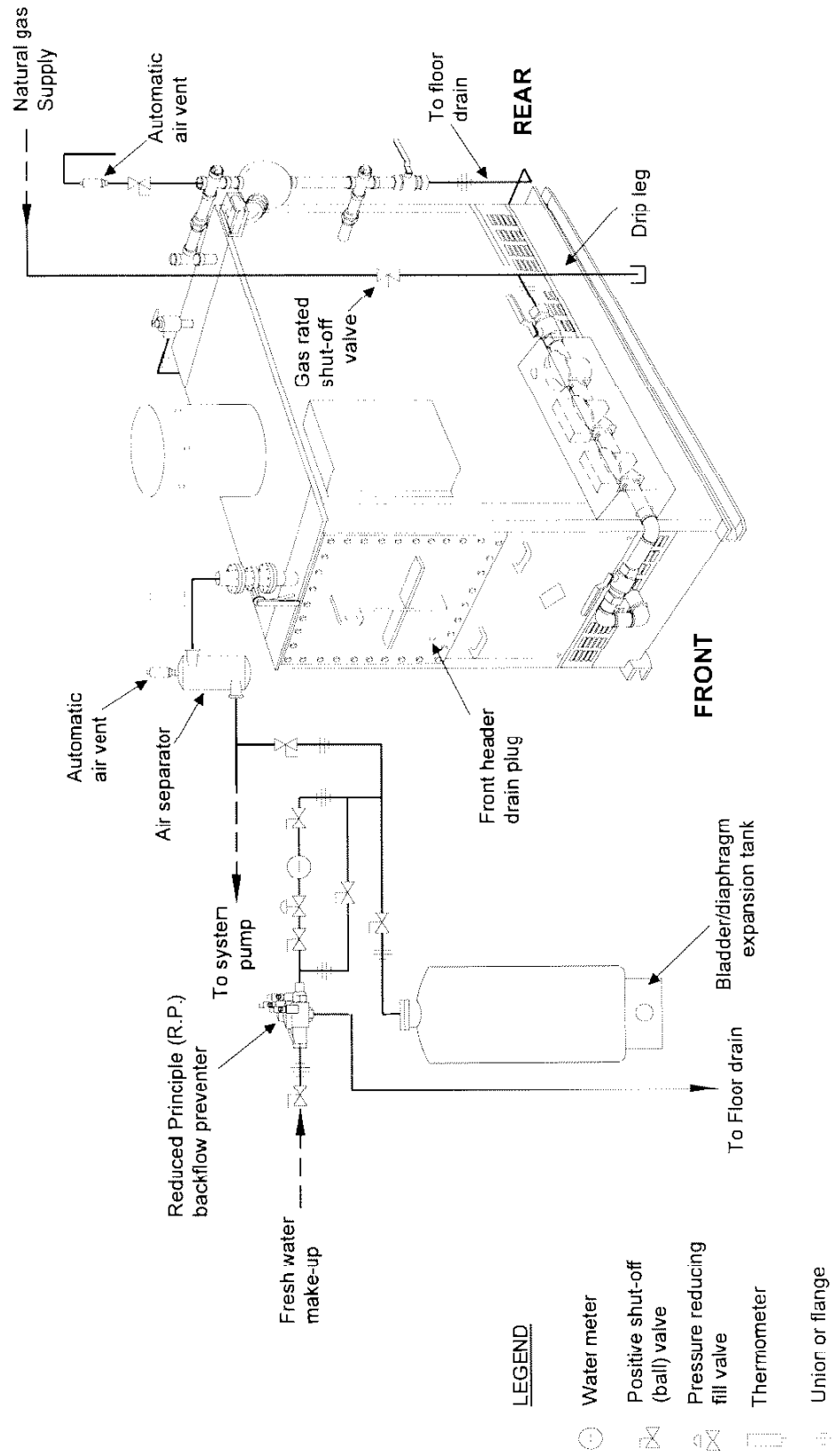


Figure 12

Rite Steam Boilers Recommended Piping for Low & High Pressure Steam Featuring Condensate Return Tank & Feedwater Piping

