

B.1 Appendix B Summary

Safety:

Steam piping is a burn hazard from contact and from steam flashing.

Steam @ 250psi is nominally 400F, 205C.

Sensors are installed in, and pumps inject into pressurized piping. Loose or improperly assembled fittings may leak water or chemicals and/or flash steam.

Do not leave the controller turned ON unless you have configured it for the site's water treatment program & verified that the pumps and blowdown valve or solenoid are operating.

FYI: inserts 'For Your Information' explanations.

Here's what we're going to do:

Startup walks you through controller set-up step by step. We'll start by verifying the blowdown, followed by each sensor and then we'll adjust blowdown and feed setpoints and limit alarms. Finally we'll ensure that the pumps are pumping.

You'll need to know and be able to do the following:

You'll need to be able to measure the non-flashed, un-neutralized boiler water conductivity. You'll need to know the target conductivity for the boilers and the feed rates for the boiler treatment, sulfite & amine.

It helps to know the expected percentage of condensate return since you may feed less treatment chemical if the volume of softened make-up is low.

Volume Meters

If you've installed one or more water meters, you'll need to know the Gallons/contact for each meter. If they are turbine meters you'll need to know the 'K' factor.

Steam Demand

If you have a steam demand meter installed, you'll need to know the span of its current output signal (Example: 4-20mA = 0 to 50,000 lbs/hour of steam). If you are sharing the steam demand current loop with other controls, you'll need a current loop splitter.

First time users:

Have the controller user manual available to step you through the calibrate, configure and setpoint sequences.

If you have the '**LB**' LAN-browser option installed, you can use a notebook PC & Ethernet crossover cable to startup. Refer to Appendix 'C' of the user manual if you haven't set-up your notebook to browse the controller

FYI: Your controller may have been pre-configured for this site. Skip steps that involve setpoint adjust, feed mode & feed timing.

B.2 Minimum Startup Sequence

Unplug Pumps. Valve OFF Blowdowns & Sensors: 1

If not hardwired, unplug the chemical pumps.
Valve OFF the upstream & downstream isolation valves
on the conductivity sensor-blowdown valve piping.
Set the throttling needle valves to 25-30% open.

FYI: Needle valve setting typical for most captured-sample controlled blowdowns.

Check for leaks: 2

Inspect the chemical injection points for leaks & correct.
If you've just installed water meters make sure they are not bypassed
& that the installation fittings are not leaking or flashing steam.

Verify the Boiler1 Interlock: 3

Plug-in or power up the controller. Scroll **UP** or **DOWN** to the '**S**'
Operating1 _S display and ensure that it shows ON indicating that the EMS or DCS
is providing a closed contact set
Don't proceed until Operating1_S shows ON.

FYI: If you are not using the interlock, install a wire or jumper from S to the adjacent ground terminal.

Verify the Boiler2 Interlock: 4

Scroll **UP** or **DOWN** to the '**T**'
Operating2 _T display and ensure that it shows ON indicating that the EMS or DCS
is providing a closed contact set
Don't proceed until Operating2_T shows ON.

FYI: If you are not using the interlock, install a wire or jumper from T to an adjacent ground terminal.

START BOILER 1 BLOWDOWN STEPS

Open Boiler1 Isolation Valves, Verify Blowdown1 Closed: 5

Open the isolation valves on the sensor – blowdown valve piping & check for leaks.
Disconnect the interlock wire from the '**S**' terminal and ensure that the valve or solenoid is closed.
This check is very necessary for motorized valves, since it's common to wire
so that a valve is open when it should be closed.

FYI: Motorized valves usually have a valve stem position indicator. Solenoid coils can be checked for magnetized:ON or you can IR temperature measure the drop across the valve.

Verify Boiler1 Blowdown Piping: 6

Reconnect the 'S' interlock wire.
Scroll **UP** or **DOWN** to the valve '**2**' Blowdown1_2 display,
key **ENTER** & then select **Test-Prime** for 5 minutes.
Go back to the blowdown valve & make sure that it's open and that the boiler is blowing down.
End **Test-Prime**: Key **ENTER** at Blowdown1_2 & scroll to **Alarms-Limits**,
ENTER & **ENTER** at **Reset Alarm** .

