Facilities Management Procedure
Weber State University
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Standard Operating Procedures for Boiler Operations

Description:
This document provides a general procedure checklist for Facilities Management boiler operators to follow when performing regular operating, maintenance and emergency duties for scheduled or unscheduled situations as they pertain to boiler operations.

Responsible Party:
Facilities Management Heat Plant Boiler Operators

Procedure:
Facilities Management will maintain sustainable practices when performing boiler operations in the heat plant. The following procedures must be adhered to when performing boiler operations.

When handling boiler operations check to see if the following three issues are taken into account before beginning any procedure:

1. Is the ceramic warm?
   Ceramic insulation is designed to slow down the transfer of heat. Repeatedly heating it too fast will cause stress fractures needing repair.

2. Is the boiler making steam fast enough it is in control of header pressure?
   When boiler controls are placed in automatic it is assumed the boiler is affecting pressure; if it is not controls will fail to minimum or worst case MAXIMUM FIRE in an attempt to change pressure.

3. Is steam pressure still above 30 PSI?
High pressure traps automatically keep the header drained (to prevent water hammer) but cannot work when there is no pressure to drive condensate uphill to the De-aerating tank. If pressure has dropped below 30 psi for over an hour, open manual valves and drain header BEFORE pressurizing with steam.

A. RE-FIRING ON LINE BOILER
Identify why boiler tripped off and correct deficiency
Set controls to manual (local) and set firing rate at minimum position
Start boiler By reset Fire Eye controller and start boiler
Fire Eye will:
  ▪ 2 minute high fire purge
  ▪ 30 second low fire purge
  ▪ Light pilot and establish flame
  ▪ Light main and establish main flame
Fire Eye will release to PLC control and monitor boiler safeties. Steam pressure will be brought up in manual control until the boiler is producing sufficient steam to be in control of header pressure.
Set Steam SET POINT (green on PID loop) to where boiler pressure is and put control loop in automatic execution.
SLOWLY raise set point to bring boiler back up to desired operating pressure, do not raise set point more than ten pounds at a time.
Once boiler has reached new set point and stabilized raise set point again until boiler is back at desired operating pressure.
Once boiler has returned to operating pressure verify all controls are in automatic
Verify drum level controller is in automatic.
Check and log according to shift checklist.

B. FIRING ON NATURAL GAS AS FUEL SOURCE
1. Bringing a cold boiler with steam isolation valve open into service
Verify that the natural gas main and pilot manual isolation valves are closed.
Turn on power to boiler.
Check that controls are reporting to HMI.
Set controls to manual (local) and set firing rate at minimum position.
Start boiler
  ▪ Starting boiler with all fuel sources off test flame sensing system
Open natural gas pilot manual isolation valve.
Reset Fire Eye controller and start boiler again
  ▪ Starting boiler with fuel off tests low gas safeties
Open natural gas main manual isolation valve.
Reset Fire Eye controller and start boiler
  ▪ Fire eye will
    ▪ 2 minute high fire purge
    ▪ 30 second low fire purge
    ▪ Light pilot and establish flame
    ▪ Light main and establish main flame
Fire Eye will release to PLC control and monitor boiler safeties.
Using PLC inter face maintain boiler at low fire to warm boiler
  For warm boiler:
    ▪ Boiler will come up to operating temperature quickly
  For cold boiler warming:
    ▪ Fire boiler for ten minutes and turn off for twenty
    ▪ Restart boiler and continue process for two hours to slowly warm ceramic
    ▪ Two hour minimum to bring boiler up to operating temperature before starting to raise pressure in drum (this will warm the ceramic slowly and prevent damage)
Maintain drum level by opening drain when water expands and place controller in auto once water has expanded and is no longer raising drum level. Once boiler ceramic is warmed slowly raise drum pressure to current operating pressure.

