



# Boiler Best Practices

2019 Washington Mint Convention



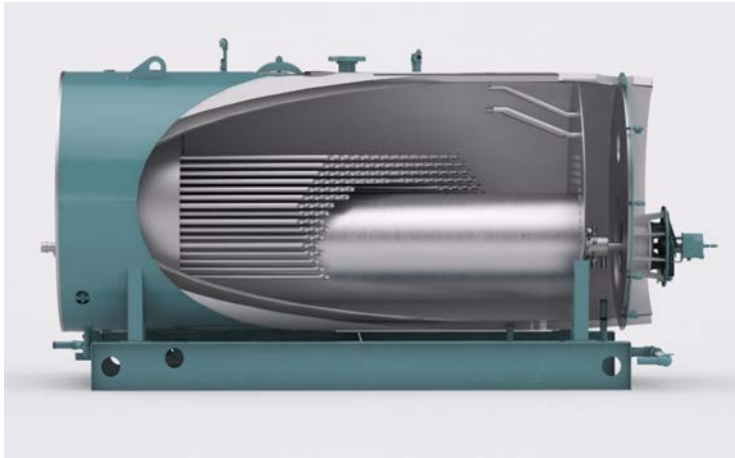
Presented by Jason Herbst



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# Basic Overview

For the purposes of this discussion we will keep the topic of confined to the Boiler/Burner proper, however knowledge of your system as a whole is essential for plant safety and optimum operation.



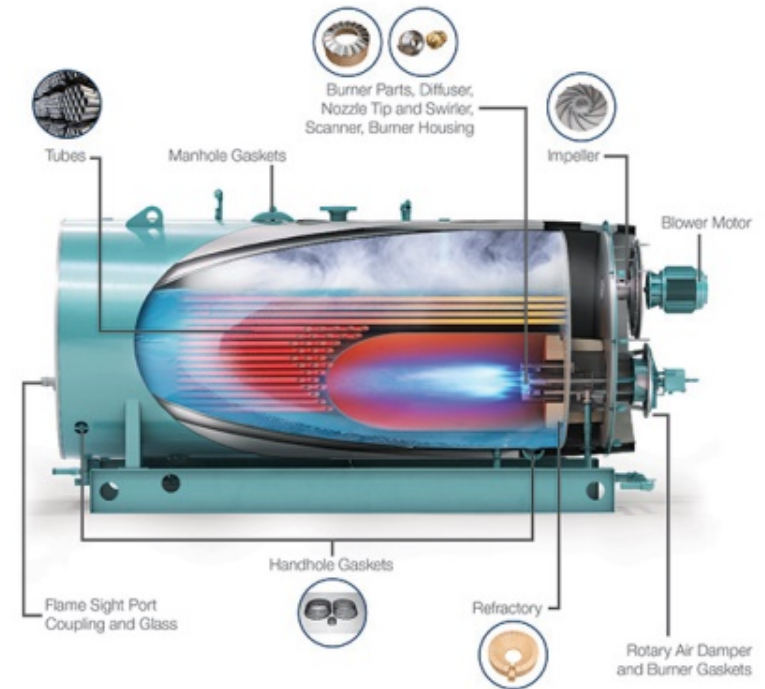
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# Basic Overview



1. Become Familiar with the Boiler
  - a. Components and controls
  - b. Boiler / Control Wiring
  - c. Boiler Sequence of operation
  - d. Flame Safeguard timing
2. Know the System
  - a. Operation of all devices and what they do
  - b. Any external wiring or control air systems
  - c. Any sequence of operation for Auxiliary components or systems