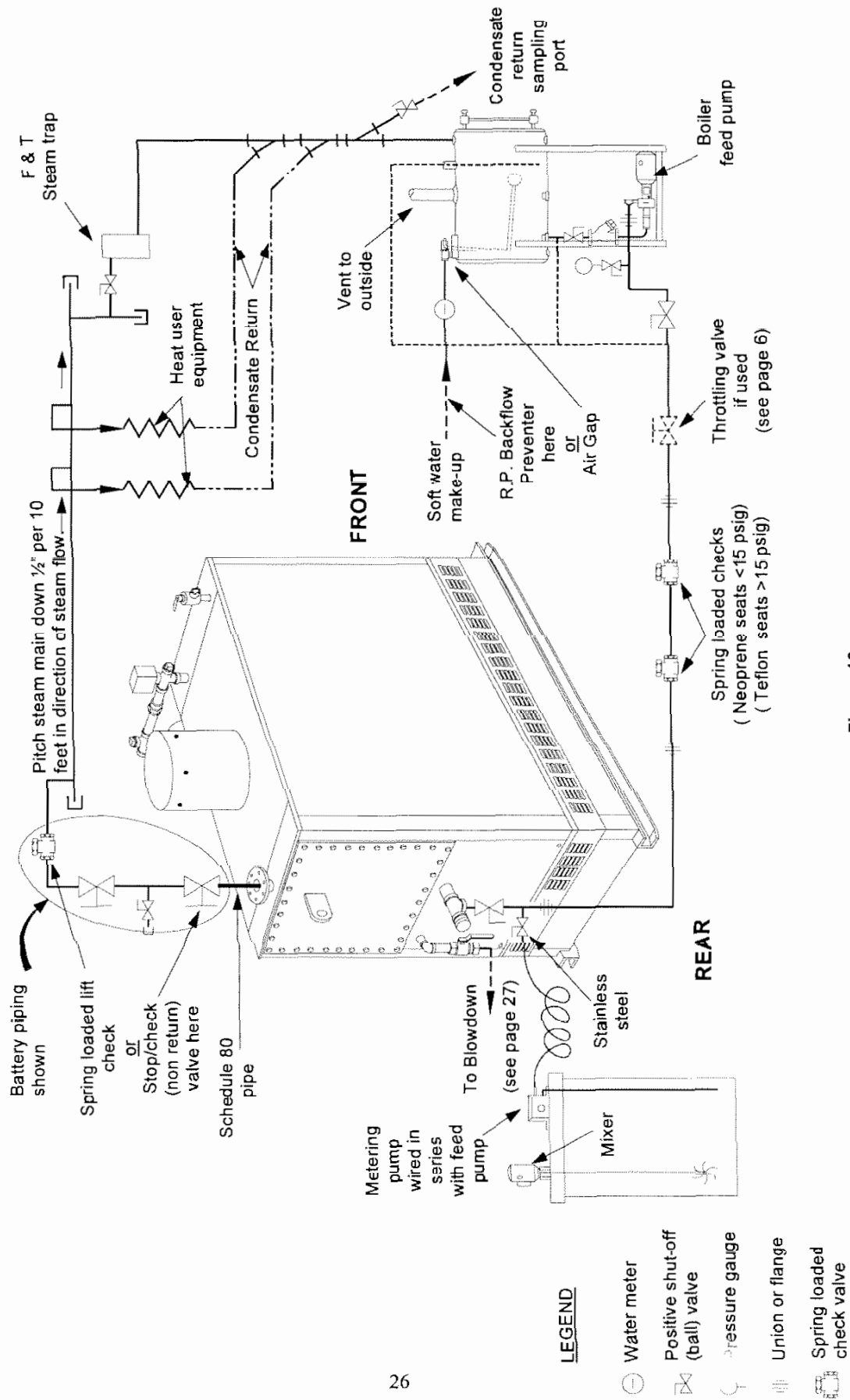


Figure 13

Rite Steam Boilers Recommended Piping for High Pressure Steam Boilers Featuring Blowdown & Safety Relief Valve Piping