  Set Steam SET POINT (green on PID loop) to where boiler pressure is and put control loop in auto.
  SLOWLY raise set point to bring boiler back up to desired operating pressure, do not raise set point more than ten pounds at a time.
  Once boiler has reached new set point and stabilized raise set point again until boiler is back at desired operating pressure.
  Verify drum level controller is in automatic.
  Check and log according to shift checklist.

2. Bringing Cold Boiler with Steam Isolation Valve Closed into Service
Except for stop-check valves, all isolation valves require equal pressure on both sides of gate valve to open. Opening valve before pressure equalizes will damage valve seat. Use drain valves to determine which gate valve is holding differential pressure, open the other and Stop-check root valve.

  Verify that the natural gas main and pilot manual isolation valves are closed.
  Turn on power to boiler.
  Check that controls are reporting to HMI.
  Open header drain line to drain any condensed water from header line.
  Set controls to manual (local) and set firing rate at minimum position.
Start boiler
- Starting boiler with all fuel sources off to test flame sensing system

Open natural gas pilot manual isolation valve.
Reset Fire Eye controller and start boiler again
- Starting boiler with fuel off tests low gas safeties

Open natural gas main manual isolation valve.
Reset Fire Eye controller and start boiler
- Fire Eye will:
  - 2 minute high fire purge
  - 30 second low fire purge
  - Light pilot and establish flame
  - Light main and establish main flame

Fire Eye will release to PLC control and monitor boiler safeties.
Using PLC interface maintain boiler at low fire to warm boiler
- Two hour minimum to bring boiler ceramic up to operating temperature before starting to raise pressure in drum
- Maintain drum level by opening drain with water expands and place controller in auto once water has expanded and is no longer raising drum level

Once boiler is warmed slowly raise drum pressure to current operating pressure.
Close Header drain line.
“Crack” open gate valve isolating boiler from main header.
Once header is warmed and pressure is equalized SLOWLY open gate valve
- Slowly opening valve is to prevent water hammer if a pool of water is trapped in boiler steam pipe.

Set Steam SET POINT (green on PID loop) to where boiler pressure is and put control loop in automatic.
SLOWLY raise set point to bring boiler back up to desired operating pressure, do not raise set point more than ten pounds at a time.
Once boiler has reached new set point and stabilized raise set point again until boiler is back at desired operating pressure.
Verify drum level controller is in automatic.
Check and log according to shift checklist.

C. FIRING ON FUEL OIL #2 AS FUEL SOURCE
Fuel oil is a more concentrated flame than gas. It will cause greater differential heating stress on the ceramic front wall. If possible, warm the boiler on minimum gas flame for an hour; however, the boiler can be brought up rapidly on oil if necessary.
Firing on fuel oil requires a source of fuel atomizing, boilers 2 and 3 require steam provided by another boiler operating at or above 95 psi. Boiler 1 has an option to use compressed air.

1. **Starting fuel pumping station**
   - Identify boiler that will be ran on fuel oil and tank to be used.
   - Verify position of isolation valves to allow fuel to flow to the boiler.
   - Start pump on tank that is in service.
   - Start taking logs on fuel oil tank level and strainer differential pressure (DP)
     - Shift and clean strainer if the DP shows a buildup in the strainer