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# Basic Overview

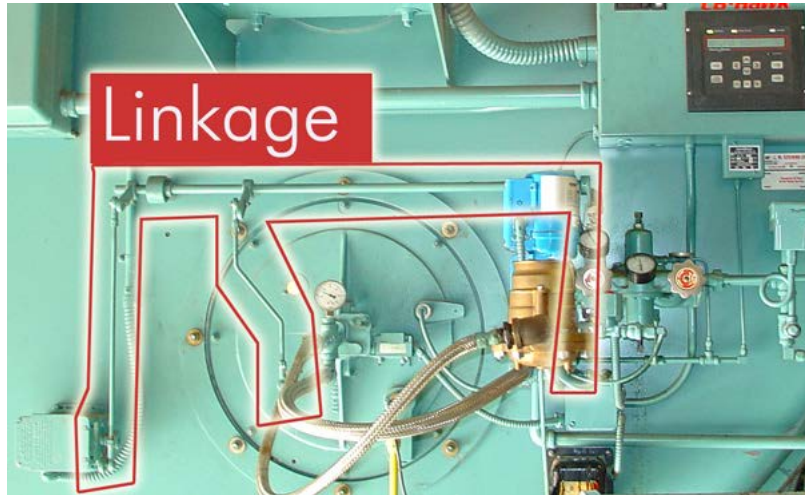
3. Keep Excellent Records
  - a. Insist and maintain boiler room logs
  - b. Review and keep water treatment logs
  - c. Review recommendations from the experts
  
4. Plan and Follow Good Maintenance Practices
  - a. Plan annual maintenance before harvest
  - b. Review boiler plant operations at the end of the season
  - c. Test safeties, often
  
5. Training



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# Basic Overview



Regular Visual & Mechanical Inspection:

1. Freedom of movement of individual mechanical controls
2. Condition of mercury tubes  
(should be bright and mobile, not dull and stringy)
3. Connecting piping, Check for leakage or plugging
4. Check set point settings of controls
5. Check condition of linkages



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# Basic Overview

6. Inspect the flame
7. Listen to the motors & pumps
8. Inspect pump strainers
9. Check for hotspots



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# Basic Maintenance Considerations

## Waterside Care

It is important to have and maintain a good water side care program for both Steam and Hot Water systems.

This is best done by consulting a water management professional and maintaining any testing and water Treatment program developed for your site.



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# Basic Maintenance Considerations

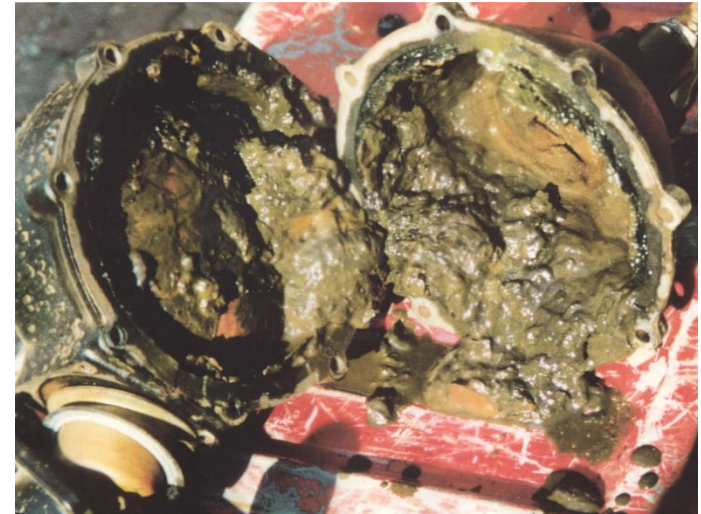
## Four Common Waterside Problems

1. Sludge – Soft deposits generally found in the bottom of the boiler or LWCO.

Sludge buildup can be caused by lack of or improper water treatment programs or inadequate bottom blow down of the boiler.

Most modern water treatment programs for boilers operating below 600 PSIG are designed to prevent the formation of sludge in the boiler. Any sludge buildup should be reported to your water treatment professional

If sludge buildup is found in your boiler it must be washed out using water.



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# Basic Maintenance Considerations



## Four Common Waterside Problems

2. Scale – Hard deposits typically found on surfaces of the waterside of the boiler or flaked off of the watersides and in the bottom of the boiler

Scale deposits are also caused by a lack of or improper water treatment.

Scale can cause:

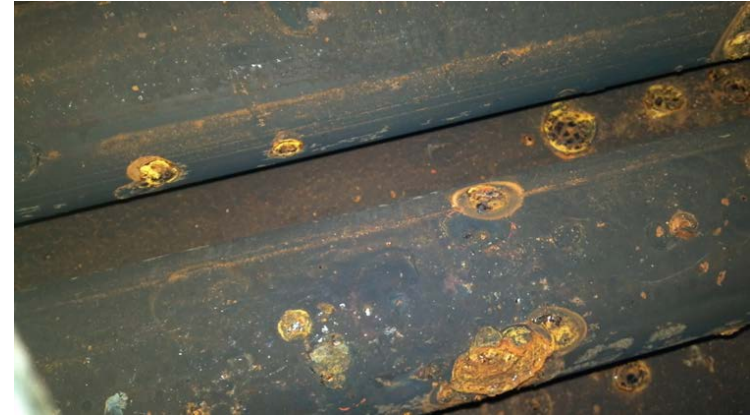
- a. Efficiency loss. Scale inhibits the transfer of heat
- b. Tube leaks due to deposits that get into the mechanical joints between tubes and tube sheets or drums
- c. Tube overheating, blistering, rupture.