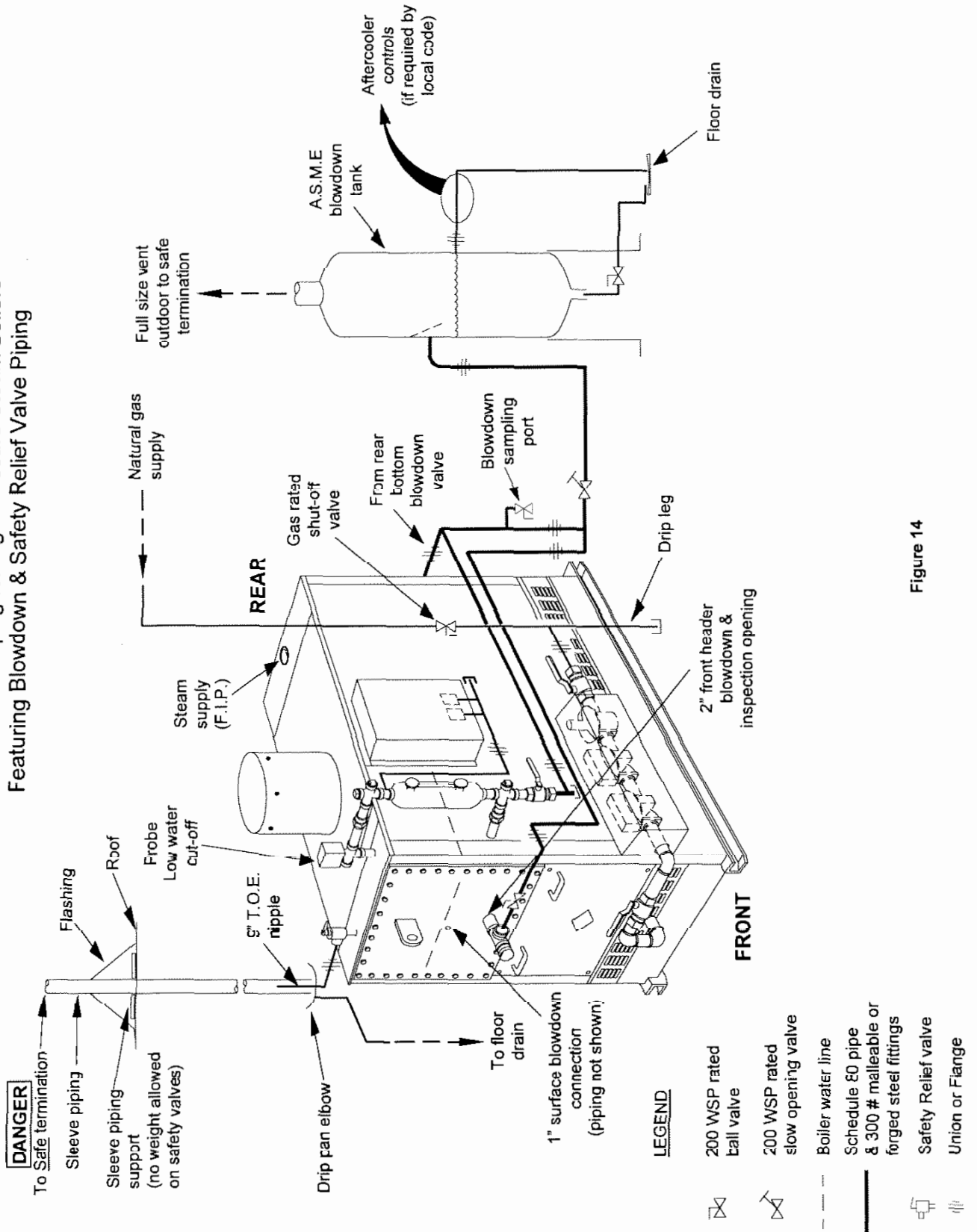


Figure 14

Rite Steam Boilers
Recommended Piping for Low Pressure Steam Boilers(15psig)
Featuring Blowdown Piping & Safety Relief Valve