2. **Bringing a cold boiler with steam isolation valve open into service**
   - Verify that the fuel oil main and pilot manual isolation valves are closed.
   - Verify that fuel oil is circulating through supply system.
   - Turn on power to boiler.
   - Check that controls are reporting to HMI.
   - Set controls to manual (local) and set firing rate at minimum position.
   - Start boiler
     - Starting boiler with all fuel sources off test flame sensing system
   - Open natural gas pilot manual isolation valve.
   - Reset Fire Eye controller and start boiler again
     - Starting boiler with fuel off tests low fuel safeties
   - Open fuel oil main manual isolation valve.
   - Reset Fire Eye controller and start boiler
   - Fire Eye will:
     - 2 minute high fire purge
     - 30 second low fire purge
     - Light pilot and establish flame
     - Light main and establish main flame
   - Fire Eye will release to PLC control and monitor boiler safeties.
   - Using PLC inter face maintain boiler at low fire to warm boiler
     - Two hour minimum to bring boiler up to operating temperature before starting to raise pressure in drum
     - Maintain drum level by opening drain with water expands and place controller in auto once water has expanded and is no longer raising drum level
   - Once boiler is warmed slowly raise drum pressure to current operating pressure.
   - Set Steam SET POINT (green on PID loop) to where boiler pressure is and put control loop in automatic.
   - SLOWLY raise set point to bring boiler back up to desired operating pressure, do not raise set point more than ten pounds at a time.
Once boiler has reached new set point and stabilized raise set point again until boiler is back at desired operating pressure.
Verify drum level controller is in automatic.
Check and log according to shift checklist.

3. **Bringing a cold boiler with steam isolation valve closed into service**
Except for stop-check valves, all isolation valves require equal pressure on both sides of gate valve to open. Opening valve before pressure equalizes will damage valve seat. Use drain valves to determine which gate valve is holding differential pressure, open the other and Stop-check root valve.

- Verify that the fuel oil main and pilot manual isolation valves are closed.
- Verify that fuel oil is warmed to temperature by circulating through supply system.
- Turn on power to boiler.
- Check that controls are reporting to HMI.
- Set controls to manual (local) and set firing rate at minimum position.
- Open header drain line to drain any condensed water from header line.
- Start boiler
  - Starting boiler with all fuel sources off test flame sensing system
  - Open natural gas pilot manual isolation valve.
- Reset Fire Eye controller and start boiler again
  - Starting boiler with fuel off tests low gas safety
  - Open fuel oil main manual isolation valve.
- Reset Fire Eye controller and start boiler
- Fire eye will:
  - 2 minute high fire purge
  - 30 second low fire purge
  - Light pilot and establish flame
  - Light main and establish main flame
- Fire Eye will release to PLC control and monitor boiler safety.
- Using PLC interface maintain boiler at low fire to warm boiler
  - Two hour minimum to bring boiler up to operating temperature before starting to raise pressure in drum
  - Maintain drum level by opening drain with water expands and place controller in auto once water has expanded and is no longer raising drum level
- Once boiler is warmed slowly raise drum pressure to current operating pressure.
- Close Header drain line.
- “Crack” open gate valve isolating boiler from main header.
- Once header is warmed and pressure is equalized SLOWLY open gate valve
- Slowly opening valve is to prevent water hammer if a pool of water is trapped in boiler steam pipe.

Set Steam SET POINT (green on PID loop) to where boiler pressure is and put control loop in automatic.
SLOWLY raise set point to bring boiler back up to desired operating pressure, do not raise set point more than ten pounds at a time.
Once boiler has reached new set point and stabilized raise set point again until boiler is back at desired operating pressure.
Verify drum level controller is in automatic.
Check and log according to shift checklist.

D. SHUT DOWNS

1. **Shutting Down Boiler and Maintaining Steam Generation**
   Set firing controls to manual and drive to minimum fire.
   Switch boiler to off and let controls cycle to turn boiler off.
   Verify online boiler is holding the load.
   Shut fuel isolation valves.
   Monitor offline boiler is maintaining drum level until it has cooled completely.
   Set controls to manual and drive to “closed”.
   Wet Lay-up process.

2. **Shutting Down Heat Plant System**
   Set firing controls to manual and drive to minimum fire.
   Switch boiler to off and let controls cycle to turn boiler off.
   Shut fuel isolation valves.
   Monitor offline boiler is maintaining drum level until it has cooled completely.
   Monitor DA and Condensate tanks are maintaining level.
   Once all steam generator have cooled shut off feed water and transfer pumps.
   Set controls to manual and drive to “closed”.
   Wet Lay-up process.