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# Basic Maintenance Considerations



## Four Common Waterside Problems

3. Oxygen Pitting Corrosion – Localized oxidation of watersides  
This condition is caused by free oxygen in the boiler water.

Control of oxygen in the boiler is essential. In steam boilers the removal of 99%+ of oxygen from the feed water is by the use of a Deaerator. Any remaining oxygen that gets into the boiler can be controlled using the recommended dosage of your water treatment professionals recommendation of sulfite treatment.

This condition should be reported to your water management professional



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# Basic Maintenance Considerations

Figure 3.12

## PRIMING

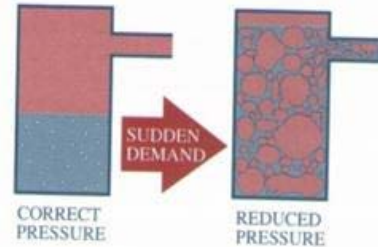
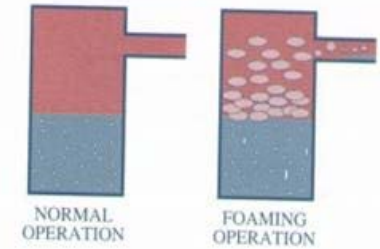


Figure 3.13

## FOAMING



## Four Common Waterside Problems

### 4. Wet Steam or Carryover

Can be caused By:

- Lack of or improper water treatment,
- High concentrations of solids in the boiler (improper blow down schedule),
- Sudden and excessive load increases causing boiler to evaporate more water than designed and exceeding the design velocity of the steam passing through the steam nozzle.
- Undersized steam piping at the boiler steam nozzle causing velocity of steam to be above design.



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# Basic Maintenance Considerations

## Boiler 'Lay - Up' methods

### 1. Wet Lay - Up

Recommended for short term lay - up of steam boilers lasting no more than 3 months.

- a. Add any water treatment products recommended by your water management professional
- b. Fill the boiler to capacity
- c. If available connect hose to vent and a bucket or barrel with water to contain any water from the boiler due to expansion and to supply water to the boiler due to any contraction of the boiler water
- d. Fire the boiler with the vent open to steaming temperature to drive off any entrained oxygen



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# Basic Maintenance Considerations

## Boiler 'Lay - Up' methods

1. Wet Lay - Up Cont.
  - e. Close all valves (except the vent valve with the hose attached)
  - f. If possible open a door in the last pass of the fireside break any induced draft causing condensation on the fireside
  - g. Make periodic checks of the water level in the expansion bucket and maintain water level.



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# Basic Maintenance Considerations

Boiler 'Lay - Up' methods

## 2. Dry Lay - Up:

Recommended for periods of more than 3 months and if freezing is a possibility during lay - up. Consult with your water management professional for the proper lay - up chemical for your particular situation.

It is important that the boiler has been completely drained and dried before introducing any moisture absorbing or corrosion control chemicals to the waterside of the boiler and closing all valves, hand holes and man ways.