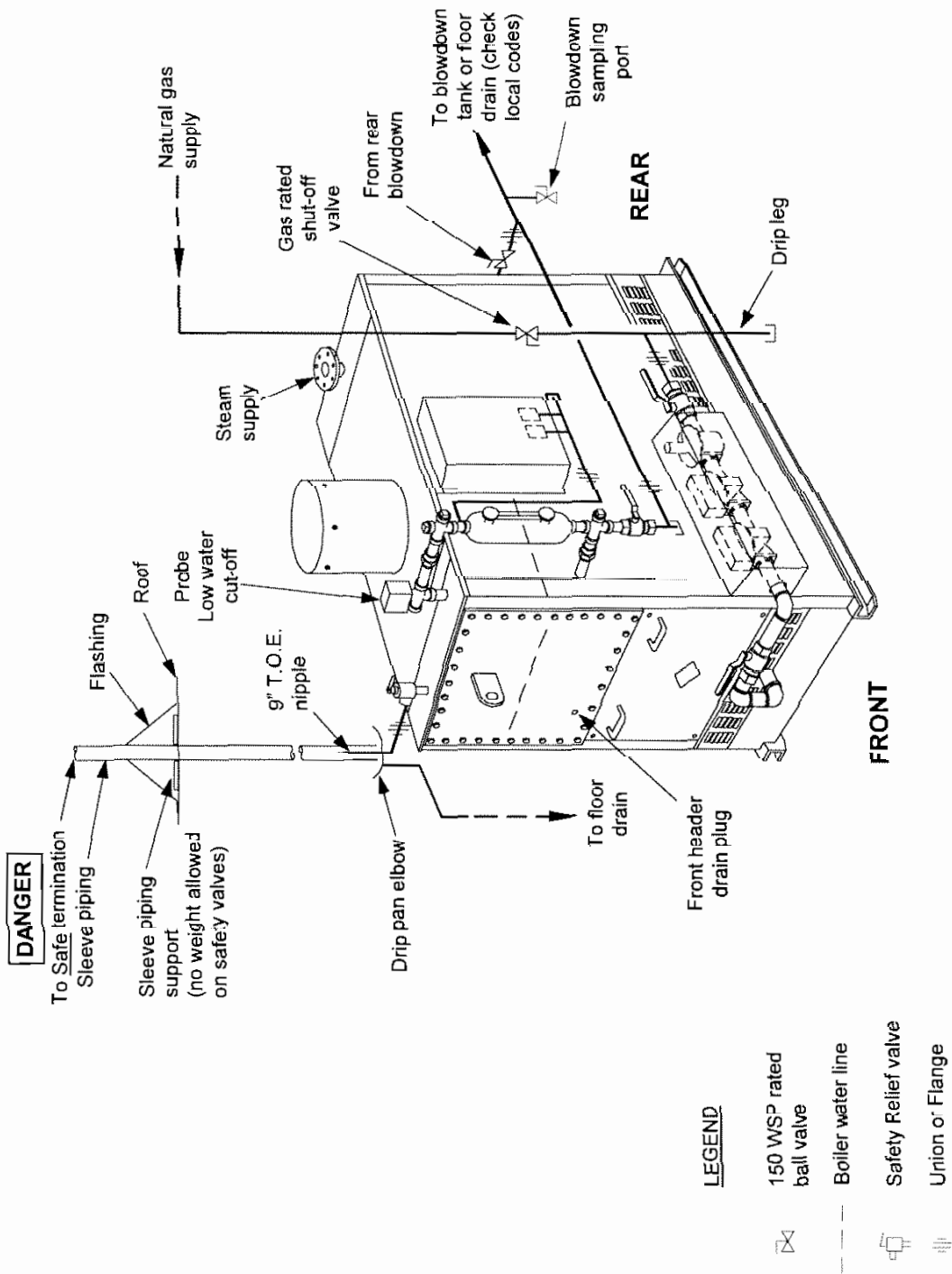


Figure 15

Rite Steam Boilers Recommended Piping for Low Pressure Steam Boilers(15psig) Featuring Hartford Loop*