FYI: After 30 seconds, an IR temperature measure should show the same temperature all the way up to the throttling needle valve. You can be accidentally valved OFF upstream OR downstream of the blowdown valve.

B.2 Minimum Startup Sequence continued

Adjust Boiler1 Blowdown Timing: 7

Scroll **UP** or **DOWN** to the sensor '2' Blowdown1_2 display, key **ENTER**
Scroll to **Configure** & **ENTER** & then to **Special Control** & **ENTER** twice.

Modify the **Captured Sample** timing for your site.

FYI: Refer to user manual Section 7.2 for sample timing guidance.

Many sites, only need to adjust the **Re-sample-Wait** time from the default 60 minutes.

Calibrate Boiler1 Conductivity: 8

Scroll **UP** or **DOWN** to the sensor 'A' Boiler1_A conductivity display

Measure an un-flashed & un-neutralized boiler water sample
and calibrate the Boiler1_A conductivity sensor.

FYI: Ensure that blowdown control has captured a representative boiler water sample
at the sensor, upstream of the blowdown valve, before calibrating conductivity.

Check for Boiler1 Flashing @ Sensor: 9

Scroll **UP** or **DOWN** to the valve '2' Blowdown_2 display, key **ENTER**
& scroll to **Diagnostic** then select **Sensor Watch**

Watch the conductivity in real time during the

Sample-Measure sequence & verify not flashing.

FYI: Refer to user manual Section 7.4 for a detailed explanation.

Critical: Flashing at the sensor prevents accurate and repeatable blowdown control.

Correct for Time Zone: 10

Key **EXIT** to the Day – Time display.

If necessary, key **ENTER** & scroll to **Time&Date** & adjust the time for your time zone.

FYI: Sets the time & date stamp correctly for alarms & data logging.

Configure Boiler Water Meters: 11

FYI: Skip 7 if you don't have a feedwater or softened make-up meter

Scroll **UP** or **DOWN** to the meter 'O' Feedwater1_O display

It's currently a contact head meter @ 100 Gallons/contact.

Key **ENTER** to **Configure** if you need to modify the meter type or gallons per contact.

Scroll **UP** or **DOWN** to the meter 'P' Feedwater2_P display

It's currently a contact head meter @ 100 Gallons/contact.

Key **ENTER** to **Configure** if you need to modify the meter type or gallons per contact.

Scroll **UP** or **DOWN** to the meter 'R' Softened_R display

It's currently a contact head meter @ 100 Gallons/contact.

Key **ENTER** to **Configure** if you need to modify the meter type or gallons per contact.

Note the water meters current volume display.

Set Boiler1 Blowdown Setpoints: 12

Scroll **UP** or **DOWN** to the valve '2' Blowdown1_2 display, key **ENTER**.

Key **ENTER** to **Setpoints** and adjust the **Turn ON** & **TurnOFF** setpoints for your treatment program
and feedwater chemistry. Typically the two setpoints are 10uS apart.

B.2 Minimum Startup Sequence continued

Verify Boiler1 Meters: 13

In step 11 we noted the current volume on each meter.
Scroll **UP** or **DOWN** to the meter 'O' Feedwater1_O display & verify a volume increase.
Scroll **UP** or **DOWN** to the meter 'R' Softened_R display & repeat.
FYI: Sites seldom have a single boiler fed from the common de-aerator sump or feedwater tank.
Level controls in the feedwater tank and variation in %condensate return obscure any ratio between feedwater and softened make-up volumes.

START CHEMICAL FEED STEPS

Select Treatment Feed Mode: 14

Scroll **UP** or **DOWN** to the '1' Treatment1_1 display.
It's currently set to feed based on the to Feedwater1_O meter volume.
If you don't have a feedwater meter key **ENTER** to **Configure & Special Control** & then select **PercentTime**.
FYI: You may wish to add the Interlock2_T to this pump or feed on the sum of meters 'O' and 'P' if you don't have a separate pump for Boiler2 treatment.

Set Feed Setpoints: 15

Scroll **UP** or **DOWN** to the '1' Treatment1_1 display & key **ENTER** to **Setpoints**.
If you are using a meter based feed, you'll enter meter volume & pump ON time setpoints.
If you are using **PercentTime**, you'll setpoint the % of every 5 minutes that interlock Operating1_S is ON.
FYI: **PercentTime** may work if you are pumping into a sump but may not if you are feeding into a lightly loaded feedwater line. Consider using a feedwater pump starter contact set to feed proportional to load.