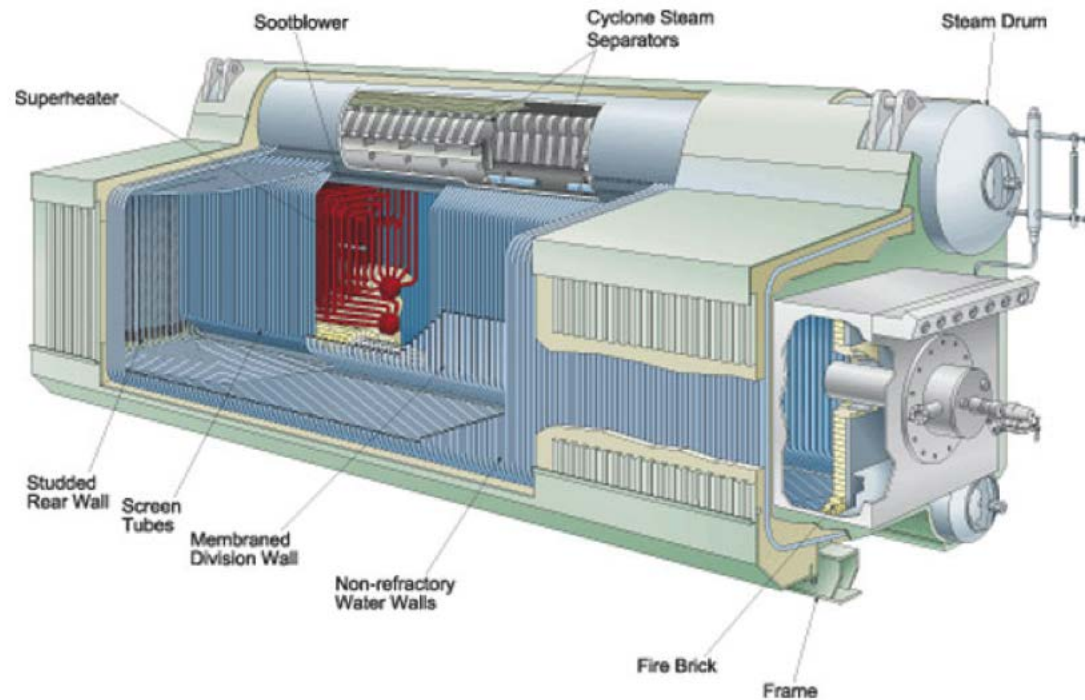
Periodic inspection of the humidity level in the waterside or status of any chemical is required.



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# Basic Maintenance Considerations



## Fireside Care

3 areas of concern on the fireside of the boiler:

1. Tube, Tube Sheet (Firetube) / Drum Connection and Furnace surfaces (Watertube)
2. Refractory
3. Gaskets



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# Basic Maintenance Considerations

## Fireside Care



1. Tube, Tube Sheet / Drum Connection, Furnace surfaces

Care should be taken to inspect these surfaces for any signs of soot build up, blistering, or 'pock marks' during inspections of the boiler and sooner if an unusually high stack temperature is encountered.

Unusually high stack temperatures can indicate the build up of soot on the fireside of the boiler. The build up of soot in a boiler causes loss of efficiency, A good rule of thumb to gauge this is for every 40°F increase in stack Temperature at a given fire rate = a loss of 1% in efficiency.



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# Basic Maintenance Considerations

## Fireside Care

1. Tube, Tube Sheet, Drum Connection, Furnace surfaces



Blistering and 'pock marks' on the fire sides could be an indication of excessive condensation of flue gasses causing corrosion on the fireside surfaces when the condensate comes in contact with the Sulfur or Nitric compounds found in flue gas. This can be controlled to a point by:

- a. On hot water systems set point can not be any lower than 170°F
- b. Setting pressure and temperature controls to limit cycling of boilers



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# Basic Maintenance Considerations

## Fireside Care

### 2. Refractory



Inspect the boiler refractory during inspection and repair or replace any loose or broken brick especially in the burner throat or any liner tile in the furnace of a fire tube boiler or any corner or tube seal refractory in a Water tube boiler. Any cracks of not less than 1/8" across can be calked using a good quality ceramic fiber caulking.



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# Basic Maintenance Considerations

## Fireside Care

### 3. Gaskets

Gaskets should be replaced on the fireside at each inspection. Each fire side gasket must be in good condition and compressed against the sealing surface. A leaking gasket on the fire side of the boiler can cause:



- a. Tramp air into the furnace inhibiting burner fuel air ratio control
- b. Hot gasses passing by and burning up the steel in the burner mounting, rear door (fire tube) or inner and outer case (water tube)
- c. Loss of efficiency due to bypass of flue gasses
- d. Leakage of flue gasses into the building



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# Opportunities for Improvement

- Combustion Tune Up
- Linkage Rebuild
- Linkage Elimination
- OEM Parts
- Reduce Cycling
  - Change operating conditions
  - Modify Controls



# Q&A





# Boiler Maintenance Strategies

**Thank you!**

Presented by Jason Herbst



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