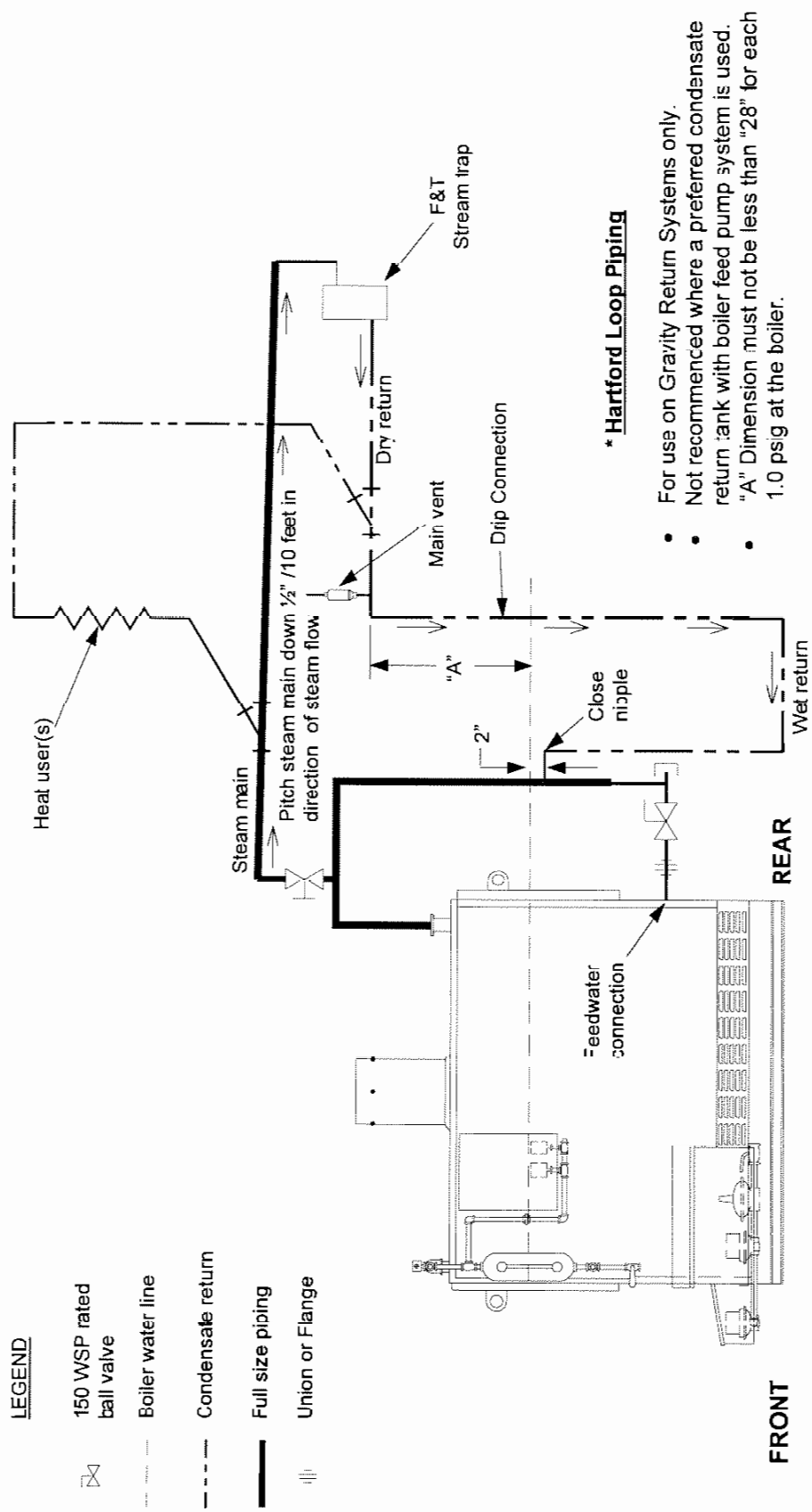
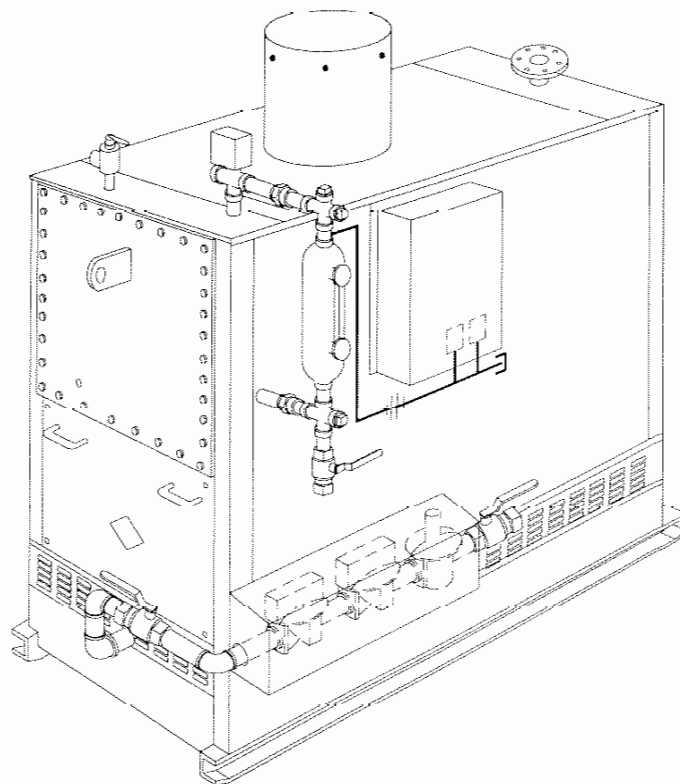


