

## TRIAD BOILER SYSTEMS, Inc.

### Section VII

#### GENERAL MAINTENANCE



**CAUTION:** Start with a review of the warnings, cautions, notes and NBBI recommendations found in Section I of this manual.

Maintain a clean boiler room. Provide "clean" water to the boiler. Maintain a planned program of proactive preventive maintenance.

**WARNING:** NEVER "dry fire" the boiler - operate the boiler and burner without the boiler being completely filled with water.



NEVER operate the boiler without a functional Low Water Cut Off control.

NEVER operate the boiler without a functional High Pressure Limit control.

NEVER reset a "tripped" manual shut-off without first removing the boiler from service, determining the cause of the problem and correcting the cause.

**WARNING:** NEVER operate the boiler without an ASME approved, steam rated safety relief valve matched for both BTU/hr and pressure relief values.



Test and inspect the relief valve at least annually. Replace defective valves immediately or as required by code. See Safety Relief Valve manufacturer's tag.

NEVER operate a boiler if the safety relief valve has discharged. If the safety relief valve has discharged, something is wrong. Immediately remove the boiler from service and have a trained service technician investigate and correct the problem.

**Warning:** "Blow-down" – flush – the Low Water Cut Off controls at least daily during service periods. Failure to thoroughly flush the controls can render them inoperative.



If the burner continues to operate during a blow-down, the boiler needs to be removed from service and the controls inspected immediately.

NEVER add water to an overheated boiler. This can cause an immediate conversion of the water to steam with an explosive increase in volume. Turn OFF the burner and allow the boiler to cool slowly.

NEVER fire a boiler without the turbulators installed in the fire tubes.

NEVER fire the boiler if the firebox or tubes have excessive buildup or there appears to be signs of water leakage in the combustion chamber. .

NEVER bypass any of the controls on the boiler, fuel train or burner. If a control is considered defective, REPLACE it before using the boiler/burner again.

NEVER fire a boiler above its rated input.

NEVER allow a boiler to be exposed to freezing conditions. If used outdoors, properly protect the system from the weather.

All TRIAD boilers are built to meet or exceed the Section IV ASME standard and are registered with the National Board to perform at a maximum of 15 psi at 250°F. The boilers and their controls are designed only for heating water.

NEVER expose a boiler to thermal shock. Thermally induced stress cycling can result in metal fatigue or failure. Maintain a minimum temperature differential between boiler feed water and vessel water. NEVER introduce "cold" water into a hot boiler. Boiler feed water should be a nominal 160°F before entering a hot boiler. NEVER exceed a maximum differential of 140°F. Thermal shock voids the boiler warranty.

In a steam system, good water quality and treatment are very important. The introduction of new water into a steam system also introduces oxygen (possibly with other dissolved gasses, minerals, particulates and organic material).

This can cause internal corrosion, scaling and fouling material to build up in the boiler and system. Establish a suitable boiler water treatment program to reduce oxygen, scale, sludge buildup, corrosion and to control ph.



Regularly verify that all ventilation, combustion air openings and louvers are clean and free of debris.

### **OPERATORS & TRAINING**

Operators should be trained in and develop a thorough familiarity of the system and its controls.

Operators should be trained in the use of fire prevention equipment.

Operators should review and become familiar with all manuals, diagrams and warnings related to the system, the boiler and the burner.

Written site procedures should be developed and be readily accessible to all operators.

A permanent log book should be maintained in the boiler room to record maintenance work, inspections, tests and other pertinent data.

Only a qualified service technician should make burner or system adjustments and perform heating season start up.

The boiler should normally operate on its own controls once it receives the "Call For Heat" signal. If the burner should fail to light after a "Call For Heat", a system malfunction has probably occurred. A qualified service technician should determine the problem and correct it before putting the boiler back into service.

### **PREVENTIVE MAINTENANCE – SUMMARY**

**NOTE:** Read the tag attached to the Safety Relief Valve -- FOLLOW THE MANUFACTURER'S INSTRUCTIONS COVERING INSPECTION, TESTING, AND REPLACEMENT.

**WARNING:** Protect yourself when testing Safety Relief Valves and performing blow-down of Low Water Cut-Off valves – hot water and steam will flow from the drain pipes. If the burner does not shut-off during blow-down procedure, remove the boiler from service, determine the cause and correct it before returning this boiler to service. .

Safety relief valves should be inspected and tested at the start of each service period and monthly during the service period.

During the annual boiler inspection and cleaning, remove the valve and check for deposits in the valve

and plumbing. If the valve has buildup, fails to operate or leaks, replace the valve only with an ASME approved steam relief valve of both the same pressure and BTU/hr rating. NEVER operate a boiler without a functional safety relief valve.

Under normal service conditions, replace the valve every three to five years

Blow-down valves should be inspected and tested at the beginning of each service period. Blow-downs should be performed at least daily during service period. See manufacturer's tag.

The boiler room area should be kept as clean as possible and free of all debris. The boiler room should be thoroughly washed down at least weekly to eliminate all dust and dirt which will help extend the intervals between boiler fireside cleanings. .

### **DAILY/WEEKLY PROCEDURES – VERIFY:**

- Boiler operation on "Call For Heat".
- Normal burner light-off.
- Pump and boiler feed solenoid operations.
- Fuel supply is not restricted. .
- Feed water temperature to a nominal 160°F.
- Water treatment and expansion tank operations.
- Damper operations.
- Combustion air supply.
- Gauge glass is clear.