Verify Treatment Feed: 16

Scroll **UP** or **DOWN** to the '1' Treatment1_1 display.
Plug in the treatment pump to the plug labeled 1.
Key **ENTER** to **Prime-Test** & feed for 5 minutes.
Verify that the pump primes & feeds.

Set Treatment Feed Limits: 17

Scroll **UP** or **DOWN** to the '1' Treatment1_1 display.
Key **ENTER** to **Alarms-Limits**.
Key **ENTER** & scroll to **Minutes/Day**. Adjust this feed limit to prevent overfeeding.
FYI: The Inhibitor feed limit is reset @ midnight so that the same amount of inhibitor is available for each day's treatment.
The Mins/Actuation limit is seldom used for inhibitor feeds.

B.2 Minimum Startup Sequence continued

Select Amine Feed Mode: 18

Scroll **UP** or **DOWN** to the '5' AminePump_5 display.
It's currently set to feed based on the to Feedwater1_O meter volume.
If you don't have a feedwater meter key **ENTER** to **Configure**
& **Special Control** & then select **PercentTime**.

FYI: If you have a 4-20mA signal that represents steam demand, connect the signal to controller input 'G'.
Convert the steaming rate to volume & use it to control the amine pump

Set Amine Feed Setpoints: 19

Scroll **UP** or **DOWN** to the '5' AminePump_5 display & key **ENTER** to **Setpoints**.
If you are using a meter based feed, you'll enter meter volume & pump ON time setpoints.
If you are using **PercentTime**, you'll setpoint the % of every 5 minutes
that interlock Operating1_S OR Operating2_T is ON.

FYI: **PercentTime** may work if you are pumping into a steam header & load is constant.
Consider using a feedwater pump starter contact set to feed proportional to load.

Verify Amine Feed: 20

Scroll **UP** or **DOWN** to the '5' AminePump_5 display.
Plug in the amine pump to the plug labeled 5.
Key **ENTER** to **Prime-Test** & feed for 5 minutes.
Verify that the pump primes & feeds.

Set Sulfite Feed Setpoint: 21

Sufite is currently set to feed based on **PercentTime**.
Scroll **UP** or **DOWN** to the '4' SulfitePump_4 display & key **ENTER** to **Setpoints**.
Setpoint the % of every 5 minutes that interlock Operating1_S OR Opertaing2_T is ON.
FYI: If you have a feed water meter or pump signal, you may wish to
re-configure to feed sulfite proportional to load.

Verify Sulfite Feed: 22

Scroll **UP** or **DOWN** to the '4' SulfitePump_4 display.
Plug in the amine pump to the plug labeled 4.
Key **ENTER** to **Prime-Test** & feed for 5 minutes.
Verify that the pump primes & feeds

B.2 Minimum Startup Sequence continued

START BOILER 2 BLOWDOWN STEPS

Open Boiler2 Isolation Valves, Verify Blowdown2 Closed: 23

Open the isolation valves on the sensor – blowdown valve piping & check for leaks. Disconnect the interlock wire from the 'T' terminal and ensure that the valve or solenoid is closed.

This check is very necessary for motorized valves, since it's common to wire so that a valve is open when it should be closed.

FYI: Motorized valves usually have a valve stem position indicator. Solenoid coils can be checked for magnetized:ON or you can IR temperature measure the drop across the valve.

Verify Boiler2 Blowdown Piping: 24

Reconnect the 'T' interlock wire.

Scroll **UP** or **DOWN** to the valve '3' Blowdown2_3 display, key **ENTER** & then select **Test-Prime** for 5 minutes.

Go back to the blowdown valve & make sure that it's open and that the boiler is blowing down.

End **Test-Prime**: Key **ENTER** at Blowdown2_3 & scroll to **Alarms-Limits**, **ENTER** & **ENTER** at **Reset Alarm**.

FYI: After 30 seconds, an IR temperature measure should show the same temperature all the way up to the throttling needle valve. You can be accidentally valved OFF upstream OR downstream of the blowdown valve.