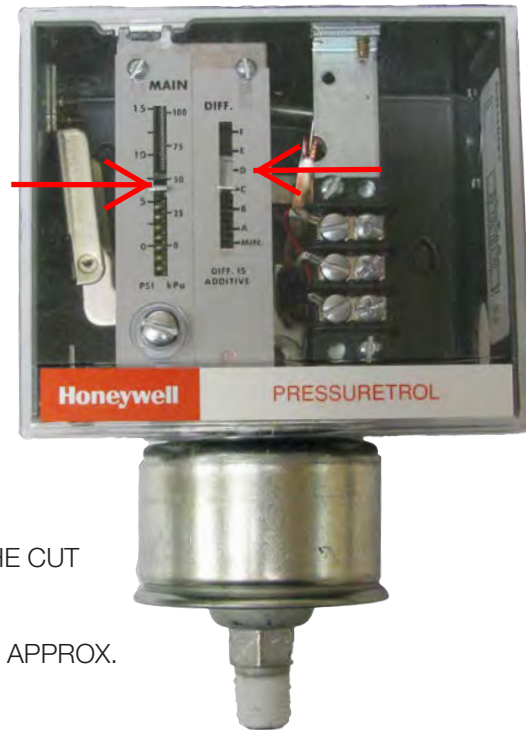
Figure 16



WARRANTY: RITE Engineering and Manufacturing Corporation warrants boilers of its manufacture and bearing its nameplate, when not misused or neglected, to be free from defects in workmanship or material. The company's obligation under this warranty is limited to repairing or replacing at its factory any device or part thereof which shall, within one year delivery to the original purchaser, be returned to the factory, transportation charges prepaid, and which on examination shall prove to have been defective. The company assumes no liability for consequential damages of any kind; the purchaser by acceptance of this equipment shall assume all liability for the consequences of its use or misuse by the purchaser, his employees, or others. A defect in the meaning of this warranty, in any part of said equipment, shall not, when such part is capable of being repaired or replaced, operate to condemn such equipment. This warranty is expressly in lieu of other warranties, obligations or liabilities, expressed or implied by the company or its representatives. All statutory or implied warranties, other than title, are hereby expressly negated and excluded.



SETTING THE L91B 1035 PRESSURETROL



SETTING THE L91B 1035 PRESSURETROL

L91B MAIN SCALE SETTING IS SET AT APPROX. $\frac{1}{2}$ OF THE CUT OUT SETTING ON THE PA404A.
(EACH LINE EQUALS APPROX. 2.5PSI)

L91B DIFFERENTIAL SCALE EACH LETTER REPRESENTS APPROX. 1.8 PSI INCREASE IN DIFFERENTIAL.
(A TO B = 1.8, A TO C = 3.6, A TO D = 5.4)

THE TOTAL OF MAIN PLUS DIFF. MUST BE LESS THAN THE SETTING ON THE PA404A.

EXAMPLE: PA404A SETTING IS 12PSI

L91B

MAIN SCALE SET AT $\frac{1}{2}$ OF 12 = APPROX. 6.25
(HALF WAY BETWEEN 5 AND 7 ON THE SCALE)
DIFF. SCALE IS SET AT LETTER D

$(1.8+1.8+1.8 = 5.4)$

TOTAL IS $6.25 + 5.4 = 11.65$ WHICH IS LESS THAN 12 PSI ON THE PA404A.

WARNING:

THE PRESSURETROL SETTINGS FOR MODULATION FOR HIGH FIRE OR LOW FIRE CANNOT EXCEED THE UPPER OR LOWER RANGE OF THE PA404A CONTROL SETTINGS. (A VALUE LESS THAN 0 (ZERO) IS NOT ALLOWED).

EXAMPLE:

IF THE PA404A IS SET AT 9PSI
THEN THE L91B MAIN WOULD BE SET AT 4.5
BUT THE DIFFERENTIAL CAN ONLY BE SET AT C MARK SINCE
 $4.5 + (1.8+1.8) = 8.1$ PSI LESS THAN 9 PSI
 $4.5 - (1.8+1.8) = .9$ PSI GREATER THAN 0 PSI

$4.5 - (1.8+1.8+1.8) = -0.9$ PSI NOT ALLOWED IF IT WAS D

CHECKING THE CORRECT OPERATION OF THE MODULATING PRESSURETROL AND THE MOTORIZED VALVE.