### **WEEKLY/MONTHLY PROCEDURES**

- A thorough wash down of the boiler room.
- Check the safety relief and blow-down valves.
- Check and lubricate all system motors.
- Check and clean any strainers.
- Check all venting and breeching.
- Review burner combustion readings.
- Verify that the air separation, water treatment and makeup/feed/condensate systems are operating per manufacturer's instructions.

### **ANNUALLY or during a lay-up period:**

Shut down the boiler by following the procedure in "REMOVING A BOILER FROM SERVICE" below in this section.



The waterside and fireside of the boiler should be inspected to determine their condition. Boilers out of service for extended periods (more than seasonal) should be properly laid-up dry. Ensure that idle boilers are protected from freezing conditions if laid-up wet.

The frequency of cleaning will depend on the effectiveness of the water treatment program, the fuel type, efficiency of the burner, characteristics of the site combustion air supply and breeching effectiveness.

A coating of 1/8" of scale on the lower tube sheet can cause a loss of 13 percent of BTU/hr transfer and may lead to tube failure from thermal shock.

Inspection of the boiler vessel should occur at least annually or whenever a 1/8 inch of scale has built up in the vessel. Initial 30 and 90 day inspections are recommended.

### **WATERSIDE CLEANING**

**SURFACE SKIMMING:** After the first several days of operations, a new boiler needs the water level surface to be skimmed. Anytime there is evidence of moisture above the water line in the gauge glass, surging ("priming"), frothing, or violent changes in the water line, or carry over into the top of the gauge glass, the boiler should be skimmed. Since this requires some plumbing and operating the boiler under controlled and monitored conditions, it is covered in the technical support section of this manual – see Section VIII.

**ANNUAL INSPECTION:** Drain and flush the vessel. Remove all inspection clean-out caps. Inspect interior surfaces for signs of corrosion or pitting. If advanced corrosion is evident, remove all supply/return lines and arrange for boiler pressure testing or replacement.

A light coating of scale is acceptable, but deposits or evidence of sludge must be cleaned and water treatment procedures set up/improved immediately. High pressure water spray should be directed at any deposits. Deposits are typically easier to remove while still warm and wet as long as the boiler has drained and cooled enough for maintenance. Chemical agents may be used, but follow the chemical agents manufacturer's instructions.

Inspect the safety relief valve.

If the boiler is not to be returned to service soon, dry the inside with forced warm air and minimize exposure to humidity and moisture..

If the boiler is to be laid-up wet, then run through at least one full cycle after filling before isolating it from the system to drive off excess oxygen. This will help limit corrosion exposure.

### **FIRESIDE CLEANING**

Fireside cleaning is critical because a 1/16" coating of soot which is essentially unburned fuel may present a fire hazard and can cause a 25 percent loss of efficiency of the boiler.

A qualified service technician should perform the following maintenance items:

Remove the burner, the burner adapter, the boiler jacket top, insulation disk and smoke hood. Inspect surfaces including turbulators, interior of fire tubes, and firebox for evidence of soot. Brush clean each fire tube; wipe clean each turbulator, vacuum the entire firebox of soot.

Replace turbulators that are worn or damaged or that have their lower portion burned off.

Burned-off turbulators and excessive sooting indicates problems with the fuel supply, burner settings, combustion air supply, and/or breeching.

Clean, check and adjust the burner. .

Inspect firebox refractory for cracks or deterioration. Repair with suitable refractory material if required, following the manufacturer's instructions.

Inspect all sealing gaskets and rope and replace as required.

Re-install the burner, burner adapter, smoke hood, insulation disk and jacket top

### **AFTER CLEANING**

Leak test the fuel train.

Verify the operation of all boiler mounted controls and gauges. Replace as necessary.

Lubricate all mechanical equipment such as fans and pumps and verify motor rotation.

Check all plumbing for leaks or missing insulation.

Check all venting and breeching for leaks.

Have the water retested and the water treatment system serviced.

If required, have the boiler inspected by an authorized inspector. Local/state codes may apply.

### RESTARTING THE BOILER

**WARNING:** NEVER "dry fire" the boiler - operate the burner without the boiler completely filled with water.



Do not operate the boiler without a functional Low Water Cut Off control.

Do not operate the boiler without a functional High Pressure Limit control.

Follow the initial startup procedures as outlined in Section V above and in particular refilling the boiler with water, properly re-connecting the fuel source and properly re-connecting the electric wiring.

Follow the burner manufacturer's startup instructions.

Monitor the boiler through several complete cycles to confirm proper operation. Check burner for normal light-offs and complete shutdown

Record combustion product readings and compare with initial values. Investigate significant changes.

Return the boiler to service.

Update all maintenance information in the log book.

### REMOVING A BOILER FROM SERVICE

**WARNING:** Verify that the burner has completed its cycle and that it has turned itself OFF.



Turn the power switch on the burner to OFF.

1. Turn the ON/OFF switch on the boiler to OFF.
2. Turn off the control signal to the boiler (thermostat).
3. Allow the boiler to cool slowly and then relieve any residual pressure (check the gauge and

carefully open the safety relief valve) before performing maintenance

4. Disconnect the fuel supply from the burner and the power to the boiler and all its accessories.

5. Isolate the boiler by cutting off the make-up water to the vessel and closing the gate valve to the steam header.

If the boiler has been taken out of service due to an operational problem, ensure that the necessary repairs/services have been completed before putting it back into service. If required, arrange to have the boiler inspected. Follow the initial startup procedures as outlined in Section V above.