Adjust Boiler2 Blowdown Timing: 25

Scroll **UP** or **DOWN** to the sensor '3' Blowdown2_3 display, key **ENTER** Scroll to **Configure** & **ENTER** & then to **Special Control** & **ENTER** twice.

Modify the **Captured Sample** timing for your site.

FYI: Refer to user manual Section 7.2 for sample timing guidance. Many sites, only need to adjust the **Re-sample-Wait** time from the default 60 minutes.

Calibrate Boiler2 Conductivity: 26

Scroll **UP** or **DOWN** to the sensor 'E' Boiler2_E conductivity display

Measure an un-flashed & un-neutralized boiler water sample and calibrate the Boiler2_E conductivity sensor.

FYI: Ensure that blowdown control has captured a representative boiler water sample at the sensor, upstream of the blowdown valve, before calibrating conductivity.

Check for Boiler2 Flashing @ Sensor: 27

Scroll **UP** or **DOWN** to the valve '3' Blowdown2_3 display, key **ENTER** & scroll to **Diagnostic** then select **Sensor Watch**

Watch the conductivity in real time during the **Sample-Measure** sequence & verify not flashing.

FYI: Refer to user manual Section 7.4 for a detailed explanation.

Critical: Flashing at the sensor prevents accurate and repeatable blowdown control.

B.2 Minimum Startup Sequence continued

Set Boiler2 Blowdown Setpoints: 28

Scroll **UP** or **DOWN** to the valve '3' Blowdown2_3 display, key **ENTER**.
Key **ENTER** to **Setpoints** and adjust the **Turn ON** & **TurnOFF** setpoints for your treatment program and feedwater chemistry. Typically the two setpoints are 10uS apart.

Verify Boiler2 Meters: 29

In step 11 we noted the current volume on each meter.
Scroll **UP** or **DOWN** to the meter 'P' Feedwater2_P display & verify a volume increase.
FYI: Sites seldom have a single boiler fed from the common de-aerator sump or feedwater tank.
Level controls in the feedwater tank and variation in %condensate return obscure any ratio between feedwater and softened make-up volumes.

Optional:End Prime-Tests: 30

Scroll **UP** or **DOWN** to each priming pump's display.
Key **ENTER** & **UP** or **DOWN** to **Alarms-Limits** & **ENTER**.
Scroll to **Clear Alarms** & **ENTER** to ending any active **Prime-Test**.
FYI: If you noted the feedwater and/or softened water meter volumes in Step 11, check that the current volume on each meter reflects the incremental volume that has occurred during Start-up.

B.3 Startup Sequence Options

Not all sites will require or wish to do the following optional steps.
Refer to the user manual for guidance on selecting and setting.

Set Boiler1 Conductivity Alarm: A

Scroll **UP** or **DOWN** to the sensor 'A' Boiler1_A conductivity display.
Key **ENTER** to **Alarms** and adjust both **High Alarm** and **Low Alarm**.

FYI: High conductivity alarms on captured sample blowdowns are of limited use, since a valve fault will prevent a conductivity update.
If the boiler is always on-line, a low conductivity alarm is useful since it will flag a failure to get a hot sample.

Set Boiler2 Conductivity Alarm: B

Scroll **UP** or **DOWN** to the sensor 'E' Boiler2_E conductivity display.
Key **ENTER** to **Alarms** and adjust both **High Alarm** and **Low Alarm**.

Set Feedwater & Softened Meter Volume/Day Alarms: C

Scroll **UP** or **DOWN** to the meter 'O' Feedwater1_O display
Key **ENTER** to **Alarms** and adjust **High Alarm**.

Repeat for 'P' Feedwater2_P.

Repeat for 'R' Softened_R.

FYI: If you have a 24/7 boiler, set the Low Alarm to flag a meter failure.
High softened make-up may indicate a lower %condensate return.

Treatment Pumps for each Boiler: D

If you are feeding treatment into a feedwater tank or de-aerator sump, you don't need a 2nd pump control. Modify the control and interlocks of Treatment1_1 to interlock on 'S' or 'T' and to control on the sum of meters 'O' and 'P'.

If you enable Treatment2_7, you'll find that it's already configured to be the Boiler2 treatment pump.
You'll need a frequency controlled pump to feed Boiler2 treatment.

FYI: The controller defaults to the simplest pump configuration, one pump feeding treatment to both boilers.