AS THE PRESSURE IN THE BOILER LOWERS FROM THE SET POINT ON THE PA404A, THE MOTORIZED VALVE WILL BEGIN TO MODULATE OPEN TO HIGH FIRE POSITION AND THE OHM READINGS WILL INCREASE ON AN OHM METER CONNECTED BETWEEN THE W AND B TERMINALS IN THE L91B.

AS THE PRESSURE INCREASES THE OHM READINGS WILL DECREASE ON THE METER AND THE MOTORIZED VALVE WILL MODULATE CLOSED TO A LOW FIRE POSITION.

MID RANGE OHM READINGS ARE ABOUT 140 OHMS AT APPROX. 6.25 PSI PRESSURE.

Steam Boilers *continued*

Bolt Lubrication/Anti-Seize on High Pressure Steam Boilers

1. Before re-tightening the headplate bolts on a Rite High Pressure Steam boiler, follow these procedures so the bolts can be removed at a later date without galling or seizing.
2. Remove all bolts and inspect them for signs of wear, cross-threading, galling, etc. Any bolts with damaged threads must be replaced with Grade 8 bolts.



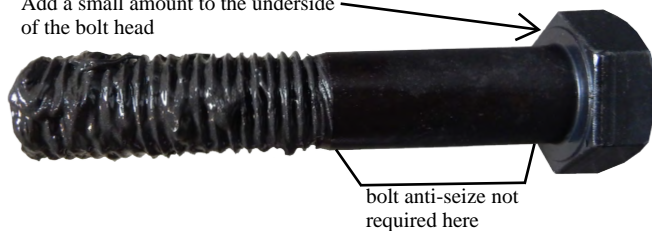
3. Chase all flange tappings with a 3/4-10 tap with an H-5 ground thread limit.



4. Coat all threads of the bolt with a smooth layer of Armite L-P 250 and add a small amount to the underside of the bolt head. The purpose of the Armite L-P 250 is to prevent oxidation of the bolt and flange threads.



Add a small amount to the underside of the bolt head



5. Bolts must be tightened **by hand** until the head of the bolt engages the head plate. If not, remove bolt and re-tap the hole. After all bolts are hand tight, back each bolt out several turns to ensure the anti-seize coats the leading and trailing threads. Re-tighten bolts and use an alternating torque pattern starting from the 4 center bolts (top, bottom, left side, right side) finishing at the corners. Repeat two more times until all bolts are uniformly snug. Fill boiler with water. If there are no leaks, bring the boiler up to steam pressure. Bolts have a tendency to "relax" when hot so check bolt tightness one more time after reaching operating pressure.

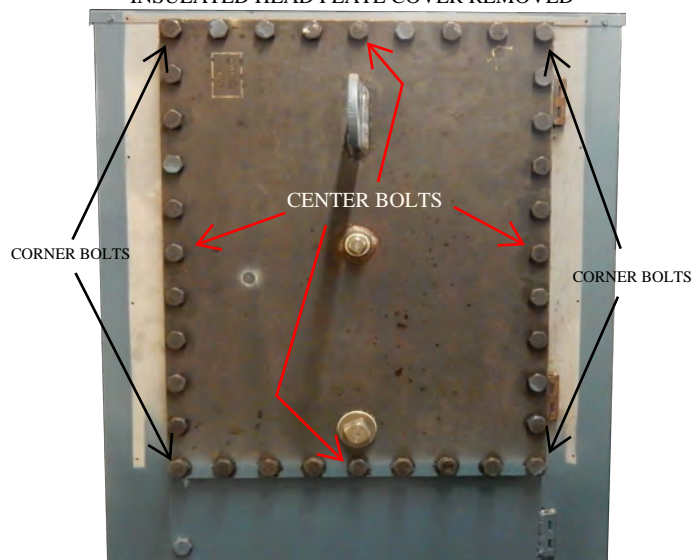


6. Failure to follow the bolt lubrication instructions can result in bolts that "seize up" the next time they are removed.



7. After the dressing and tightening procedures have been followed and no leaks have occurred after 2-3 hours at normal operating pressure, re-install the insulated head plate covers

INSULATED HEAD PLATE COVER REMOVED



INSULATED HEAD PLATE COVER INSTALLED

